

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

This manual describes the hardware of the XG-7000 Series ultra high-speed, flexible machine vision system (hereinafter, "the controller") and its basic operation. 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 controller.

Related manuals

Also, read the following manuals when using the controller.

- **XG-7000 Series Controller Instruction Manual:** This manual explains the specifications and precautions for the installing of the XG-7000 Series.
- **XG-7000 Series User's Manual (this document)**
- **XG VisionEditor Reference Manual (Programming Edition):** This manual explains the functions and operating procedures of the XG VisionEditor.
- **XG VisionEditor Reference Manual (Control/Data Edition):** This manual lists the control settings and data for the XG VisionEditor.

Reference

The manuals, except for the "XG-7000 Series Controller Instruction Manual" are provided in PDF format in V-Works for XG.

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.

Trademarks

- Windows 2000/XP/Vista/7 are registered trademarks of Microsoft Corporation (US).
- "SD Memory Card" is a registered trademark of the SD Association.
- Other company names and product names noted in this document are registered trademarks or trademarks of their respective companies. The TM mark and [®] mark have been omitted in this manual.

Safety Precautions

General Cautions

- 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 the system to protect of the human body.
- Do not subject the controller or connected devices to a sudden change in temperature, as condensation may occur.

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 system. 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

Cautions

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 deformation of the controller. If the controller has been marked in anyway, use a cloth moistened with a mild detergent to wash off, then wipe dry with a dry cloth.

Notes about CE Marking

Keyence evaluates CE compliance in accordance with the requirements of the associated EMC directives according to how products fulfill the stated conditions. Keyence has confirmed that the XG-7000 Series meets these requirements.

When the XG-7000 Series is used in EU nations, obey the precautions listed below.

Note, the below precautions do not guarantee that the customers entire machinery installation is compliant with the EMC directive.

The customer is responsible for determining compliance of the overall machinery installation.

Precautions regarding the EMC Directive (2004/108/EC)

- Compatible specifications: EN61326-1 (Class A)
- Use cables shorter than 30 m to connect the controller and its external devices.
- When using a CC-Link unit CA-NCL10E, attach a ferrite core (OP-84364) to the CC-Link dedicated cable, within 300 mm of the CA-NCL10E.

Differences between the XG-7000 Series Controller (7701/7501/7001)

This manual covers the XG-7000 Series Ver. 3.0, which includes the XG-7701/XG-7501/XG-7001/XG-7001A models. All references, unless otherwise stated, pertain to the XG-7501. Additionally, all screen images in this manual are taken from the XG-7501.

The differences between each model are listed below.

- The image processor used in the XG-7701/XG-7501/XG-7001A are 30% faster than the XG-7001. Actual speeds will vary depending on the contents of the program. Processing speed should be evaluated by uploading the program to the actual model to be used.
- The XG-7701 has twice the image memory and processing memory of other controller models.
- For more details on differences between the models, refer to "Main Specifications" (Page 7-2).

		XG-7701	XG-7501	XG-7001	XG-7001A
Number of cameras	XG-035C	2(4) ^{*1}	2(4) ^{*1}	2(4) ^{*1}	x
	XG-S035C	2(4) ^{*1}	2(4) ^{*1}	2(4) ^{*1}	x
	XG-H035C	2(4) ^{*1}	2(4) ^{*1}	2(4) ^{*1}	x
	XG-H100C	2(4) ^{*1*2}	2(4) ^{*1*2}	x	x
	XG-200C	2(4) ^{*1*2}	2(4) ^{*1*2}	x	x
	XG-S200C	2(4) ^{*1*2}	2(4) ^{*1*2}	x	x
	XG-H200C ^{*3}	2(4) ^{*1*2}	2(4) ^{*1*2}	x	x
	XG-H500C	2(4) ^{*1*2}	x	x	x
Number of cameras	XG-035M	2(4) ^{*1}	2(4) ^{*1}	2(4) ^{*1}	x
	XG-S035M	2(4) ^{*1}	2(4) ^{*1}	2(4) ^{*1}	x
	XG-H035M	2(4) ^{*1}	2(4) ^{*1}	2(4) ^{*1}	x
	XG-H100M	2(4) ^{*1*2}	2(4) ^{*1*2}	x	x
	XG-200M	2(4) ^{*1*2}	2(4) ^{*1*2}	x	x
	XG-S200M	2(4) ^{*1*2}	2(4) ^{*1*2}	x	x
	XG-H200M ^{*3}	2(4) ^{*1*2}	2(4) ^{*1*2}	x	x
	XG-H500M	2(4) ^{*1*2}	x	x	x
Analog Monochrome camera	CA-CM20	x	x	x	2(4) ^{*1}
Monochrome camera	VGA cameras tested ^{*4}	x	x	x	2(4) ^{*1}

^{*1} Up to 4 cameras can be connected and used simultaneously by using the appropriate camera expansion unit (XG-E700/XG-E700A).

^{*2} In addition to the 240'000 and 310'000 pixel standard cameras, the XG-7701/XG-7501 is also capable of processing 1 and 2 mega-pixel images from 1 or 2 mega-pixel cameras. Furthermore, the XG-7701 supports 5-megapixel cameras.

^{*3} The XG-H200C and XG-H200M cannot be used with the XG-7501 Ver.1.0. These cameras can be only used through a controller firmware upgrade. However, depending on the date of manufacture, the XG-7501 may be limited to the use of up to two XG-H200C/H200M cameras if it has been upgraded from Ver.1.0 to Ver. 2.0 or later. Refer to "Compatibility of program data" (Page 13) for more details.

^{*4} Refer to "Main Specifications" (Page 7-2) for details on tested analog VGA cameras.

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 an XG-7701 onto another controller.

Reference

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

Changes to XG-7000 Ver. 3.0 and Earlier Versions

This document has been written for the XG-7701, XG-7501, XG-7001, and XG-7001A running Ver. 3.0.

Reference

- The firmware on your controller can be checked by clicking "System Information" on the System Configuration menu (Page 5-36).
- While some exceptions apply, dedicated software is required to use the functions described in this manual.

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: Addition of 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 8-27) 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 stain 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 (ConvPixToWorld, ConvWorldToPixel); and a function to calibrate multiple 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 and ShapeTrax2.
- Accuracy options for Pattern searches: Options were added for very fine (3) and very coarse (-3).
- Expansion in the maximum number of items detected by ShapeTrax2: Up to 2,000 items can be detected.
- 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-7501, XG-7001, and XG-7001A: 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 4-7): A dedicated menu [Edit Unit menu] was added for changing the unit settings.
- Statistics (Page 3-16): 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 6-14): Addition of support for PLC systems from Mitsubishi Electric Corporation and Omron Corporation. Also, the addition of 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-7701
- 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: CA-DC20E (Note: up to 4 units can be connected)

▶ Note

- XG-H500C / H500M can only be used with the XG-7701.
- XG-H200C / H200M cannot be used with the XG-7001.
- CA-DC20E can be used with all controllers.
- The 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 8-27) and the XG VisionEditor Reference Manual (Programming Edition).

- **ShapeTrax2:** ShapeTrax2 is an enhanced version of the ShapeTrax tool featured on the Keyence CV-3000 Series and CV-5000 Series. This measurement unit now offers greatly improved speed, accuracy, and stability.
- **Trend edge stain:** This vision tool detects stains on the outline of the inspection target (protrusions and indentations) from the edge detected by the trend edge 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 stain:** "Fine Color" was added as a color extraction setting in the stain unit. Stain inspections make direct use of the HSB information (hue, saturation, and brightness) for easy and stable stain 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 filtering:** 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 5-12): 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 5-8): This feature places a delay between the trigger input and the start of processing.
- **Rename, copy, delete programs** (Page 4-321, 4-322): The function menu now supports rename, copy, and delete functions for user-specified programs.
- **Built-in menu for library files** (Page 8-20): 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 8-2, 8-13): This feature supports global changes across multiple units using a single menu.
- **Specifying a reference unit in the Register Image built-in menu** (Page 8-11): An image can be registered from a specified position adjustment unit after it has been corrected.
- **Region selection in the Inspection Region built-in menu** (Page 8-2): 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. 3.0 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 included with V-Works for XG Ver. 2.1 and earlier does not support Ver. 3.0 controllers. Note, V-Works for XG Ver. 3.0 has forward compatibility with previous versions.
- The XG VisionTerminal included with V-Works for XG Ver. 1.0 can communicate with those controllers up to Ver. 3.0. However, it does not support new functions (such as receiving images from a 5 megapixel camera) that were added from Ver. 2.0 onwards.
- XG VisionEditor included with V-Works for XG Ver. 3.0 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. 3.0, 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-7000 (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-7500 (2 cameras at maximum load/4 cameras at maximum load)
 - Ver. 1.0: 2.3 A/3.0 A
 - Ver. 2.0: 2.4 A/3.2 A
- XG-7500A (2 cameras at maximum load/4 cameras at maximum load)
 - Ver. 1.0: 2.3 A/3.0 A
 - Ver. 2.0: 2.2A/2.6A
- XG-7000A (2 cameras at maximum load/4 cameras at maximum load)
 - Ver. 1.0: 2.1A/2.8A
 - Ver. 2.0: 2.1A/2.5A
 - Ver. 3.0: 2.2A/2.6A
- Specification and rating modifications to the XG-7000A due to discontinuation of the XG-7500A: Due to discontinuation of the XG-7500A on February 2010, the replacement model XG-7000A was modified to the same specifications and ratings of the XG-7500A.
 - DSP changed from standard to high speed type.
 - Environmental resistance (ambient temperature) for (2 cameras/4 cameras): Was 0 to +50°C and is now 0 to +50°C and 0 to +45°C, respectively.

Compatibility of program data

- Due to functional enhancements in Ver. 3.0, the program data (inspection settings, global variable settings, and system settings) are now in Ver. 3.0 format. (Program files for Ver. 1.0, 2.0, and 2.1 are in Ver. 1.0, 2.0, and 2.1 formats, respectively).
Ver. 3.0 has backward compatibility and can read programs created in earlier versions.
- Upward compatibility has not been provided. Therefore, programs in Ver. 3.0 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. 3.0. 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. 2.1 and earlier controllers can be upgraded to Ver. 3.0 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 if the hardware version displayed in the [System Information] under System Configuration is 1.0.

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 5-36).

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Chapter **1**

Overview

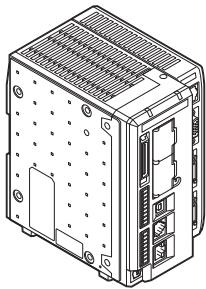
Overview

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

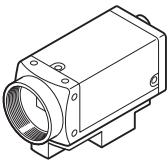
- Controller (XG-7701/XG-7501/XG-7001/XG-7001A) x 1



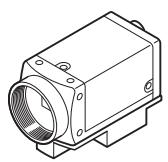
- SD memory card (OP-87133 (512 MB): XG-7501/XG-7001/XG-7001A, CA-SD1G (1GB): XG-7701) x 1
(Pre-installed in SD card slot 1)
- Controller instruction manual x 1
- Set of terminal block labels x 1

Options

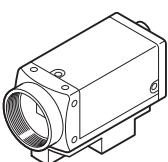
- XG-200C
(2-megapixel color camera)
- XG-200M
(2-megapixel monochrome camera)



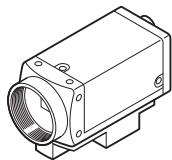
- XG-035C
(320,000 pixel double speed color camera)
- XG-035M
(320,000 pixel double speed monochrome camera)



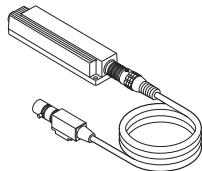
- XG-H100C
(1-megapixel 7x-speed color camera)
- XG-H100M
(1-megapixel 7x-speed monochrome camera)
- XG-H200C
(2-megapixel 7x-speed color camera)
- XG-H200M
(2-megapixel 7x-speed monochrome camera)
- XG-H500C
(5-megapixel 11x-speed color camera)
- XG-H500M
(5-megapixel 11x-speed monochrome camera)



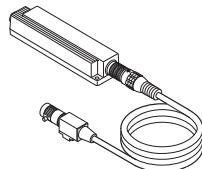
- XG-H035C
(310,000 pixel 7x-speed color camera)
- XG-H035M
(310,000 pixel 7x-speed monochrome camera)



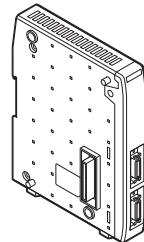
- XG-S035C
(320,000 pixel ultra small double speed color camera)
- XG-S035M
(320,000 pixel ultra small double speed monochrome camera)



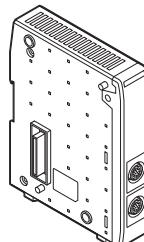
- XG-S200C
(2-megapixel ultra small color camera)
- XG-S200M
(2-megapixel ultra small monochrome camera)



- XG-E700
(Camera expansion unit)



- XG-E700A
(Analog camera expansion unit)



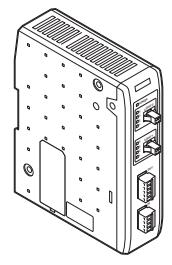
- OP-84231
(Handheld controller)

Reference

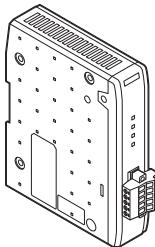
OP-84236 (blank) also available.



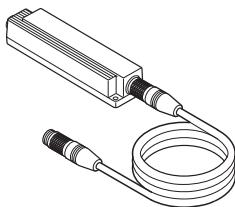
- CA-DC20E
(Illumination expansion unit)



-
- CA-NCL10E
(CC-Link unit)



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



-
- XG-H7NE (dedicated software V-Works for XG)
 - XG VisionEditor
 - XG VisionTerminal

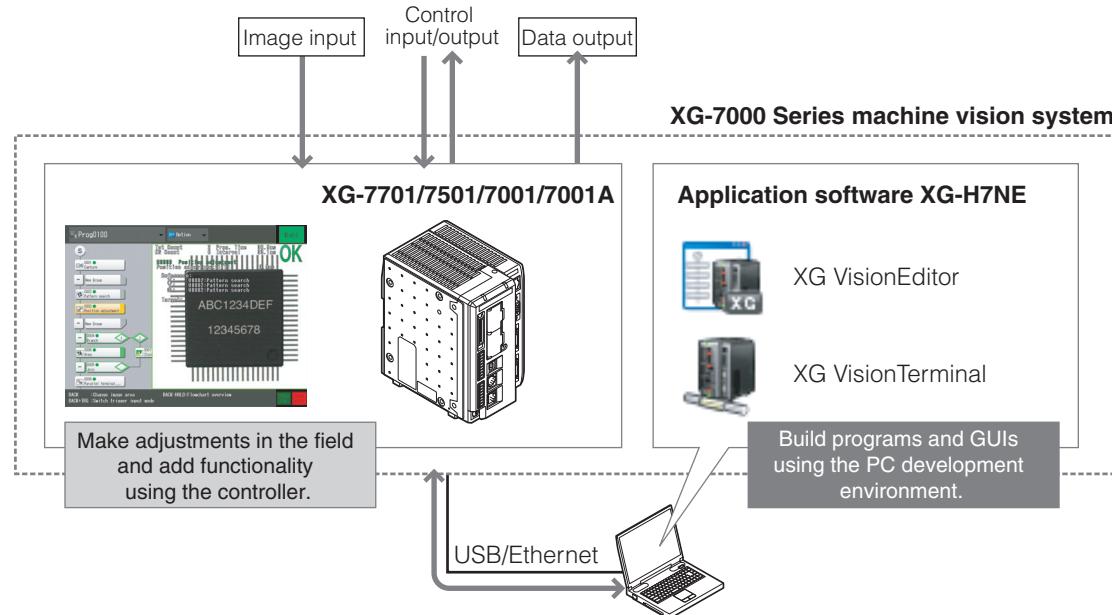
► Note

For more details on options available for the controller, see "Options" (Page 7-34).

Overview of the XG-7000 Series Machine Vision System

System Overview

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



XG-7000 Series controller

The XG-7000 Series platform features a super high speed, parallel "3+1" processor.

- In addition to running user-developed inspection programs, the handheld controller can be used to check and edit inspection flowcharts. This allows for instant adjustments and program changes as they become necessary.
- Refer to Chapters 2 and beyond for more details on connection and operating procedures.

XG VisionEditor

The XG VisionEditor is the integrated development software for the ultra high-speed, flexible machine vision system XG-7000 Series.

- 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. The environment also provides powerful tools for debugging and simulated field-testing.

- For more details, see the XG VisionEditor Reference Manual (Programming Edition), and the XG VisionEditor Reference Manual (Control/Data Edition).

XG VisionTerminal

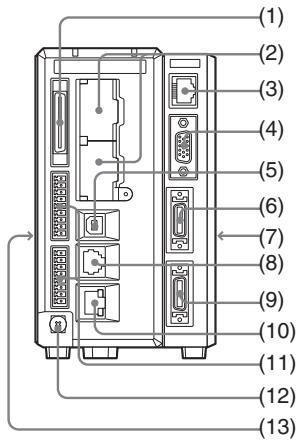
The XG VisionTerminal is an application designed specifically for the ultra high-speed, flexible machine vision system XG-7000 Series.

- The XG VisionTerminal uses a remote desktop function that allows you to issue console commands from the PC and view the monitor output from the XG-7000 Series on your PC.
- The XG VisionTerminal also collects log data from the XG-7000 Series.

For more details, see the XG VisionTerminal User's Manual.

Identifying Controls and Connectors

Controller



(1) Parallel I/O connector

Use to connect to the parallel input/output signals (Page 6-19).

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

Insert an SD card (Page 2-34).

The lower slot (SD1) holds the included SD Card 1 (512 MB or 1 GB).

▶ Note

SD Card 1 must be inserted to operate the controller.

(3) Modular connector

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

(4) SVGA output terminal

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

(5) USB connector

Use for USB communication (Page 6-8).

(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 for RS-232C communication (Page 6-2).

(9) Camera 1 connector

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

(10) Ethernet connector

Use for Ethernet (TCP/IP) communication (Page 6-4).

(11) Terminal block

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

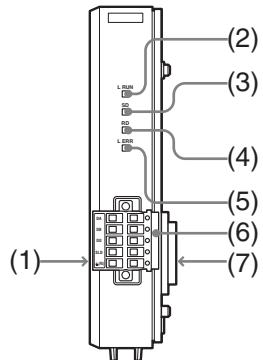
(12) Grounding terminal

Use to frame ground the unit (Page 2-24).

(13) Expansion unit connector 2 (left side)

Use to connect the illumination expansion unit CA-DC20E or CC-Link unit CA-NCL10E (Page 2-5).

CC-Link Unit (option)



(1) Connector on expansion unit side

Use to connect the illumination expansion unit CA-DC20E (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:** Area code or communication speed setting is changing 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.

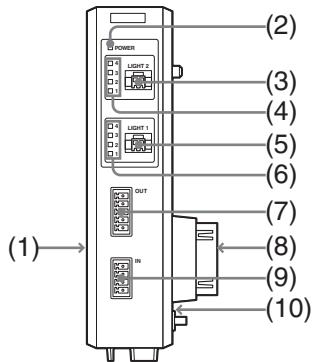
(6) Terminal block

See the wiring diagram (Page 6-17).

(7) Connector on controller side

Connect to the controller.

Illumination Expansion Unit (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 for LED light No.2.

(4) Light 2 intensity LED

Indicates the intensity of Light 2 in four steps.

(5) Light 1 output connector

Use for 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

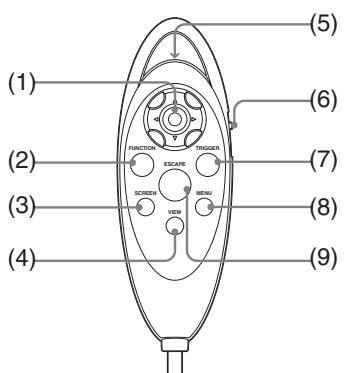
Use to select the output voltage on the output connector (Page 2-29).

Handheld Controller

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

Reference

- The text in parenthesis shows the labelling on the OP-84231. A blank console (OP-84236) is also available for customizing 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 (Page 3-39). 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 (Page 3-2).

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.) (Page 3-12).

(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 (Page 3-9).

(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) Selector switch (8) (RUN/STOP)

Flicking this switch toggles between edit and run modes (Page 4-5).

Reference

This switch can also force the controller to 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 cycles the dialog menu through different levels of opacity (100% → 90% → 75% → 50% → 25 → 100%).

(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
Forcibly start the controller in Offline mode	No. 1 button + 8-way touchpad UP + 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 system setting file which contains settings for terminal assignments, etc. When the controller is started immediately after it has been initialized, the controller will return to its initial state.

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

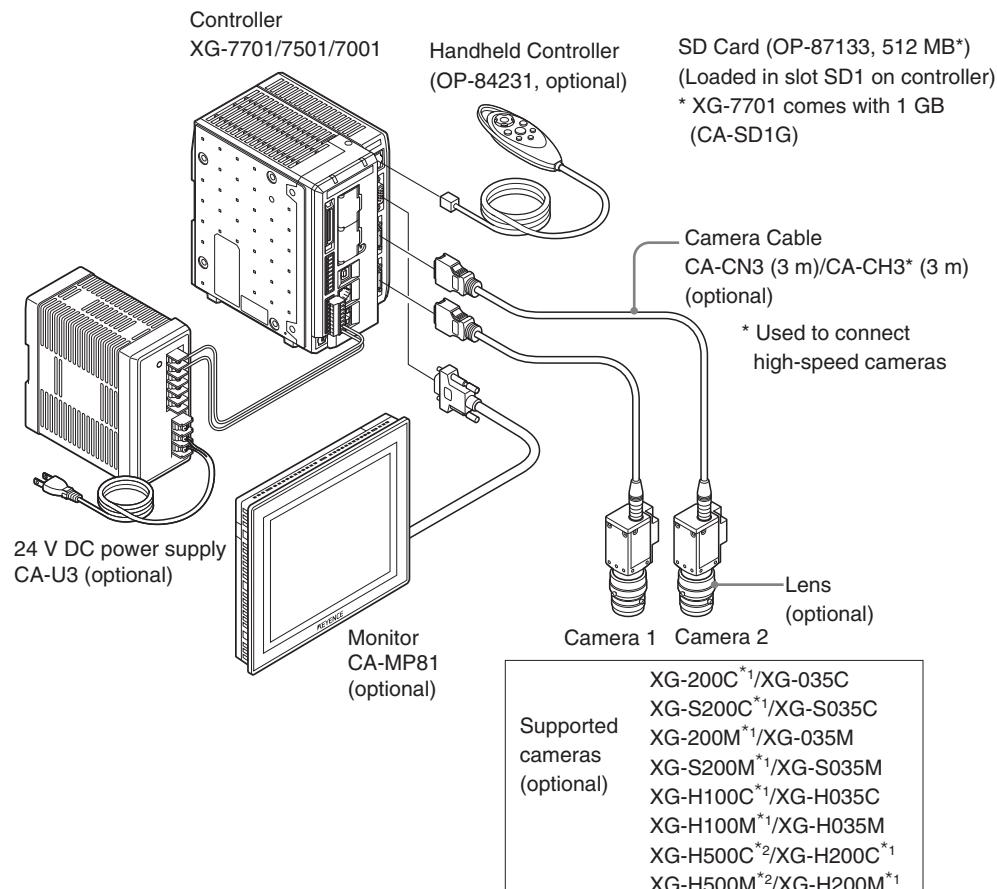
Operation	Buttons to use
Saving the current image on the screen to SD Card 2 (Screen capture)	No. 1 button (FUNCTION) + No. 5 button (VIEW) Or No. 7 Back button + No. 5 button (VIEW)
Send a reset signal to the controller during Run mode.	No. 1 button (FUNCTION) + No. 2 button (ESCAPE) Or No. 7 Back button + No. 2 button (ESCAPE)
Switching the screen display (Page 3-12)	No. 1 button (FUNCTION) + No. 4 button (SCREEN) Or No. 7 Back button + No. 4 button (SCREEN)
Switching to the overview of the flowchart	No. 1 button (FUNCTION) + No. 7 Back button

Chapter **2**

Installation and Connection

Standard System Configuration

Example of a standard system setup with two cameras



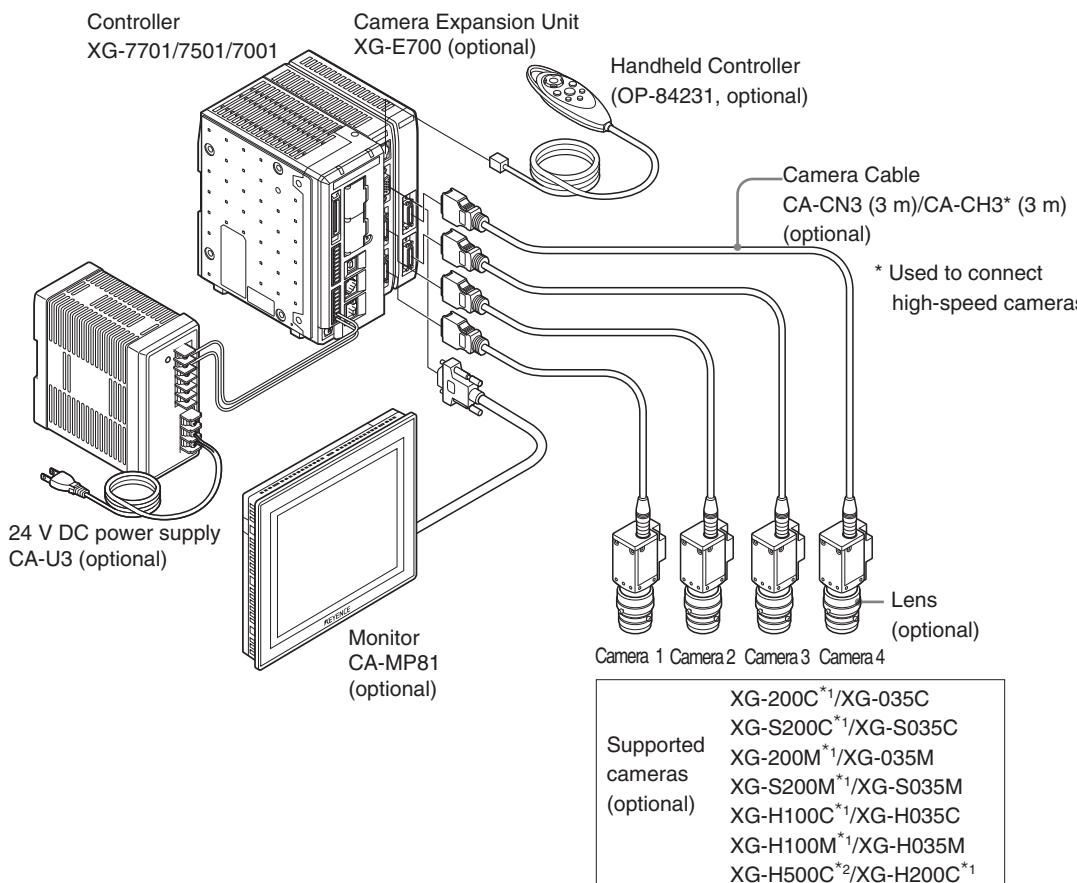
*1 XG-7701/7501 only.

*2 XG-7701 only.

Reference

- Products that can be used with the analog camera-compatible controller XG-7001A 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 7-27) and "Camera Cable (Analog Cameras)" (Page 7-32).

Example of a standard system setup with four cameras



*1 XG-7701/7501 only.

*2 XG-7701 only.

Reference

- Products that can be used with the analog camera-compatible controller XG-7001A 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 7-27) and "Camera Cable (Analog Cameras)" (Page 7-32).

Installing the Controller

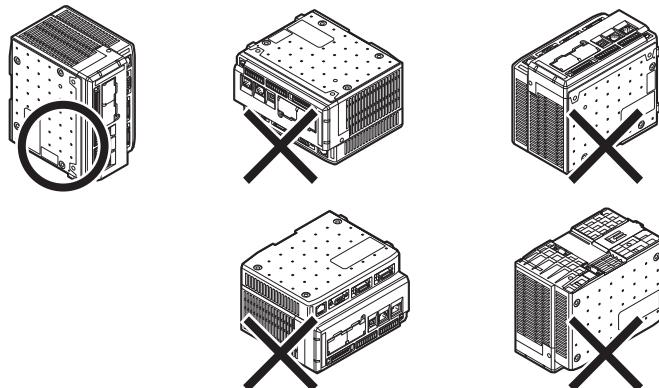
Install the controller to the DIN rail, or use the holes on the bottom of the controller to secure it with screws.

► 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.

Caution on Direction of Controller Mounting

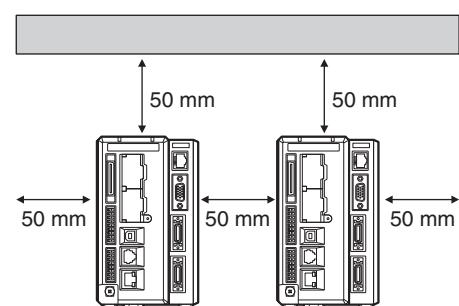
- Install the controller in the direction indicated by the circle shown below. Do not install the controller in any other direction.



- For ventilation purposes, maintain 50 mm or more of space above the controller and 50 mm or more on both sides.

Maintain 90 mm or more of space in front of the connector panel to enable connection of the cables safely.

- When two or more controllers are installed side by side, maintain 50 mm or more of space between the controllers, and 50 mm or more 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 the Expansion Unit

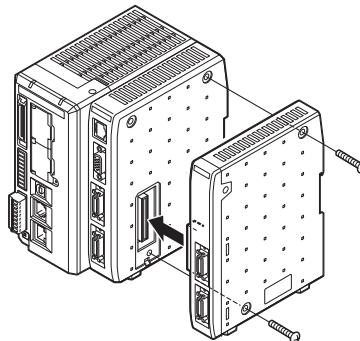
▶ Note

- 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 Unit

Use the camera expansion units (sold separately) XG-E700 (for the XG-7701/7501/7001) or the analog camera expansion unit XG-E700A (for the XG-7001A) to connect three or more cameras.

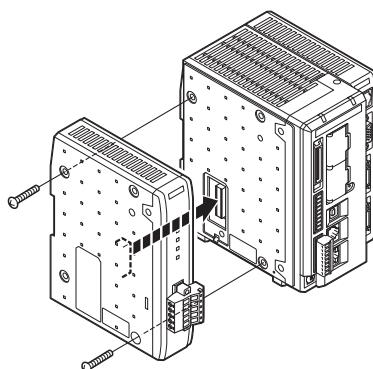
Remove the protective cover from connector 1 on the right side of the controller and install the camera expansion unit as shown below.



Installing the Communication Expansion Unit

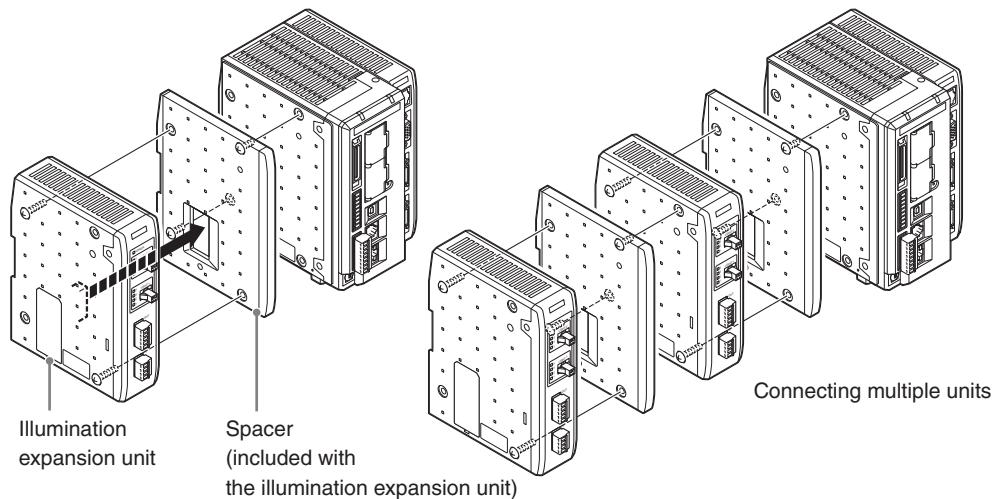
The optional CC-Link unit CA-NCL10E is used when communicating via CC-Link (Page 6-17).

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 Unit

Up to 4 CA-DC20E illumination expansion units 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.

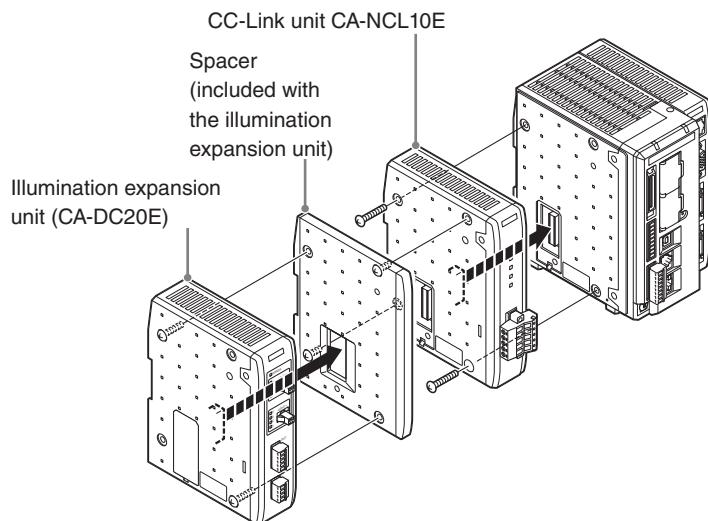


▶ Note

- 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.

When using the illumination expansion unit and CC-Link unit together

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



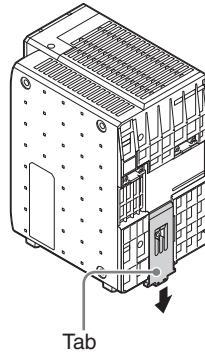
▶ Note

The CC-Link unit 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

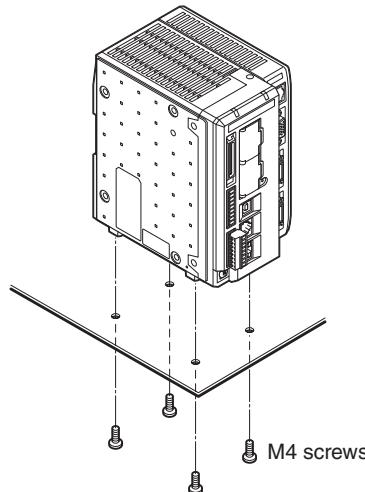
Installing the Controller on a DIN Rail

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.

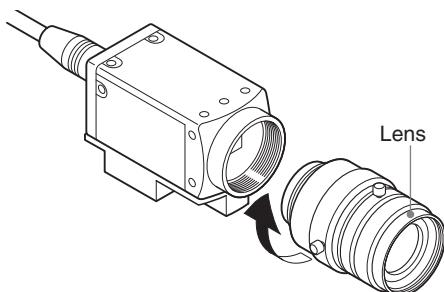
Installing the Camera

⚠ 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

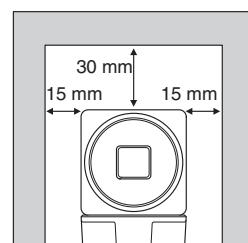
- When installing the camera, use a tightening torque of 0.5 Nm and a maximum tension of 30 N.
- Focus and aperture adjustment (Page 2-33) are necessary upon completion of installation. Leave enough space around the lens to ensure easy adjustment of the focus and aperture.
- If the camera is mounted 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.

Warning on installation space for the camera

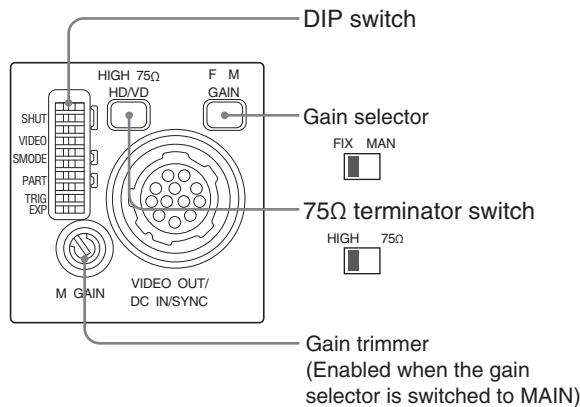
When installing the camera, maintain 30 mm or more of space above the camera and 15 mm or more on both sides.



Changing the DIP switches on an analog camera

When connecting an analog camera to the analog camera-compatible controller XG-7001A, 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 setting of the DIP switch positions are indicated by the ■.

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.

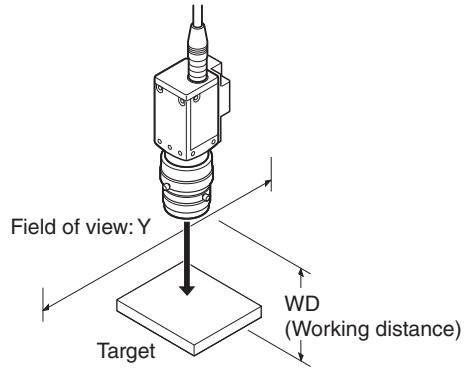
Image sensing	Capture range	Bit 7	Bit 8
Progressive	640 x 480	OFF	OFF
	640 x 210	OFF	ON
	640 x 70	ON	ON
Interlaced	640 x 480	OFF	OFF
	640 x 140	OFF	ON
	640 x 50	ON	ON

▶ 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 the 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.



Confirm the Working Distance from the FOV 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.

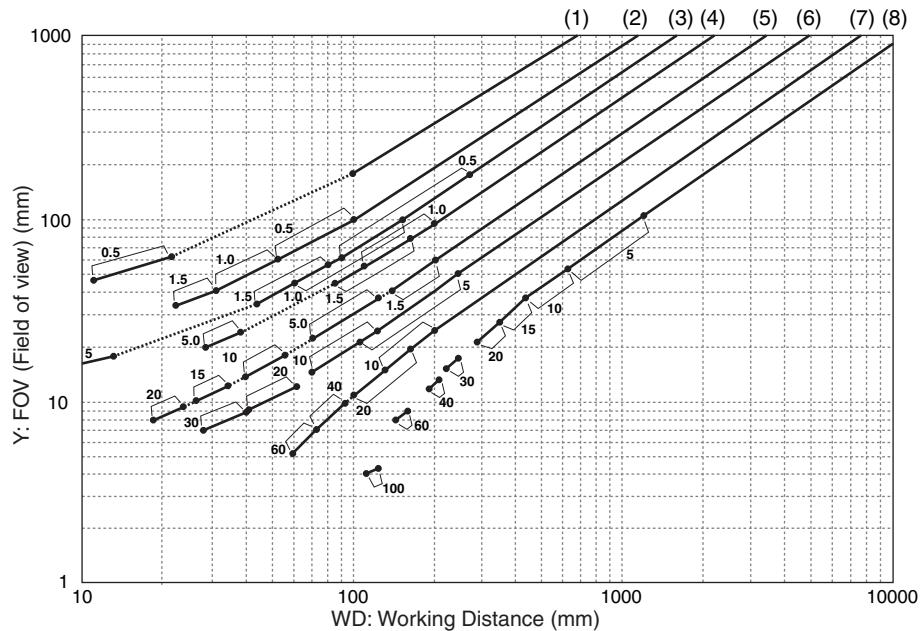
► Note

The numerical numbers shown in the FOV chart are typical values. The values must be fine tuned when installing the camera.

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.

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

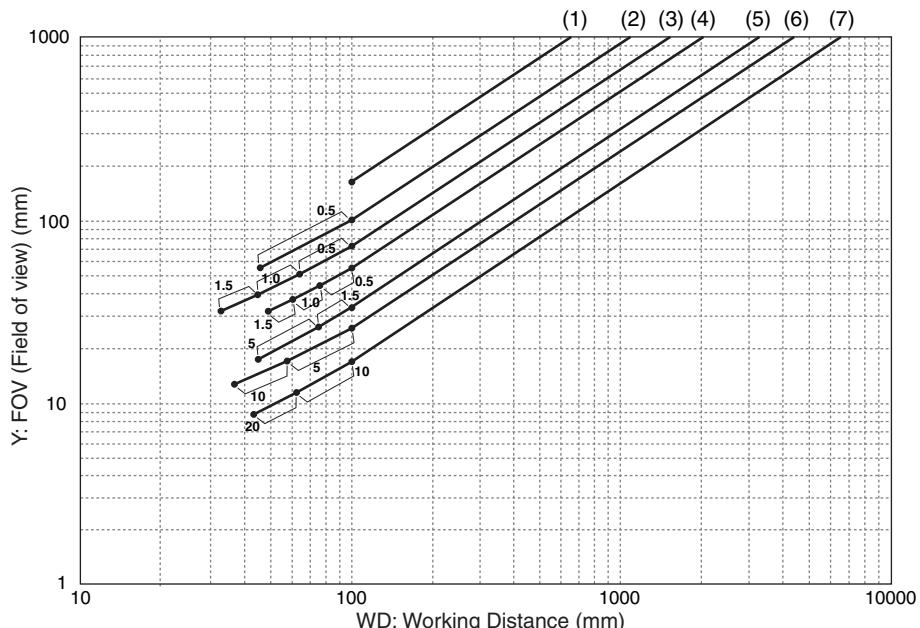


(1) CA-LH4 (2) CA-LH8 (3) CA-LH12 (4) CA-LH16 (5) CA-LH25 (6) CA-LH35 (7) CA-LH50 (8) CA-LH75

► Note

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

High-resolution, low distortion lens (CA-LHR*): Using 2432 x 2050 pixels

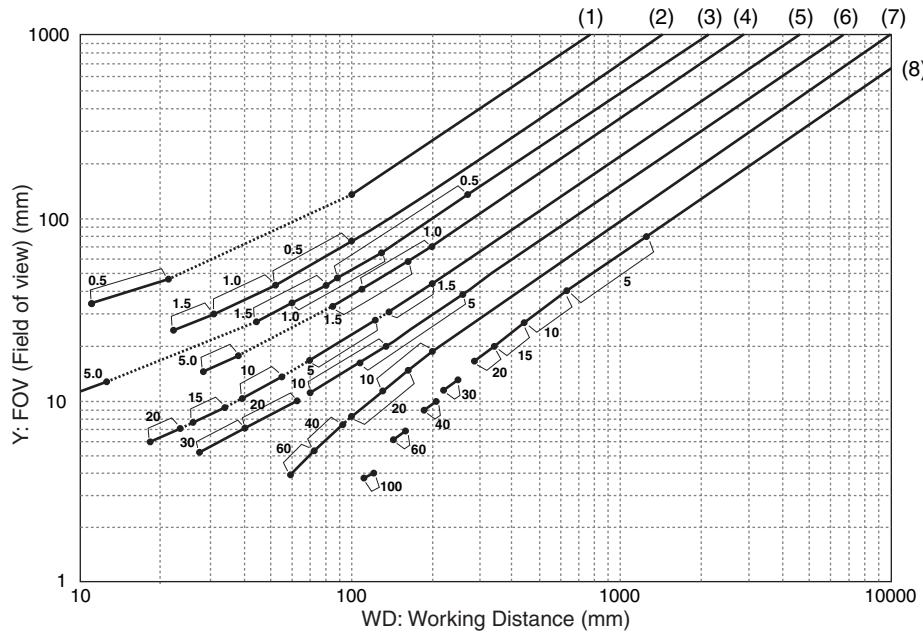


(1) CA-LHR5 (2) CA-LHR8 (3) CA-LHR12 (4) CA-LHR16 (5) CA-LHR25 (6) CA-LHR35 (7) CA-LHR50

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

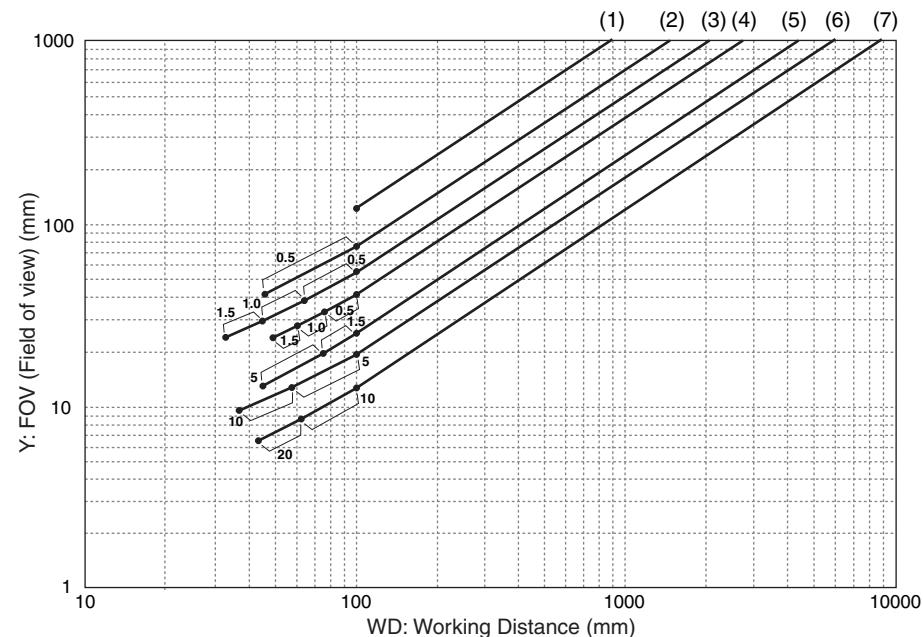
When using the CA-LH16 on the XG-200C at 2 megapixel mode with a required FOV of 40 mm, the chart shows that the working distance should be set to 100 mm and the 1.5 mm close-up ring should be used.

Low distortion lens (CA-LH^{*}): Using 1600 x 1200 pixels (2 megapixel mode)

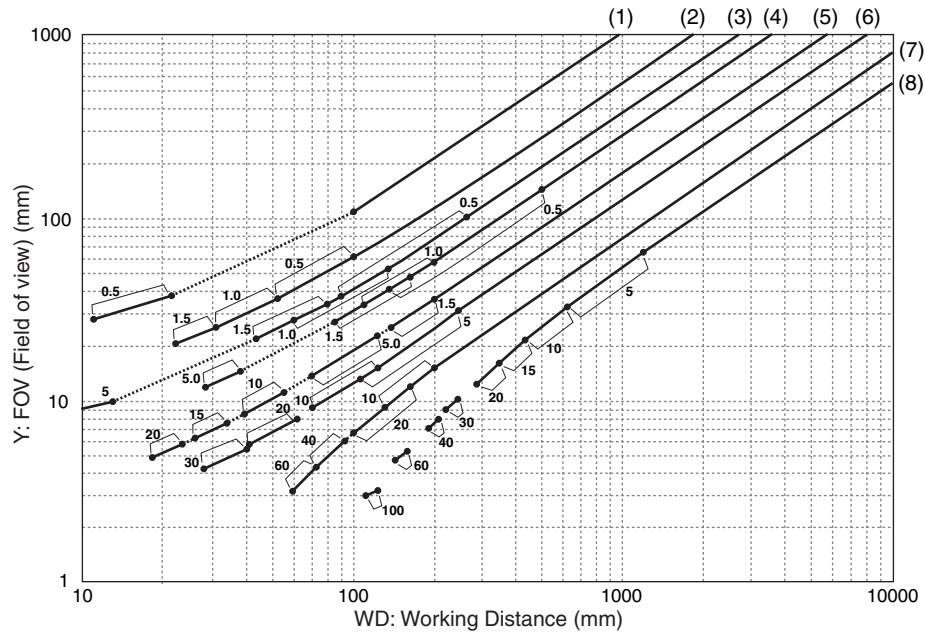
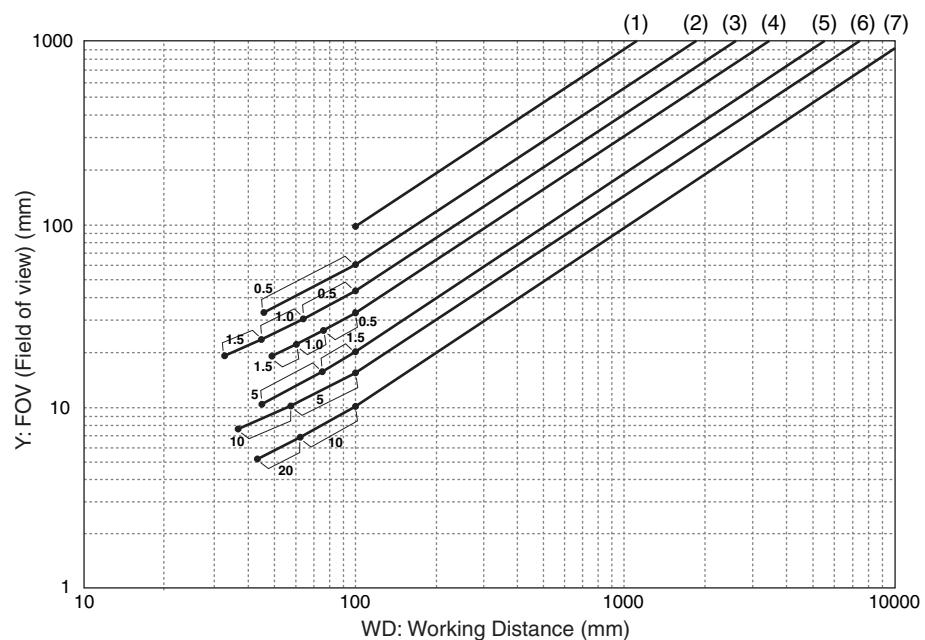


(1) CA-LH4 (2) CA-LH8 (3) CA-LH12 (4) CA-LH16 (5) CA-LH25 (6) CA-LH35 (7) CA-LH50 (8) CA-LH75

High-resolution, low distortion lens (CA-LHR^{*}): Using 1600 x 1200 pixels (2 megapixel mode)

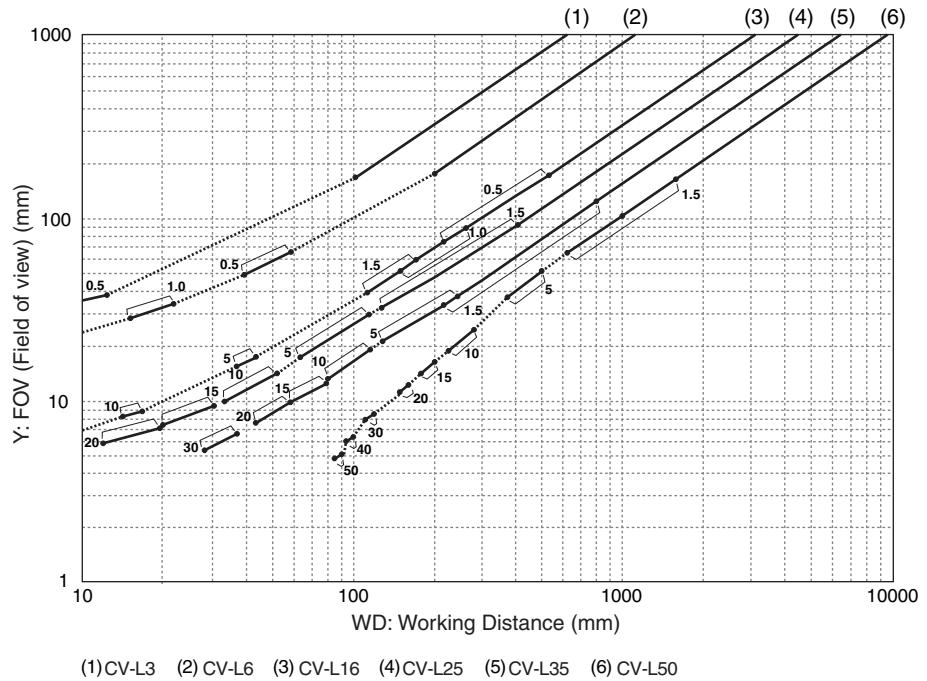


(1) CA-LHR5 (2) CA-LHR8 (3) CA-LHR12 (4) CA-LHR16 (5) CA-LHR25 (6) CA-LHR35 (7) CA-LHR50

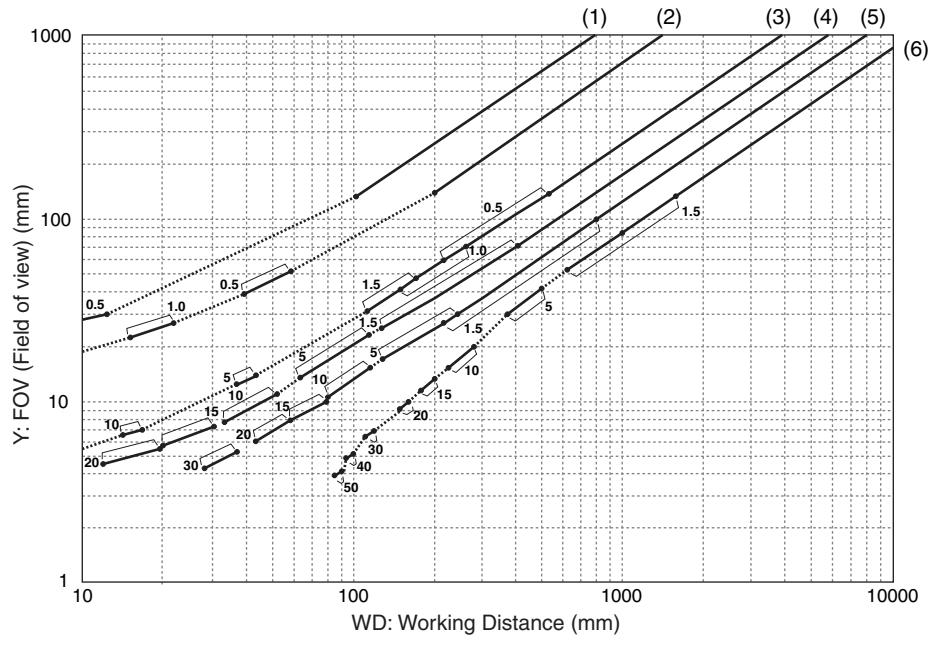
Low distortion lens (CA-LH^{*}): Using 1024 x 960 pixels (1 megapixel mode)

High resolution, low distortion lens (CA-LHR^{*}): Using 1024 x 960 pixels (1 megapixel mode)


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

Standard lens (CV-L^{*}): Using 1600 x 1200 pixels (2 megapixel mode)

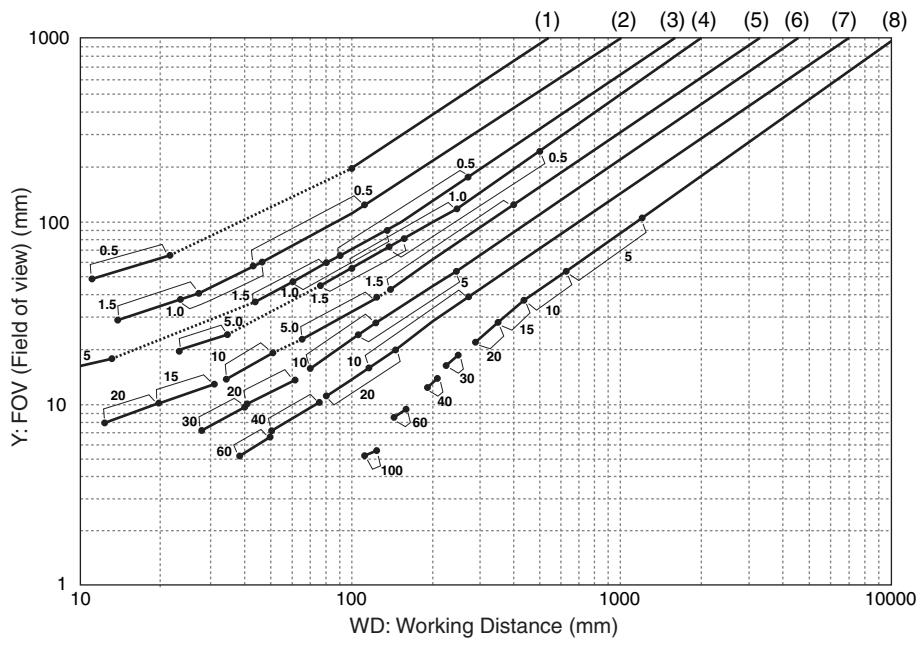


Standard lens (CV-L^{*}): Using 1024 x 960 pixels (1 megapixel mode)



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

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



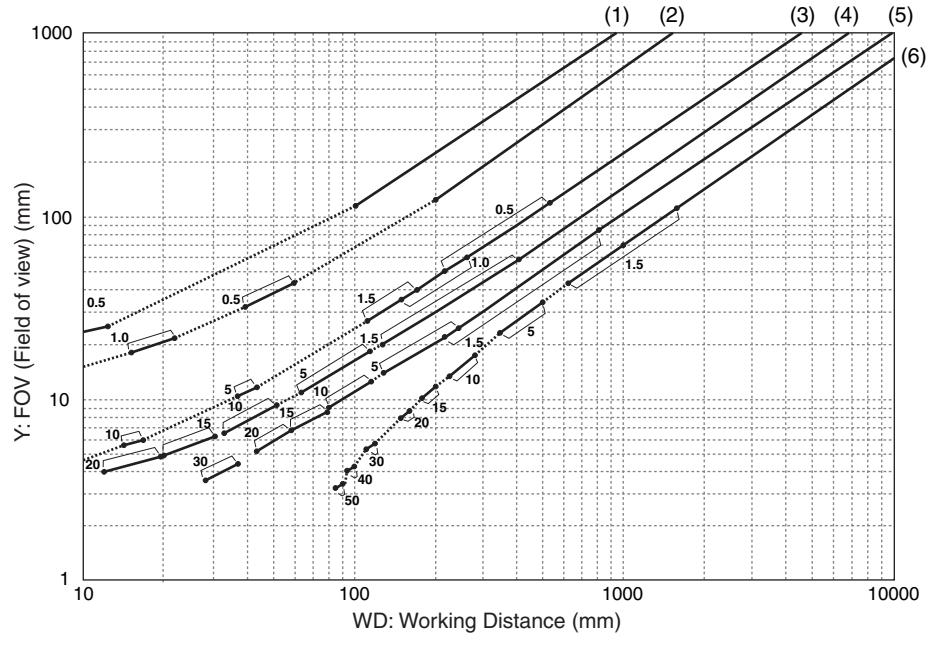
(1)CA-LH4 (2)CA-LH8 (3)CA-LH12 (4)CA-LH16 (5)CA-LH25 (6)CA-LH35 (7)CA-LH50 (8)CA-LH75

► Note

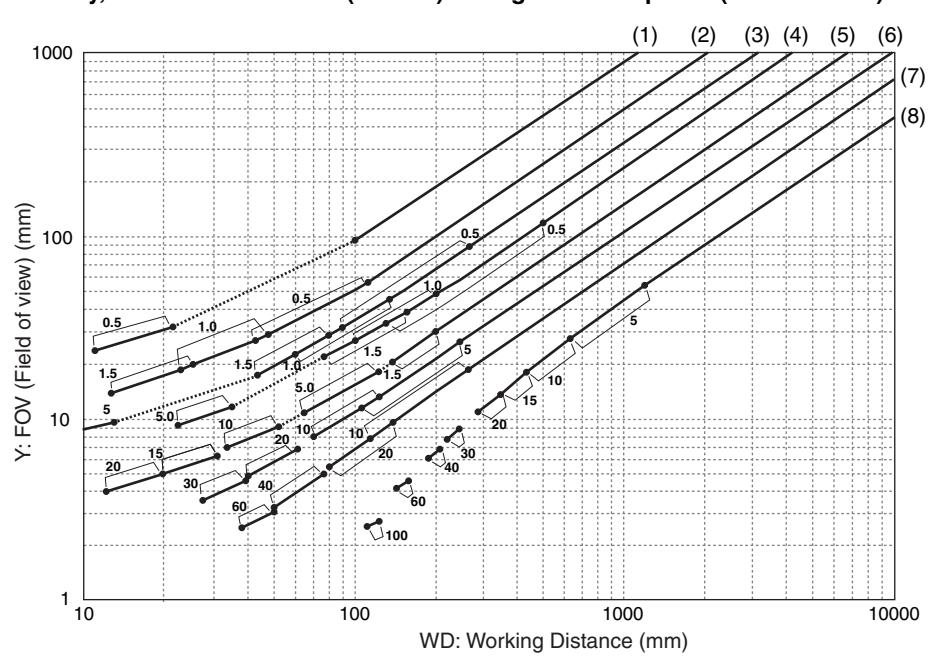
The standard CV-L lens cannot be used with XG-H100C/XG-H100M high-speed 1 megapixel cameras due to vignetting.

Using a Double-speed Camera (XG-035C/XG-H035M), or a High-speed Camera (XG-H035C/XG-H035M), or an Analog Double-speed Camera (CAM20)

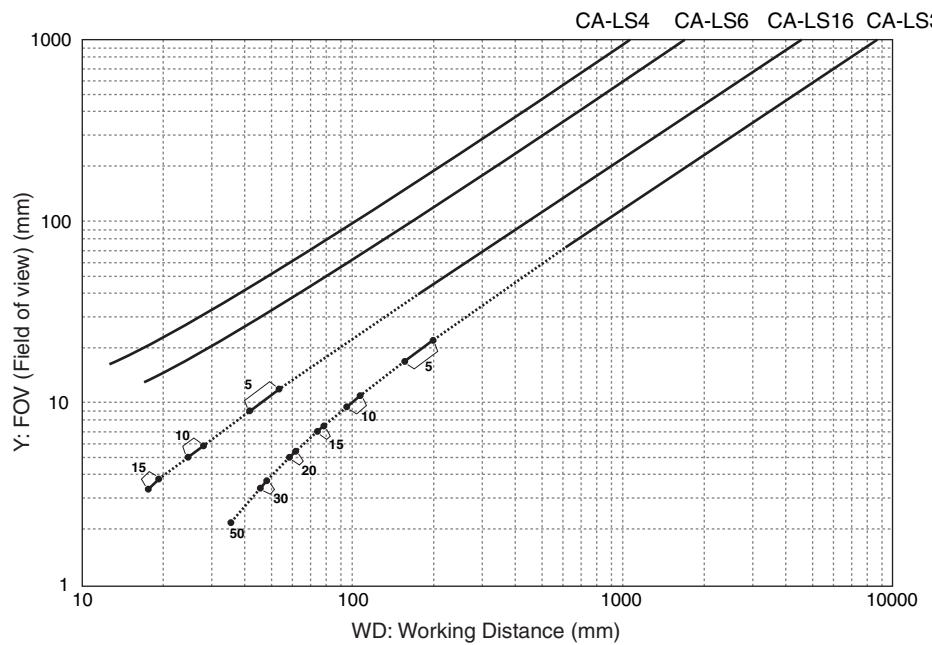
Standard Lens (CV-L*): Using 512 x 480 pixels (default mode)



High Accuracy, Low distortion Lens (CA-LH*): Using 512 x 480 pixels (default mode)



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

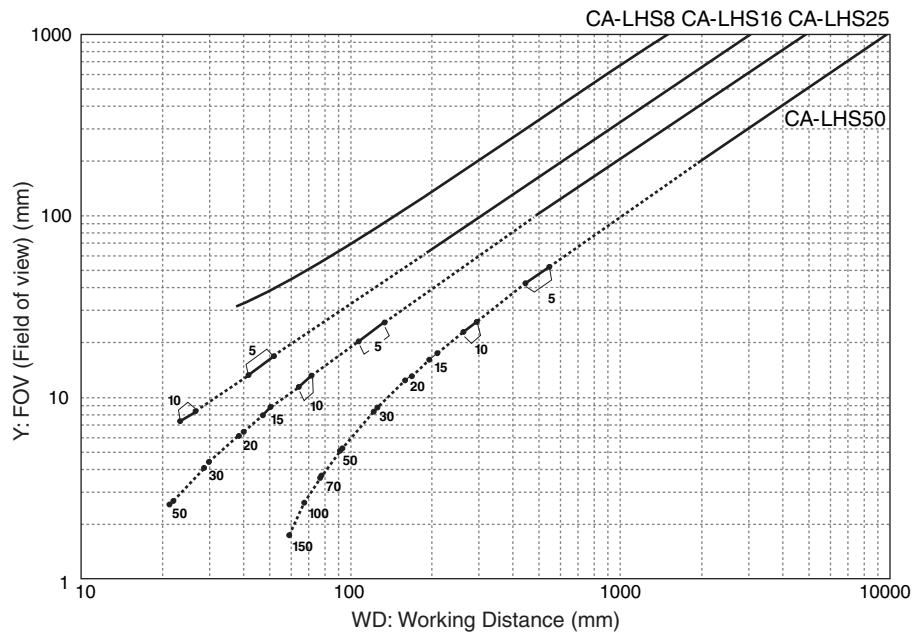


► Note

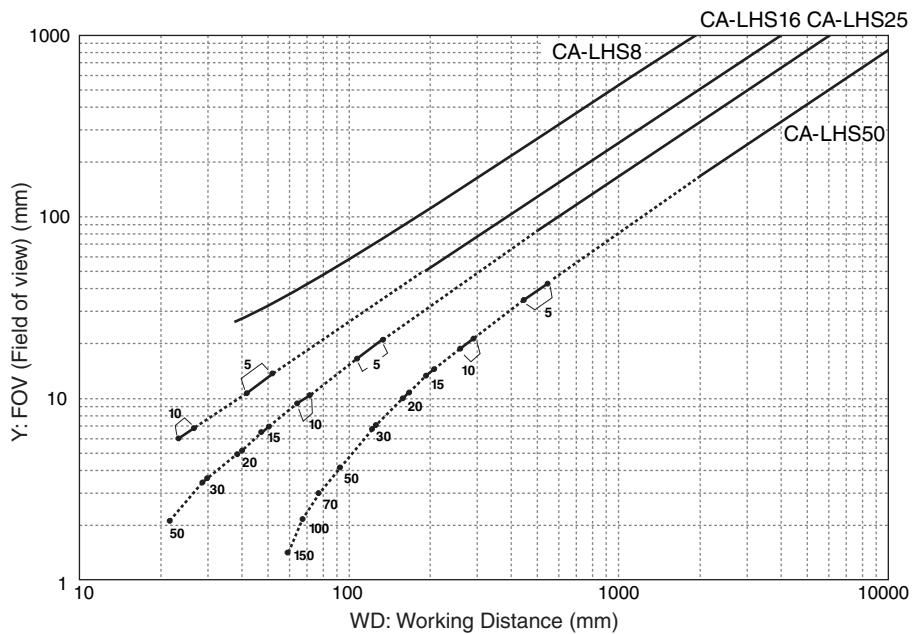
- The numerical numbers shown in the FOV chart are typical values. Adjust the settings as required when installing the camera.
- For more information on installing and adjusting ultra small cameras, refer to the instruction manual provided with the camera.
- When attaching the side view attachment OP-51503,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

For XG-200C/200M/H200C/H200M/035C/035M/H035C/H035M/Analog cameras (CA-CM20)

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

For XG-H500C/H500M/200C/200M/H200C/H200M/H100C/H100M/035C/035M/H035C/H035M/Analog cameras (CA-CM20)

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) to 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 (Page 5-12) is positioned at the edge of the CCD while using the macro lens.

Reference

- When calculating the field of view of a macro lens, use the following equation.
Field of view (mm) = CCD size (Y) / optical magnification
For example, when using a XG-035M with a CA-LM2, 3.6 (the CCD size) / 2 (the optical magnification) gives a field of view of 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 / CA-CM20	3.6 mm
XG-H100C / XG-H100M	7.4 mm
XG-H500C / XG-H500M	7.1 mm

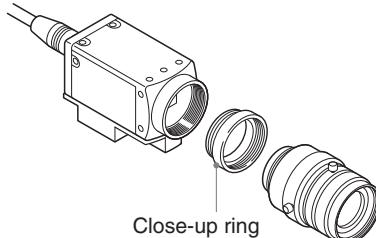
- The optical magnification is based on the optical design value. Individual variability will occur depending on installation.

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

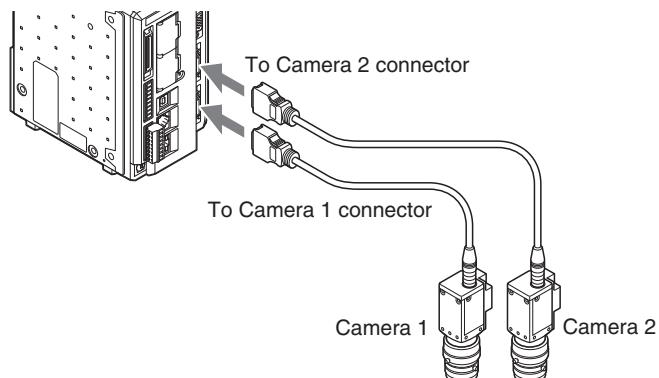
Connecting Cables

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 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.

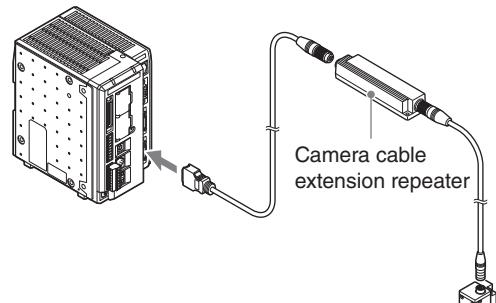


▶ Note

- Camera cables CA-CN17, CA-CN17L, and CA-CN17R can only be used to connect the XG-035C and XG-035M.
- The CA-CH* camera cables can only be used with the high speed camera XG-H**** series.
- Do not connect the CA-CH cable to other cameras. Doing so may result in malfunction. When using the analog camera-compatible controller XG-7001A, 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 7-27) and "Camera Cable (Analog Cameras)" (Page 7-32).
- For more details on analog camera models that are supported by this controller, see "Main Specifications" (Page 7-2).

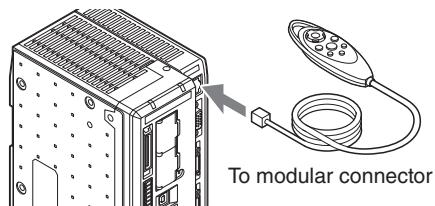
Using the camera cable extension repeater

Camera cables can be extended by using the camera cable extension repeater (Page 7-32).

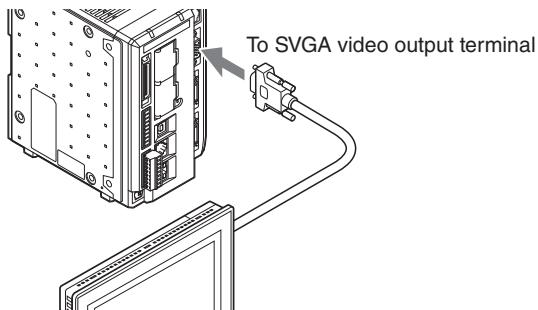


For more information on connection, read the instructions provided with the camera extension repeater.

2 Connect the optional handheld controller (OP-84231 or OP84236) to the modular connector on the controller.



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



► Note

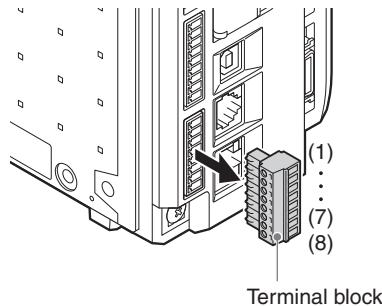
- When using a commercial RGB analog monitor that is not SVGA (800 x 600 pixels) in size, the displayed image quality may degrade and the screen may not appear correctly depending on the specifications of the monitor. (Recommended monitor: CA-MP81)
- When connecting a monitor via the Keyence touch panels VT3 and VT3-VD4, use the dedicated RGB cable (3 m) OP-66842 or RGB cable (10 m) OP-87055. The display may not function properly if a commercial RGB cable is used.

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

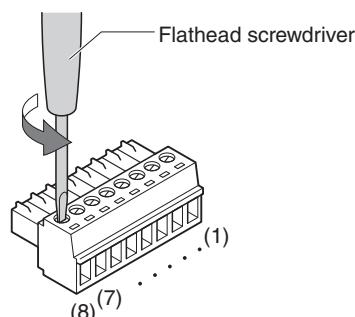
► Note

- 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 24 V DC power source to a type D ground.
- Do not supply power until the installation is completed.

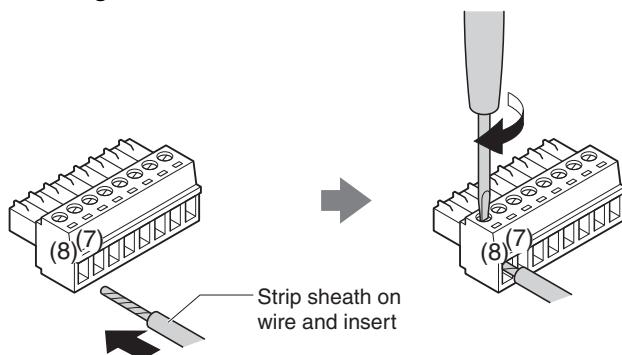
(1) Remove the terminal block from the controller.



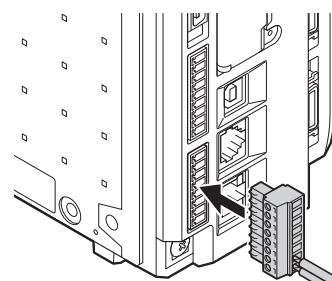
(2) Loosen the screws on the terminals with the flat head screwdriver.



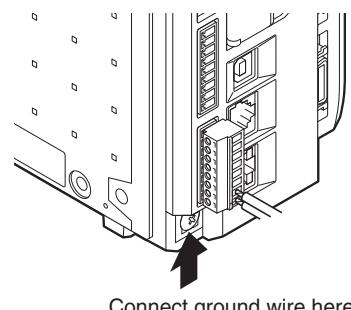
(3) After stripping the insulating sheath 7 mm, insert the wires to terminal No. 7 (24 V DC) and No. 8 (0 V), and then tighten the screws.



(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.

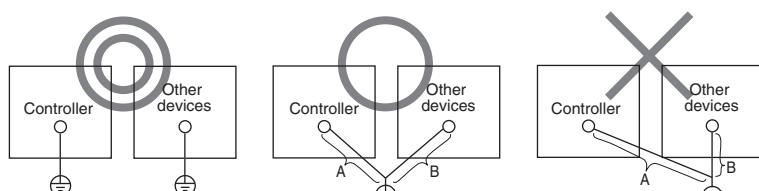
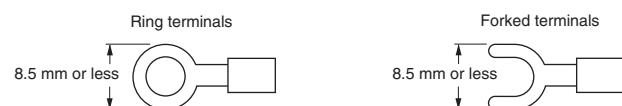


(5) Connect the ground wire to the grounding terminal.



► **Note**

- Ground each device separately.
- Use a D type ground.
- Keep ground resistance under 100 Ω.
- 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 to a torque of 0.8 [Nm].



Ground per Class D
Ground resistance 100 Ω

A = B
Ground per Class D
Ground resistance 100 Ω

A > B
A < B

Selection and Installation of LED lighting

Reference

Up to 8 LED lights can be controlled using the optional illumination expansion unit CA-DC20E. Refer to "Using the Illumination Expansion Unit" (Page 2-27) for more details.

Selecting the Correct Lighting System

Use the correct lighting system to ensure stable inspection

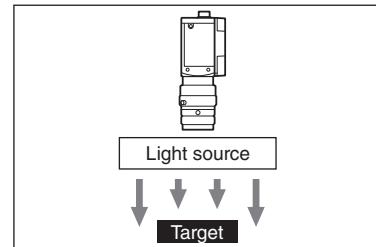
Inspecting in one of the following locations may lead to unstable detection. Relocate the inspection or use a dedicated lighting system.

- 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.

Direct Illumination

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



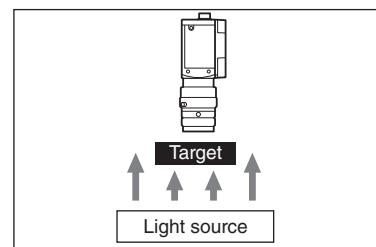
LED Illumination System

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

Backlight Illumination

Illuminates from behind the target.

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



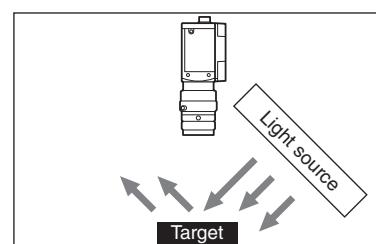
LED Illumination System

Backlight (CA-DS series)

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 light (CA-DB series)

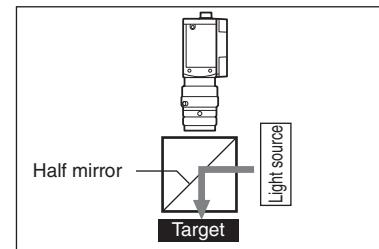
Coaxial Illumination

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 light (CA-DX series)



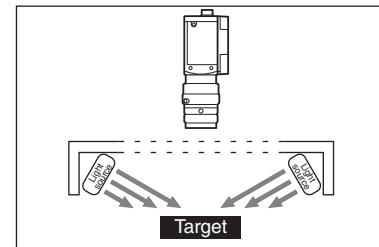
Low-angle Illumination

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 light (CA-DL series)
- Multi-angle light (CA-DR*M/DQ*M series)
- Square bar light (CA-DQ series)



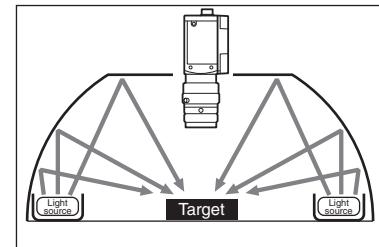
Dome Illumination

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 light (CA-DD series)



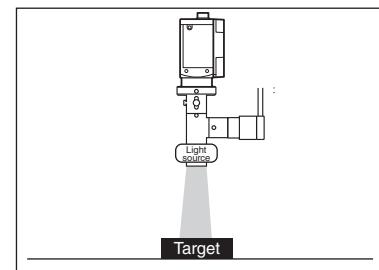
Spot Illumination

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 light (CA-DP series)



Using the Illumination Expansion Unit

Precautions and wiring when using the optional illumination expansion unit CA-DC20E are explained here.

Usage precautions

▶ Note

- For more details on general precautions for the illumination expansion unit, see "Safety Precautions" (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 24 V DC. 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.
- Observe the following instructions when using LED units categorized as a Class 1M LED product in accordance with the IEC60825-1/JIS C 6802.
 - Do not look directly at the beam of LED optical equipment.
 - Eye injury may occur when LED output is observed with certain optical equipment (such as a loupe, magnifier, or with a microscope) within a distance of 100 mm.

Terminal Block Interface

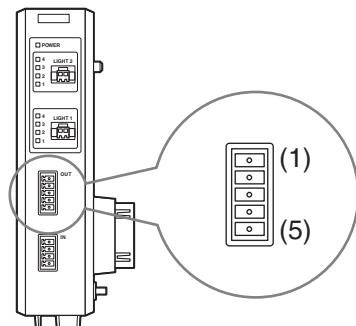
The following section details the terminal block specifications for the illumination expansion unit (CA-DC20E).

► Note

Tightening above the standard torque may cause damage to the terminal block.

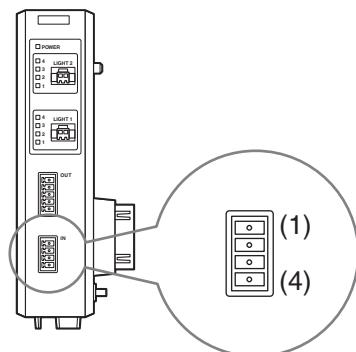
OUT Connector

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



IN 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	Usage
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

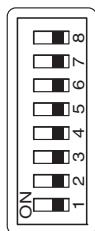
- Connecting a 12 V DC illumination unit to an output terminal at 24 V DC may cause fire, electric shock, or damage to the controller and user operating the unit.
- Ensure that the DIP switch located on the right side of the unit is configured correctly for the illumination being connected.
- IN Connector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

No.	Signal (terminal block display)	Signal Description	Usage
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	0V (0V)	- ve power supply input (0 V)	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 setting of the DIP switch positions are indicated by the ■.



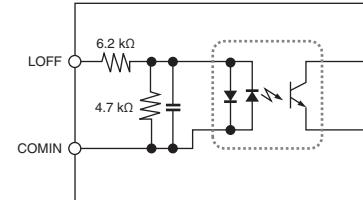
Bit								Output voltage
1	2	3	4	5	6	7	8	
OFF	OFF	OFF	OFF	-	-	-	-	Light 1: 12 V
ON	ON	ON	OFF	-	-	-	-	Light 1: 24 V
-	-	-	-	OFF	OFF	OFF	OFF	Light 2: 12 V
-	-	-	-	ON	ON	ON	OFF	Light 2: 24 V

⚠ Warning

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

Input circuit diagram

- Max. imposed 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.

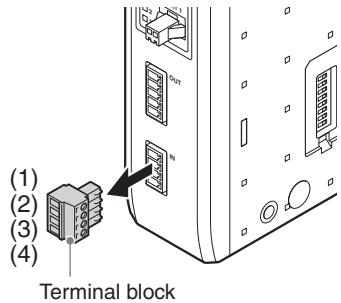
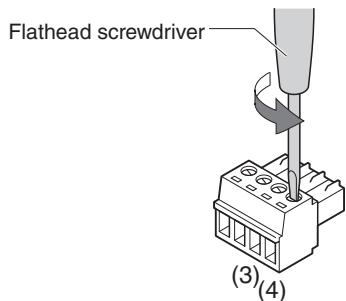
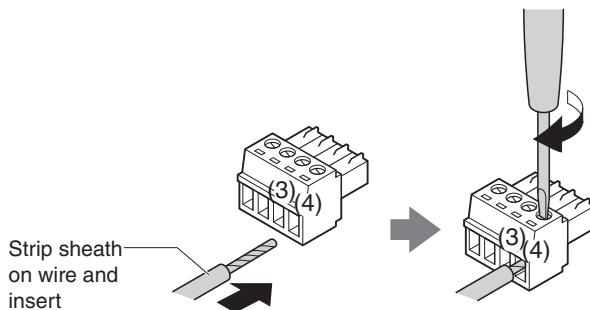
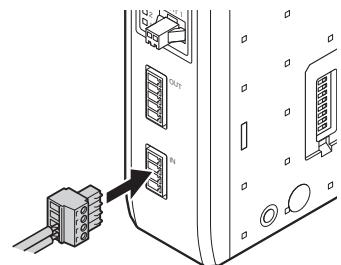
Reference

24 V lights, with different output connector configurations can be connected directly to the terminal block. Refer to "Connector Specifications" (Page 2-28) 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 24 V DC power source to a type 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 appears on the monitor, the initial run mode screen should appear.



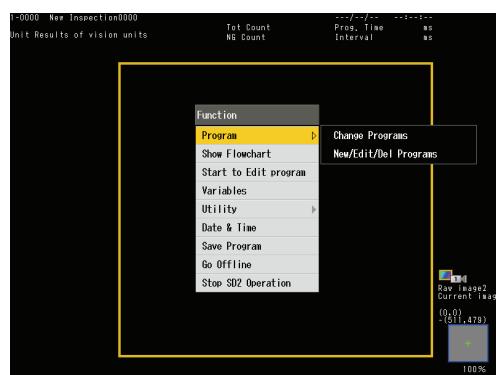
If nothing appears on the monitor

Check the following:

- Are the power input terminals connected correctly?
 - Is a 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, and 60 Hz vertical frequency?

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

The [Function] menu appears.



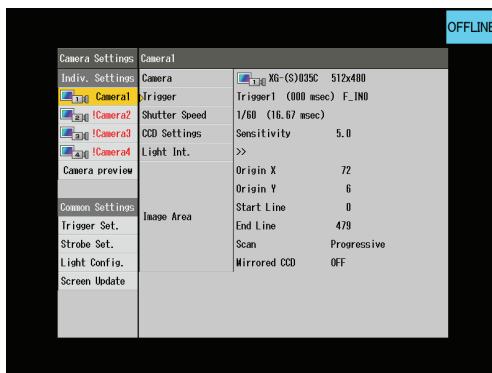
3 Select [Go Offline].

The [System Configuration] menu appears.



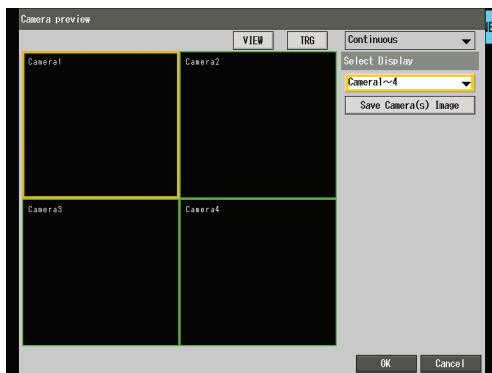
4 From the System Configuration menu, select [Cameras] - [Camera Settings].

The [Camera Settings] screen appears.



5 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]. (Page 5-16)
- You can refresh by pressing and holding 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

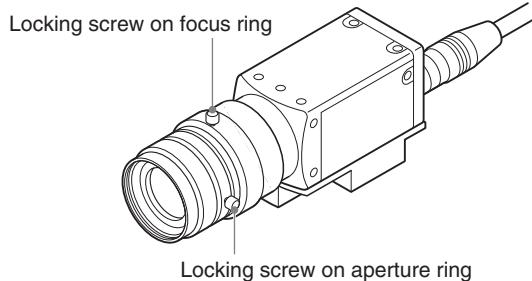
Check the following:

- 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

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

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

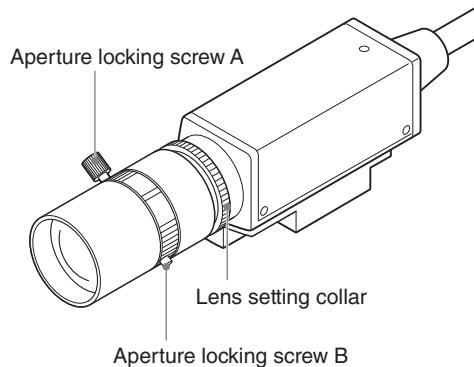


- Adjusting the aperture: Loosen the locking screw on the aperture ring to make the target and the surroundings brighter / darker.
- Adjusting the focus: Loosen the locking screw on the focus ring to sharpen the outline of the target image.

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 system 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

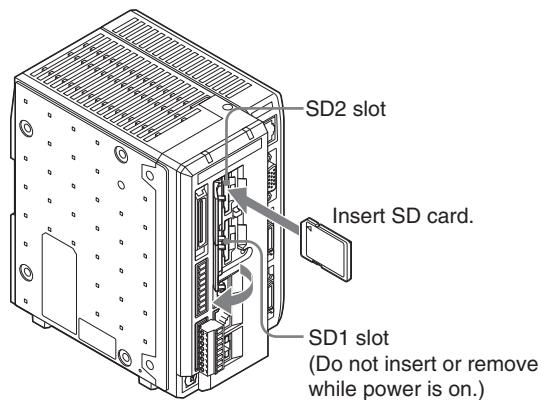
The OP-87133 (512 MB), CA-SD1G (1 GB), and CA-SD4G (4 GB,) from KEYENCE are supported on the controller. Note, the controller ships with OP-87133 (or CA-SD1G for the XG-7701) inserted in the SD1 slot.

► 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.

Inserting an SD Card

Insert an 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 accessible. (The SD card can be removed from the slot.)
- When inserting the SD card into the SD1 slot, turn off the controller. Make sure the SD Card 1 is loaded at startup and when powering up.

Removing an SD Card

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

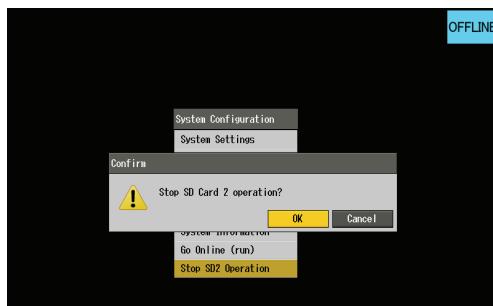
▶ Note

- 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 the power supply stops while the card is being accessed, the file saving 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 (Page 3-2) or System Configuration menu (Page 5-1), select [Stop SD2 Operation].



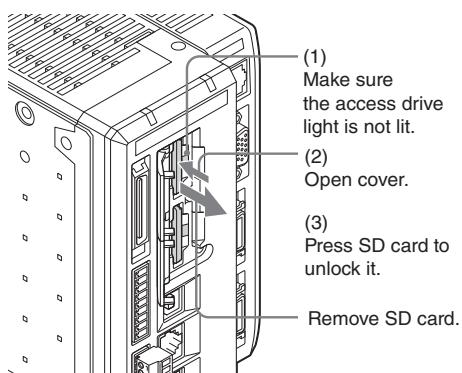
A confirmation screen appears.



2 Select [OK].

The access drive light turns off, indicating that SD Card 2 can now be removed.

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



Reference

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 methods to access the controller from 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: standard RS-232C (Page 6-2) or Ethernet (Page 6-4), PLC Link (Page 6-10), CC-Link (Page 6-17), and the FTP client function (Page 4-317) (which supports historical data output only). 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. 3.0 (XG-H7NE). 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 12) for more details on compatibility.

Integrated Vision Editing Software "XG VisionEditor"

XG VisionEditor is programming software that provides access to all functions on the controller.

XG VisionEditor can create all program files 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"

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



XG
VisionTerminal
Ver.3.0

Main features of the XG VisionTerminal

- Save measurement results and image data output from the controller to the PC.
- Allow remote console operation of the controller (Remote Desktop) while viewing images acquired via communication on the display screen.
- Retrieve files on 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 Interface" (Page 6-4) for more details about the Ethernet interface.

Settings

- Configure the IP address, subnet mask, and default gateway on the controller (Page 5-23).
- 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 6-8) 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 6-9)
- 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	<input type="radio"/>	<input type="radio"/>
Offline mode	<input type="radio"/>	<input type="radio"/>
Remote capture mode	<input type="radio"/>	<input type="radio"/>

► 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.
- See each software manual for more details on controller behavior during connections.

Chapter 3

Run

Basic System Operation

Run

The controller has the following operating modes: Run mode for running inspections, Offline mode (Page 5-1) allow for system changes to be made with the system offline, and Remote capture mode, used exclusively for communicating with the XG VisionEditor.

- Run mode is typically used for changing programs and running vision based inspections. If changes need to be made to any system settings (such as date & time, controller name etc) stop the inspection and switch to Offline mode.
- The only way to switch to Remote capture mode is through the XG VisionEditor software. For more details on the Remote capture mode, refer to the XG VisionEditor Reference Manual.

This section explains the various functions available during Run mode. Refer to "Features Available in Run Mode" (Page 3-2) for an overview of the functions available during operation.

▶ Note

- The handheld controller (OP-84231 or OP-84236) is required to operate the controller directly.
- 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 3-39).
- 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 Global Settings" in the XG VisionEditor Reference Manual.

Features Available in Run Mode

This section provides an overview of the functions available during operation.

For details on how to select and use items or how to enter numerical values and characters, refer to "Basic System Operation" (Page 3-6).

Starting and Ending Inspections

The ability to run an inspection starts automatically by switching the controller to Run mode. Refer to the following for more details.

- Running inspections (Page 3-4)
- Stopping / ending inspections (Page 3-5)

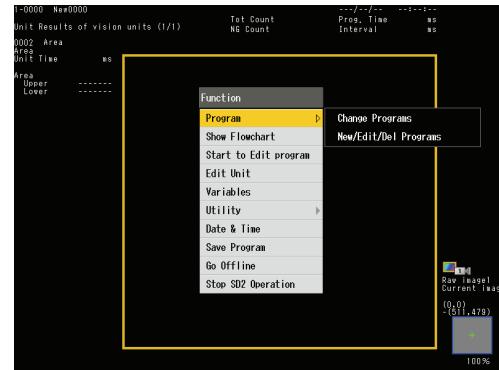
Changing the Screen Display

The VIEW toolbar allows for the user to interact and change the screen displayed (Page 3-9). Refer to the following for more details.

- Using the View toolbar (Page 3-9)
- Zooming in/out of the displayed image (Page 3-9)
- Scrolling the image (Page 3-10)
- Changing units / pages (Page 3-11)
- Changing the displayed image type (Page 3-12)
- Switching between displayed images (Page 3-12)
- Changing screens (Page 3-12)
- Changing the opacity of menus (Page 3-13)

Built-in Functions

The function menu provides access to built in functions of the system. Press the No. 1 (FUNCTION) button on the handheld controller to display the function menu.



Reference

- Some or all function menu operations may be limited by the logged in users account settings (Page 3-39).
- The function menu is not available in Offline or Remote capture mode (Page 3-1).

To close the function menu

Press the No. 1 (FUNCTION) button or the No. 2 (ESCAPE) button.

Function Menu Options

► Note

- The function menu displays different items based on the operating mode of the controller and items currently selected.
- If the controller has been upgraded from a version earlier than 2.1, the systems settings can be configured to display functions specific to version 2.1 in addition to the menu items shown below.

Program

- **Change Programs:** Provides the opportunity to change the program currently running to a user specified program stored on the controller's SD card (Page 3-14).
- **New/Edit/Del Programs:** Displays the [New/Edit/Del Programs] menu for creating, renaming, loading and saving programs. Refer to "Program File Management" (Page 4-320) for more details.

Show/Hide Flowchart

Shows or hides the flowchart. Refer to "Showing/hiding a flowchart" (Page 4-2) for more details.

Program Flow Edit Start/End

Starts or ends the ability to edit the flowchart. Refer to "Editing a Flowchart" (Page 4-1) for more details.

Variables

Displays the [Variables] menu used to define and configure variables. Refer to "Variable Settings (Variables)" (Page 4-306) for more details.

Utility

- **Statistics:** Displays the [Statistics] results menu, which shows measurement results as statistical data using trend graphs, histograms, and other display formats (Page 3-16).
- **Image Archive:** Displays the [Image Archive] results menu, which can be used to check captured images from the inspection process. (Page 3-24).
- **View Files:** Displays the [View Files] menu, which can be used to view, verify and format files on the SD cards used in the controller (Page 3-31).
- **I/O Diagnostic:** Displays the [I/O Diagnostic] screen, which can be used to check the real time status of terminal inputs and outputs on the controller (Page 3-37).
- **RS-232C Diagnostic:** Displays the [RS-232C Diagnostic] screen, which can be used to check the real time status of the RS-232C port data on the controller (Page 3-38).
- **Change Login User:** Gives the ability to change the logged in user (Page 3-39).
- **Modification Logging:** Starts/stops logging operations performed with the handheld controller (Page 3-40).
- **Resources:** Displays the amount of memory (program, image, and processing memory) used by the controller.

Date & Time

Reset the date and time of the controller's internal clock (Page 3-41).

Save Program

Saves the current program (Page 3-42).

Go Offline

Switches to Offline mode (Page 5-1).

Stop SD2 Operation

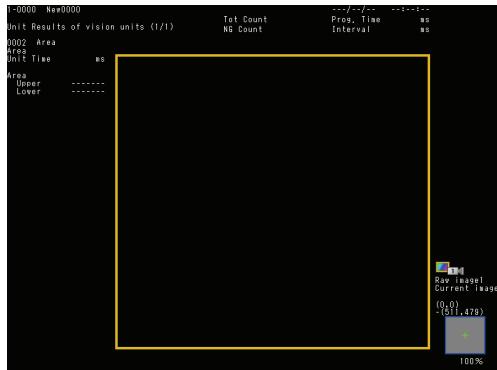
Stops writing to the SD2 card allowing for safe removal (Page 2-34).

Starting and Ending Inspections

Running Inspections

1 Turn on the controller

The controller displays the startup screen, and automatically loads the last saved program file (Page 3-42), ready to start performing inspections in Run mode.



Reference

The controller may be configured to display a modified startup screen or to startup in a different mode.

If the program cannot be loaded

If the specified program file cannot be loaded from the SD card, the controller will display an error message and default to Offline mode. Click [Confirm] on the error screen and choose an option from the following menu.

- **Create a new program:** To create a new program.
- **Go Offline:** Switch to offline mode and show the system configuration menu (Page 5-1).
- **Change Programs:** Change to a different program and go to Run mode.

Note

If a program number is not set or created after initialization (Page 1-9) or the controller is in factory condition, it will start up with program file New 0000.

2 If using an external trigger, input trigger signals.

This starts capture and image processing.

Reference

Depending on settings, the controller may be configured to start capturing and processing images as soon as it is placed in Run mode without the need of an external trigger.

Loading a different program file immediately after turning power ON

The program file loaded when the system is turned on is either the last saved program, or the startup program number specified in XG VisionEditor. To load a different program, switch to that desired program (Page 3-14), save it and then cycle power.

Reference

The file does not need to be saved if the program is being changed by the handheld controller.

Stopping / Ending Inspections

Stopping Inspections

Switching to Offline mode stops the current inspection and displays the System Configuration menu (Page 5-1).

From the Function menu select [Go Offline] (Page 3-2).

The System Configuration menu appears.



When the controller goes offline

- Inspections in Run mode stop.
- Data for the last inspection cycle in progress when the controller is switched is processed and output before going to offline mode.

Resuming Inspections

From the System Configuration menu select [Go Online (run)] (Page 5-1).

The controller will resume inspections using the last program file when the controller was switched to offline.

► **Note**

If the controller cannot find this program file, it will display the Start menu for creating a new or choosing a different program.

Ending inspections

Turn off the controller.

► **Note**

Turning off the controller while it is accessing an SD card may damage and or corrupt the data of the SD card.

Basic System Operation

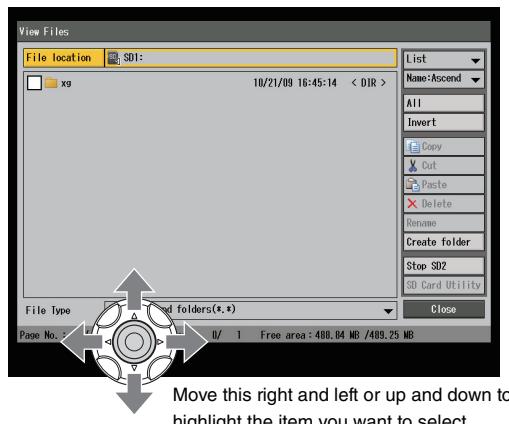
Selecting Items

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.



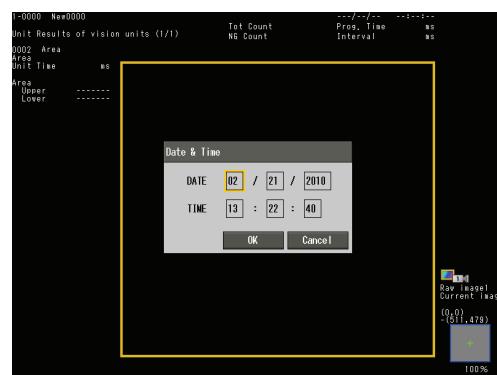
To cancel the operation

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

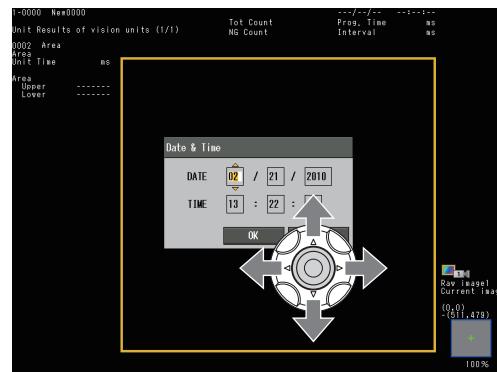
Entering Values

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 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.

Inputting Characters

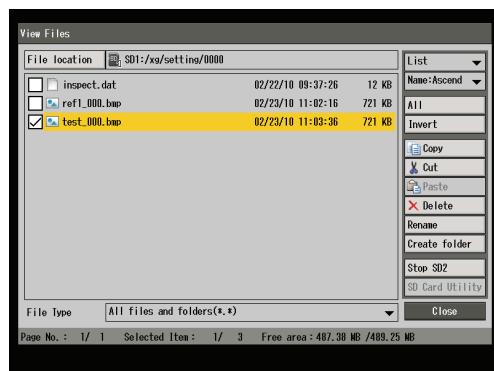
To input text for file names and other settings use the procedure described below. As an example, this procedure explains how to change the file name in the View Files screen (Page 3-31).

1 From the Function menu (Page 3-2) or System Configuration menu (Page 5-1) select [Utility] - [View Files].

The [View Files] menu appears.

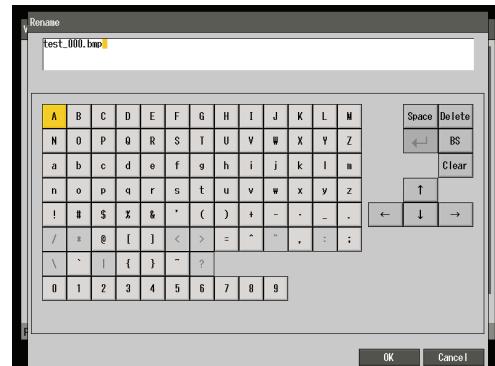


2 Highlight the file to rename and place a check in the check box.



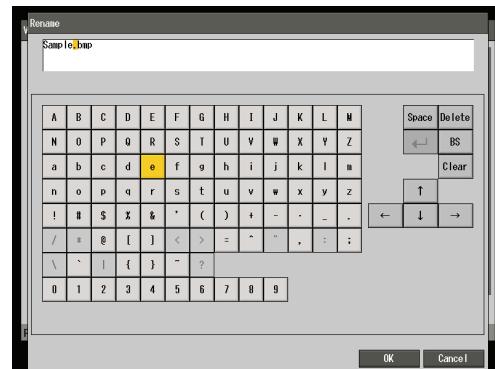
3 Choose [Rename].

The [Rename] menu appears.



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

4 Input "Sample1" one character at a time.



To input characters

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

Entering symbols

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

Inputting a space

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

Selecting and deleting characters

Use the [\uparrow], [\downarrow], [\rightarrow], [\leftarrow] 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

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

Reference

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

5 After entering the text, select [OK].

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

Changing the Screen Display

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

- Zooming in/out of the displayed image (Page 3-9)
- Scrolling the image (Page 3-10)
- Changing units / pages (Page 3-11)
- Changing the displayed image type (Page 3-12)
- Switching between displayed images (Page 3-12)
- Changing screens (Page 3-12)
- Changing the opacity of menus (Page 3-13)

▶ 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.

Reference

- Using the View toolbar during operation does not affect the inspection being performed.
- Changes to the screen using the View toolbar can be saved with the program (Page 3-42) and recalled the next time the controller is turned on. This option can be set in XG VisionEditor. For more details, refer to "Screen Editor" in the XG VisionEditor Reference Manual.

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 and image displays are available the focus can be chosen (Page 3-12) 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 of the Displayed Image

The image displayed can be enlarged or shrunk as desired.

The zoom ratio ranges from 4% ($x^{1/25}$ magnification) to 2500% ($x25$ magnification).

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.

1 Click (Zoom in/out) on the View toolbar.

The  symbol appears on the screen.

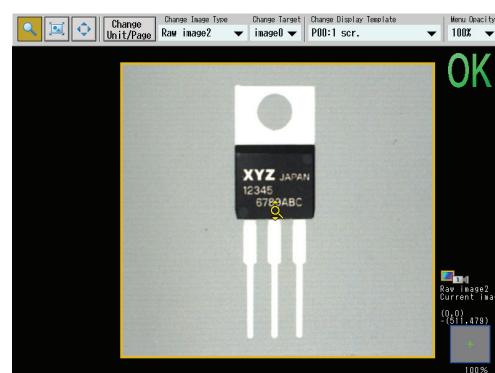
Reference

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

2 Place the over the point of the image to be enlarged.

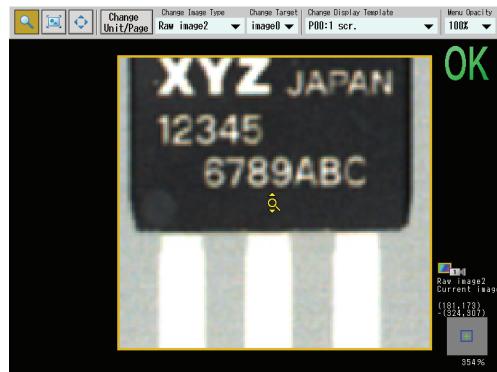
3 Press the No. 0 (ENTER) button.

When the  symbol changes to , then the displayed image can be enlarged or shrunk.



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

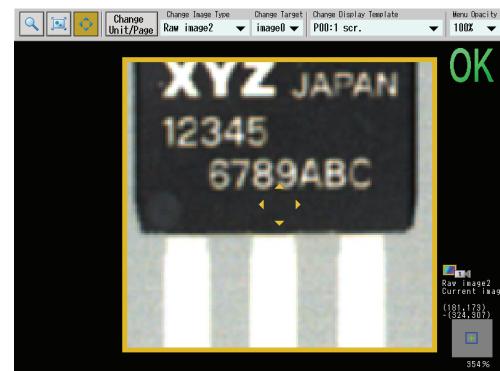
Using the View toolbar during operation does not affect the inspection being performed.

1 Click  (Scroll) on the View toolbar.

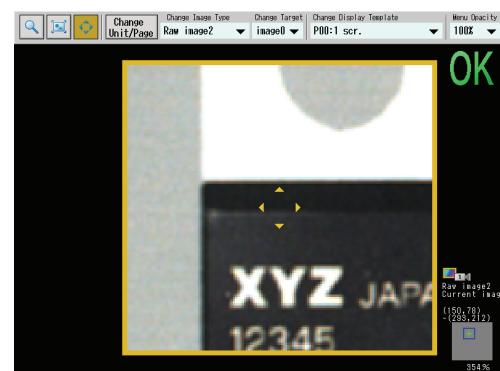
When the  symbol appears on screen, the displayed image can be scrolled.

Reference

If multiple screens and image displays are available the focus can be chosen (Page 3-12) 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 the normal display (no scroll)

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 3-12) 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 image1**: displays the raw image as it is without any regions or processing.
- **Raw image2**: displays the raw image as it is with regions but no processing.
- **Grayed image**: displays the image showing the effects of color extraction in the region for the unit.
- **Filtered img.**: displays the image showing the effects of processing in the region (or full image based on settings) for the unit.
- **Filtered img. 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 img.**: displays a color representation of the distribution of the stain level measured by a stain unit. If the currently selected unit is not a Stain unit, the type displayed is [Filtered img.] for non-ShapeTrax2 units, or for ShapeTrax2 units the [Run feature] (when the current image is the displayed image), or the [Train feature] (when the displayed image is the registered image).

Reference

- If multiple screens and image displays are available the focus can be chosen (Page 3-12) 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 Opacity of Menus

This function can be used to change the opacity of menus and screens so that what is going on in the background 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 opacity can also be changed by pressing the No. 6 (MENU) button on the handheld controller.

Changing Programs

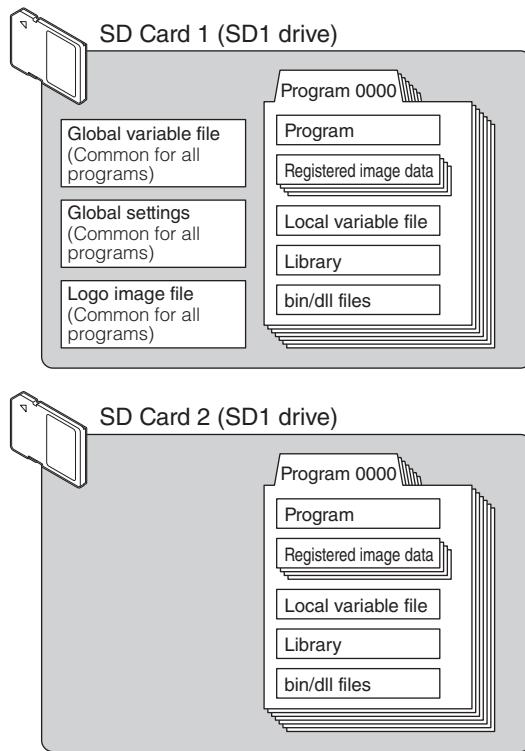
This function allows the change of the running program to a different user specified program stored on an SD card in the controller.

What is a Program?

All the settings required for an inspection including camera settings, inspection regions, limits etc are grouped together in one entity in the controller called a program. This helps by making the organization of everything very easy so that switching programs or performing product changeovers is a simple process.

Data storage on the controller

Each program in the controller is managed and saved in a folder as a group files. This includes the individual program used for image processing, image data, library data, image data, variables and other files.



Note

- SD Card 1 and 2 can individually manage up to 1000 programs from 0000 to 0999, where as the actual number of programs that can be stored depends on the available space of the SD card.
- Removing SD Card 1 will remove the system settings file and prevent the controller from operating properly.
- Make sure SD Card 1 is inserted when using the controller.

Reference

- The systems settings are referenced by all programs in the controller.
- The bin/dll files are used for C Plug In units.

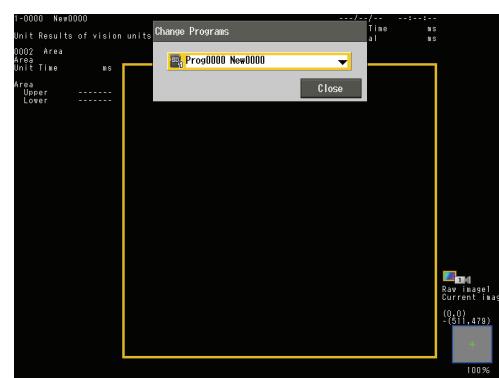
Changing Programs

Note

- Changing the program will stop the inspection in progress and clear all archive and statistics data in the controller's memory. Any unsaved variables being used in the current program will also be cleared and returned to their initial values.
- If data is being output (terminal I/O, data output, image output) when the request to change programs is made the program change is not completed until the data output is finished. Depending on the data being output the output, the program changeover could take up to a minute. During this time, the controller will be inoperable. For more details, refer to "Output Unit" in the XG VisionEditor Reference Manual (Programming Edition).
- During the program change, the controller will read from and write to the SD card where the program data is stored. The flash memory used as in the SD card has a read/write life. Corruption and or loss of data may result if programs are frequently changed. It is strongly recommended that data stored on the SD card is backed up regularly to other storage media.

1 From the Function menu (Page 3-2) select [Program] - [Change Programs].

The Change Programs menu appears with the current program selected.



Reference

- The icon to the left of the program indicates the program is stored on either SD Card 1 or SD Card 2.
- SD Card 1 and SD Card 2 can individually manage up to 1000 programs from 0000 to 0999. Where as the actual number of programs that can be stored depends on the available space of the SD card.

2 Select the program to change to from the pull down menu.

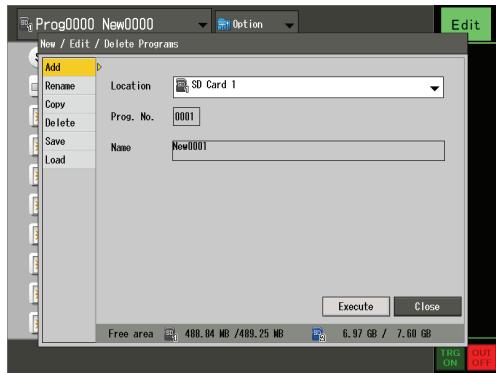
The controller changes to the selected program.

Reference

Program changes can also be made via an external command.

Additional Program Management Functions

The functions listed below are accessed by selecting [Program] - [New/Edit/Del Programs] from the function menu (Page 3-2).



- Adding a new program (Page 4-320)
- Renaming a program (Page 4-321)
- Copying and deleting programs (Page 4-322)
- Saving and loading programs (Page 4-323)

For further details refer to the noted pages.

Statistics

Any of the data used or generated from the running of a program and inspection of parts can be recorded for later viewing and analysis through the [Statistics] option in the XG Vision Editor or Edit mode on the XG-7000 controller. In Run mode the items identified for collection can be viewed in real-time, while also allowing for changes to be made directly to upper and lower limits. At the same time any images stored in the image archive can also be directly referenced and viewed based on the statistical analysis. Statistics provide useful information for many allowing the verification of optimal tolerance levels in a test run as well as the checking, configuring and fine tuning of settings during production.

► Note

- The [Statistics] screen cannot be displayed while the XG VisionEditor or any other program is accessing the image archive data.
- The maximum number of statistical data points that can be recorded per item is 100'000. If the data exceeds the preset limit the oldest data is overwritten.
- Up to 256 items can be recorded at one time. If the items being recorded contain multiple targets the primary target data is used.
- Only the results generated during the Run mode are recorded.
- Recorded statistical data is deleted in the following situations.
 - When the controller is turned off
 - When the controller is reset
 - When changing programs
 - When the current program is overwritten via an external command
 - When selecting [Clear] on the [Statistics] screen.
 - When the Statistics Data Clear command is executed.
 - When the operating mode is changed to Remote capture mode
 - When opening the camera settings or white balance settings in Offline mode
 - When editing the targets for statistical analysis or criteria for image archiving
- The statistical data can be viewed during Run mode without affecting image processing, however the refresh rate for the [Statistics] screen maybe slower depending on runtime conditions.

Specifying Items to be Recorded

To store statistical results on the controller and during simulation, specify items to gather data from beforehand.

Reference

- Up to 256 items can be recorded at one time.
- The statistical analysis function records the results when the program execution reaches the end unit. Thus results for a unit processed multiple times in a loop will be the value from the last execution.

► Note

Specifying items for statistical analysis consumes program memory space.

1 From the function menu (Page 3-2), select [Start to Edit program].

A confirmation screen appears.

2 click [OK].

The options menu is now available for setting up the statistics function.

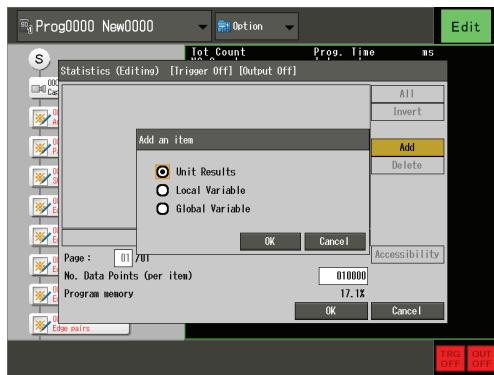
3 From the [Option] menu, select [Statistics].

The [Statistics] screen appears.



4 Click [Add].

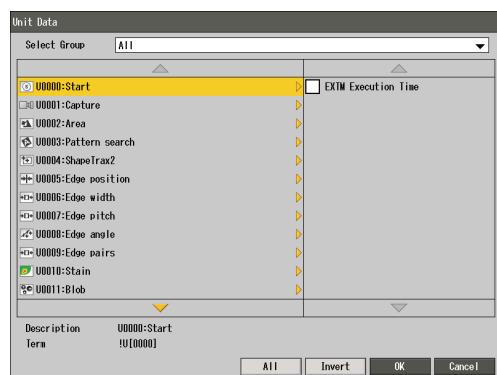
The [Add an item] menu appears.



5 Choose the item type, then click [OK].

A menu to select items and data from for the item type selected appears.

Example shown for [Unit Results]

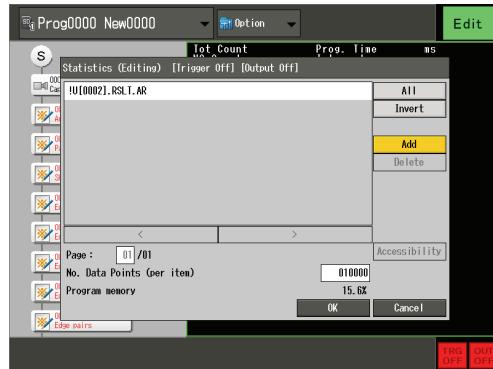


▶ Note

Groups can not be selected for statistical analysis.

6 Select the desired item and data, then click [OK].

The unit data or variable is added to the list of statistics, and the display returns to the [Statistics] screen.



Reference

An item in an array can also be specified by including the index number.

7 Make changes to the controller's statistical processing [Statistics] screen (Page 3-18) as required.

Accessibility

The accessibility to changing upper and lower limits on the controllers [Statistics] screen can be set for each user group (UG0 to UG4).

Highlight the item to set the accessibility for and click [Accessibility]. In the [Accessibility] menu, remove the checks for user groups that should not have access to the limit values.

No. Data Points (per item)

Specify the number of data points (from 10 to 100000) to be collected by the statistics function.

- The statistics will set aside as many data points as required to collect all the data.
- When the data exceeds the preset limit, the oldest data will start to be overwritten.

8 Click [OK].

Deleting statistical items

In the [Statistics] screen, select the measured values or variables to delete and click [Delete].

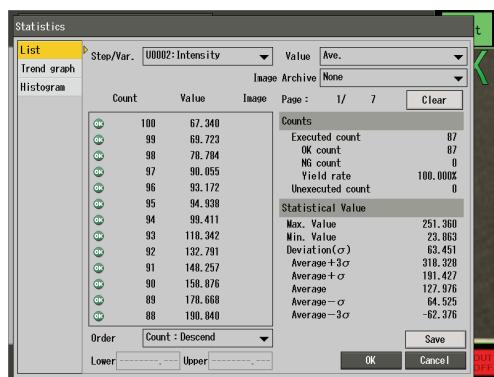
Displaying Statistics (List)

The list view displays the results of items that have been selected for statistical processing.

- Here statistical summary data such as OK/NG counts, standard deviation of each item can be seen and saved to an SD card.
- The cause of rejects can also be analyzed by checking the data against the image archive.
- Upper and lower limits can also be optimized based on the statistical data.

1 From the Function menu select [Utility] - [Statistics].

The [Statistics] result screen appears.



2 Select [List].

The list screen appears.

3 From the drop down menu select the data to see the summary for.

The selected measurement values appear.

► Note

The list does not show data for items not specified for statistical analysis.

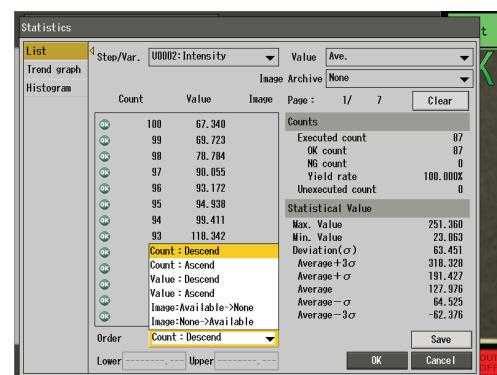
4 To view the details for each recorded value move the cursor to the item in the list.

- To change pages, use the 8-way key right and left with the list selected.
- If a NG has occurred, a NG icon appears to the left side of the [Count] column. If the item is OK or no limit is set, an OK icon appears.

Reference

- Data that cannot be processed is handled as follows.
 - 0 appears in the value column in the list (except for stain measurements which appear as "9999999").
 - Results in the [Counts] group reflect the judgment settings specified for data that cannot be measured.
 - Calculations in the [Statistical Value] group do not include items that cannot be measured.
- Unexecuted units are handled as follows.
 - The [Value] column in the list displays "-----".
 - No OK or NG icon is displayed.
 - Calculations in the [Statistical Value] group do not include items that cannot be measured.

5 To sort the displayed order by inspection number, value, or presence of an image, select [Order].



- **Count: (Descend/Ascend):** Displays the list in order (ascending or descending) by inspection number.

- **Value: (Descend/Ascend):** Displays the list in order (ascending or descending) by the size of the value.

- **Image: (Available→None/None→Available):**

Displays the list in order giving priority to items with a recorded image.

6 To display the associated image, select the appropriate image archive from [Image Archive]. Then use the data summary to choose which image based on the image flag type, "*" or "+". "*" indicates the image was recorded as it matched the image archive criteria, and "+" indicates the image was recorded as part of a multiple archive series (Page 3-28).

- Select an item that has an image flag and press the No. 0 (ENTER) button to display the images.
- When the image is displayed, move the 8-way key left and right while holding down the No. 1 (FUNCTION) button to scroll through additional images and data in the image archive.
- To exit replay mode, press the No. 2 (ESCAPE) button.

► Note

- If the [Image] column does not contain any image flags, there are no images associated between the statistical and image archive data.
- When continuously recording images during Run mode, the image archive updates after the images have been recorded. Thus images may not yet be recorded even if the item shows an image flag.
- If no image archive criteria has been set, no image flags will appear during Run mode.

7 To adjust the limits, change the values in the [Upper] and [Lower] fields, then click [OK].

The summary data changes as the upper and lower limits are changed. Adjust the values while observing changes to the yield rate.

Reference

- When changing the limits, the summary data is displayed with simulation values for the program. After the [Statistics] screen is closed and reopened, selecting the items again from the list returns the summary data based on the result history.
- If the item references a variable as its limit, changing the limits will take effect when the processing reaches the initial capture or end unit.

► Note

- Limits are shown on a light blue or gray background if they reference variables. A limit on a gray background indicates a system variable and cannot be changed.
- The limits cannot be changed if accessibility is turned off for the current user group.

8 After checking the statistics, click [OK].

Saving recorded results to an SD card

Clicking [Save] with an SD card inserted into the controller saves the recorded data, judgment results, and item name as text data.

Two csv text files are saved into the "/xg/stat" folder of the specified SD card.

• **YYMMDD_HHMMSS_SD No. in program_Program**

No._dat.csv: data (count/total count/statistic item/individual status)

• **YYMMDD_HHMMSS_SD No. in program_Program**

No._idx.csv: item name

Reference

- The SD card can be specified in the System Settings in XG VisionEditor (default: SD2).
- The data in the saved files can be viewed or edited using a text or spreadsheet program.
- The controller keeps track of the inspection number until it is reset. This allows it to resume properly for the second run and onwards. The upper limit for the inspection count on the controller is 1,000,000,000.

► Note

- If the data exceeds the maximum amount of statistical data, the oldest results are overwritten so part of the results may not be saved.
- The [Save] button is disabled if [Save] has been disabled for the user group logged in.

Deleting recorded results (Clear)

Clicking [Clear] deletes the currently recorded statistical data.

► Note

The [Clear] button is disabled if [Clear] has been disabled for the user group logged in.

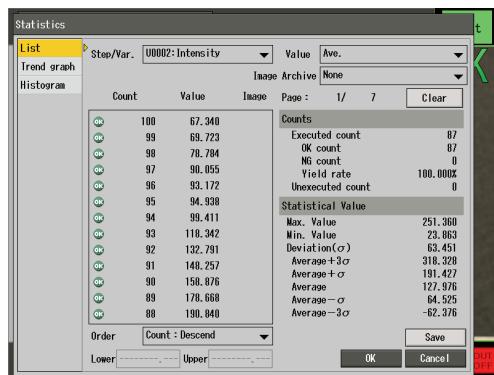
Display Data as a Trend Graph

Data can be displayed as a trend graph against the inspection number. This function is useful for checking how data is changing over the course of time or several inspections during Run mode.

- Upper and lower limits can be changed during the Run mode while observing changes in the yield rate the trend of the data collected.
- The graph also displays whether image data was recorded with the image archive and allows images to be viewed directly.

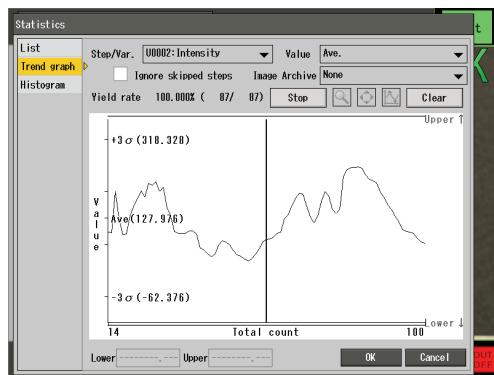
1 From the Function menu select [Utility] - [Statistics].

The [Statistics] result screen appears.



2 Select [Trend graph].

The [Trend graph] screen appears.



3 From the drop down menu select the data to see the trend graph for.

The trend graph of the selected data appears.

► Note

The list does not show data for items not specified for statistical analysis.

Reference

If the [Ignore skipped units] option is checked, the graph will exclude the data for units that were not executed.

4 To adjust the limits, change the values in the [Upper] and [Lower] fields, then click [OK].

Select the bar for upper and lower limit, then move the 8-way key up and down to adjust the tolerance.

The judgment results and yield rate change when the upper and lower limits are changed. Adjust the values while observing changes to the yield rate.

Reference

- When changing the tolerance, the yield rate is displayed with simulation values for the program. After the [Statistics] screen is closed once and reopened, selecting items again from the list returns the yield rate to the actual result history.
- If the measurement references a variable, changed tolerance values will take effect when execution reaches the initial capture/end unit. Otherwise, the changes take effect immediately.

► Note

- Tolerances are shown on a light blue or gray background if the upper and lower limits reference variables. Since the setting value shown on a gray background references a system variable, that value cannot be changed.
- The upper and lower limits cannot be changed if accessibility is turned off for the current user group.

5 After checking the statistics, click [OK].

Enlarging / Reducing the trend graph size

The trend graph can be enlarged or reduced for easier viewing. During Run mode, click [Stop] to stop updating the graph and zoom in / out of the graph for an enlarged / reduced view.

- Use the Zoom icon (magnifying glass) and go to the desired center point for the zoom using the 8-way key up, down, left, and right. The display will zoom in or out centered on the position of the zoom cursor.
- Use the Move icon to scroll around the trend graph.
- Use the Fit icon to fit the trend graph to the Y axis range.

Reference

The initial display state for the trend graph is to automatically adjust according to the range of data based on the settings below:

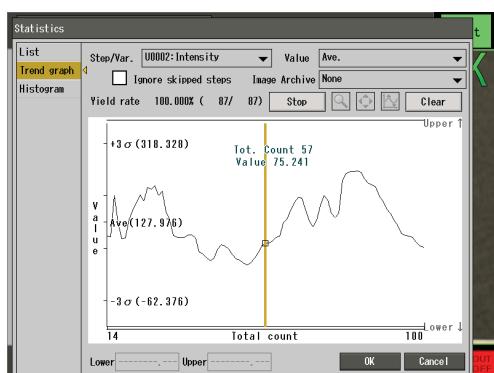
- X direction: Previous 515 inspections
- Y direction: Results $\pm 3\sigma$ or range between the upper and lower limits, whichever is larger

Note

- After closing the [Trend Graph] screen or updating the screen in Run mode, the zoom ratio in the Y direction returns to the initial state of automatically adjusting to the range of data.
- The zoom ratio in the X direction is maintained until the system is restarted.

Checking the values on the trend graph

Use the vertical data selection cursor on the screen and move the 8-way key left and right. The display will show the inspection number and item data at the position of the cursor.



Viewing images from the trend graph

To check the data against an image recorded by the image archive use the data selection cursor. At each data point a square will appear on the graph.

- Place the cursor over a square and press the No. 0 (ENTER) button to display the image from the image archive.
- When the image is displayed, moving the 8-way key left and right while holding down the No. 1 (FUNCTION) button scrolls additional images and data in the image archive.
- To exit replay mode, press the No. 2 (ESCAPE) button.

Reference

Dark blue squares indicates the image was recorded as it matched the image archive criteria, while the light blue squares indicate images recorded as part of a multiple archive series (Page 3-28).

Note

- If the data point does not have a square next to it, there are no images associated between the statistical and image archive data.
- When continuously recording images during Run mode, the image archive updates after the images have been recorded. Thus images may not yet be recorded even if the data point a square.
- If no image archive criteria has been set, no squares will appear on the graph.

Reference

Moving the cursor bar left and right while holding down the No. 1 (FUNCTION) button jumps between data points that have images.

Deleting recorded results (Clear)

Clicking [Clear] deletes the currently recorded statistical data.

Note

The [Clear] button is disabled if [Clear] has been disabled for the user group logged in.

Displaying Data as a Histogram

The collected data can be displayed as a histogram to help users to grasp an understanding of the distribution of values to assist in the settings of tolerances.

- Upper and lower limits can be changed during the Run mode while observing changes in the yield rate and the distribution of data.
- The graph also displays whether image data was recorded with the image archive and allows images to be viewed directly.

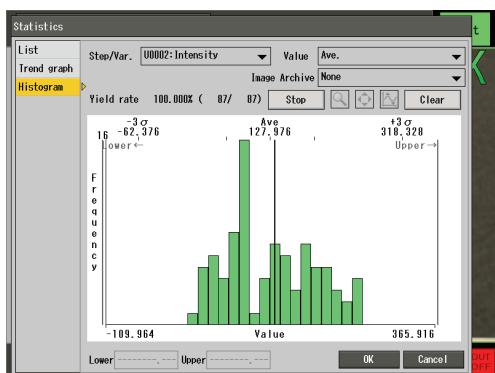
1 From the Function menu select [Utility] - [Statistics].

The [Statistics] result screen appears.



2 Select [Histogram].

The [Histogram] screen appears.



3 From the drop down menu select the data to see the trend graph for.

The histogram of the selected data appears.

► Note

The list does not show data for items not specified for statistical analysis.

4 To adjust the measurement limits, change the values in the [Upper] and [Lower] fields, then click [OK].

Select the bar for upper limit and lower limit, then move the 8-way key left and right to adjust the tolerance.

The judgment results and yield rate change when the upper and lower limits are changed. Adjust the values while observing changes to the yield rate.

Reference

- When changing the tolerance, the yield rate is displayed with simulation values for the program. After the [Statistics] screen is closed once and reopened, selecting items again from the list returns the yield rate to the actual result history.
- If the measurement references a variable, changed tolerance values will take effect when execution reaches the initial capture/end unit. Otherwise, the changes take effect immediately.

► Note

- Tolerances are shown on a light blue or gray background if the upper and lower limits reference variables. Since the setting value shown on a gray background references a system variable, that value cannot be changed.
- The upper and lower limits cannot be changed if accessibility is turned off for the current user group.

5 After checking the statistics, click [OK].

Enlarging / Reducing the histogram size

The histogram can be enlarged or reduced for easier viewing. During Run mode, click [Stop] to stop updating the graph and zoom in / out of the graph for an enlarged / reduced view.

- Use the Zoom icon (magnifying glass) and go to the desired center point for the zoom using the 8-way key up, down, left, and right. The display will zoom in or out centered on the position of the zoom cursor.
- Use the Move icon to scroll around the histogram.
- Use the Fit icon to fit the histogram to the Y axis range.

Reference

The initial display state for the trend graph is to automatically adjust according to the range of data based on the settings below:

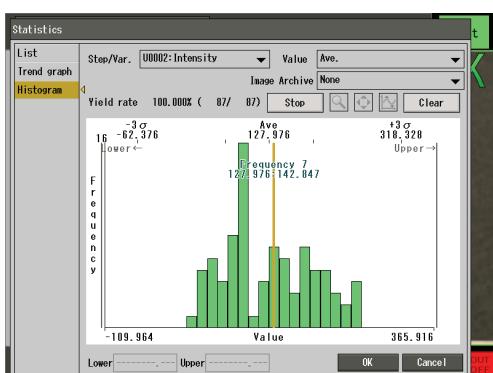
- X direction: Results $\pm 3\sigma$ or the range between the upper and lower limits, whichever is larger
- Y direction: Maximum frequency

Note

After closing the [Histogram] screen, or after updating the screen in Run mode, the zoom ratio returns to its initial state of automatically adjusting to the range of data.

Checking values on the histogram

Select the cursor bar on the screen and move the 8-way key left and right. This displays the recorded count and value range at the position of the cursor.



Viewing images from the histogram

To check the data against an image recorded by the image archive use the data selection cursor. At each data point a square will appear on the graph.

- Place the cursor over a square and press the No. 0 (ENTER) button to display the image saved during measurement in archive mode.
- When the image is displayed, moving the 8-way key left and right while holding down the No. 1 (FUNCTION) button scrolls additional images and data in the image archive.
- To exit archive mode, press the No. 2 (ESCAPE) button.

Reference

Dark blue squares indicates the image was recorded as it matched the image archive criteria, while the light blue squares indicate images recorded as part of a multiple archive series (Page 3-28).

Note

- If the data point does not have a square next to it, there are no images associated between the statistical and image archive data.
- When continuously recording images during Run mode, the image archive updates after the images have been recorded. Thus images may not yet be recorded even if the data point a square.
- If no image archive criteria has been set, no squares will appear on the graph.

Reference

Moving the cursor bar left and right while holding down the No. 1 (FUNCTION) button jumps between data points that have images.

Deleting recorded results (Clear)

Clicking [Clear] deletes the currently recorded statistical data.

Note

The [Clear] button is disabled if [Clear] has been disabled for the user group logged in.

Image Archive

The image archive is a useful troubleshooting tool for reviewing inspections that have failed during Run mode. The image archive allows for Images captured in Run mode to be archived in the controllers internal memory for review at a later time. Data can also be stored for the images archived allowing for full process to be understood when the image is reviewed. Both image and data can be viewed together from the [Image Archive] screen.

► Note

- The display and functionality of the Image Archive may be limited due to settings in the XG VisionEditor. For more details, refer to "Controller Global Settings" in the XG VisionEditor Reference Manual.
- The [Image Archive] screen cannot be displayed while the XG VisionEditor or any other program is accessing the image archive.
- Images can only be archived during Run mode.
- The image archive data is recorded in the controller's memory and will be cleared in the following circumstances. If the information is required for later use, save the data to an SD card or another media (Page 3-29).
 - When the controller is turned off
 - When the controller is reset
 - When changing programs
 - When the current program is overwritten via an external command
 - When the Image Archive Clear command is executed
 - When the operating mode is changed to Remote capture mode
 - When opening the camera settings (Page 5-6) or white balance settings (Page 5-21) in Offline mode
 - When editing the image archive criteria
 - When adding, editing, or deleting image variables in the [Variables] menu
 - When the camera selection in a capture unit is changed
 - When using the [Area Settings] menu in a capture unit

Reference

- Using the image archive does not affect the processing time.
- Images can be recorded from multiple cameras at the same time.

Number of images that can be archived

The number of images that can be archived varies depending on the camera settings and the combination of connected cameras. The maximum number of images that can be archived into the system image memory is as follows.

Typical data for the XG-7701

	When using a monochrome camera	When using a color camera
240,000-pixel images	Maximum 1,013 images	Maximum 1,008 images
310,000 pixel images	Maximum 501 images	Maximum 498 images
1-megapixel images	Maximum 245 images	Maximum 240 images
2-megapixel images	Maximum 117 images	Maximum 112 images
5-megapixel images	Maximum 40 images	Maximum 35 images

Typical data for the XG-7501 and XG-7001

	When using a monochrome camera	When using a color camera
240,000-pixel images	Maximum 501 images	Maximum 496 images
310,000 pixel images	Maximum 245 images	Maximum 242 images
1-megapixel images	Maximum 117 images	Maximum 112 images
2-megapixel images	Maximum 53 images	Maximum 48 images

► Note

The figures above represent the maximum number of images that can be recorded in Run mode based on these conditions: one camera; default image capture buffer settings (enabled, fixed buffer of 1); archive condition [Archive all images].

Specifying Criteria for Image Archiving

Criteria needs to be set to archive images and inspection data to the controllers memory. Up to eight individual image archives can be set each with its own unique set of criteria.

Even if the same criteria is specified in multiple image archives the data is handled separately.

▶ Note

Enabling an image archive consumes image and program memory.

1 From the Function menu (Page 3-2), select [Start to Edit program].

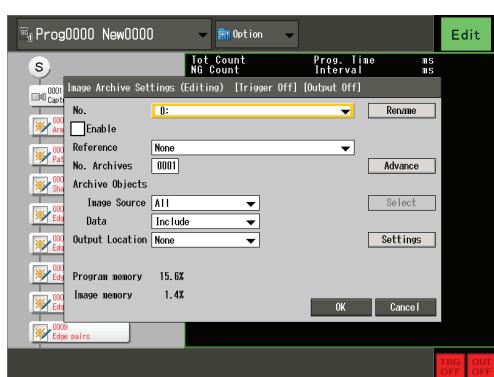
A confirmation screen appears.

2 Click [OK].

The options menu is now available for setting up the image archive function.

3 From the [Options] menu, select [Image Archive Settings].

The [Image Archive Settings] menu appears.



The [Image Archive Settings] menu displays the current image archive criteria and shows amount of resources currently consumed by the current program.

▶ Note

If the program and image memory are close to 100%, it may not be possible to enable the image archive.

4 Choose the image archive to set criteria for.

5 Change the settings as required.

Enable

Check this box to enable the image archive, at this time the controller will allocate program and image memory according to the image archive settings.

Reference

Specify the unit reference condition and the result (OK / NG) to be used for archiving images.

Reference

- The result of the [Total Status] depends on the Total Status Settings (Page 4-313).
- In addition to the [Total Status] option, the reference includes all units that have a judge value (UJG) available.

No. Archives

Specify the number of archives (max. 1024 times).

- If [Images] is set to [Single]: images are stored one at a time.
- If [Images] is set to [Multiple]: multiple images (including preceding images as set under [Advance]) are stored one at a time.

▶ Note

Make sure there is enough memory when storing preceding inspection images as well as the current image. If the archive criteria is set to store a lot of images including preceding images this will consume a large amount of memory.

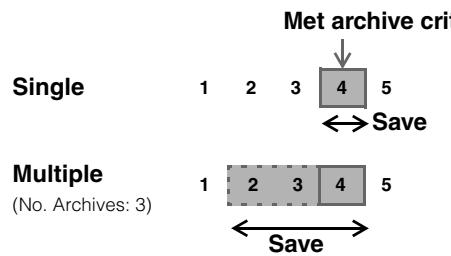
Advance



- **Images:** Choose the images to be archived.
 - **Single:** Archives the single image that matches the criteria.
 - **Multiple:** Archives the current image when it matches the criteria and a number of preceding images as specified in [No. Archives (inc. latest)] (max. 512). This is useful when the images before the NG state need to be reviewed as well.
- **Buffer:** Choose how the image buffer works when the capacity is reached.
 - **Overwrite buffer each time:** Continues storage by overwriting images starting with the oldest first.
 - **Process until buffer full:** Pauses archiving until the controller is reset, or the image data in the archive criteria is cleared.

Reference

The following diagram explains how the [Images] setting affects storage range when the archive criteria is met.



Archive Objects

- **Image Source:** Choose the image variables to be archived.
 - **All:** All image variables that are used in the program are archived.
 - **Select:** Select which image variables to archive (up to 256 image variables can be select).
- **Data:** Choose whether to include unit and variable processing data with the image.

Note

- If the data is not archived, the data will not be able to be checked when using the image archive replay mode in the XG VisionEditor software or on the XG Controller screen display.
- If the [Archive all images] option is checked, images for associated with unused image variables will not be output. To output the black image from the unused variable, remove the check for [Archive all images] and apply checks to each desired image variable.
- If [Select] is used under [Image Source] and all the image variables are removed this will force the data to be not be included.

Output Location

Choose the output location where images and results data are output to when they meet the archive criteria.

- **None:** No archive data is output.
- **SD Card:** Output to the SD card in the controller.
- **PC Program:** Output to XG VisionTerminal or an ActiveX control.
- **FTP:** Output to an FTP server.

Note

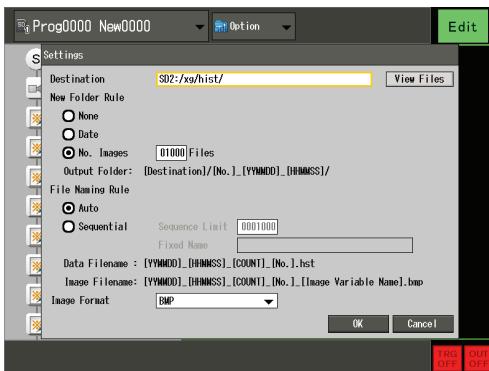
If [Archive Objects] is set to [Select] and the image variable with a check mark is not actually used, the data is output as a black back image.

Reference

Outputting archived images differs from using the image output unit (Page 4-299) as all images are stored in the image archive before they are output. This prevents the loss of images, even for a continuous stream, as long as there is enough memory to hold the images required.

Settings

This menu is used to set the destination for the image archive.



- **Destination:** Specify the destination for the image archive.

Reference

- If [PC Program] is selected as the [Output Location], the image archive data will be saved in the specified folder below the destination base path folder, or in a newly created folder.
- If [FTP] is selected as the [Output Location], the image archive data will be saved in the specified folder below the FTP server home directory, or in a newly created folder. Note, depending on the FTP server the server may require the full path including the home directory. For details on such settings consult with your network administrator.
- **New Folder Rule:** This rule is for creating new folders for saving archive data.
 - **None:** The archive data is saved in a specified destination folder without separating new folders.
 - **Date:** The archive data is saved in a folder created below the specified destination folder when each output begins. Folders are named [No.].[YYMMDD]. When the date changes, a new folder is created and this becomes the new destination folder for archive data.
 - **No. Images:** The archive data is saved in a folder created below the specified destination folder. Folders are named as [No.].[YYMMDD]_[HHMMSS]. (Folders can store up to 10,000 images.) When the number of images in the folder reaches the specified limit, a new folder is created and this becomes the new destination folder for archive data.

▶ Note

If [None] is selected and a large number of files are going to the same folder, saving may become time-consuming.

- **File Naming Rule:** These are rules for naming files when saved.

- **Auto:** Files are named automatically with the date and time when the data was output,

[YYMMDD]_[HHMMSS]_[Count]_[No.].extension (jpg/bmp (image file) and hst (results file)).

- **Sequential:** The files are named as [Sequential_fixed name_image variable.jpg/bmp] (image file) and [Sequential_fixed name.hst] (results file). Specify the maximum number of images in the [Sequence Limit] field (max.1000000), and a fixed name to use in the [Fixed Name] field. Each field may contain no more than 64 characters.

▶ Note

When the sequential number exceeds the limit, the count rolls over to 0. This may result in old output data files being overwritten if the new folder rule is set to [None] or [Data], or if specified [No. Images] is greater than the maximum serial number.

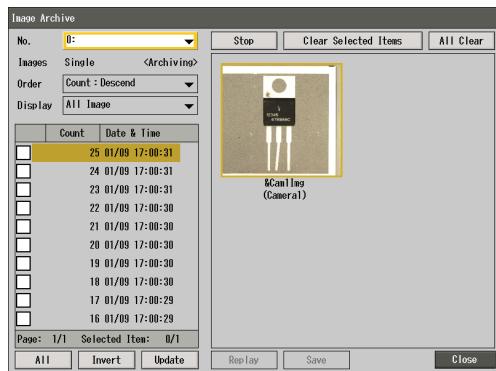
- **Image Format:** This specifies the file format for saving the image data.
 - **BMP:** Outputs the image as a Windows bitmap file (24-bit color: color camera, 8-bit gray scale: monochrome camera).
 - **BMP (1/2-pixel Resolution):** Outputs the image as a Windows bitmap file, reducing the number of vertical and horizontal pixels by 1/2 (24-bit color: color camera, 8-bit gray scale: monochrome camera).
 - **BMP (1/4-pixel Resolution):** Outputs the image as a Windows bitmap file, reducing the number of vertical and horizontal pixels by 1/4 (24-bit color: color camera, 8-bit gray scale: monochrome camera).
 - **BMP (1/8-pixel Resolution):** Outputs the image as a Windows bitmap file, reducing the number of vertical and horizontal pixels by 1/8 (24-bit color: color camera, 8-bit gray scale: monochrome camera).
 - **JPG:** Outputs the image as a JPEG file.

6 Click [OK].

Viewing Images in the Image Archive

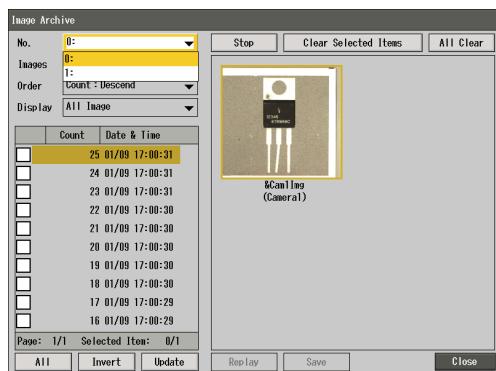
1 From the Function menu select [Utility] - [Image Archive].

The [Image Archive] screen appears.



2 Select the image archive to be viewed.

A summary list of the images recorded based on the set criteria are displayed along with the [Images] and [Status].



Images

- **Single**: is displayed when only the current image is being archived.
- **Multiple**: is shown when preceding images are being archived as well as the current image.

Status

- **<Archiving>**: Images are being archived.
- **<Hold>**: Archiving has stopped, retaining the images in the archive, preventing them from being overwritten.
- **<Suspend>**: Archiving has been temporarily stopped.

3 Use [Order] to change the display order of the image files.

4 Use [Display] to choose the image variables to show.

- **All Image** (default): Displays all the images from all the variables.
- **&<image variable>**: Displays only images for the user-specified image variable.

5 After reviewing the images, click [Close].

Clearing the image archive

Use the following procedure to clear the image archive.

To clear only the current image archive

Click [Clear Selected Items].

To clear all of the image archive

Click [All Clear].

Pausing the image archive

The image archive can be paused to review archive data before it is overwritten. This is particularly useful when data is being archived at high speeds.

To pause the image archive

Click [Stop].

While the image archive is paused, the button changes to [Start].

To resuming the image archive

Click [Start].

Reference

The image archive will remain paused even if the [Image Archive] screen is closed. The paused condition will remain in effect until either power is turned off and on again, or until it is canceled via an external command.

Replaying image archive results

Images and data archived in the memory can be replayed for analysis and review. This is useful for reviewing the conditions when a NG (fail) occurred without having to take the controller offline.

► Note

- If the image archive is not configured to archive data, only images are replayed.
- If the program is changed via the Edit Unit menu option (Page 4-7), the archived data recorded before the change may not match the changed parameters preventing proper replaying of the archived result.

1 Check the box for the images from the list in the [Image Archive] screen to replay.

2 Click [Replay].

The image and the data for the selected inspections is displayed.

3 If multiple images were selected, press and hold the No. 1 or No. 7 button while moving the 8-way key left and right to move through the inspections.

The image and the data for the selected inspection is displayed.

4 To finish the replaying of the image archive, press the No. 2 (ESCAPE) button.

Reference

Results displayed during replay cannot be output to an external device.

► Note

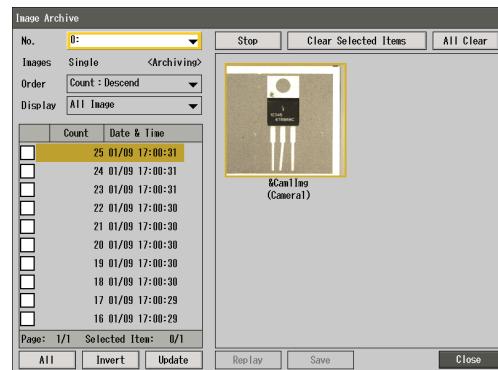
If program data is changed in the Edit Unit menu, the archived result data recorded before the change may not replay properly.

Saving the Image Archive

Follow this procedure to save the archived image and result data to an SD Card.

1 From the Function menu select [Utility] - [Image Archive].

The [Image Archive] screen appears.



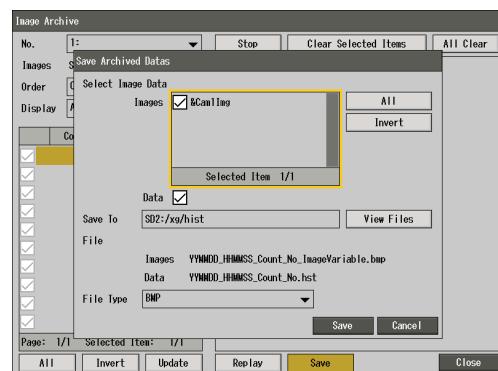
2 Check the box for the images from the list in the [Image Archive] screen to save the image and data for.

Reference

- Clicking [All] places check marks next to all the items in the image archive list.
- Clicking [Invert] reverses the checked and unchecked states.

3 Click [Save].

The [Save Archived Data] menu appears.



4 Choose which image variables from the image archive to save the data for.

To save the data as well, check the [Data] box.

5 Use the [Save To] field to specify where to save the image archive to.

Reference

Use [View Files] to specify the folder path from the [View Files] screen (Page 3-31).

6 Specify the file format in the [File Type] field.

Specify the file format used when the image data was saved from the formats below.

- **BMP**: Outputs the image as a Windows bitmap file (24-bit color).
- **BMP (1/2-pixel Compression)**: Outputs the image as a Windows bitmap file, reducing the number of vertical and horizontal pixels by 1/2 (24-bit color)
- **BMP (1/4-pixel Compression)**: Outputs the image as a Windows bitmap file, reducing the number of vertical and horizontal pixels by 1/4 (24-bit color)
- **BMP (1/8-pixel Compression)**: Outputs the image as a Windows bitmap file, reducing the number of vertical and horizontal pixels by 1/8 (24-bit color)
- **JPG**: Outputs the image as a JPEG file.

7 Click [Save].

The image and results data from the image archive are saved.

The image and data files are named as follows when they are saved.

- **Image**: YYMMDD_HHMMSS_Count_No_ImageVariable.bmp (jpg).
- **Data**: YYMMDD_HHMMSS_Count_No.hst.

8 After saving is complete, click [Close].

Note

- Depending on the amount of data saving can take several minutes.
- The controller cannot be operated while saving is taking place.

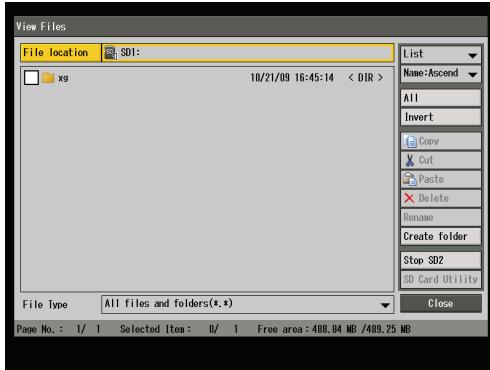
SD Card File Management

From the [View Files] screen, files and the SD cards used in slot 1 & 2 can be viewed, checked and managed.

Viewing Files

1 From the Function menu select [Utility] - [View Files].

The [View Files] menu appears.

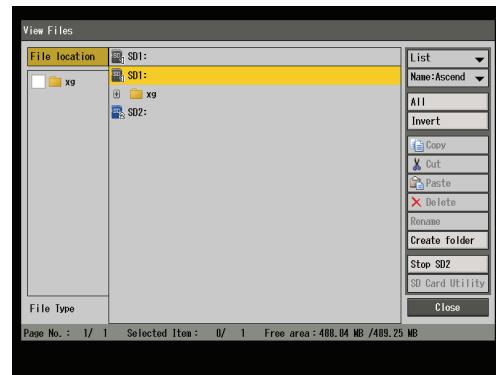


2 Click close to finish viewing files.

Viewing Files Saved on the SD Card

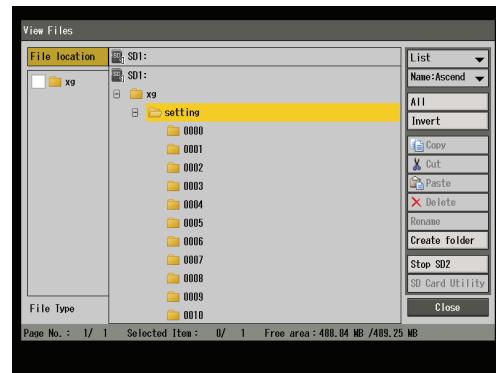
1 From the [View Files] menu, select the [File location].

Two icons are displayed representing SD Card 1 (SD1) and SD Card 2 (SD2)



2 Select the drive or folder containing the files to view move the 8-way key to the right.

Moving the 8-way key to the right expands the folders in the drive or folder.



Reference

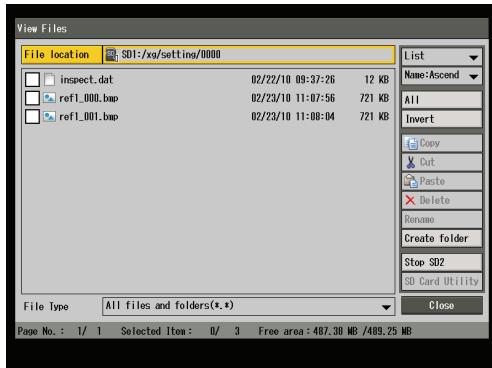
Continue moving the 8-way key to the right to open lower level folders one after another.

► Note

Up to 1,024 items can be displayed in the [View Files] screen.

3 To view files within folders or to check a list of files / folders, highlight the desired folder and press the No. 0 (ENTER) button.

A list of files or folders inside the folder is displayed.



Switching display methods

The view files menu display can be switched between a list and a preview display.

To switch the display method, select the desired method from the menu on the right side of the [View Files] menu.

List



Preview



Reference

- The preview display will only show 24-bit color or 8-bit grayscale BMP or JPEG images supported by the system. 5-megapixel (2432 x 2050 pixels) preview images can be displayed only when a 5-megapixel camera is assigned for the XG-7701 controller.
- Screen capture images cannot be displayed.
- Progressive JPEG images cannot be displayed.

Display order

The order for displaying files and folders can be switched between ascending and descending based on file name, last saved, or file size.

To change the display order, select the desired display order from the menu on the right side of the [View Files] screen.

Managing Folders and Files

Folders and files in the SD card can be managed just the same as folders and files on a computer.

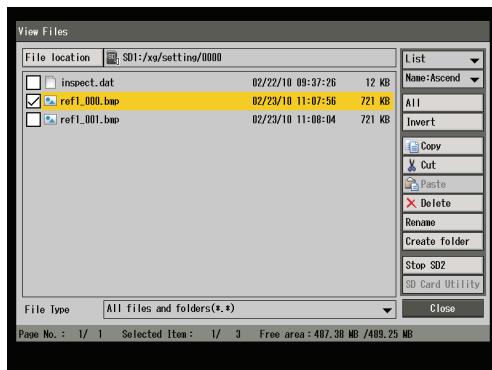
► Note

The controller may not be able to read saved data correctly if folders are moved or if the names of folders or files are changed.

Copying folders and files

To replicate folders and files follow this procedure.

1 Select the folders and files to be copied by using check marks.



Reference

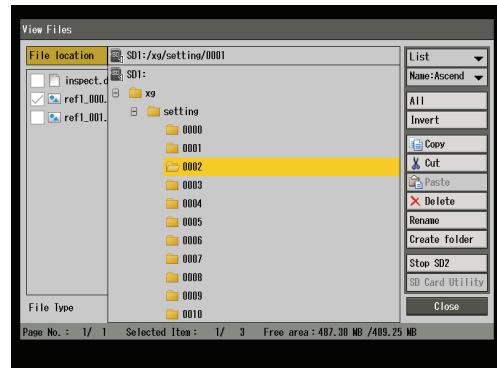
- Clicking [All] puts a check mark next to all the folders and files displayed in the list.
- Clicking [Invert] reverses the checked / unchecked state.

2 Click [Copy].

A confirmation screen appears.

3 Click [Close].

4 Select the folder location to copy the files to.



5 Press the No. 0 (ENTER) button to display the destination list.

6 Click [Paste].

A confirmation screen appears.

7 Click [OK].

The selected folders and files are copied.

► Note

- Copying may take up to several minutes, depending on the size of the information.
- The controller cannot be operated while copying files.
- Do not turn the controller off or eject the SD card while copying. Doing so may corrupt the data and or damage the SD card.

Moving folders and files

To move folders and files follow this procedure.

1 Select the folders and files to be copied by using check marks.

Reference

- Clicking [All] puts a check mark next to all the folders and files displayed in the list.
- Clicking [Invert] reverses the checked / unchecked state.

2 Click [Cut].

A confirmation screen appears.

3 Click [Close].

4 Select the folder location to move the files to.

5 Press the No. 0 (ENTER) button to display the destination list.

6 Click [Paste].

A confirmation screen appears.

7 Click [OK].

The selected folders and files are moved.

Deleting folders and files

Note

Once folders or files are deleted, they cannot be restored.

1 Select the folders and files to be deleted by using check marks.

Reference

- Clicking [All] puts a check mark next to all the folders and files displayed in the list.
- Clicking [Invert] reverses the checked / unchecked state.

2 Click [Delete].

A confirmation screen appears.

3 Click [OK].

4 Click [Close].

Renaming folders and files

1 Select a single folder or file to be renamed and place a check mark next to it.

2 Click [Rename].

The [Rename] menu appears.

3 Change the name of the folder or file and click [OK].

Refer to "Inputting Characters" (Page 3-7) for more details on entering text.

A confirmation screen appears.

4 Click [Close].

Creating new folders

- 1 From the [File Location] select the location to create the folder.**
- 2 Press the No. 0 (ENTER) button to display the destination list.**
- 3 Click [Create folder].**
The [Create folder] menu appears.
- 4 Input the name of the folder and click [OK].**
Refer to "Inputting Characters" (Page 3-7) for more details on entering text.
A confirmation screen appears.
- 5 Click [Close].**

Removing SD Card 2

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.
- Turn off the controller when removing the SD card in the SD1 slot (SD Card 1).
- 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.

- 1 From the [View Files] menu, select [Stop SD2].**
A confirmation screen appears.

- 2 Click [OK].**
The LED indicator turns off, indicating that SD Card 2 can now be removed.
- 3 Press the SD card in the SD2 slot inward to release and remove the card.**

Checking and Formatting SD Cards

▶ Note

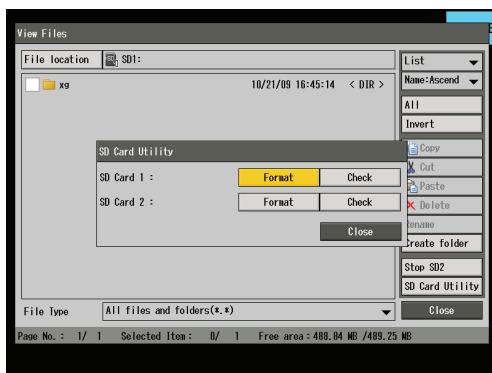
The SD Card Utility function can only be used during Offline mode.

Checking the SD Card

If an error occurs with an SD card it may cause additional problems such as the inability to load files or the loss of files. If these types of problems occur, the Check function can be used to resolve such errors.

1 From the [View Files] menu select [SD Card Utility].

The [SD Card Utility] menu appears.



2 Choose [Check] for [SD Card 1] or [SD Card 2].

A confirmation screen appears.

3 Click [OK].

After the check is complete, the "Check is complete" confirmation message appears.

4 Click [Close].

Reference

Refer to "Error Messages" (Page 8-94) when abnormal messages are displayed after the Check function has been performed.

Formatting the SD Card

▶ Note

Formatting erases all of the data on the SD card, and data cannot be restored. Format the SD card after copying the data from the SD card onto a computer.

1 From the [View Files] menu select [SD Card Utility].

The [SD Card Utility] menu appears.



2 Choose [Format] for [SD Card 1] or [SD Card 2].

A confirmation screen appears.

3 Click [OK].

After formatting the confirmation screen appears.

4 Click [Close].

Verifying the Connection Status of Input and Output Terminals

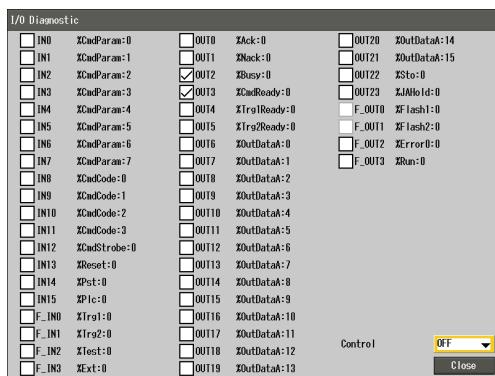
The I/O Diagnostic tool allows for the checking of the status of incoming and outgoing signals via the inputs and outputs of the terminal block and parallel port. This is very useful for verifying the connection status of external equipment wired to the terminals on the controller.

► Note

If the system variables %Flash1 to %Flash4 are assigned to F_OUT0 to F_OUT3, these terminals cannot be monitored through the I/O diagnostic function. For more details on system variables, refer to "Variables" in the XG VisionEditor Reference Manual.

1 From the Function menu select [Utility] - [I/O Diagnostic].

The [I/O Diagnostic] screen appears.



2 Verify the connections.

Each input and output is displayed with their respective assigned system variable.

- The status display for each terminal is updated in real time in response to the incoming and outgoing signals. A check mark next to the input / output indicates the terminal is ON (shorted).
- To forcibly turn on specific output terminals, set [Control] to [ON], and put check marks next to the terminals to be turned on (only available during Offline mode).

Reference

In Offline mode, no variables are output apart from a couple of terminals. To verify data output, switch to Run mode or use the [Control] function in the I/O Diagnostic tool.

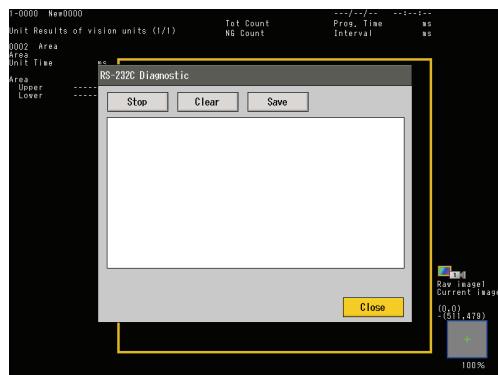
3 Click [Close].

Verifying the Status of RS-232C Communication

The RS-232C Diagnostic tool allows for the checking of the status of incoming and outgoing signals via the RS-232 port of the controller. This feature is very useful for verifying the communication status and content between the controller and external equipment. The most recent communication content (up to 10Kb) can also be saved for later review.

1 From the Function menu select [Utility] - [RS-232C Diagnostic].

The [RS-232C Diagnostic] screen appears.



2 Verify the communication status.

The communication data is updated in response to incoming and outgoing RS-232C commands.

- A "<" appears at the beginning of the data when output from the controller, and a ">" appears at the beginning of received by the controller.
- Characters other than ASCII code are displayed as in hexadecimal.

Reference

In Offline mode, the only RS-232 communication output that occurs are responses to commands input from external devices. To check whether data output from the program is functioning correctly, switch to Run mode.

3 Use the following operations as required.

- **To stop data being displayed on screen:** Click [Stop].
- **To clear the log:** Click [Clear].
- **To save the log to the SD card:** Click [Save] to save the log as text data. The log is saved in the "xglrs_log\" folder on the specified SD card with the name "File creation date YYMMDD_HHMMSS_SD No._ProgramNo.log".

Reference

The SD card can be specified in the System Settings in XG VisionEditor (default: SD2).

4 Click [Close].

Changing the Login User

This function enables a different user to be able to log into the system and operate the controller.

What is a User Account?

A user account belongs to a user group which has a defined set of privileges for operating the controller. Depending on which account is logged in different items can be used or displayed based on the user group (UG0 through 4) that account belongs to. Logging in with a different user account and password changes the user group and allows different control over the information displayed and available options. Handheld controller actions can also be recorded for different users using the system for traceability purposes. Refer to "Logging Handheld Controller Operations" (Page 3-40).

Reference

Only through the System Settings in XG VisionEditor or via external commands can user accounts and groups be added, edited or deleted. For more details on how to setup accounts, refer to "Controller Global Settings" in the XG VisionEditor Reference Manual.

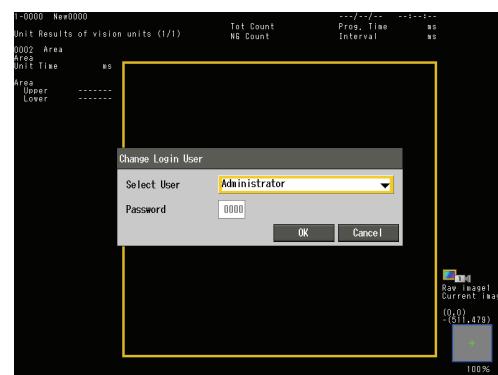
Changing the Login User

1 From the Function menu select [Utility] - [Change Login User].

The [Change Login User] menu appears with the currently logged in user account displayed.

Reference

"Administrator", registered to user group UG0, is the default logged in account.



2 From the drop down menu choose the desired user account.

Reference

User accounts can be set without a password.

Note

If the password is lost that account cannot be used until a new password is assigned via the XG VisionEditor software.

3 Click [OK].

This changes the logged in user.

Reference

If the controller is turned off and on again, the controller will log in to the start up user account setup through the XG VisionEditor software.

Logging Handheld Controller Operations

Use the following procedure to start / stop logging any operations made with the handheld controller.

What is Logging?

Logging is a function which logs all the handheld controller operations made along with the user name and a data time stamp in a CSV text file. With this function modifications made by the logged in user can be traced and reviewed for traceability purposes (Page 3-39).

Reference

- Log settings can only be changed in the System Settings in the XG VisionEditor software. For more details on logging, refer to "Controller Global Settings" in the XG VisionEditor Reference Manual.
- Log files are saved to the controller SD card in the "\xg\op_log\" folder under the name "file creation dateYYMMDD_HHMMSS.csv" or "User-defined text.csv".
- The log file cannot be viewed on the controller. To view the logs, use a spreadsheet or text editor to open the file.
- The modification log only records operations performed with the handheld controller and some operations performed in offline mode.

Starting / Stopping the Log

To start logging

- 1 **From the Function menu select [Utility] - [Modification Log (logging)]**

A confirmation screen appears.

- 2 **Click [OK].**

Logging has started

Reference

If the menu shows [Modification Log (stopped)], logging will resume automatically when the controller is turned on if based on the settings set with the XG VisionEditor software.

To stop logging

- 1 **From the Function menu select [Utility] - [Modification Log (stopped)].**

A confirmation screen appears.

- 2 **Click [OK].**

Logging is stopped.

Reference

Stopping the log from the menu only works temporarily if it is configured in the XG VisionEditor to start automatically when the controller is turned on. Logging will resume automatically when the controller is turned off and on.

Adjusting the Internal Clock

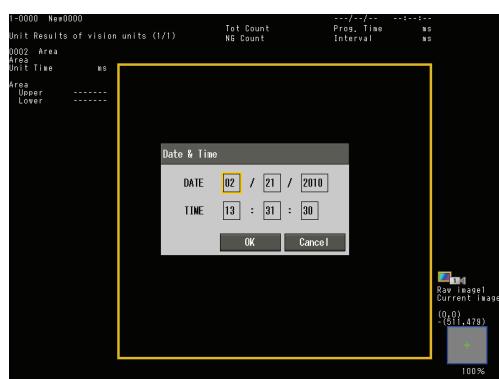
Use the following procedure to set the controllers built in clock. The date and time information is used for time stamping purposes, such as when data is transmitted from the controller.

Reference

This function can also be accessed from the [System Configuration] menu.

1 From the Function menu select [Date & Time].

The [Date/Time] screen appears.



2 Specify the [Month], [Day], and [Year], respectively.

3 Specify the [Hour], [Minute], and [Second], respectively.

4 Select [OK] to confirm the new settings.

Saving Program Settings

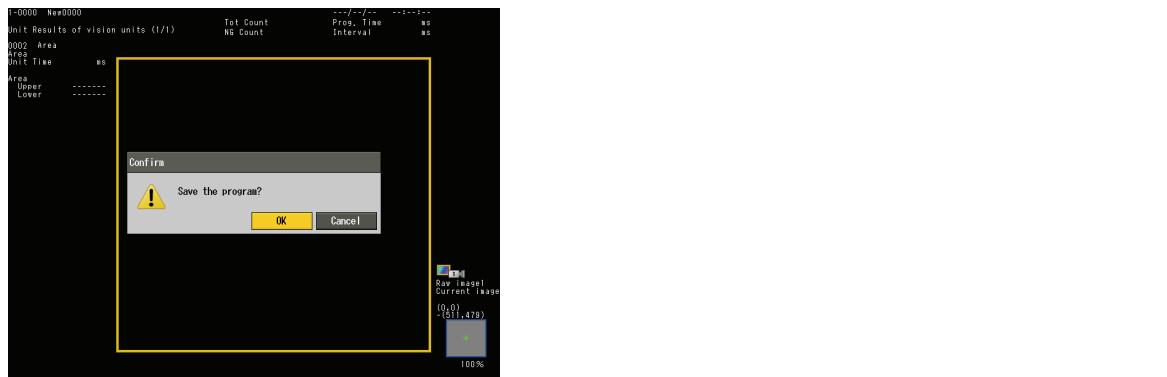
Save the current program.

► Note

- If the controller is turned off before any settings are saved, all of those settings will be deleted.
- Do not turn the controller off while saving, as doing so may cause errors in the saved data.

1 From the Function menu select [Save Program].

A confirmation screen appears.



2 Click [OK].

The settings are saved to the current program file in SD Card 1 or SD Card 2.

► Note

Items specified not to be saved are excluded from the saving operation.

For example, variable values changed in the current program or the current screen displayed can be excluded from the saving function.

Chapter 4

Flowchart Editing - Setting the Inspection and Measurement Conditions

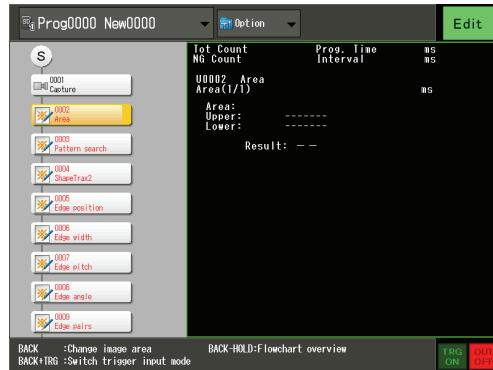
Editing a Flowchart

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 5-5) 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 5-5) to show a flowchart by default.

Operational Flow

A flowchart is edited using the procedures below.

1 Enable editing of a flowchart (Page 4-5).

2 Addition of unit(s) to a flowchart (Page 4-6).

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 4-10).

3 Changing a unit settings (Page 4-7).

In the Edit Unit menu, configure the settings for each unit.

4 Changing of other settings as required.

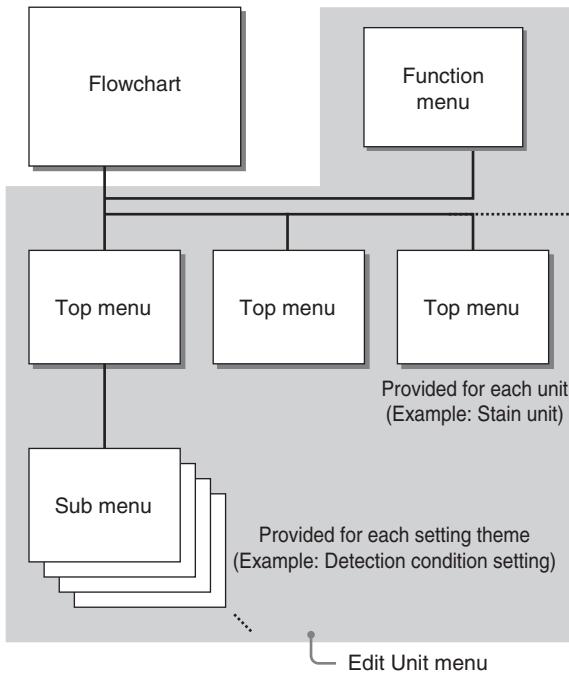
From [Option], you can change various settings associated with the flowchart.

- Changing the operation during flowchart editing (Page 4-305)
- Changing the variable settings (Page 4-306)
- Specifying the unit(s) to be used for total status output (Page 4-313)
- Specifying the unit(s) to be used for total error output (Page 4-314)
- Setting the scale factor of each camera (Page 4-314)
- Specifying the type of connected camera (Page 4-315)
- Changing the settings of image buffer for images captured when processing (Page 4-316)
- Specifying items to be used for statistical analysis (Page 3-16)
- Setting the conditions to archive images used for inspection and result data (Page 3-25)
- Specifying the FTP server to which archived data will be output (Page 4-317)
- Universal updating of image information used for registered images (Page 4-317)
- Universal updating of the positioning information for the position adjustment units in the inspection settings (Page 4-318)
- Locking/unlocking groups (Page 4-318)

5 Save the setting.

Editing the Flowchart

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



Top menu

This menu is used to access the edit menu (sub menus) for each unit. When you select the item 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 [Select Detection Conditions].

► Note

- Depending on the unit, top menus may not exist.
- See "Editing a Pre-Programmed Unit" (Page 8-25) 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 + Change Image Type button (when a flowchart is enlarged): 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

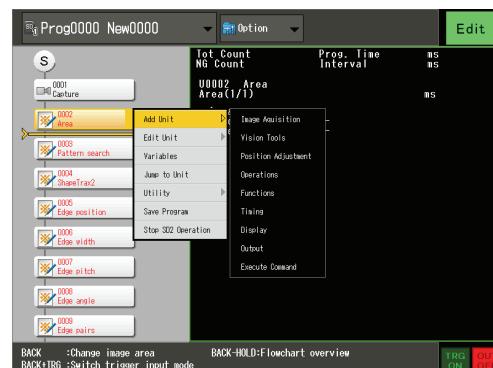
The following three types of function menus are displayed when the No. 1 (FUNCTION) button of the handheld controller is pressed during flowchart editing. The menu displayed will depend on the situation.

► 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

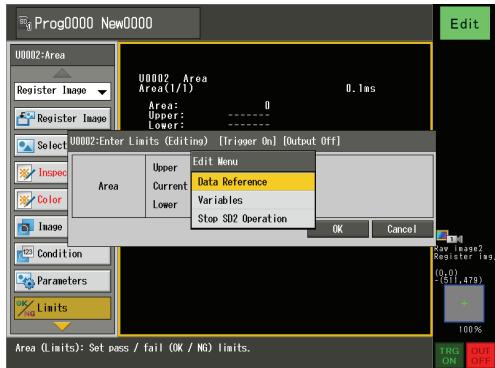
The [Flowchart edit menu] is displayed.



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.

- **Data Reference:** Set a reference term so that it references a variable or the result data of a unit.
- **Variables:** Edit and or create variables. See "Variable Settings (Variables)" (Page 4-306) for more details.
- **Stop SD2 Operation:** Stop the SD card 2 operation so that the SD card can be removed.

► Note

For those parameters which cannot reference variables or result data, the [Data Reference] is grayed out.

Other situations

The normal function menu (Page 3-2) appears for additional operations such as switching programs or using utilities.

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.

Trigger ready output (%Trg1 - 4Ready) status change

When a change in some functions, such as the image capture buffer settings is applied, the ON/OFF status of %Trg*Ready changes. When the trigger input is disabled, %Trg*Ready always turns OFF.

Changing a setting value which references data

- A setting value with a data reference setting is shown on a light blue or gray background. Since the setting value shown on a gray background references a system variable, setting data or result data of a unit, that value cannot be changed.
- The setting value shown in red has an error due to an absence of a referenced variable or for another reason. Consequently, that value cannot be changed.
- A data reference will be canceled when a setting value with a data reference setting is cleared or when any setting is changed as a result of the reference setting being cleared.
- When the [Change Variable Settings] of the user account settings is disabled, only a direct input along with a setting value a data reference setting is allowed. The clearing of setting values (initialize), changes in settings as a result of clearing and the setting of new data references for the setting value can not be done.

Setting items affected by the user account settings

Depending on the user account configuration, the settings of the following items cannot be changed.

- Changing a flowchart
- Changing a variable setting or data reference setting
- Changing the display image
- Disabling trigger inputs
- Disabling outputs
- Updating the reference position adjustment value
- Changing the maximum count value

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 one immediately following the opening of the sub menu (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 also return to the values immediately following the opening of the top menu.
- 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.

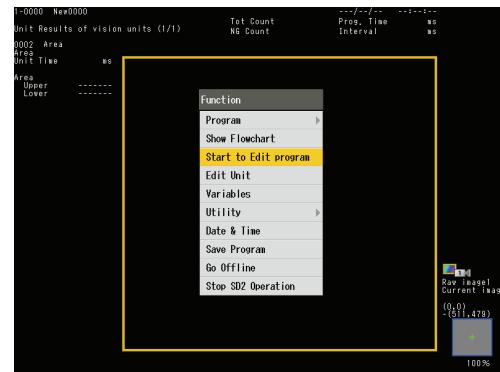
▶ Note

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

1. 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 [Start to Edit program].



A confirmation screen appears.

2 Select [OK].

You can now edit the flowchart and units.

Ending the flowchart editing process

From the function menu (Page 4-3), select [End to Edit Program].

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.

2. 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

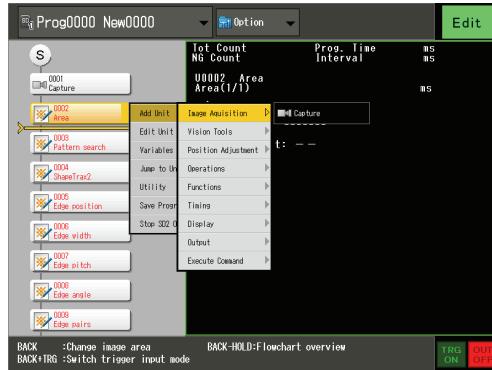
- Up to 1000 units can be added to a flowchart, including the start and end units. When you exceed 1000 units in a flowchart, no more units are able to be added.
- Even with 999 units in a flowchart, a branch unit and loop unit cannot be added because they are considered a pair.
- If there is not enough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



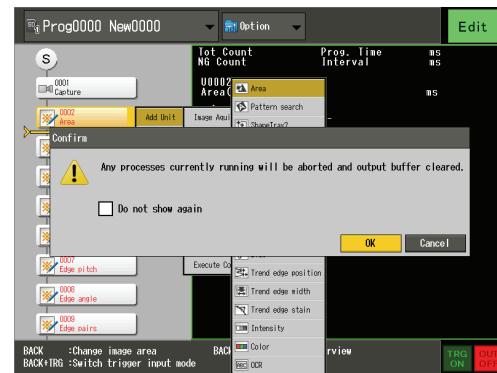
2 Select [Add Unit].

The position where a unit will be added is highlighted.



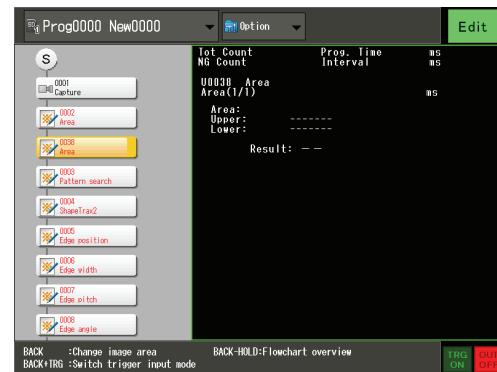
3 Select the type of unit to be added.

A confirmation screen appears.



4 Select [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

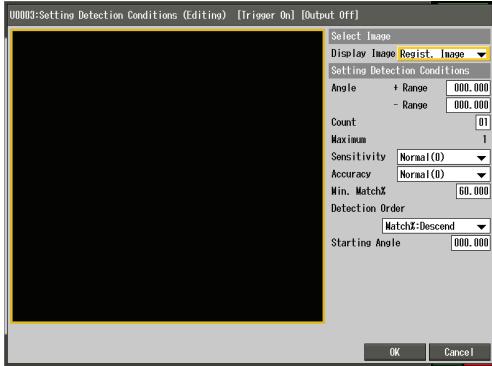
Various functions are available such as deleting/copying/cutting/pasting a unit, grouping units, jumping to a specified unit, renumbering unit IDs, and viewing information. See "Other Flowchart Edit Menu Functions" (Page 4-10) for more details.

3. 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 4-312).



▶ Note

- Changing the setting in the Edit Unit menu during inspection may greatly affect the inspection result. It is recommended you stop the inspection operation before you change the setting in the Edit Unit menu.
- Since the controller allows the program to apply partial or entire operational restrictions on the functions in the menu, some or all of the functions described here may not be available or their operation or behavior may be different from the description.

Reference

- Depending on the program, this Edit Unit menu can be invoked from [Edit Unit] in the function 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 Pre-Programmed Unit" (Page 8-25).

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 of the C Plug In, start and end units cannot be changed on the controller. See the XG VisionEditor Reference Manual (Programming Edition) for more details.

Image Acquisition

- Capture (Page 4-16)

Vision Tools

- Area (Page 4-28)
- Pattern search (Page 4-37)
- ShapeTrax2 (Page 4-49)
- Edge position (Page 4-63)
- Edge width (Page 4-75)
- Edge pitch (Page 4-87)
- Edge angle (Page 4-99)
- Edge pairs (Page 4-109)
- Stain (Page 4-122)
- Blob (Page 4-136)
- Trend edge position (Page 4-149)
- Trend edge width (Page 4-164)
- Trend edge stain (Page 4-179)
- Intensity (Page 4-195)
- Color (Page 4-204)
- OCR (Page 4-213)

Position Adjustment

- Position adjustment (Page 4-232)

Operation

- Branch / Join (Page 4-236)
- Loop function / Loop end (Page 4-239)
- Break (Page 4-240)
- End (Page 4-240)

Functions

- Calculation (Page 4-241)
- Image operation (Page 4-244)
- Calibration (Page 4-256)

Timing

- Pause (Page 4-267)
- Timer (Page 4-268)
- Timer setup (Page 4-269)
- Terminal I/O delay (Page 4-270)
- Variable delay (Page 4-272)
- User menu (Page 4-274)

Display

- On-screen graphics (Page 4-275)

Output

- Parallel terminal output (Page 4-291)
- Data output (Page 4-294)
- Image output (Page 4-299)

Execute Command

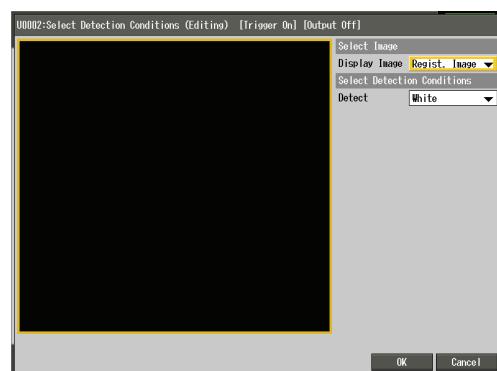
- Command (Page 4-303)

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 confirm the message before selecting [OK].
- When there are many units in a flowchart, it is useful to use the jump function (Page 4-15) which allows easy selection of the unit to be edited.

2 Open the appropriate sub menu and change the setting of the unit.

See the explanation of each unit for more details.

Reference

When a unit has setting parameters which support variable assignment, you can assign variables to change or control the setting parameters externally or to use common parameters across several units. Refer to "Assigning variables to Parameters" (Page 4-312) for more details.

3 Select [OK].

Saving settings

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

▶ Note

When you turn off the controller without saving settings, all of the changes to settings made so far will be deleted.

Combination key operations with the Edit Unit menu

On the Edit Unit menu, the following combinations have been added to the handheld controller.

Menu	Combination keys	Operation
Top menu, Enter limits menu	No. 1 or No. 7 button + Right/left movement of No. 0 button	Switch pages
Top menu, Enter 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 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 composition 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 conversion processes
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 menu (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.

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 8-2) and the [Inspection Region] (sub menu) of the Edit Unit menu.
- Register menu (Page 8-11) and the [Register] (sub menu) of the Edit Unit menu.
- Color menu (Page 8-13) and the [Color] (sub menu) of the Edit Unit menu.
- Library Setting menu (Page 8-20) 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 in the upper left of the menu.

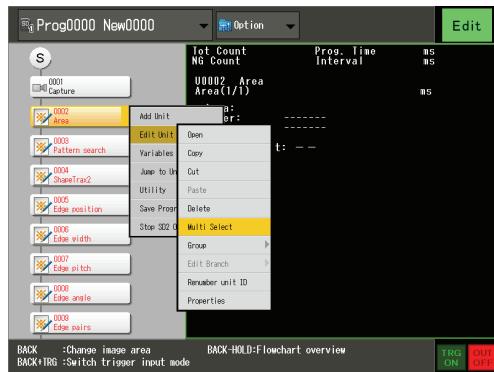


Other Flowchart Edit Menu Functions

Selecting two or more units on a flowchart simultaneously

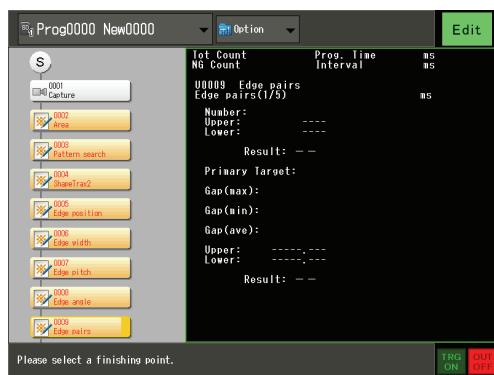
This function is useful when you want to copy/cut/delete two or more units in one operation.

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

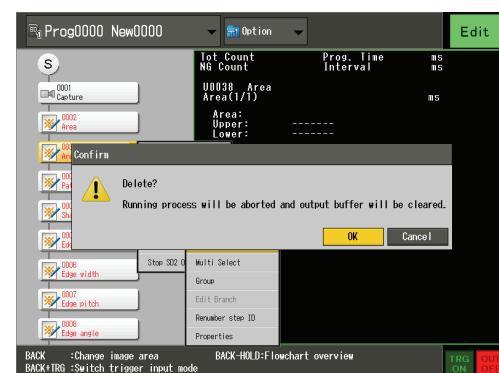
- When you select a group and delete it, all units in the group are deleted.
- When a locked group is included in the selection, the deletion is disabled.
- When a branch of a branch unit is deleted, all units of the deleted branch No. are deleted.
- The start unit and the end unit at the end of a flowchart 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).



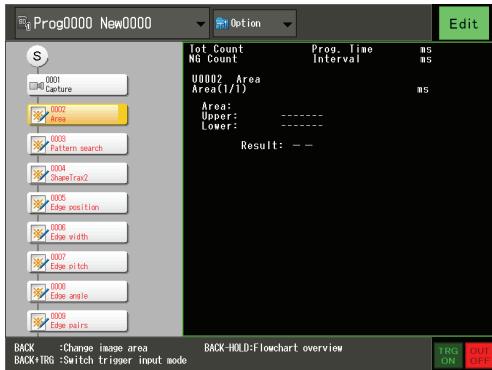
2 Select [Edit Unit] - [Delete].

A confirmation screen appears.



3 Select [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.

► 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 Select [OK].

The cut / copied unit(s) are pasted into the flowchart.

► Note

You can also paste a unit which was copied from a program with a different No. However, this may not be possible 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.

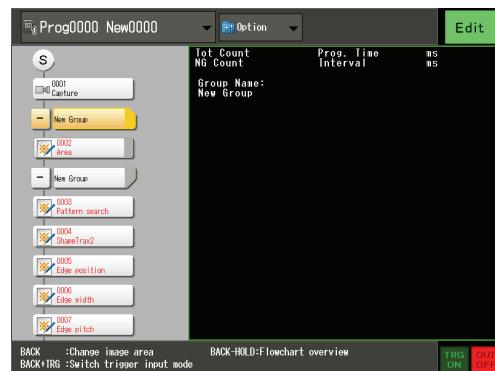
► Note

- 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].

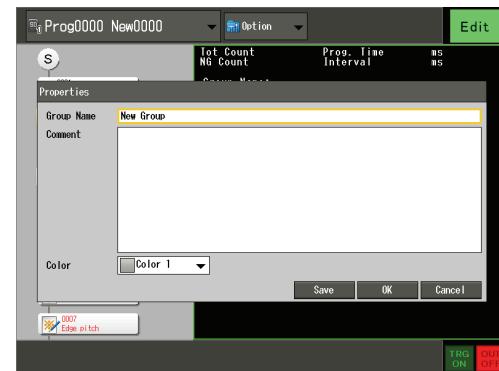
The unit(s) selected in step 1 are grouped as [New Group] and shown in the flowchart as a group icon.



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 Select [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 4-11) 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 4-318), 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 4-237) and "Removing part of a branch" (Page 4-237) of the branch / join units.

Renumbering the unit IDs

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

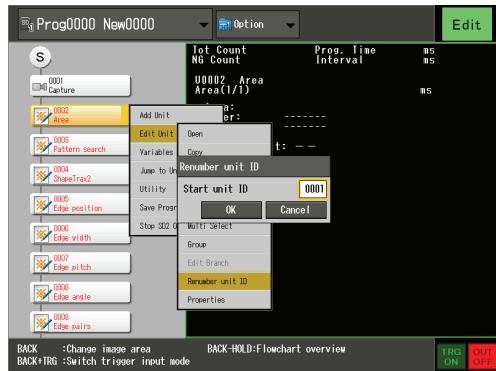
- The unit IDs are renumbered based on the following principles:
 - **Units other than branch / join units:** Unit IDs are renumbered one by one from the top of the flowchart.
 - **Branch / join units:** After the unit ID of the branch unit is renumbered, the unit IDs under the branch are renumbered 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 references
 - Command units
 - Calculation units
 - Output units
 - Position adjustment units
 - Branch units
 - Position adjustment units used in other units
 - Screen editor (unit references)
 - Custom commands
 - Statistics function
 - Archive function
 - 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 Place the cursor on the unit that you want to start renumbering IDs for, and then display the flowchart edit 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 Select [OK].

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

► Note

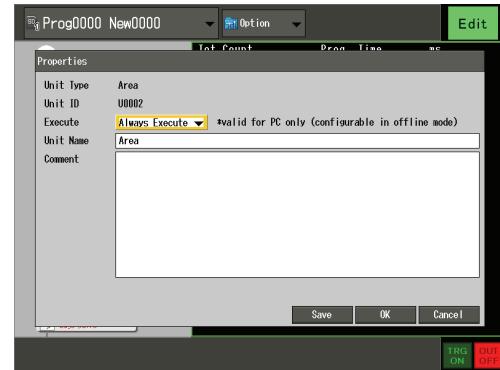
If the unit ID renumbering causes an overflow for those units with maximum character limitations (such as calculation units or command units), the unit IDs for the parameters in those functions may not be updated. Consequently, there may be some inconsistency in the unit ID referencing relationship.

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 5-5). 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. Any comments (up to 256 characters, 512 single byte characters) can be entered for easy, intuitive referencing.

Color settings (Branch, Loop and Group units only)

Select which color to display the unit / group in the flowchart from the 10 available colors.

4 Select [OK].

► Note

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

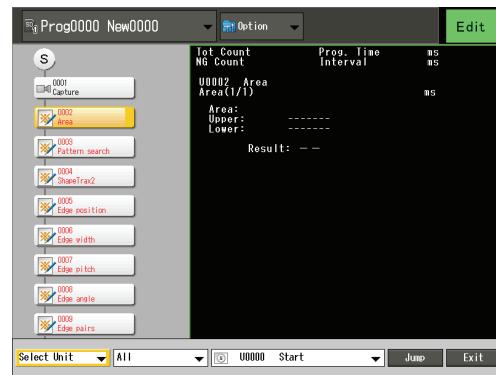
Finding and displaying units based on their ID (Jump)

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 to 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 capturing an image for inspection. When the CA-DC20E illumination expansion unit is connected, you can control connected lights (strobe settings, intensity and configuration) through the FLASH (strobe) output settings.

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 all 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 4-21).
- 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 5-6).

Top Menu Layout

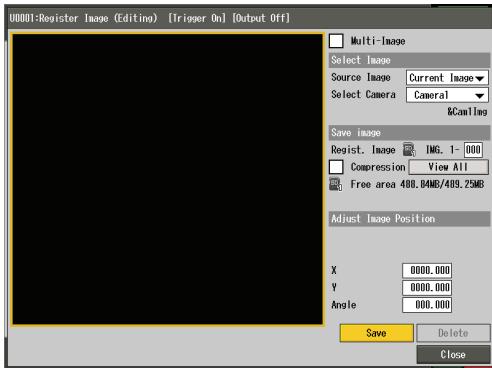
The capture unit menu has the following options.



Register Image (Page 4-17)	Registration of an image to be used as a template for settings.
Capture Opt. (Page 4-18)	Settings for image capture.
Camera Set. (Page 4-21)	Settings for the camera(s) used for image capture.
Trigger Set. (Page 4-22)	Settings for the trigger signal(s) used for image capture.
Strobe Set. (Page 4-24)	Settings for strobing lights for image capture.
Light Int. (Page 4-25)	Light intensity adjustment when the CA-DC20E illumination expansion unit is used.
Light Config. (Page 4-26)	Light configuration when the CA-DC20E illumination expansion unit is used.
Save (Page 4-27)	Save image capture settings.

Register Image

Registration of an image to be used as a template for settings. It is recommended to carefully adjust lighting and other conditions before registering an image.



Multi-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 5-17).
- When multi-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, multi-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 most recent captured unit executed is being edited, the images collected in the buffer will still be displayed even if the captured unit is no longer being executed.

Select Image

Source Image

Select an image to register.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Save Image] is displayed.

Select Camera

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

Save Image

Number

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

Compression

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

There may be some deterioration in image quality due to compression. Inspection results when using a compressed image may differ from results when using an uncompressed image.

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 -2432.000 and 2432.000 pixels.

Y

Adjust the movement in the Y (vertical) direction between -2050.000 and 2050.000 pixels.

Angle

Adjust the 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 of the registered image.

Save

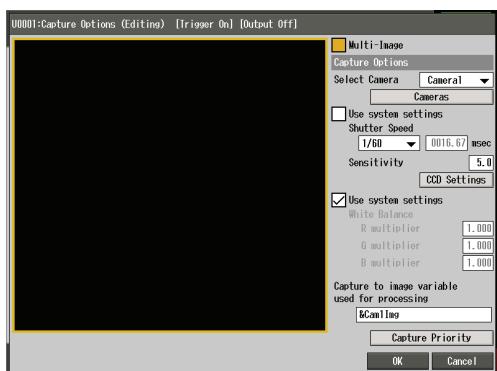
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Regist. Image] is selected for [Source Image], you can delete the registered image specified under [Save Image].

Capture Options

Specify the options for image capture.



Including adjustment of image quality by changing the cameras sensitivity and gain-adjustment for captured images. This function is useful when lightening a darkened image or importing an image with black compression or white clipping.

▶ Note

If you change the capture options after extracting the color, the color extraction result for the current image may be different. Make sure to reset the color settings if the capture options are changed.

Reference

The gain adjustment can be set separately for each camera. It can also be set as a contrast conversion filter (Page 8-30) for each vision tool unit.

Multi-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.
- If the capture on trigger input is disabled in the trigger settings (Page 4-22), this check box is always unchecked and the setting cannot be changed.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 5-17).
- When multi-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.
- The image variable used for the select image of the vision tools unit should be the same as the image variable used for the capture unit being executed. When the image capture buffer is set to custom, the image variable which contains the image of the capture unit executed most recently will be displayed.

Capture Options

Select Camera

Select the camera used for setting the capture options.

Cameras

Specify a camera to be used to capture images in this unit.

▶ Note

- Different cameras affect the consumption of the image memory resource.
- When this setting is changed, the processing of other operations will stop temporarily.

Use system settings

Use the values set in the system settings ([Camera Settings] of the System Configuration menu (Page 5-6)).

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. If using a fast shutter speed ensure there is enough light intensity to produce a high quality image.

▶ Note

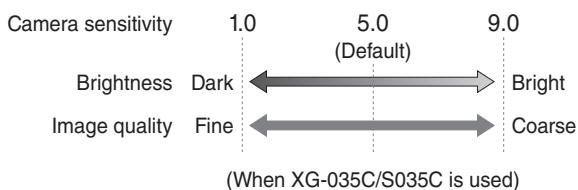
- The range of possible shutter speeds are different for each camera.
- When a fast shutter speed is used and a bright light enters the camera, vertical streaking of the image may occur. To compensate for this, close the lens aperture as far as possible.

Sensitivity

You can adjust the sensitivity of the CCD of the camera specified in [Select Camera]. To adjust the brightness of an image, typically the lens aperture, shutter speed of the camera, or the lighting is changed. However, if none of these improve image brightness by then change the camera sensitivity.

Reference

When you raise the camera sensitivity, the overall brightness of the image improves, but noise elements in the image become more visible, and the image becomes coarser. When you lower the camera sensitivity, the overall image darkens, but the noise elements lessen and the image becomes less coarse and higher quality.



▶ Note

When the camera sensitivity is set higher than the initial state using the high-speed camera (XG-H035C/H035M/H100C/H100M/H200C/H200M/H500C/H500M), a vertical line may appear in the screen. This phenomenon is related to the CCD configuration and is not an error. When this phenomenon occurs, set the camera sensitivity lower and adjust the external lighting.

Reference

The range of adjustment for camera sensitivity is different for each camera.

- XG-H035C/H035M/H100C/H100M/S200C/S200M/H200C/H200M/H500C/H500M: 1.0 to 7.0
- Other cameras (including analog cameras): 1.0 to 9.0

CCD Settings

To adjust high or low contrast 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 up for RGB 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 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 the RGB individually, select [SEL], and then select the color (R, G or B).

After a color is selected, the graph at the top of the screen will be displayed in the selected color.

▶ Note

This setting cannot be changed when the [Use system settings] is checked.

Reference

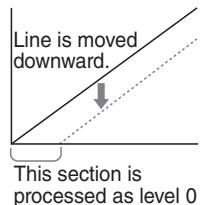
To adjust RGB together, select [ALL]. When the selection state is returned to [ALL], the previous individual settings are reset to the setting values for the R channel.

3 Select [Shift], and then specify the shift (offset) level for the entire digital signal.

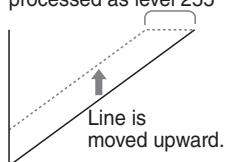
The range of values you can specify is from -255 to +255 (default: 0).

• To darken the overall image:

Specify a negative value to move the entire line downward. The X range (input) below the minimum value on the Y-axis is processed as level 0 (black).

**• To lighten the overall image:**

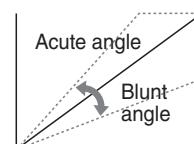
Specify a positive value to move the entire line upward. The X range (input) above the maximum value on the Y-axis is processed as level 255 (white).

**Reference**

You can also set values above (or below) a specified contrast change to 255 or 0.

4 Specify a value for [Span (All)], and then specify the degree of adjustment for the contrast level.

The range of values you can specify is from 0.0 to 7.9 (default: 1.0).



- **To obtain higher contrast images:** Specify a large value to make the tilt angle of the line acute.
- **To obtain lower contrast images:** Specify a small value to make the tilt angle of the line blunt.

▶ Note

- This setting cannot be changed when the [Use system settings] is checked.
- Similar to [Shift] in step 3, the X range (input) below the minimum value on the Y-axis is processed as level 0 (black), and the X range (input) above the maximum value is processed as level 255 (white).

5 When the setting is complete, select [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 measurement result may change due to an adjustment of the white balance setting. Be sure to verify the operation after changing the white balance setting.

Capture to an image variable used for processing

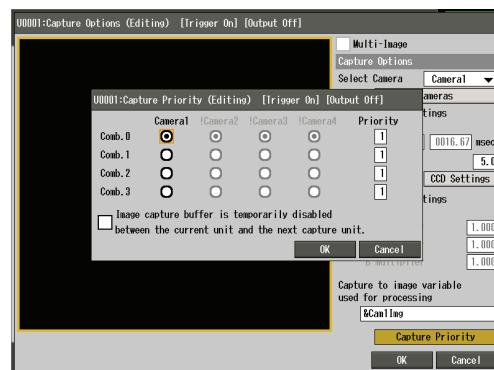
Specify an image variable which will contain the image captured with the camera selected in [Select Camera].

▶ Note

The image variable may need to be added in advance in the [Variables] menu (Page 4-306).

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 four sets of 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 4-18).
- 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 1st (1) to 4th (4)) 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 4-316), 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

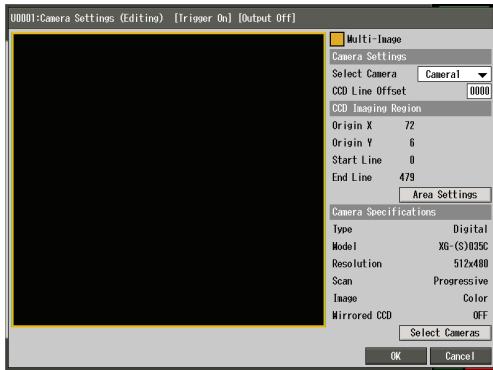
When this setting is changed, the processing of other operations will stop temporarily.

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.



Multi-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 5-17).
- When multi-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.

Camera Settings

Select Camera

Select the camera to change the settings for.

CCD Line Offset (Digital camera 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].

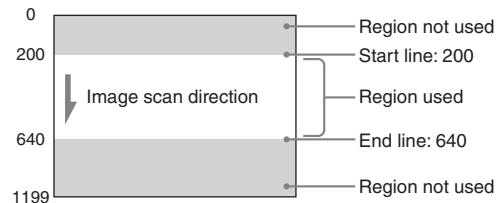
▶ Note

When the offset value is changed, the processing time for the capture unit executed is extended due to the changes being applied.

CCD Imaging Region (Digital camera only)

The current CCD imaging region for the camera is displayed.

Example: CCD imaging region is set to "Start Line: 200, End Line: 640"



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.

▶ Note

- Information may not be inspected if they do not fully lie between the start and end lines, even if it is in the process region.
- The area around the captured image might darken when a lens whose maximum image size is small and the process region is positioned at the edge of the CCD.
- This setting is common for all capture units.
- When the CCD imaging region is set, the processing of other operations stops, and all image variables and archived data is cleared.
- Only cameras which support interlaced scanning can capture even lines.

Mirrored CCD

Select whether to mirror the image horizontally for the camera selected in [Select Camera].

- **OFF:** Do not mirror the image horizontally.
- **ON:** Mirror the image horizontally.

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 setting

Select the model of the camera.

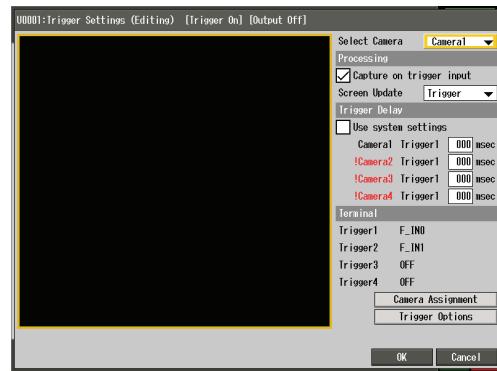
When a camera is connected, selecting [Auto] automatically sets the [Model] and [Resolution].

► Note

- If all 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.
- When the model or resolution is changed, the settings of each capture unit, which depend on that camera model, are reset to their default settings.
- When the model or resolution is changed, the processing of other stops, and all image variables and archived data is cleared.

Trigger Settings

Specify the settings for the image capture trigger operations.



Select Camera

Select the camera to change the settings for.

Processing

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 4-316) 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.

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 to 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 200 μ s of the expected capture time. See 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 5-6)).

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 the external trigger, click and select 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 through RS-232C
 - **Ethernet**: Trigger input through Ethernet
 - **PLC-Link**: Trigger input through RS-232C or Ethernet PLC-Link
 - **CC-Link**: Trigger input through CC-Link
 - **PC Program**: Trigger input through ActiveX Control
- **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.

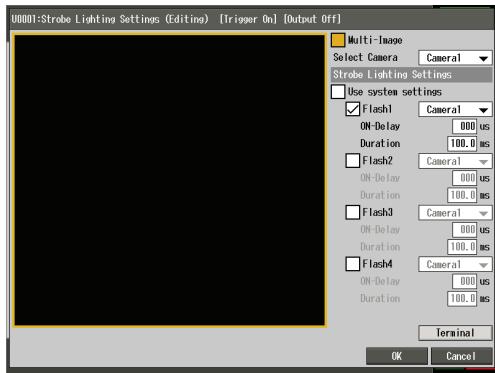
Reference

When the internal trigger is selected, trigger signals are continuously generated during Run mode operation. To stop the trigger signal generation via an external device, use any of the following methods. When internal trigger is disabled, the output of the result data up to that point continues.

- Terminal block input (EXT terminal) (Page 6-21)
- 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.

Strobe Lighting Settings

Specify the settings for strobe control of lights for image capture.



When the CA-DC20E illumination expansion unit is connected, the specified settings are applied to the illumination expansion unit through the FLASH (strobe) signals.

Multi-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 5-17).
- When multi-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.
- The image variable used for the select image of the vision tools unit should be the same as the image variable used for the capture unit being executed. When the image capture buffer is set to custom, the image variable which contains the image of the capture unit executed most recently will be displayed.

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 5-6)).

Flash 1

Check this box and then select the camera associated with the Flash 1 signal, specifying the ON-delay and duration.

- **ON-Delay:** Specify the starting point for the Flash 1 signal output within the range -500 to 500 (μs), where 0 is the image capture trigger. If a negative value is specified, the output starts before the image capture. If a positive value is specified, output starts after the image capture.
- **Duration:** Set the Flash 1 signal output time within the range 0.1 to 999.9 (ms).

Flash 2 though to 4

Specify the settings for Flash 2 through to Flash 4 in the same way as those for Flash 1.

► Note

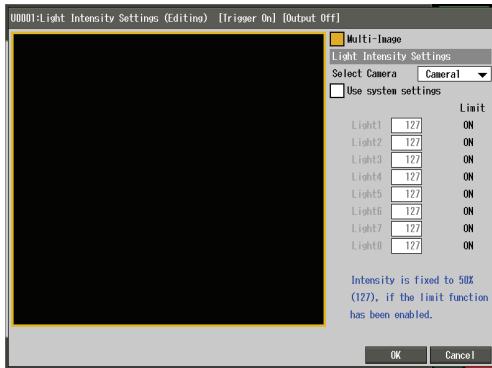
- This setting cannot be changed when the [Use system settings] is checked.
- To assign several strobed lights to a single camera, specify the settings so that the delay in the output starting points among the terminals is 500 μs or less.

Terminal

Selecting [Terminal] displays the assignment of the Flash output terminals.

Light Intensity

Adjustment of the illumination light intensity settings when the CA-DC20E illumination expansion unit is connected to the controller.



Adjust the light intensity to an optimal level according to how the image appears with the correct shutter speed set.

Multi-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 5-17).
- When multi-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.
- The image variable used for the select image of the vision tools unit should be the same as the image variable used for the capture unit being executed. When the image capture buffer is set to custom, the image variable which contains the image of the capture unit executed most recently will be displayed.

Light Intensity Settings

Select Camera

Select the connected camera (1 through to 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 5-6)).

Light 1 to 8

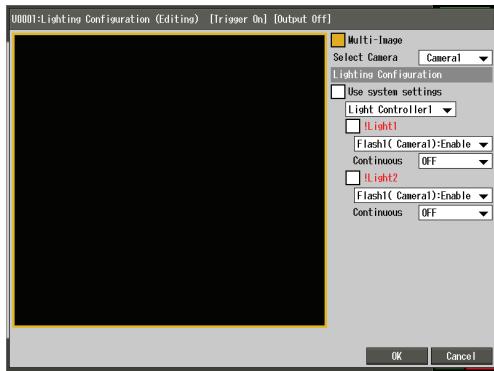
The brightness of each light can be set to an intensity ranging from 0 to 255 (default: 127). The light ID number corresponds to the order in which the illumination expansion units were connected.

▶ 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 [Lighting Configuration] menu (Page 4-26).
- 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 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.

Lighting Configuration

Adjust the configuration for each light when a CA-DC20E illumination expansion unit is connected to the controller.



Change the settings and assignments of the Flash (strobe) output terminals for controlling the illumination expansion units. The Flash output terminals enable the manipulation of the lighting configuration without the need for wiring external terminals.

Multi-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 5-17).
- When multi-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.
- The image variable used for the select image of the vision tools unit should be the same as the image variable used for the capture unit being executed. When the image capture buffer is set to custom, the image variable which contains the image of the capture unit executed most recently will be displayed.

Select Camera

Select the camera to change the settings for.

Lighting Configuration

Select the illumination expansion unit for the connected light that will be assigned to the Flash terminal output.

Reference

- When multiple illumination expansion units are connected, they will be numbered 1 through 4, with 1 being the unit closest to the controller.
- When the illumination expansion unit 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 5-6)).

Light 1

Check the box next to the light number to be assigned to the Flash terminal output, then set the assignment of Flash1 through 4.

- **Flash1 to 4:** Select a Flash signal used for lighting control from Flash1 through 4. The light will illuminate according to the output status of the assigned Flash signal.
- **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.
- The light will not illuminate even after the setting if the selected Flash signal is not assigned to a terminal or the terminal is not checked in [Strobe Lighting Settings] (Page 5-17).
- The Flash assignments cannot be configured when continuous lighting is set to [ON].

Light 2 through to 8

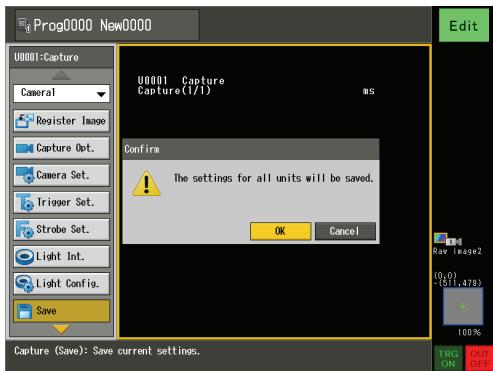
Specify the settings of Light 2 through to 8 in the same way as those for Light 1.

Save

Save the current unit changes the program file.

▶ Note

- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller 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

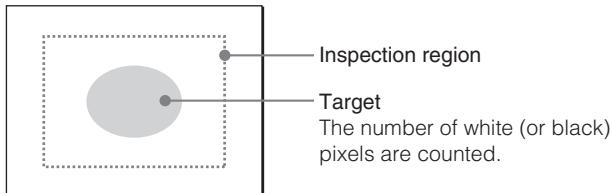
- Items specified not to be saved in XG VisionEditor are excluded from the saving operation. For example, variable values changed in the current program or the default screen display, and display parts, can be excluded when saving.

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 layout



Major results

The major results displayed by the area tool are as follows:

Area	The result is output as the number of pixels. <small>Available in the limits menu</small>
Unit judgment value	When the measurement result is outside the specified tolerance range (between the upper and lower limits), it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).

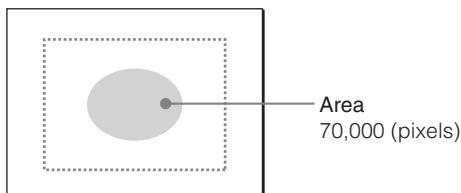
Reference

For a summary of available measurement output values and setting parameters, see "List of Setting Parameters/Result Data" in the XG VisionEditor Reference Manual (Control/Data Edition).

Example

Example showing the results of an inspection performed under the following conditions:

- Detect color: Black



Top Menu Layout

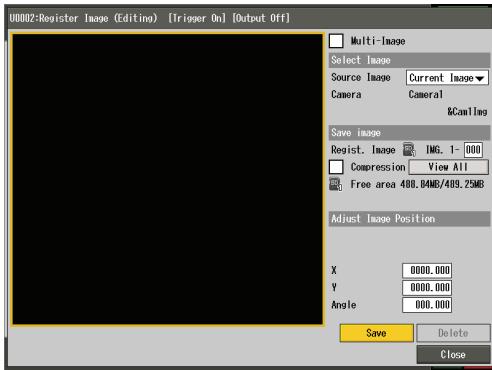
The area unit menu has the following options.



Register Image	Registration of an image to be used as a template for settings.
Select Image	Selection of the registered or current image to be used for settings.
Inspect Region	Outline the region on the captured image to be used for the inspection.
Color	Color extraction and conversion settings for a color image to gray-scale or binary. (only available for color cameras)
Image Enhance	Selection and setting of pre-processing filters to apply to the image.
Condition	Conditions for detecting an area for measurement / inspection.
Parameters	Additional optional parameters for the inspection.
Limits	Pass / fail tolerance (upper and lower limits) settings for the inspection.
Dsp. Options	Inspection region and mask region display settings.
Save	Save area tool settings.

Register Image

Registration of an image to be used as a template for settings. It is recommended to carefully adjust lighting and other conditions before registering an image.



Multi-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 5-17).
- When multi-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.
- The image variable used for the select image of the vision tools unit should be the same as the image variable used for the capture unit being executed. When the image capture buffer is set to custom, the image variable which contains the image of the capture unit executed most recently will be displayed.

Select Image

Source Image

Select an image to register.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Save Image] is displayed.

Save Image

Number

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

Compression

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

There may be some deterioration in image quality due to compression. Inspection results when using a compressed image may differ from results when using an uncompressed image.

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 -2432.000 and 2432.000 pixels.

Y

Adjust the movement in the Y (vertical) direction between -2050.000 and 2050.000 pixels.

Angle

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

Reference

When you select [Current Image] as the source image for the unit for which the position adjustment ID has been specified in [Inspection Region] (Page 4-31), you can select [Pos. Adjust. value] as well as [Number Input]. This option is useful because even when the image capture position deviates, the current image is automatically adjusted using the adjustment value based on the reference unit. However, note that when [Pos. Adjust. value] is selected in the state where a proper adjustment value cannot be measured for the current image, the position used for registration may be incorrect.

▶ Note

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

Save

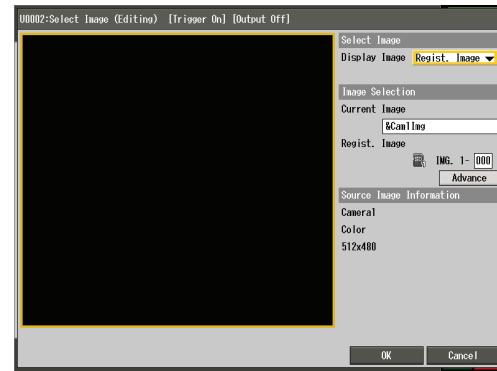
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Regist. Image] is selected for [Source Image], you can delete the registered image specified under [Save Image].

Select Image

Selection of the registered or current image to be used for settings.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Image Selection

Current Image

Set an image variable to be used as a current image for the unit.

Regist. Image

Specify the registered image to be used as a template.

- 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.

- **Assign variables to registered image No.:** To use a variable for the registered image No., check this box and assign a scalar or scalar 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. See the XG VisionEditor Reference Manual (Control/Data Edition) for more details.
- **Assign variables only when changing programs:** Use this option to switch 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

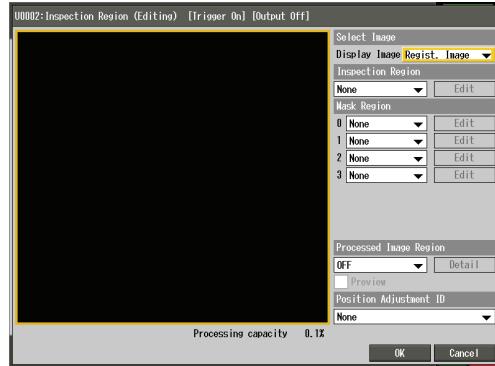
Note that the displayed registered image No. does not switch in accordance with a change in the variable.

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 the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Inspection Region

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. Refer to "Inspection Region Menu" (Page 8-2) 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 8-8) 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 8-7).

Processed Image Region

To use a processed region from a resultant image variable (Page 4-253), select [ON] and then select [Detail] for configuration.

Reference

See "Generating a Region from an Image" (Page 8-10) for more details on the image region.

Result

Specify the resultant image variable used for the processed image region.

Detect

Select the area and border color for the inspection region from the image data in the resultant image variable by selecting either [Black] (Level 0) or [White] (Level 255, default).

Preview

When this box is checked, the specified resultant image variable is displayed. When the checkmark is removed, the display returns to its normal state.

Position Adjustment ID

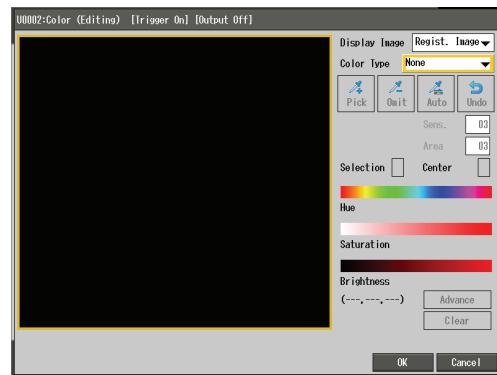
To apply position adjustment to the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).



▶ Note

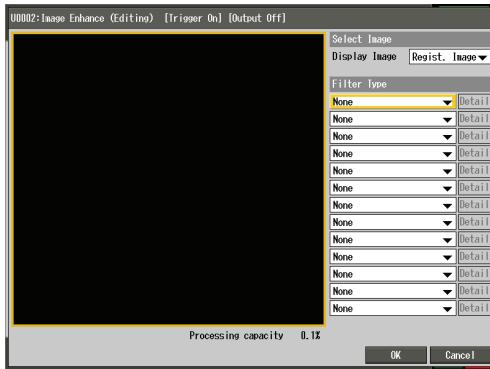
This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-253) is referenced as the current image.

Refer to "Working with Color Images" (Page 8-13) for concepts involving color extraction and its operation.

Image Enhance

Selection and setting of pre-processing filters 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.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Filter Type

Select the [Filter Type] 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 8-27) for more details of each filter processing.

▶ Note

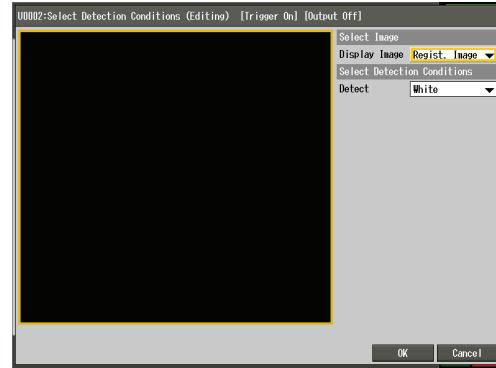
- For the area tool, [Binary] must be selected unless color to binary is used in the color extraction settings.
- When the binary filter is not selected or another filter is applied after the binary filter, the inspection result may not be correct.
- The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 21 types of filters can be set according to application requirements. When multiple filters are set, they are processed one by one from the top.
- You can change the order of the filters 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 up or down.

Detection Conditions

Conditions for detecting an area for measurement / inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Select Detection Conditions

Detect

Specify the color of pixels (black/white) to be detected in the binary image.

- **White:** The number of white pixels are counted.
- **Black:** The number of black pixels are counted.

Parameters

Additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Parameters

Origin

By default, the origin is set to the top left point of the camera but you can specify its position 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 4-314).
- 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 VisionEditor Reference Manual (Control/Data Edition).

Coordinate Value

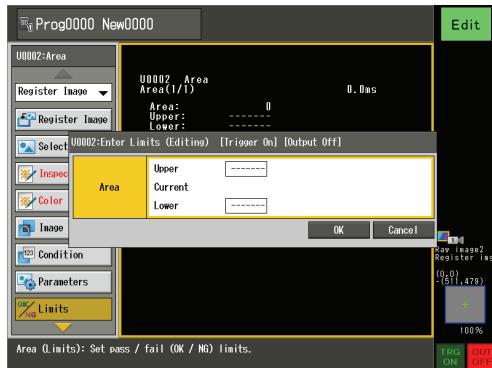
Select the coordinate system to be used after position adjustment. If position adjustment is not used, this setting will have no effect on the measurement.

- **After position adjust:** The inspection uses the adjusted coordinate system determined after position adjustment.
- **Before position adjust:** The distance from the position specified for the [Origin] of the inspection is used.

Enter Limits

Pass / fail tolerance (upper and lower limits) settings for the inspection.

When the measurement result is outside of the specified tolerance range, it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).



Select [Direct Input] to set the tolerance and then enter a value.

Reference

- [----] indicates an empty state where no tolerance is set. In this state, judgment will not be performed after the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Area

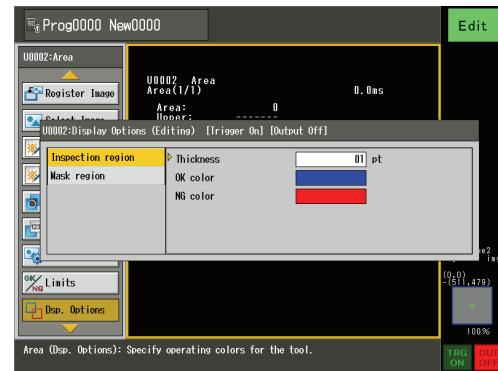
Set the tolerance for the inspected area.

The unit of tolerance is the "number of pixels" inside the measured area.

Display Options

Inspection region and mask region display settings.

The display color can be changed based on the judgment result for that unit. The color can also be removed (transparent) by selecting [Setting] - [Select color] - [None].



Inspection region

Specify the line width and display color of the inspection region.

Mask region

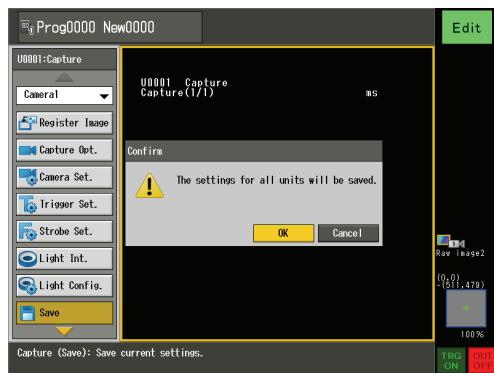
Specify the line width and display color of the mask region.

Save

Save the current unit changes the program file.

▶ Note

- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller 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 screen display, and display parts, can be excluded when saving.

Pattern search

Pattern Search Tool

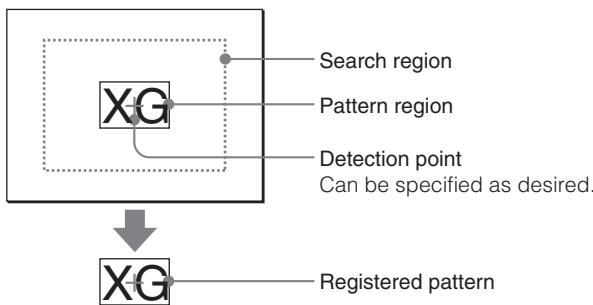
A particular shape or pattern from the registered image can be stored and compared to the current image. From this comparison, the position, angle, and correlation value can be calculated and output.

▶ Note

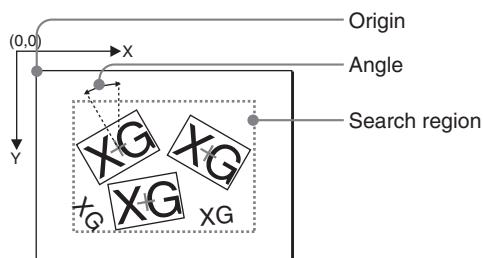
The size of the pattern region may be limited by the remaining program memory. The program memory is shared by all units in one program. When processing multiple units which use the program memory, you need to limit the total memory usage to less than that of the program memory. In the pattern search, 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 layout

Teaching a pattern



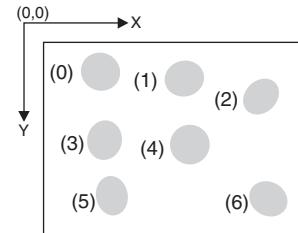
During operation



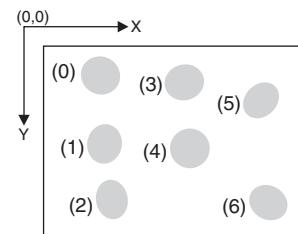
Ordering detected patterns

There are 10 ways the patterns can be ordered.

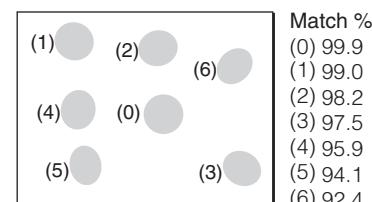
- Y>X: Ascend (ordering in rows)



- X>Y: Ascend (ordering 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 4-45).

Major results

The major results displayed by the pattern search tool are as follows:

Count	Outputs the number of detected patterns. Available in the limits menu
Detected point (X, Y) []	Outputs the coordinates of all detected patterns in pixels. Available in the limits menu Available through outputs
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. Available in the limits menu Available through outputs
Correlation Value % []	Outputs the percentage match (0 to 99.99) between the registered pattern and the detected patterns in the search region. Available in the limits menu Available through outputs
Unit judgment value	When the measurement result is outside the specified tolerance range (between the upper and lower limits), it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).

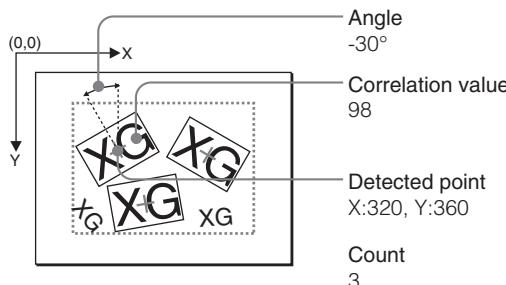
Reference

For a summary of available measurement output values and setting parameters, see "List of Setting Parameters/Result Data" in the XG VisionEditor Reference Manual (Control/Data Edition).

Example

Example showing the results of an inspection performed under the following conditions:

- Detection Order: X>Y:Ascend
- Primary Target: 0



Top Menu Layout

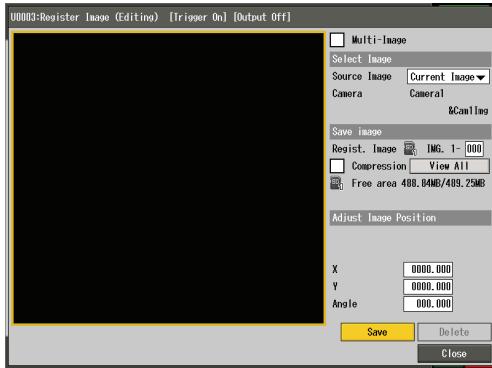
The pattern search unit has the following options.



Register Image (Page 4-39)	Registration of an image to be used as a template for settings.
Select Image (Page 4-40)	Selection of the registered or current image to be used for settings.
Search Region (Page 4-41)	Outline the region on the captured image to be used for searching.
Pattern Region (Page 4-42)	Outline the region on the captured image to record the pattern.
Color (Page 4-43)	Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).
Image Enhance (Page 4-43)	Selection and setting of pre-processing filters to apply to the image.
Condition (Page 4-44)	Conditions for detecting a pattern for measurement / inspection.
Parameters (Page 4-45)	Additional optional parameters for the inspection.
Limits (Page 4-47)	Pass / fail tolerance (upper and lower limits) settings for the inspection.
Dsp. Options (Page 4-47)	Search region and mask region display settings.
Save (Page 4-48)	Save pattern search tool settings.

Register Image

Registration of an image to be used as a template for settings. It is recommended to carefully adjust lighting and other conditions before registering an image.



Multi-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 5-17).
- When multi-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.
- The image variable used for the select image of the vision tools unit should be the same as the image variable used for the capture unit being executed. When the image capture buffer is set to custom, the image variable which contains the image of the capture unit executed most recently will be displayed.

Select Image

Source Image

Select an image to register.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Save Image] is displayed.

Save Image

Number

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

Compression

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

There may be some deterioration in image quality due to compression. Inspection results when using a compressed image may differ from results when using an uncompressed image.

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 -2432.000 and 2432.000 pixels.

Y

Adjust the movement in the Y (vertical) direction between -2050.000 and 2050.000 pixels.

Angle

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

Reference

When you select [Current Image] as the source image for the unit for which the position adjustment ID has been specified in [Inspection Region] (Page 4-41), you can select [Pos. Adjust. value] as well as [Number Input]. This option is useful because even when the image capture position deviates, the current image is automatically adjusted using the adjustment value based on the reference unit. However, note that when [Pos. Adjust. value] is selected in the state where a proper adjustment value cannot be measured for the current image, the position used for registration may be incorrect.

▶ Note

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

Save

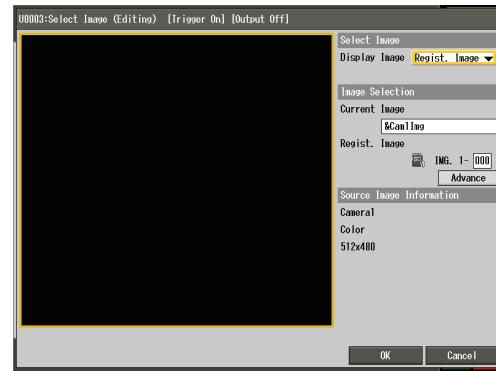
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Regist. Image] is selected for [Source Image], you can delete the registered image specified under [Save Image].

Select Image

Selection of the registered or current image to be used for settings.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Image Selection

Current Image

Set an image variable to be used as a current image for the unit.

Regist. Image

Specify the registered image to be used as a template.

- 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.

- **Assign variables to registered image No.:** To use a variable for the registered image No. check this box and assign a scalar or scalar 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. See the XG VisionEditor Reference Manual (Control/Data Edition) for more details.
- **Assign variables only when changing programs:** Use this option to switch 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 image registration:** To directly reference an image variable as a registered image, check this box and then assign an image variable (resultant image variable) to be referenced.

▶ Note

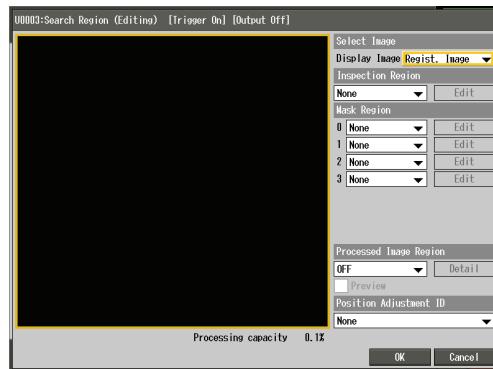
- Note that the registered image No. does not switch in accordance with a change in the variable.
- Only a resultant image variable can be assigned to [Use image variable for image registration].
- When [Use image variable for image registration] is enabled while [Referenced Image] (Page 4-46) has been set to [Constant (fast)], the [Referenced Image] setting is automatically changed to [Update every time (slow)]. This option can still set it to [Update by user (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 be used for searching (Page 4-42).



Reference

The smaller the search region, the shorter the processing time.

Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Inspection Region

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. Refer to "Inspection Region Menu" (Page 8-2) 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 8-8) 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 8-7).

Processed Image Region

To use a processed region from a resultant image variable (Page 4-253), select [ON] and then select [Detail] for configuration.

Reference

See "Generating a Region from an Image" (Page 8-10) for more details on the image region.

Image

Specify the resultant image variable used for the processed image region.

Border

Select the area and border color for the inspection region from the image data in the resultant image variable by selecting either [Black] (Level 0) or [White] (Level 255, default).

Preview

When this box is checked, the specified resultant image variable is displayed. When the checkmark is removed, the display returns to its normal state.

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.

Pattern Region

Outline the region on the captured image to record the pattern.



Reference

If the pattern region is a complicated shape, mask regions can be used to exclude unwanted parts.

Select Image

Display Image

- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Note

The display image cannot be changed.

Inspection Region

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. Refer to "Inspection Region Menu" (Page 8-2) for more details.

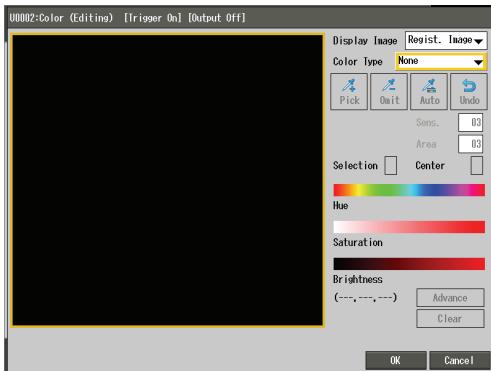
Mask Region

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 8-8) for more details.

Color

Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).



▶ Note

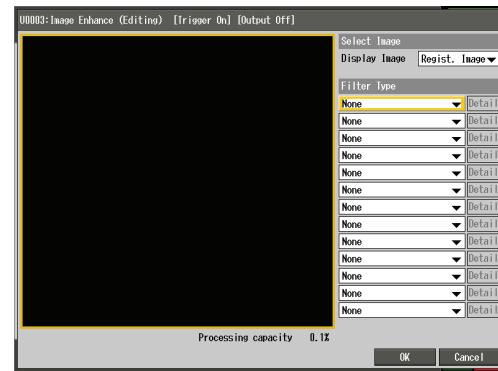
This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-253) is referenced as the current image.

Refer to "Working with Color Images" (Page 8-13) for concepts involving color extraction and its operation.

Image Enhance

Selection and setting of pre-processing filters 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.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Filter Type

Select the [Filter Type] and then select the filter to apply. See "Image Enhancement Filters" (Page 8-27) for more details of each filter processing.

▶ Note

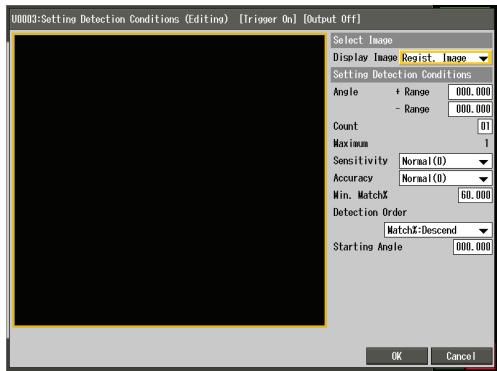
- The subtraction filter cannot be selected for the pattern search measurement.
- The binary and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 21 types of filters can be set according to application requirements. When multiple filters are set, they are processed one by one from the top.
- You can change the order of the filters 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 up or down.

Detection Conditions

Conditions for detecting a pattern for measurement / inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

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 three pattern positions.

▶ Note

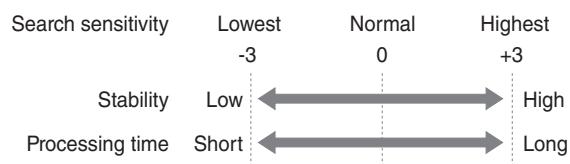
- The maximum number of patterns that can be detected depends on other settings.
- With some settings, the number of patterns to be detected cannot be changed.

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.
- It may be possible to specify a count greater than the [Maximum] value (up to 99) depending on the account setting. Although increasing the [Maximum] limit, results in more consumption of the program memory.

Sensitivity

Configure the search sensitivity. When detection is unstable, increase the level of sensitivity.

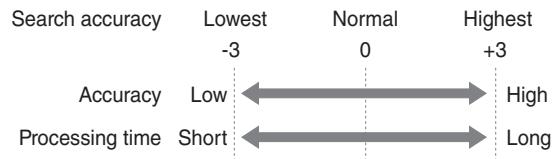


▶ Note

Increasing the level of search sensitivity may improve the stability of detection, but the processing time may become longer.

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.

Min. Match%

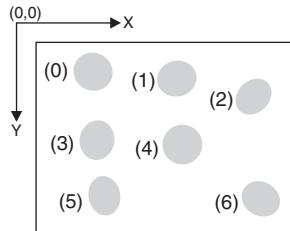
Specify the minimum correlation value for detected patterns to prevent false detection.

Example: When the [Min. Match%] is set to 80%, only those patterns having a correlation value of 80% or more are actually processed.

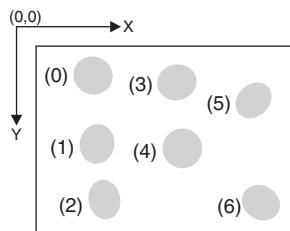
Detection Order

Specify the identification order of the detected patterns.

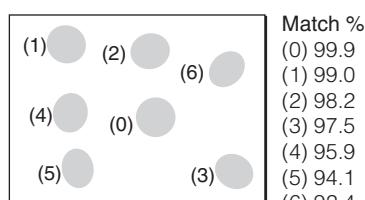
- Y>X:Ascend:



- X>Y:Ascend:



- X:Ascend
- X:Descend
- Y:Ascend
- Y:Descend
- Match%:Ascend
- Match%:Descend:



- Clockwise
- Counter CW

Starting Angle

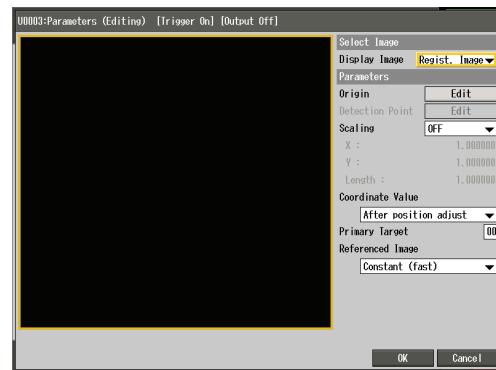
Specify the angle to start numbering when the [Detection Order] setting is [Clockwise] or [Counter CW].

▶ Note

This setting is not used if the [Detection Order] is not [Clockwise] or [Counter CW].

Parameters

Additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- Regist. Image:** The registered image specified under [Image Selection] is displayed.

Parameters

Origin

By default, the origin is set to the top left point of the camera but you can specify its position 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

You cannot set offset the detection point 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 4-314).
- 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 VisionEditor Reference Manual (Control/Data Edition).

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 system 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 to be used for judgment from the detected patterns. Setting can be from 0 to 98, although 0 is used by default.

▶ Note

Only data from the primary target is used for judgment (excluding count measurement).

Referenced Image

Select memory operation to speed up the pattern search.

- **Constant (fast)** (default): Uses only the program memory for processing variables for pattern region settings, color extraction, or image enhancement cannot be used.
- **Update every time (slow):** Variables for pattern region settings, color extraction, or image enhancement can be used the processing time increases though as the image memory has to be used to recalculate the reference image information for each inspection.
- **Update by user (fast):** This option uses both program memory and image memory to allow variable referencing but is faster when compared with the [Update every time (slow)] setting. Changes in parameters from referenced variables are applied when the update reference image information command (RU) is used. See the XG VisionEditor Reference Manual (Control/Data Edition) for more details.

Reference

- Parameters relating to the reference image information include pattern region, color extraction, image enhancement and detection conditions (angle range, search sensitivity, search accuracy).
- When [Update by user (fast)] is selected, the change in the setting parameters in the Inspect Region menu (Page 8-2), Color menu (Page 8-13) and Edit Unit menu are applied without the "RU" command. (The update reference image information and application to the relevant unit are processed immediately. Whereas in the case of the Edit Unit menu, and other menus processing is performed done when [OK] is selected menus.)

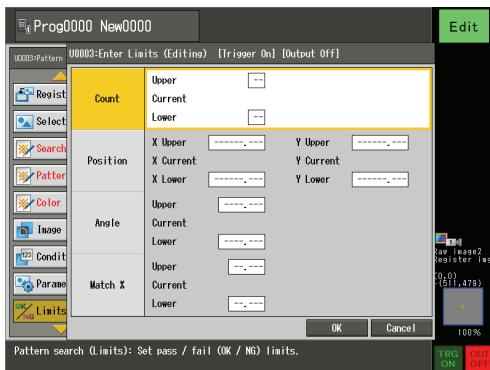
▶ Note

- If there is not enough memory for each operation, a setting error may occur.
- The [Referenced Image] cannot be set to [Constant (fast)] when a variable is assigned to the pattern region setting, color extraction or image enhancement. Cancel the variable referenced and then change the setting.

Enter Limits

Pass / fail tolerance (upper and lower limits) settings for the inspection.

When the measurement result is outside of the specified tolerance range, it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).



Select [Direct Input] to set the tolerance and then enter a value.

Reference

- [---] indicates an empty state where no tolerance is set. In this state, judgment will not be performed after 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

Search region and mask region display settings.

The display color can be changed based on the judgment result for that unit. The color can also be removed (transparent) by selecting [Setting] - [Select Color] - [None].



Search region

Specify the line width and display color of the search 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 4-45) has been set, the detected point shifts according to the offset value.

Other target

For the detected patterns, other than the primary target (Page 4-46), specify the width and display color of the detected pattern region and reference point (center of the pattern region).

Reference

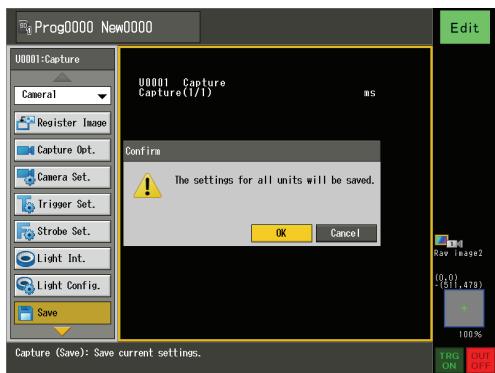
When the detection point offset (Page 4-45) has been set, the detected point shifts according to the offset value.

Save

Save the current unit changes the program file.

▶ Note

- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller 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 screen display, and display parts, can be excluded when saving.

ShapeTrax2

ShapeTrax2 Tool

Precise measurements of position, angle and correlation can be made on a target by comparing edge data from a registered image pattern to the current image.

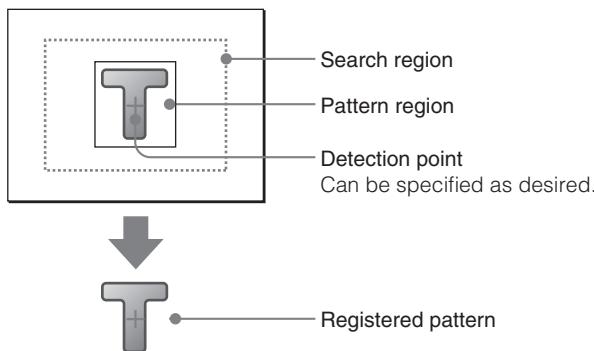
Differing from pattern searching (Page 4-37), ShapeTrax2 uses edge information from the target, making it ideal for searches on surfaces that are damaged or changing and require stability and accuracy.

▶ Note

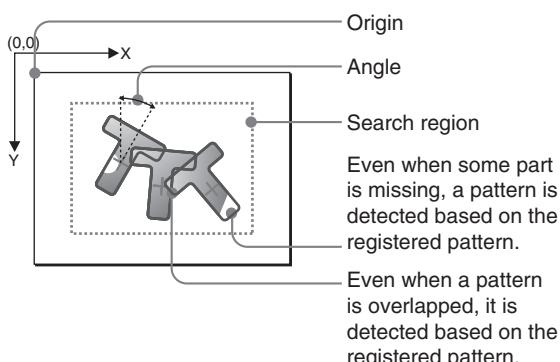
- The operation is limited by the amount of remaining program memory. In ShapeTrax2, the registration of patterns uses program memory. The program memory is shared by all units in one program. You need to limit the total memory usage of all units including ShapeTrax2 below that of the program memory of the controller. Program memory usage is displayed as [Processing capacity] during region settings and image enhancement settings. When this value approaches 100%, you may not be able to make settings.
- Changes in the state of the current image can cause changes in processing time. As edge information is extracted from the current image, processing time can change when the amount of edge information changes. If changes in processing time are an issue, use the timeout setting (Page 4-60) and confirm the operation using actual targets.

Image layout

When a pattern is registered



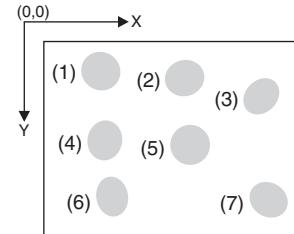
While the controller is in operation



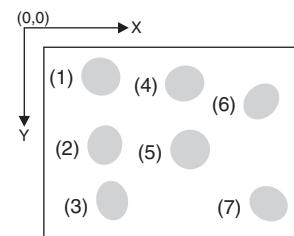
Ordering detected patterns

There are 14 ways the patterns can be ordered.

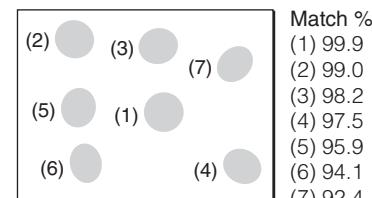
- Y>X:Ascend



- X>Y:Ascend



- X: Ascend
- X:Descend
- Y:Ascend
- Y:Descend
- Match%:Ascend
- Match%:Descend



- Clockwise
- Counter CW
- Scale:Ascend
- Scale:Descend
- ScaleDisjunction:Asc.
- ScaleDisjunction:Desc.

To select a different order, see [Detection Order] (Page 4-56).

Major results

The major results displayed by the ShapeTrax2 tool are as follows:

Count	Outputs the number of detected patterns. <small>Available in the limits menu</small>
Detected point (X, Y) []	Outputs the coordinates of all detected patterns in pixels. <small>Available in the limits menu</small> <small>Available through outputs</small>
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. <small>Available in the limits menu</small> <small>Available through outputs</small>
Correlation value % []	Outputs the percentage match (0 to 99.99) between the registered pattern and the detected patterns in the search region. <small>Available in the limits menu</small> <small>Available through outputs</small>
Scale []	Outputs the difference in size of all detected patterns, using the registered image size as a reference of 1.000. <small>Available in the limits menu</small> <small>Available through outputs</small>
Unit judgment value	When the measurement result is outside the specified tolerance range (between the upper and lower limits), it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).

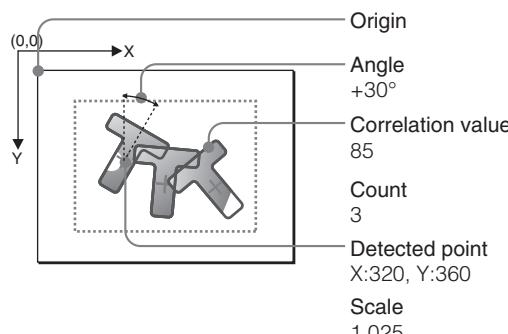
Reference

For a summary of available measurement output values and setting parameters, see "List of Setting Parameters/Result Data" in the XG VisionEditor Reference Manual (Control/Data Edition).

Example

Example showing the results of an inspection performed under the following conditions:

- Detection Order: X>Y:Ascend
- Primary Target: 0



Top Menu Layout

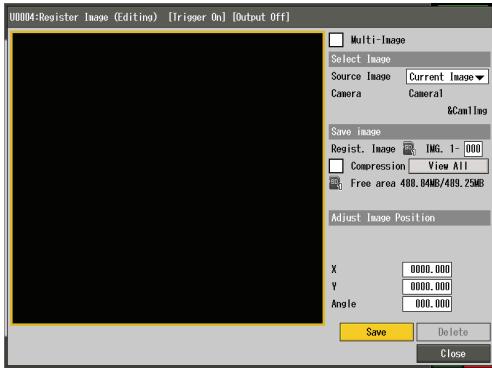
The ShapeTrax2 unit has the following options.



Register Image (Page 4-51)	Registration of an image to be used as a template for settings.
Select Image (Page 4-52)	Selection of the registered or current image to be used for settings.
Search Region (Page 4-53)	Outline the region on the captured image to be used for searching.
Pattern Region (Page 4-54)	Outline the region on the captured image to record the pattern.
Color (Page 4-55)	Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).
Image Enhance (Page 4-55)	Selection and setting of pre-processing filters to apply to the image.
Conditions (Page 4-56)	Conditions for detecting a pattern for measurement / inspection.
Edge Feature (Page 4-57)	Settings for the edge detection from a registered or current image.
Parameters (Page 4-59)	Additional optional parameters for the inspection.
Limits (Page 4-61)	Pass / fail tolerance (upper and lower limits) settings for the inspection.
Dsp. Options (Page 4-61)	Search region and mask region display settings.
Save (Page 4-62)	Save ShapeTrax2 tool settings.

Register Image

Registration of an image to be used as a template for settings. It is recommended to carefully adjust lighting and other conditions before registering an image.



Multi-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 5-17).
- When multi-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.
- The image variable used for the select image of the vision tools unit should be the same as the image variable used for the capture unit being executed. When the image capture buffer is set to custom, the image variable which contains the image of the capture unit executed most recently will be displayed.

Select Image

Source Image

Select an image to register.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Save Image] is displayed.

Save Image

Number

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

Compression

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

There may be some deterioration in image quality due to compression. Inspection results when using a compressed image may differ from results when using an uncompressed image.

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 -2432.000 and 2432.000 pixels.

Y

Adjust the movement in the Y (vertical) direction between -2050.000 and 2050.000 pixels.

Angle

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

Reference

When you select [Current Image] as the source image for the unit for which the position adjustment ID has been specified in [Inspection Region] (Page 4-53), you can select [Pos. Adjust. value] as well as [Number Input]. This option is useful because even when the image capture position deviates, the current image is automatically adjusted using the adjustment value based on the reference unit. However, note that when [Pos. Adjust. value] is selected in the state where a proper adjustment value cannot be measured for the current image, the position used for registration may be incorrect.

▶ Note

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

Save

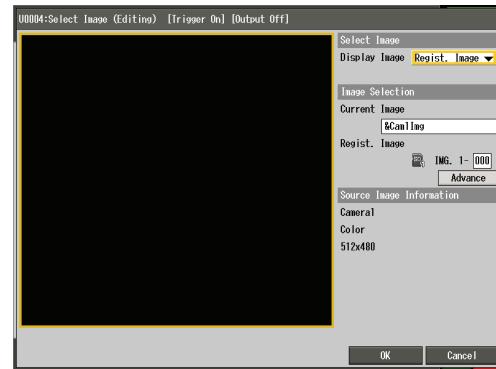
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Regist. Image] is selected for [Source Image], you can delete the registered image specified under [Save Image].

Select Image

Selection of the registered or current image to be used for settings.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Image Selection

Current Image

Set an image variable to be used as a current image for the unit.

Regist. Image

Specify the registered image to be used as a template.

- 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.

- **Assign variables to registered image No.:** To use a variable for the registered image No., check this box and assign a scalar or scalar 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. See the XG VisionEditor Reference Manual (Control/Data Edition) for more details.
- **Assign variables only when changing programs:** Use this option to switch 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 image registration:** To directly reference an image variable as a registered image, check this box and then assign an image variable (resultant image variable) to be referenced.

▶ Note

- Note that the registered image No. does not switch in accordance with a change in the variable.
- Only a resultant image variable can be assigned to [Use image variable for image registration].
- When [Use image variable for image registration] is enabled while [Referenced Image] (Page 4-60) has been set to [Constant (fast)], the [Referenced Image] setting is automatically changed to [Update every time (slow)]. This option can still set it to [Update by user (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

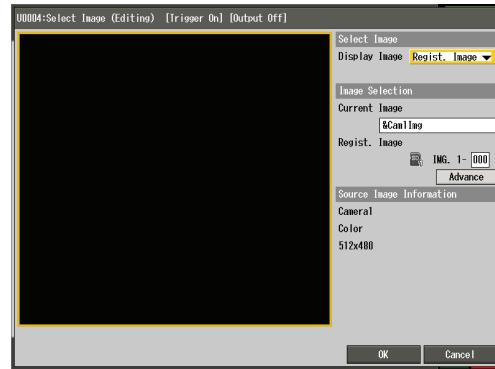
The camera No., type (color / monochrome), and resolution of the camera associated to the image variable specified is displayed.

Search Region

Outline the region on the captured image to be used for searching (Page 4-54).

Reference

The smaller the search region, the shorter the processing time.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Inspection Region

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Editing the Inspection Region (Inspection Region Menu)" (Page 8-2) 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 8-8) 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 8-7).

Processed Image Region

Change the settings of the image region. See "Generating a Region from an Image" (Page 8-10) for more details.

Reference

This option is displayed only when an image region using a resultant image variable (Page 4-253) is used.

▶ Note

Settings for whether to use an image region cannot be carried out in the Edit Unit menu.

Border

Select the area and border color for the inspection region from the image data in the resultant image variable by selecting either [Black] (Level 0) or [White] (Level 255, default).

Preview

When this box is checked, the specified resultant image variable is displayed. When the checkmark is removed, the display returns to its normal state.

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.

Pattern Region

Outline the region on the captured image to record the pattern.



Reference

If the pattern region is a complicated shape, mask regions can be used to exclude unwanted parts. Only for the pattern region of ShapeTrax2, can you use [Multiple Area] as one of the mask regions (Page 8-9).

Select Image

Display Image

- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

▶ Note

The display image cannot be changed.

Inspection Region

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Editing the Inspection Region (Inspection Region Menu)" (Page 8-2) for more details.

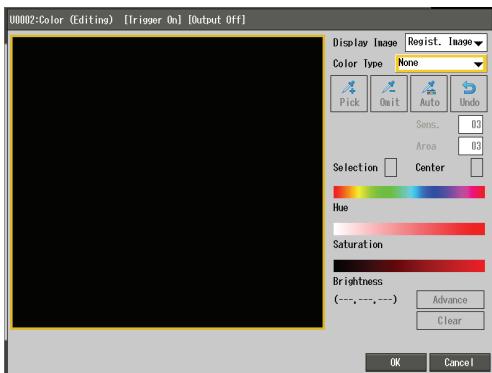
Mask Region

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 8-8) for more details.

Color

Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).



See "Converting Color Images (Color dialog)" (Page 8-13) for concepts involving color extraction and its operation.

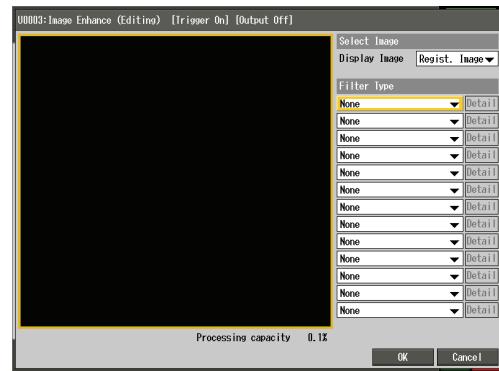
▶ Note

This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-253) is referenced as the current image.

Image Enhance

Selection and setting of pre-processing filters 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.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Filter Type

Select the [Filter Type] and then select the filter to apply.

See "Image Enhancement Filters" (Page 8-27) for more details of each filter processing.

▶ Note

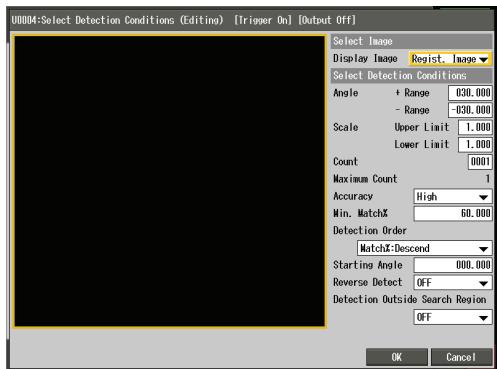
- The subtraction filter cannot be selected for the ShapeTrax2 measurement.
- The binary and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 21 types of filters can be set according to application requirements. When multiple filters are set, they are processed one by one from the top.
- You can change the order of the filters 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 up or down.

Detection Conditions

Conditions for detecting a pattern for measurement / inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

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.

Scale

The scale (0.500 to 2.000) in size (using 1.000 as the size of the registered pattern) of detectable patterns.

► Note

Increasing the scale range will increase processing time.

Count

Specify the maximum number of patterns to be detected for the ShapeTrax2. When [3] is specified, the process searches for up to three pattern positions.

► Note

- The maximum number of patterns that can actually be detected changes depending on other settings.
- With some settings, the number of patterns to be detected cannot be changed.

- 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.
- It may be possible to specify a count greater than the [Maximum] value (Maximum: 2000) depending on the account setting. Although increasing the [Maximum] limit, results in more consumption of the program memory.

Accuracy

Configure the search accuracy.

- **High:** Conduct fine search carefully to improve accuracy.
- **Low:** Give priority to processing speed rather than accuracy.

► Note

Increasing the level of search accuracy may improve the accuracy of detection, but the processing time may become longer.

Min. Match%

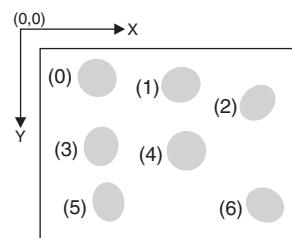
Specify the minimum correlation value for detected patterns to prevent false detection.

Example: When the [Min. Match%] is set to 80%, only those patterns having a correlation value of 80% or more are actually processed.

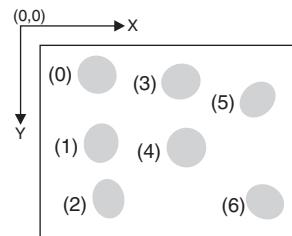
Detection Order

Specify the identification order of the detected patterns.

- Y>X:Ascend:

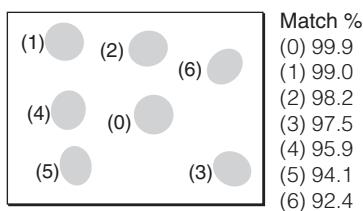


- X>Y:Ascend:



- X:Ascend
- X:Descend
- Y:Ascend
- Y:Descend
- Match%:Ascend

- Match%:Descend:



- Clockwise
- Counter CW
- Scale:Ascend
- Scale:Descend
- ScaleDisjunction:Asc.
- ScaleDisjunction:Desc.: Patterns are identified in the order starting from the pattern having the scale furthest from 1 to the one having the scale closest to 1.

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 [Detection Order] is not [Clockwise] or [Counter CW].

Reverse Detect

Use this option to detect patterns on a reversed image.

- **OFF**: Disable detection when the image is reversed.
- **ON**: Detect patterns when the image is reversed.

Detection Outside Search Region

Use to determine if a pattern falls outside of the set search region.

- **OFF**: Detect patterns outside of the search area.
- **ON**: Detect patterns only in the search region. Output values are set to 0 and an error is generated if the pattern is detected outside the search region.

▶ Note

The [Detection Outside Search Region] option is not effective if the pattern region is set larger than the search region.

Setting Extract Level of Segment

Set the detailed conditions for the edge detection of a registered image or current image. High-resolution measurement is made possible by making sure that edge information can be properly extracted from registered images and the current image. ShapeTrax2 runs a coarse search using a compressed image and a pattern model to quickly detect the approximate position, and then uses a fine search to verify the position detected. Set the specific detection conditions for the coarse and fine search.



Sensitivity

Priority can be given to search speed or stability by changing the reduction rate of the image and features.

- **Low**: Select this to prioritize search speed.
- **Normal**: Select this during normal operation.
- **High**: Select this to prioritize stability.
- **Custom**: If none of the above settings are stable, use this setting to adjust the reduction rate of each item.
 - **Coarse Image Reduction**: 0 (small reduction rate) to 10 (large reduction rate)
 - **Coarse Feature Reduction**: 0 (small reduction rate) to 10 (large reduction rate)
 - **Fine Image Reduction**: 0 (small reduction rate) to 10 (large reduction rate)

Reference

- The image reduction rate is the compression of the image being used (current or registered).
- The feature reduction rate is the compression of the features extracted from the image.

► Note

- Setting all of the reduction rates to "0 (smallest)" does not guarantee an improvement in accuracy (due to image noise), but will significantly increase processing time.
- If the fine reduction rate is set high, match % changes may vary considerably as feature data is lost.
- If the feature reduction rate is set high, features from the mask region may be extracted.
- The fine image reduction rate cannot be larger than the coarse image reduction rate.

Segment Condition

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Display Feature

Select the features you want to display.

- **Coarse:** Display the features used in the coarse search.
- **Fine:** Display the features used in the fine search.

Display all regist features

Use this function to display all of the features that meet the registered feature detection conditions. Registered features are displayed as green lines and features that meet the detection conditions are displayed as pink points.

Register

Filter out and extract the coarse and fine features to be registered based on the current or registered image.

- **Max Intensity:** Specify the upper limit (1 to 255) of the edge intensity for detecting edges.
- **Min Intensity:** Specify the lower limit (1 to 255) of the edge intensity for detecting edges.
- **Noise Cut:** Specify the strength of noise elimination for stable edge detection.

Current

Filter out and extract the coarse and fine features for detection based on the current or registered image.

- **Max Intensity:** Set the upper limit (1 to 255) of the edge intensity (intensity change) of the edge to be detected.
- **Min Intensity:** Set the lower limit (1 to 255) of the edge intensity (intensity change) of the edge to be detected.
- **Noise Cut** (for coarse features only): Set the strength of noise reduction during edge detection (0: Weak - 200: Strong).

Contrast Variation

Select the allowable contrast variation when finding targets.

- **Small:** Use [Small] to avoid false detection and when the expected contrast variation between the search target and the registered image is small.
- **Large:** Use [Large] when the expected contrast variation between the search target and the registered image is unknown or large. Searching will be more stable when the image has minimal contrast changes (with respect to the registered image). Using [Large] will result in an increased processing time.

Segment Order

Select the priority in the selection of the registered features.

- **Length↑:** Set this to give priority to registered features with short edges. When searching for a target such as a character which is comprised of multiple small edges use [Length ↑]. When searching for a such as a corner of a part that has long edges use [Length ↓]
- **Length↓:** Set this to give priority to registered features with long edges.

Coarse Fast Mode

Use this function to make the coarse search processing faster.

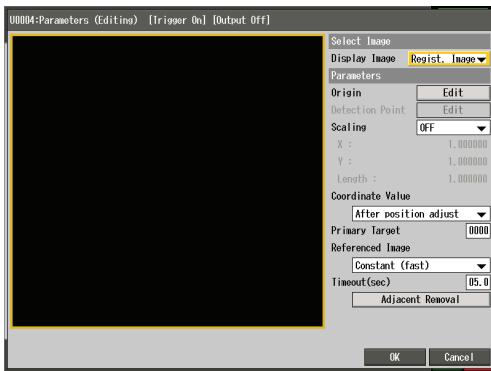
- **OFF** (default): Fast mode disabled.
- **ON:** Speed up processing by reducing the resolution of features used for the coarse search. Note this may reduce the stability of the coarse search due to removed image data.

► Note

In specific circumstances selecting [ON] may result in longer processing time depending on other settings and the current image.

Parameters

Additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Parameters

Origin

By default, the origin is set to the top left point of the camera but you can specify its position 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

Change the position of the detection point.

- **specified point:** Set the detection point by using X and Y offset values to specify coordinates based on the center of the specified pattern region. To offset, select [Edit] and then input the offset values.
- **center of gravity:** Set the detection point by using the center of gravity of the group of registered edges for the registered image. As the detection point is based on the registered / found edges in the registered image / search target, the pattern region size and shape has no bearing on the detection position. As long as the edges / features are extracted properly this option is useful for easy re-registration as the detection point will be automatically generated based on the features, not the location of the pattern region.

Reference

The origin of the offset is the center of the pattern region.

Note

You cannot set offset the detection point 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 4-314).
- 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 VisionEditor Reference Manual (Control/Data Edition).

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 system 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 to be used for judgment from the detected patterns. Setting can be from 0 to 1999, although 0 is used by default.

Note

Only data from the primary target is used for judgment (excluding count measurement).

Referenced Image

Select memory operation to speed up the pattern search.

- **Constant (fast)** (default): Uses only the program memory for processing variables for pattern region settings, color extraction, or image enhancement cannot be used.
- **Update every time (slow)**: Variables for pattern region settings, color extraction, or image enhancement can be used the processing time increases though as the image memory has to be used to recalculate the reference image information for each inspection.
- **Update by user (fast)**: This option uses both program memory and image memory to allow variable referencing but is faster when compared with the [Update every time (slow)] setting. Changes in parameters from referenced variables are applied when the update reference image information command (RU) is used. See the XG VisionEditor Reference Manual (Control/Data Edition) for more details.

Reference

- Parameters relating to the reference image information include pattern region, color extraction, image enhancement and detection conditions (angle range, search sensitivity, search accuracy).
- When [Update by user (fast)] is selected, the change in the setting parameters in the Inspect Region menu (Page 8-2), Color menu (Page 8-13) and Edit Unit menu are applied without the "RU" command. (The update reference image information and application to the relevant unit are processed immediately. Whereas in the case of the Edit Unit menu, and other menus processing is performed done when [OK] is selected menus.)

Note

- If there is not enough memory for each memory operation, a setting error may occur.
- You cannot select [Constant (fast)] in the following cases:
 1. When a variable is used for any of the following items:
 - [Pattern Region] menu
 - [Color] menu
 - [Image Enhance] menu
 - [Edge Feature] menu: Reduction rate, registered feature, segment order
 - [Conditions] menu: Angle range, scale range, reverse detection
 - [Parameters] menu: Detection point offset
 2. When the [Shading Correction] filter is set and a variable is used for the search region or an image region is set
 3. When the registered image is referenced from an image variable
 In these cases, cancel the assignment of the variable once and then change the setting.

Timeout

Set a maximum processing time. When the processing time for the unit exceeds the limit set (0.5 to 60 seconds) based on processing the current image, the unit will return a timeout error and all outputs will be set to 0.

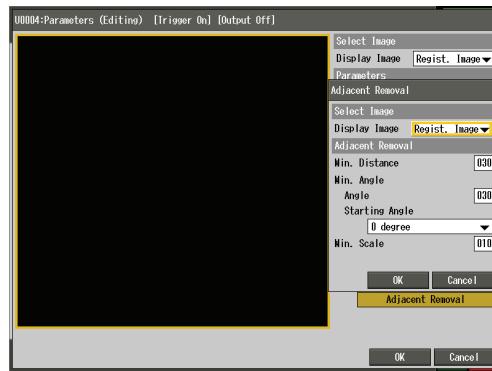
Note

Due to other processing functions the timeout function is only designed to be used as a reference in case the unit is taking too long to process.

Adjacent Removal

If there are several targets adjacent or overlapping, they can be included or filtered out to avoid false detection.

Based on the center of the circumscribed rectangle of the registered feature. Patterns which satisfy the AND condition of the "distance", "angle" and "scale" ranges set here will be excluded.



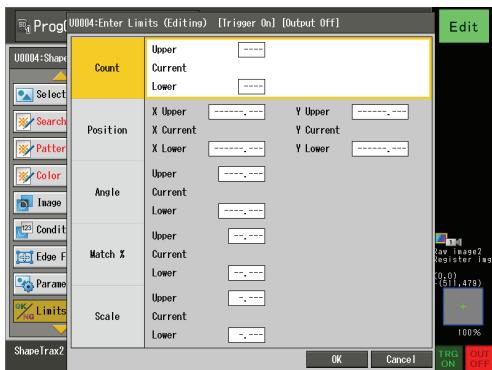
Excluding adjacent and overlapping targets can help improve detection by avoiding double detection of a single target. Whereas including adjacent and overlapping targets can ensure full 100% detection when targets are in close proximity.

- **Min. Distance**: Specify the distance for exclusion (number of pixels) from the center of the circumscribed rectangle of the registered feature.
- **Min. Angle**:
 - **Angle**: Specify the angle for exclusion from the (starting) angle of the detection target.
 - **Starting Angle**: Specify the starting angle to exclude adjacent candidates by setting the angle of the detection target to be 0 degrees. To exclude targets which are reversed, select [0/180 degree]. This excludes targets based on the angle specified about both 0 degrees and 180 degrees (i.e. reversed) from the angle of the detection target, while patterns appearing at intersecting angles (such as 90 degrees) remain as candidates.
- **Min. Scale**: Specify the scale (%) for exclusion based on the detection target.

Enter Limits

Pass / fail tolerance (upper and lower limits) settings for the inspection.

When the measurement result is outside of the specified tolerance range, it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).



Select [Direct Input] for the tolerance to be set and then enter a value.

Reference

- [----] indicates an empty state where no tolerance is set. In this state, judgment will not be performed after the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Count

Set the tolerance of the pattern detection count.

The unit of tolerance is the "number of patterns" detected.

Position

Set the tolerance of the coordinates of the detected pattern.

The unit of tolerance is the "number of pixels" indicating the coordinates of the pattern.

Angle

Set the tolerance of the angle of the pattern.

The unit of tolerance is the "angle" of the pattern.

Match %

Set the tolerance of the correlation of the pattern.

The unit of tolerance is the "correlation match" in the range of 0% to 99.999%.

Scale

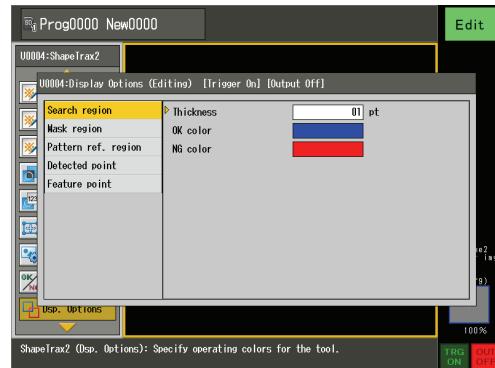
Set the tolerance of the scale of the pattern.

The measurement value is the "ratio" in the range of 0 to 9.999.

Display Options

Search region and mask region display settings.

The display color can be changed based on the judgment result for that unit. The color can also be removed (transparent) by selecting [Setting] - [Select Color] - [None].



Search region

Specify the line width and display color of the search 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 4-59) has been set, the detected point shifts according to the offset value.

Other target

For the detected patterns, other than the primary target (Page 4-59), 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 4-59) has been set, the detected point shifts according to the offset value.

Feature point

Specify the options for showing the feature points on the [Filtered img.] and [Contrast img.].

Pattern region

To hide the pattern region, select [OFF] (Default: ON).

Train feature

Select which registered features to display.

- **OFF**: Do not display registered features.
- **Fine segment** (Default): Display the fine features.
- **Coarse segment**: Display the coarse features.

Run feature

Select which detected features to display.

- **OFF** (Default): Do not display detected features.
- **Fine segment**: Display the fine features.
- **Coarse segment**: Display the coarse features.

Note

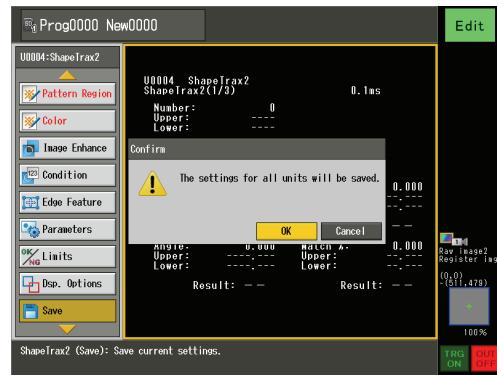
Enabling [Train feature] or [Run feature] displays consumes additional program memory. Check the amount of remaining program memory before enabling.

Save

Save the current unit changes the program file.

Note

- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller 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 screen display, and display parts, can be excluded when saving.

Edge Position

Edge Position Tool

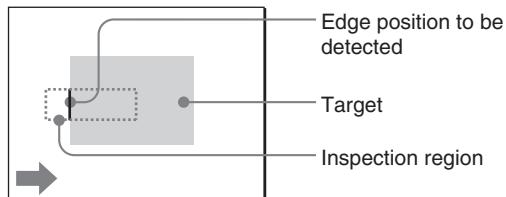
The edge position tool scans across a target in a user specified direction within a specified region detecting contrast changes. Based on these contrast changes (edge positions) the tool measures the position of a user specified edge.

As the edge detection algorithm is based on the transition from bright to dark (or dark to bright) in the inspection region and, not on absolute intensity values, so it is not greatly affected by illumination changes during image capturing.

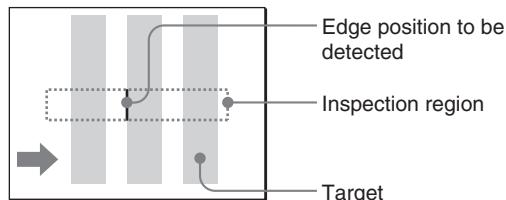
Image layout

Example: When the inspection region is a rectangle

- Primary Target: 0
- Scan Direction: →
- Edge Direction: Light to Dark

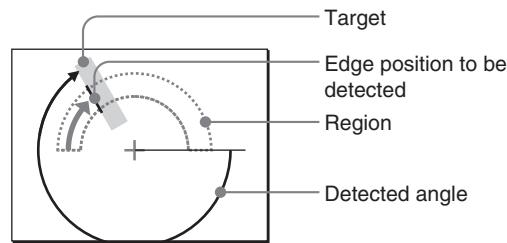


- Primary Target: 1
- Scan Direction: →
- Edge Direction: Light to Dark



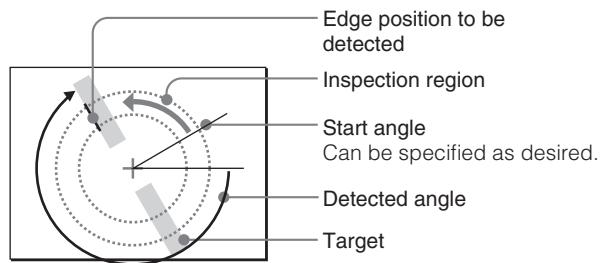
Example: When the inspection region is an arc

- Primary Target: 0
- Scan Direction: (clockwise)
- Edge Direction: Light to Dark



When the inspection region is a ring

- Primary Target: 0
- Scan Direction: (Counter CW)
- Edge Direction: Dark to Light



Major results

The major results displayed by the edge position tool are as follows:

Reference

The items to be measured may vary depending on the type of the inspection region. The result value for an item which is not measured is always 0.

When the inspection region is not a ring or an arc

Number of edges	Outputs the number of detected edges. [Available in the limits menu]
Edge position coordinates (X, Y) []	Outputs the position coordinates of all detected edges in pixels. [Available in the limits menu] [Available through outputs]
Distance []	Outputs the distances from the start of the inspection region to the position coordinates of all edges in pixels. [Available through outputs]
Intensity []	Outputs the intensity differential of all detected edges. [Available through outputs]
Unit judgment value	When the measurement result is outside of the specified tolerance range (between the upper and lower limits), or when the specified edge does not exist, it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).

When the inspection region is a ring or an arc

Number of edges	Outputs the number of detected edges. [Available in the limits menu]
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. [Available through outputs]
Angle []	Outputs the angles of all detected edges. [Available in the limits menu] [Available through outputs]
Distance []	Outputs the angles from the start of the inspection region to the positions of all edges. [Available through outputs]
Intensity []	Outputs the maximum edge intensity differential of all detected edges. [Available through outputs]
Unit judgment value	When the measurement result is outside of the specified tolerance range (between the upper and lower limits), it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).

Reference

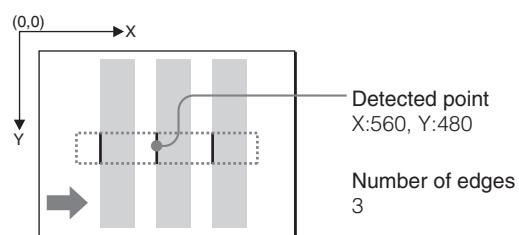
For a summary of available measurement output values and setting parameters, see "List of Setting Parameters/Result Data" in XG VisionEditor Reference Manual (Control/Data Edition).

Example

When the inspection region is a rectangle

Example showing the results of an inspection performed under the following conditions:

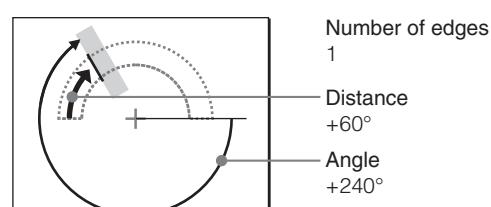
- Primary Target: 1
- Scan Direction: →
- Edge Direction: Light to Dark



When the inspection region is an arc

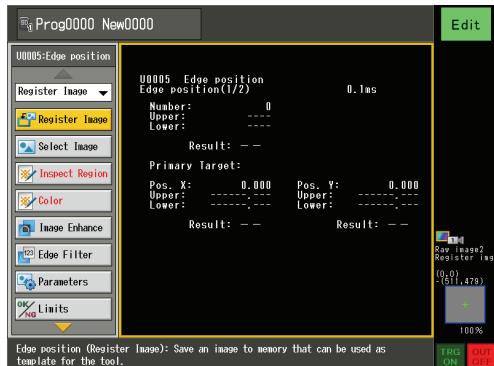
Example showing the results of a measurement performed under the following conditions:

- Primary Target: 0
- Scan Direction: (clockwise)
- Edge Direction: Light to Dark



Top Menu Layout

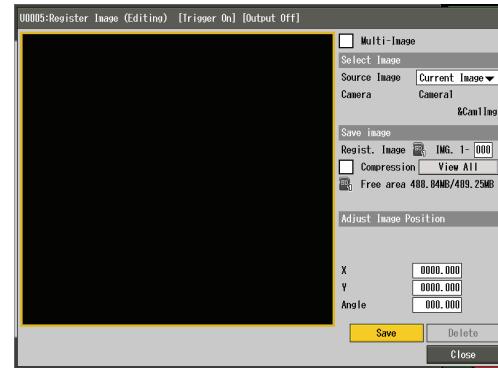
The edge position unit has the following options.



Register Image (Page 4-65)	Registration of an image to be used as a template for settings.
Select Image (Page 4-67)	Selection of the registered or current image to be used for settings.
Inspect Region (Page 4-68)	Outline the region on the captured image to be used for the inspection.
Color (Page 4-69)	Color extraction and conversion settings for a color image to gray-scale or binary. (only available for color cameras)
Image Enhance (Page 4-69)	Selection and setting of pre-processing filters to apply to the image.
Edge Filter (Page 4-70)	Settings for detecting and filtering edges, including the scan direction and edge intensity change.
Parameters (Page 4-71)	Additional optional parameters for the inspection.
Limits (Page 4-72)	Pass / fail tolerance (upper and lower limits) settings for the inspection.
Dsp. Options (Page 4-73)	Inspection region and mask region display settings.
Save (Page 4-74)	Save edge position settings.

Register Image

Registration of an image to be used as a template for settings. It is recommended to adjust lighting and other conditions completely before registering an image.



Multi-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 5-17).
- When multi-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.
- The image variable used for the select image of the vision tools unit should be the same as the image variable used for the capture unit being executed. When the image capture buffer is set to custom, the image variable which contains the image of the capture unit executed most recently will be displayed.

Select Image

Source Image

Select an image to register.

- Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- Regist. Image:** The registered image specified under [Save Image] is displayed.

Save Image

Number

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

Compression

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

There may be some deterioration in image quality due to compression. Inspection results when using a compressed image may differ from results when using an uncompressed image.

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 -2432.000 and 2432.000 pixels.

Y

Adjust the movement in the Y (vertical) direction between -2050.000 and 2050.000 pixels.

Angle

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

Reference

When you select [Current Image] as the source image for the unit for which the position adjustment ID has been specified in [Inspection Region] (Page 4-68), you can select [Pos. Adjust. value] as well as [Number Input]. This option is useful because even when the image capture position deviates, the current image is automatically adjusted using the adjustment value based on the reference unit. However, note that when [Pos. Adjust. value] is selected in the state where a proper adjustment value cannot be measured for the current image, the position used for registration may be incorrect.

▶ Note

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

Delete

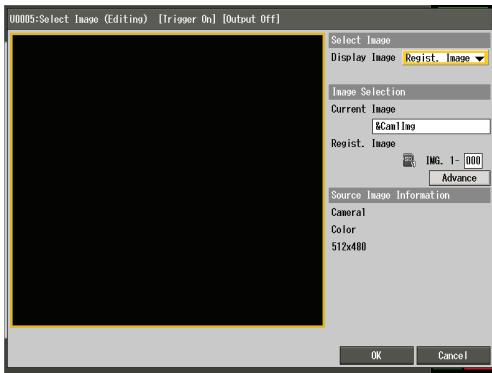
When [Regist. Image] is selected for [Source Image], you can delete the registered image specified under [Save Image].

Save

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

Select Image

Selection of the registered or current image to be used for settings.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Image Selection

Current Image

Set an image variable to be used as a current image for the unit.

Regist. Image

Specify the registered image to be used as a template.

- 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.

- **Assign variables to registered image No.:** To use a variable for the registered image No., check this box and assign a scalar or scalar 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. See the XG VisionEditor Reference Manual (Control/Data Edition) for more details.

- **Assign variables only when changing programs:** Use this option to switch 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

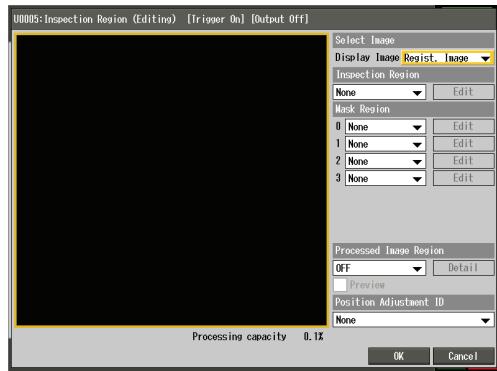
Note that the displayed registered image No. does not switch in accordance with a change in the variable.

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 the inspection.



▶ Note

Changing the shape of the region will initialize or clear some of the settings in the [Edge Filter] and [Limits] menus.

Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Inspection Region

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. Refer to "Inspection Region Menu" (Page 8-2) 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 8-8) 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 8-7).

Processed Image Region

To use a processed region from a resultant image variable (Page 4-253), select [ON] and then select [Detail] for configuration.

Reference

See "Generating a Region from an Image" (Page 8-10) for more details on the image region.

Result

Specify the resultant image variable used for the processed image region.

Detect

Select the area and border color for the inspection region from the image data in the resultant image variable by selecting either [Black] (Level 0) or [White] (Level 255, default).

Preview

When this box is checked, the specified resultant image variable is displayed. When the checkmark is removed, the display returns to its normal state.

Position Adjustment ID

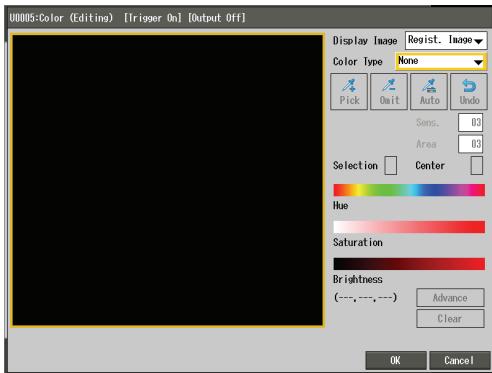
To apply position adjustment to the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).



► Note

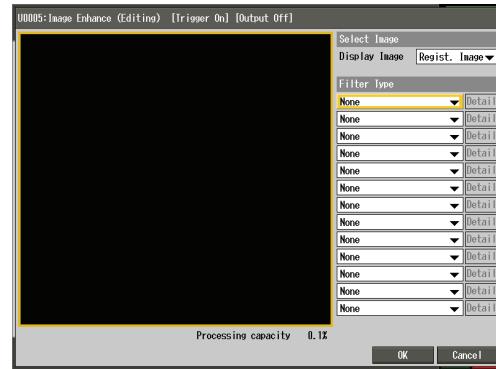
This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-253) is referenced as the current image.

Refer to "Working with Color Images" (Page 8-13) for concepts involving color extraction and its operation.

Image Enhance

Selection and setting of pre-processing filters 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.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Filter Type

Select the [Filter Type] and then select the filter to apply. See "Image Enhancement Filters" (Page 8-27) for more details of each filter processing.

► Note

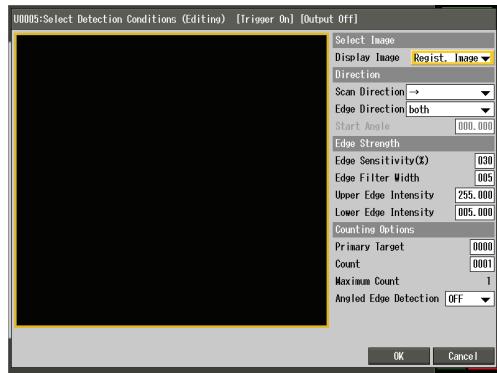
The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 21 types of filters can be set according to application requirements. When multiple filters are set, they are processed one by one from the top.
- You can change the order of the filters 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 up or down.

Detection Conditions

Settings for detecting and filtering edges, including the scan direction and edge in tensity change.



Reference

See "What is an Edge?" (Page 8-41) for the technical description of edge detection.

Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

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°.

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 of the 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 8-41) for more details.

Counting Options

Primary Target

Select the edge number (0 to 3599) of the edge to be used for OK / NG judgment. Edge numbers are assigned in order based on the scan direction (If the primary target is not found, the detected position defaults to 0.000).

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

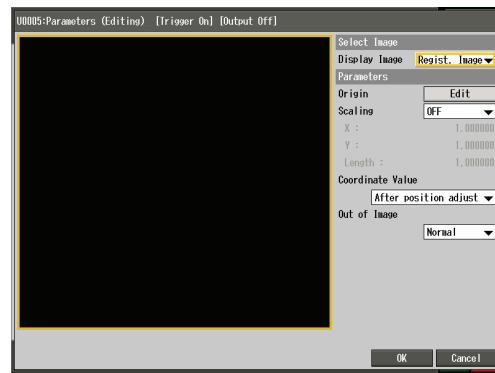
The [Count] value can be set higher than the [Maximum Count] value (Maximum: 3600) depending on the account setting. Note, this also increases the [Maximum Count] value, resulting in additional consumption of program memory.

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

Additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- Regist. Image:** The registered image specified under [Image Selection] is displayed.

Parameters

Origin

By default, the origin is set to the top left point of the camera but you can specify its position 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 4-314).
- 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 VisionEditor Reference Manual (Control/Data Edition).

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 system 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 changed 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.

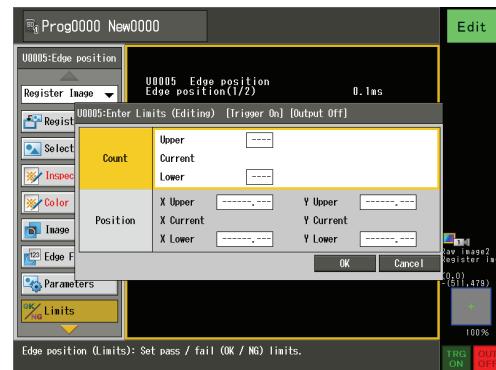
Reference

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.

Enter Limits

Pass / fail tolerance (upper and lower limits) settings for the inspection.

When the measurement result is outside of the specified tolerance range, it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).



Select [Direct Input] to set the tolerance and then enter a value.

Reference

- [-----] indicates an empty state where no tolerance is set. In this state, judgment will not be performed after the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Count

Set the tolerance of the edge detection count.

The unit of tolerance is the "number of edges" detected.

Position

Set the tolerance of the position of the detected edge (When the inspection region is not a ring or an arc).

The unit of tolerance is the "number of pixels" indicating the X, Y coordinates of the edge position.

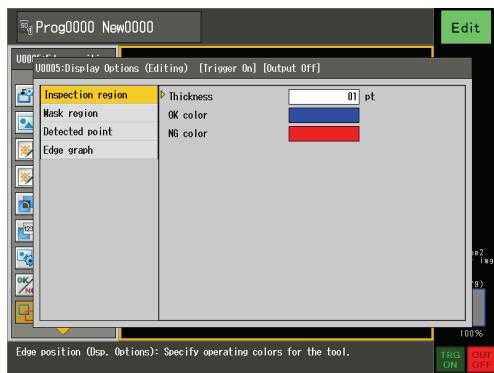
Angle

Set the tolerance of the angle of the detected edge (Only when the inspection range is a ring or an arc).

The unit of tolerance is the "angle" of the detected edge.

Display Options

Inspection region and mask region display settings. The display color can be changed based on the judgment result for that unit. The color can also be removed (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 4-71).

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

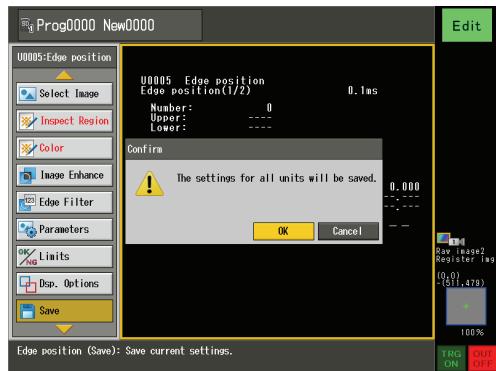
Setting [Edge graph] to [ON] consumes additional program memory. Check the amount of remaining program memory before enabling.

Save

Save the current unit changes the program file.

▶ Note

- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller 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 screen display, and display parts, can be excluded when saving.

Edge Width

Edge Width Tool

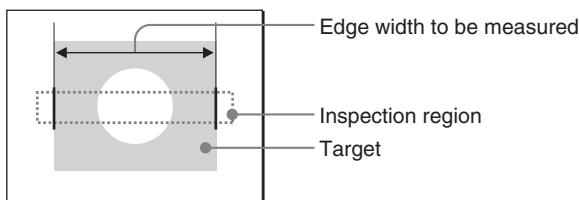
The edge width tool scans across a target in a user specified direction within a specified region detecting contrast changes. Based on these contrast changes the width between two user specified points can be measured.

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.

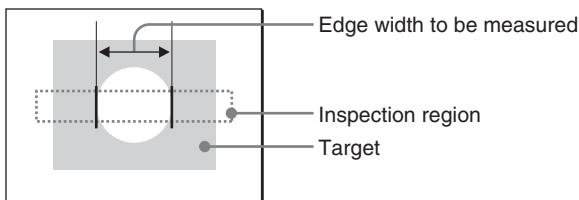
Image layout

When the inspection region is a rectangle or a rotated rectangle

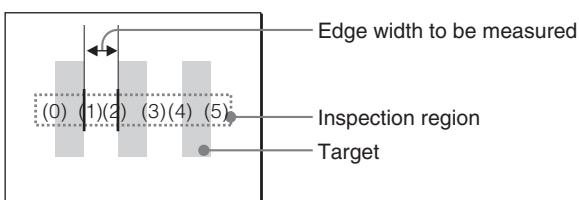
- When [Outer Gap] is the selected measurement mode



- When [Inner Gap] is the selected measurement mode

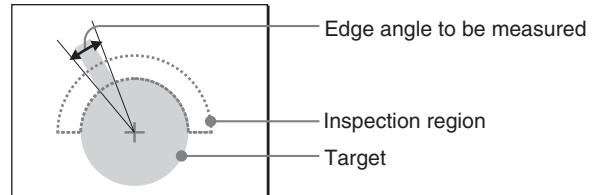


- When [Specified Edges] is the selected measurement mode

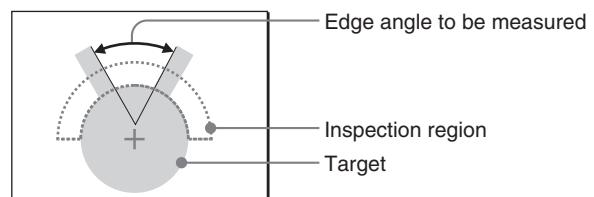


When the inspection region is a ring or an arc

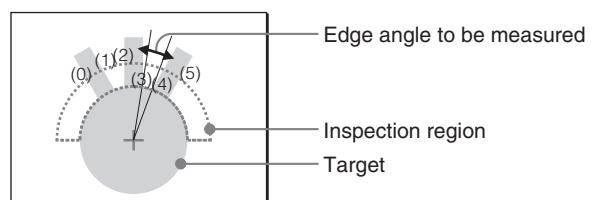
- When [Outer Gap] is the selected measurement mode



- When [Inner Gap] is the selected measurement mode



- When [Specified Edges] is the selected measurement mode



Major results

The major results displayed by the edge width tool are as follows:

Reference

The items to be measured may vary depending on the type of the inspection region. The result value for an item which is not measured is always 0.

When the inspection region is not a ring or an arc

Edge width	Outputs the width in pixels. <small>Available in the limits menu</small>
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 first identified edge (typically the one nearest the start of the inspection region) of the edge width pair in pixels.
Intensity 1	Outputs the intensity differential of the edge at edge position 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 width pair in pixels.
Intensity 2	Outputs the intensity differential of the edge at edge position 2.
Unit judgment value	When the measurement result is outside the specified tolerance range (between the upper and lower limits), it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).

When the inspection region is a ring or an arc

Edge width	Outputs the width as an angle. <small>Available in the limits menu</small>
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 (typically the one nearest the start of the inspection region) 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 of the edge at edge position 1.

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	When the measurement result is outside the specified tolerance range (between the upper and lower limits), it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).

Reference

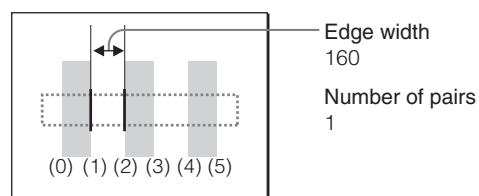
For a summary of available measurement output values and setting parameters, see "List of Setting Parameters/Result Data" in XG VisionEditor Reference Manual (Control/Data Edition).

Example

When the inspection region is a rectangle

Example showing the results of an inspection performed under the following conditions:

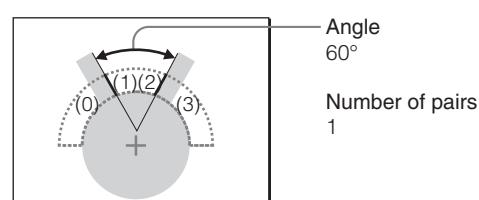
- Scan Direction: →
- Edge Direction: both
- Specified Edge 1: 1
- Specified Edge 2: 2



When the inspection region is an arc

Example showing the results of a measurement performed under the following conditions:

- Scan Direction: (clockwise)
- Edge Direction: both
- Specified Edge 1: 1
- Specified Edge 2: 2



Top Menu Layout

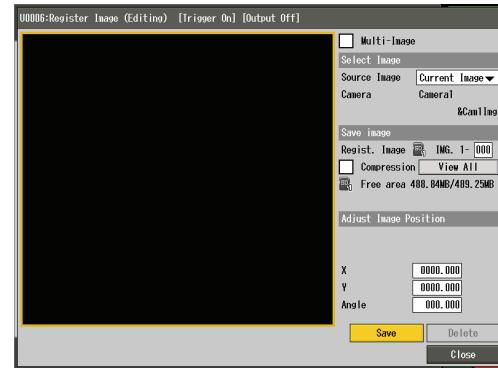
The edge width unit has the following options.



Register Image (Page 4-77)	Registration of an image to be used as a template for settings.
Select Image (Page 4-79)	Selection of the registered or current image to be used for settings.
Inspect Region (Page 4-80)	Outline the region on the captured image to be used for the inspection.
Color (Page 4-81)	Color extraction and conversion settings for a color image to gray-scale or binary. (only available for color cameras)
Image Enhance (Page 4-81)	Selection and setting of pre-processing filters to apply to the image.
Edge Filter (Page 4-82)	Settings for detecting and filtering edges, including the scan direction and edge intensity change.
Parameters (Page 4-84)	Additional optional parameters for the inspection.
Limits (Page 4-85)	Pass / fail tolerance (upper and lower limits) settings for the inspection.
Dsp. Options (Page 4-85)	Inspection region and mask region display settings.
Save (Page 4-86)	Save edge width tool settings.

Register Image

Registration of an image to be used as a template for settings. It is recommended to adjust lighting and other conditions completely before registering an image.



Multi-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 5-17).
- When multi-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.
- The image variable used for the select image of the vision tools unit should be the same as the image variable used for the capture unit being executed. When the image capture buffer is set to custom, the image variable which contains the image of the capture unit executed most recently will be displayed.

Select Image

Source Image

Select an image to register.

- Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- Regist. Image:** The registered image specified under [Save Image] is displayed.

Save Image

Number

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

Compression

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

There may be some deterioration in image quality due to compression. Inspection results when using a compressed image may differ from results when using an uncompressed image.

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 -2432.000 and 2432.000 pixels.

Y

Adjust the movement in the Y (vertical) direction between -2050.000 and 2050.000 pixels.

Angle

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

Reference

When you select [Current Image] as the source image for the unit for which the position adjustment ID has been specified in [Inspection Region] (Page 4-80), you can select [Pos. Adjust. value] as well as [Number Input]. This option is useful because even when the image capture position deviates, the current image is automatically adjusted using the adjustment value based on the reference unit. However, note that when [Pos. Adjust. value] is selected in the state where a proper adjustment value cannot be measured for the current image, the position used for registration may be incorrect.

▶ 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

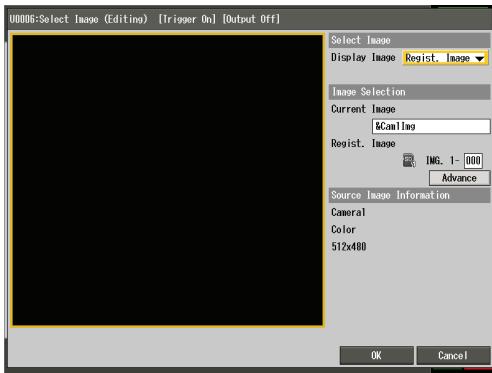
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Regist. Image] is selected for [Source Image], you can delete the registered image specified under [Save Image].

Select Image

Selection of the registered or current image to be used for settings.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Image Selection

Current Image

Set an image variable to be used as a current image for the unit.

Regist. Image

Specify the registered image to be used as a template.

- 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.

- **Assign variables to registered image No.:** To use a variable for the registered image No., check this box and assign a scalar or scalar 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. See the XG VisionEditor Reference Manual (Control/Data Edition) for more details.

- **Assign variables only when changing programs:** Use this option to switch 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

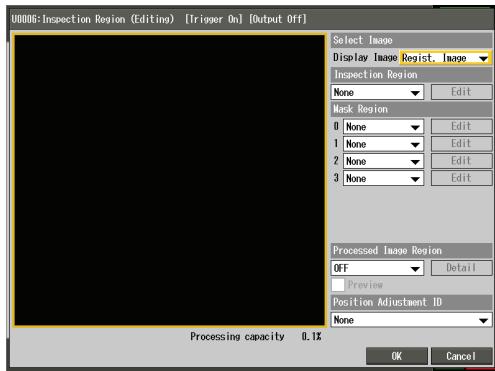
Note that the displayed registered image No. does not switch in accordance with a change in the variable.

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 measurement.



▶ Note

Changing the shape of the region will initialize or clear some of the settings in the [Edge Filter] menu.

Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

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 8-2) 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 8-8) 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 8-7).

Processed Image Region

To use a processed region from a resultant image variable (Page 4-253), select [ON] and then select [Detail] for configuration.

Reference

See "Generating a Region from an Image" (Page 8-10) for more details on the image region.

Result

Specify the resultant image variable used for the processed image region.

Detect

Select the area and border color for the inspection region from the image data in the resultant image variable by selecting either [Black] (Level 0) or [White] (Level 255, default).

Preview

When this box is checked, the specified resultant image variable is displayed. When the checkmark is removed, the display returns to its normal state.

Position Adjustment ID

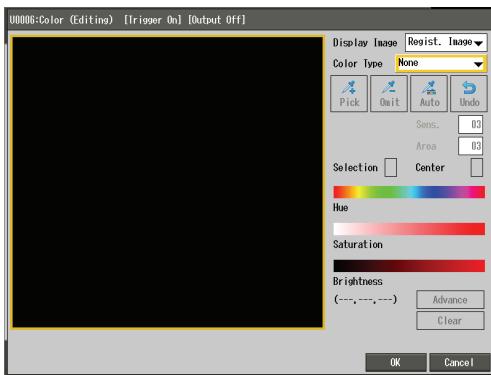
To apply position adjustment to the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).



▶ Note

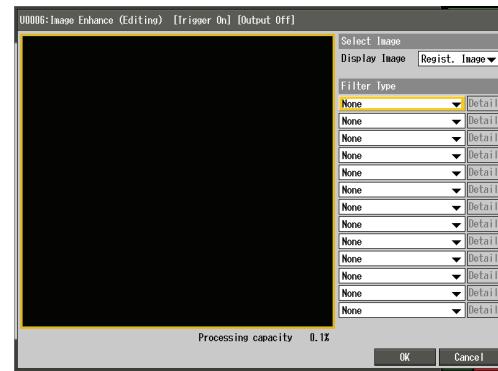
This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-253) is referenced as the current image.

See "Working with Color Images" (Page 8-13) for concepts involving color extraction and its operation.

Image Enhance

Selection and setting of pre-processing filters 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.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Filter Type

Select the [Filter Type] and then select the filter to apply. See "Image Enhancement Filters" (Page 8-27) for more details of each filter processing.

▶ Note

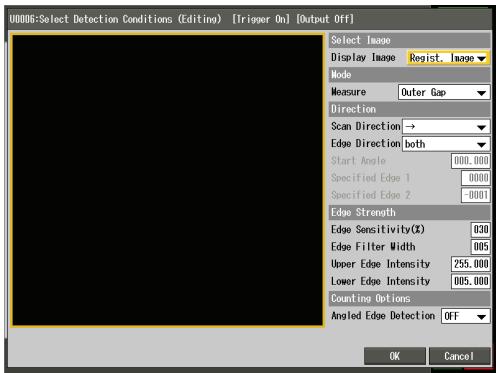
The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 21 types of filters can be set according to application requirements. When multiple filters are set, they are processed one by one from the top.
- You can change the order of the filters 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 up or down.

Detection Conditions

Settings for detecting and filtering edges, including the scan direction and edge intensity change.



Reference

See "What is an Edge?" (Page 8-41) for the technical description of edge detection.

Select Image

Display Image

Switch the image displayed on the screen.

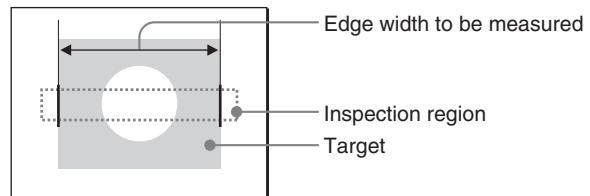
- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Mode

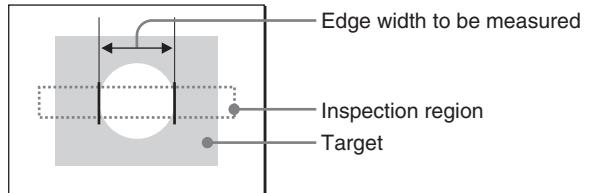
Measure

Select the type of edge width measurement.

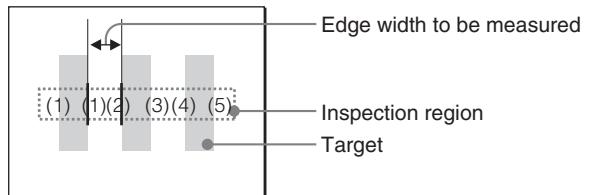
- **Outer Gap:** Measure the distance between the two outermost edges in the inspection region.



- **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 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°.

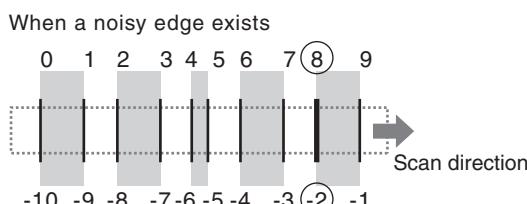
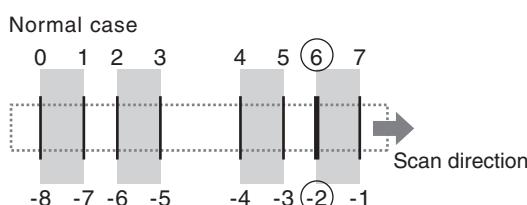
Specified Edge 1 / Specified Edge 2

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 [→], "0" is set for [Specified Edge 1] and "-2" is set for [Specified Edge 2] 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



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 of the 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 8-41) for more details.

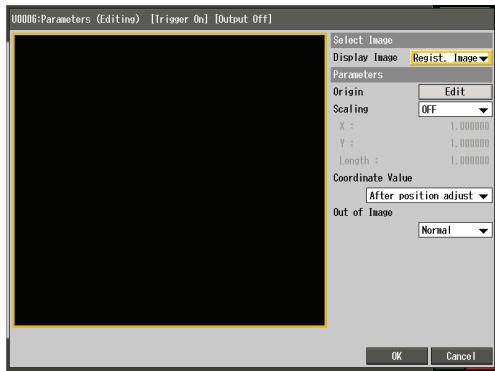
Counting Options

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

Additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Parameters

Origin

By default, the origin is set to the top left point of the camera but you can specify its position 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 4-314).
- 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 VisionEditor Reference Manual (Control/Data Edition).

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 system 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 changed 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.

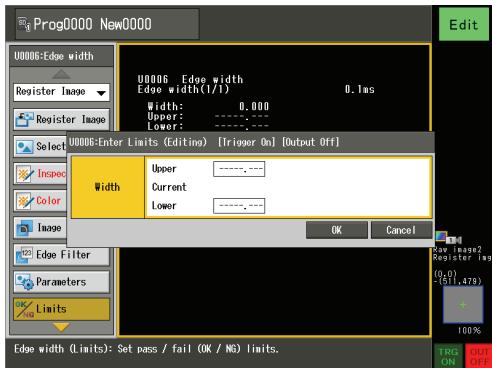
Reference

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.

Enter Limits

Pass / fail tolerance (upper and lower limits) settings for the inspection.

When the measurement result is outside of the specified tolerance range, it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).



Select [Direct Input] to set the tolerance and then enter a value.

Reference

- [----] indicates an empty state where no tolerance is set. In this state, judgment will not be performed after the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Width

Set the tolerance of the edge width (When the inspection region is not a ring or an arc).

The unit of tolerance is the "number of pixels" indicating the width.

Angle width

Set the tolerance of the edge width (Only when the inspection range is a ring or an arc).

The unit of tolerance is the "angle" indicating the width.

Display Options

Inspection region and mask region display settings.

The display color can be changed based on the judgment result for that unit. The color can also be removed (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.

Save

Save the current unit changes the program file.

► Note

- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller 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 screen display, and display parts, can be excluded when saving.

Edge Pitch

Edge Pitch Tool

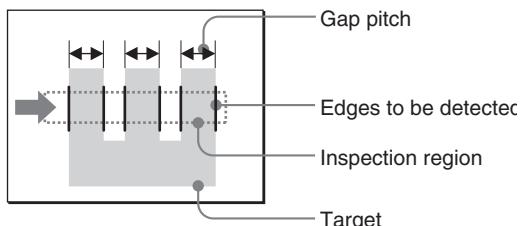
The edge pitch tool scans across a target in a user specified direction within a specified region detecting contrast changes. Based on these contrast changes the maximum, minimum and average center pitch or gap pitch between edges can be measured.

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.

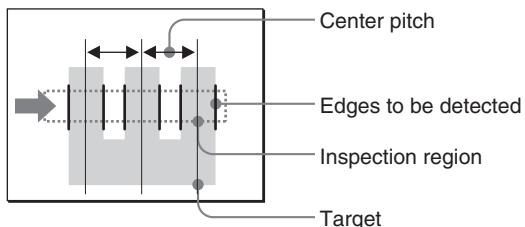
Image layout

When the inspection region is a rectangle

- Example of measuring the gap pitch

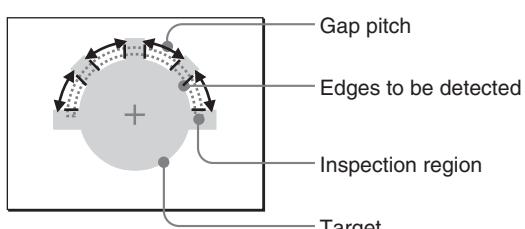


- Example of measuring the center pitch

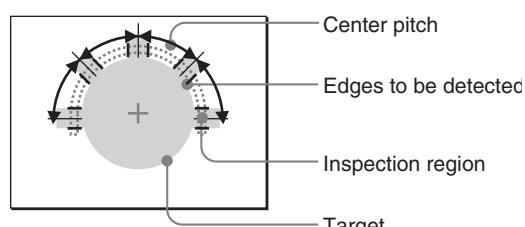


When the inspection region is a ring or an arc

- Example of measuring the gap pitch



- Example of measuring the center pitch



Major results

The major results displayed by the edge pitch tool are as follows:

Reference

The items to be measured may vary depending on the type of the inspection region. The result value for an item which is not measured is always 0.

When the inspection region is not a ring or an arc

Number of pitches	Outputs the number of detected pitches. <small>Available in the limits menu</small>
Maximum edge pitch	Outputs the maximum pitch in pixels. <small>Available in the limits menu</small>
Minimum edge pitch	Outputs the minimum pitch in pixels. <small>Available in the limits menu</small>
Average edge pitch	Outputs the average pitch in pixels.
Pitches []	Outputs all detected pitches in pixels. <small>Available through outputs</small>
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. <small>Available through outputs</small>
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. <small>Available through outputs</small>
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. <small>Available through outputs</small>
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. <small>Available through outputs</small>
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. <small>Available through outputs</small>
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. <small>Available through outputs</small>
Unit judgment value	When the measurement result is outside the specified tolerance range (between the upper and lower limits), it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).

When the inspection region is a ring or an arc

Number of pitches	Outputs the number of detected pitches. [Available in the limits menu]
Maximum edge pitch	Outputs the maximum pitch as an angle. [Available in the limits menu]
Minimum edge pitch	Outputs the minimum pitch as an angle. [Available in the limits menu]
Average edge pitch	Outputs the average pitch as an angle.
Pitches []	Outputs all detected pitches as angles. [Available through outputs]
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. [Available through outputs]
Angle 1 []	Outputs the positions of all the first identified edges (typically the ones nearest the start of the inspection region) of each edge pitch as angles. [Available through outputs]
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. [Available through outputs]
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. [Available through outputs]
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. [Available through outputs]
Angle 2 []	Outputs the positions of all the second identified edges (typically the ones nearest the end of the inspection region) of each edge pitch as angles. [Available through outputs]
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. [Available through outputs]
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. [Available through outputs]
Unit judgment value	When the measurement result is outside the specified tolerance range (between the upper and lower limits), it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).

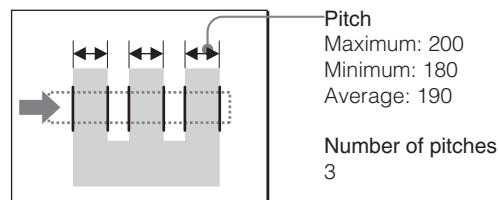
Reference

- 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 a summary of available measurement output values and setting parameters, see "List of Setting Parameters/Result Data" in XG VisionEditor Reference Manual (Control/Data Edition).

Example**When the inspection region is a rectangle or a rotated rectangle**

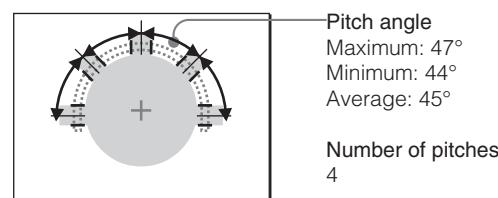
Example showing the results of an inspection performed under the following conditions:

- Measure: Gap pitch
- Scan Direction: →
- Edge Direction: both

**When the inspection region is a ring or an arc**

Example showing the results of a measurement performed under the following conditions:

- Measure: Center pitch
- Scan Direction: (Counter CW)
- Edge Direction: both



Top Menu Layout

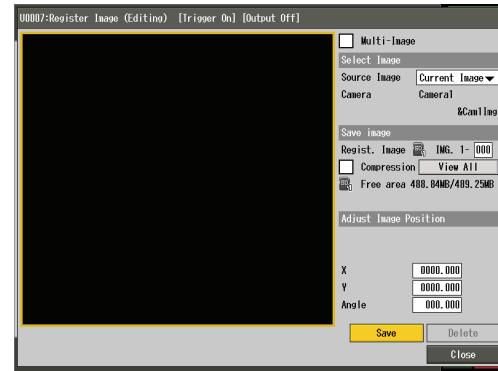
The edge pitch unit has the following options.



Register Image (Page 4-89)	Registration of an image to be used as a template for settings.
Select Image (Page 4-91)	Selection of the registered or current image to be used for settings.
Inspect Region (Page 4-92)	Outline the region on the captured image to be used for the inspection.
Color (Page 4-93)	Color extraction and conversion settings for a color image to gray-scale or binary. (only available for color cameras)
Image Enhance (Page 4-93)	Selection and setting of pre-processing filters to apply to the image.
Edge Filter (Page 4-94)	Settings for detecting and filtering edges, including the scan direction and edge intensity change.
Parameters (Page 4-96)	Additional optional parameters for the inspection.
Limits (Page 4-97)	Pass / fail tolerance (upper and lower limits) settings for the inspection.
Dsp. Options (Page 4-97)	Inspection region and mask region display settings.
Save (Page 4-98)	Save edge pitch tool settings.

Register Image

Registration of an image to be used as a template for settings. It is recommended to adjust lighting and other conditions completely before registering an image.



Multi-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 5-17).
- When multi-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.
- The image variable used for the select image of the vision tools unit should be the same as the image variable used for the capture unit being executed. When the image capture buffer is set to custom, the image variable which contains the image of the capture unit executed most recently will be displayed.

Select Image

Source Image

Select an image to register.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Save Image] is displayed.

Save Image

Number

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

Compression

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

There may be some deterioration in image quality due to compression. Inspection results when using a compressed image may differ from results when using an uncompressed image.

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 -2432.000 and 2432.000 pixels.

Y

Adjust the movement in the Y (vertical) direction between -2050.000 and 2050.000 pixels.

Angle

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

Reference

When you select [Current Image] as the source image for the unit for which the position adjustment ID has been specified in [Inspection Region] (Page 4-92), you can select [Pos. Adjust. value] as well as [Number Input]. This option is useful because even when the image capture position deviates, the current image is automatically adjusted using the adjustment value based on the reference unit. However, note that when [Pos. Adjust. value] is selected in the state where a proper adjustment value cannot be measured for the current image, the position used for registration may be incorrect.

▶ 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

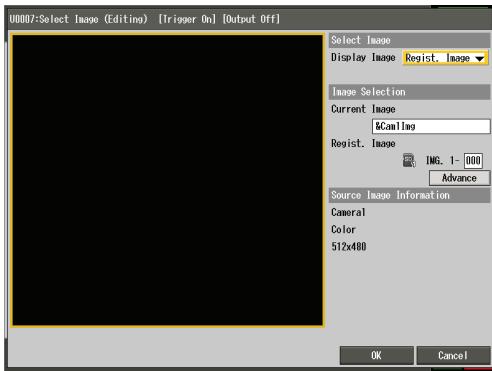
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Regist. Image] is selected for [Source Image], you can delete the registered image specified under [Save Image].

Select Image

Selection of the registered or current image to be used for settings.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Image Selection

Current Image

Set an image variable to be used as a current image for the unit.

Regist. Image

Specify the registered image to be used as a template.

- 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.

- **Assign variables to registered image No.:** To use a variable for the registered image No., check this box and assign a scalar or scalar 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. See the XG VisionEditor Reference Manual (Control/Data Edition) for more details.

- **Assign variables only when changing programs:** Use this option to switch 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

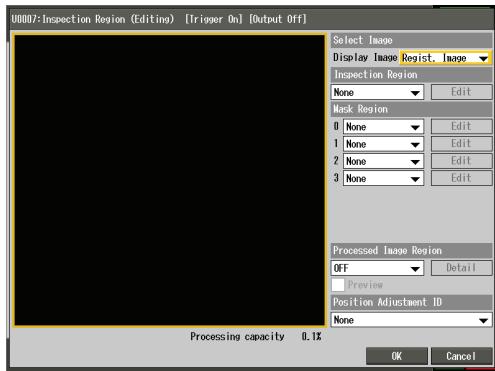
Note that the displayed registered image No. does not switch in accordance with a change in the variable.

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 measurement.



▶ Note

Changing the shape of the region will initialize or clear some of the settings in the [Edge Filter] menu.

Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

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 8-2) 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 8-8) 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 8-7).

Processed Image Region

To use a processed region from a resultant image variable (Page 4-253), select [ON] and then select [Detail] for configuration.

Reference

See "Generating a Region from an Image" (Page 8-10) for more details on the image region.

Result

Specify the resultant image variable used for the processed image region.

Detect

Select the area and border color for the inspection region from the image data in the resultant image variable by selecting either [Black] (Level 0) or [White] (Level 255, default).

Preview

When this box is checked, the specified resultant image variable is displayed. When the checkmark is removed, the display returns to its normal state.

Position Adjustment ID

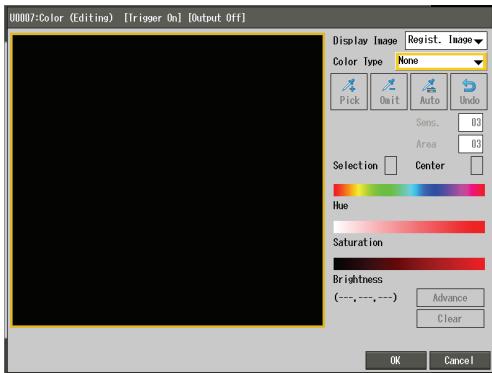
To apply position adjustment to the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).



► Note

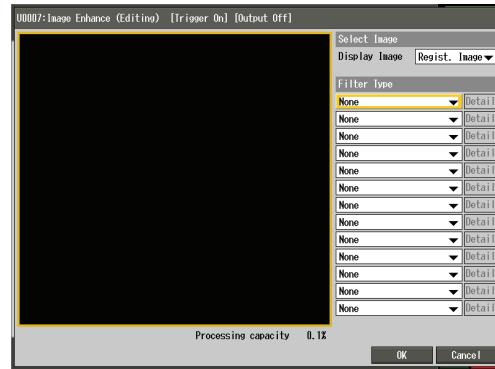
This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-253) is referenced as the current image.

Refer to "Working with Color Images" (Page 8-13) for concepts involving color extraction and its operation.

Image Enhance

Selection and setting of pre-processing filters 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.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Filter Type

Select the [Filter Type] and then select the filter to apply. See "Image Enhancement Filters" (Page 8-27) for more details of each filter processing.

► Note

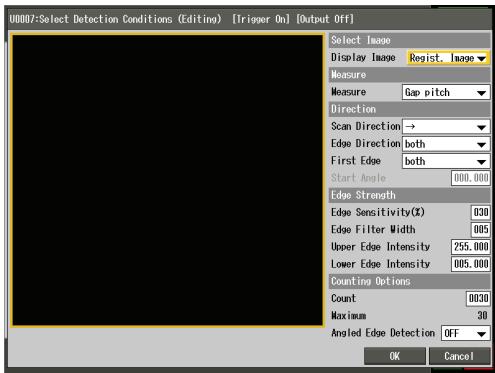
The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 21 types of filters can be set according to application requirements. When multiple filters are set, they are processed one by one from the top.
- You can change the order of the filters 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 up or down.

Detection Conditions

Settings for detecting and filtering edges, including the scan direction and edge intensity change.



Reference

See "What is an Edge?" (Page 8-41) for the technical description of the edge detection.

Select Image

Display Image

Switch the image displayed on the screen.

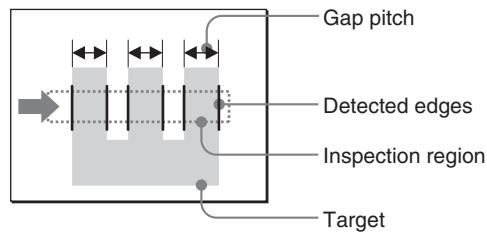
- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Measure

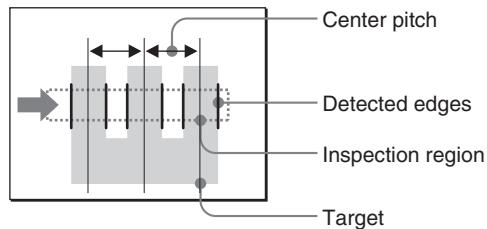
Measure

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:** $\rightarrow, \leftarrow, \uparrow, \downarrow$
- **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 can change 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 of the 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 8-41) for more details.

Counting Options

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

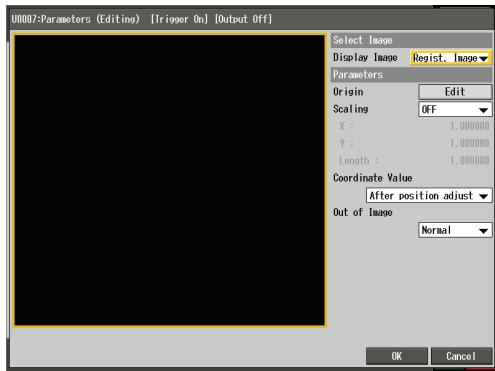
It may be possible to specify the [Count] value exceeding the [Maximum] value (Maximum: 1800) depending on the account setting. Note, however, that this also increases the [Maximum] value, resulting in more consumption of the program memory.

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

Additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Parameters

Origin

By default, the origin is set to the top left point of the camera but you can specify its position 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 4-314).
- 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 VisionEditor Reference Manual (Control/Data Edition).

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 system 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 changed 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.

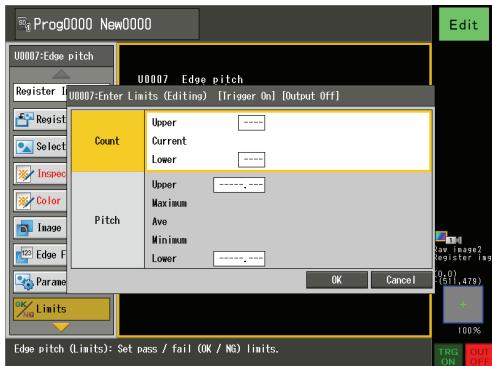
Reference

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.

Enter Limits

Pass / fail tolerance (upper and lower limits) settings for the inspection.

When the measurement result is outside of the specified tolerance range, it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).



Select [Direct Input] to set the tolerance and then enter a value.

Reference

- [----] indicates an empty state where no tolerance is set. In this state, judgment will not be performed after the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Count

Set the tolerance of the edge pitch detection count.

The unit of tolerance is the "number of edge pitches" detected.

Pitch

Set the tolerance of the width of the detected edge pitches.

The unit of tolerance 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.

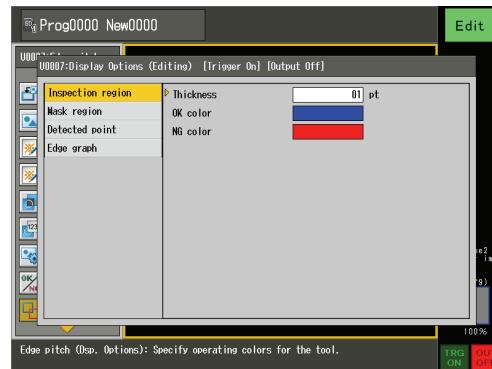
Reference

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

Inspection region and mask region display settings.

The display color can be changed based on the judgment result for that unit. The color can also be removed (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

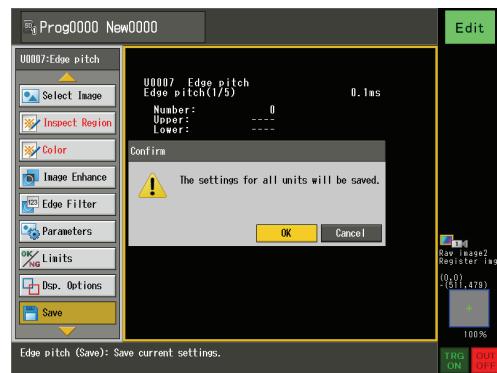
Setting [Edge graph] to [ON] consumes additional program memory. Check the amount of remaining program memory before enabling.

Save

Save the current unit changes the program file.

► Note

- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller 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 screen 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.

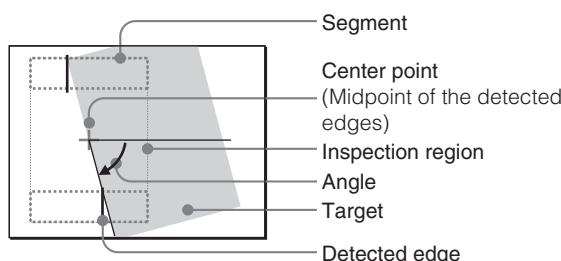
Because edge detection is based on the transition from bright to dark (or dark to bright), not on absolute intensity values, it is less affected by illumination fluctuations during image capturing.

Reference

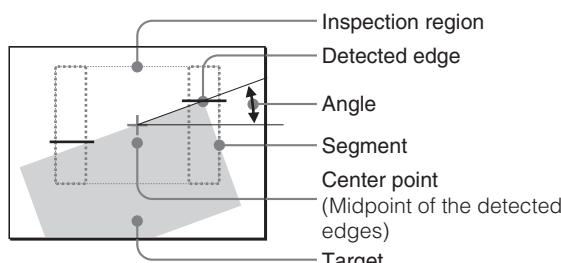
You can specify the edge detection options, such as a scan direction or edge direction, for each segment individually. This makes it easier to detect the tilt angle of a target in a single unit even when target with a complicated shape is measured.

Image layout

When the edge angle is "+75°"



When the edge angle is "-20°"



Major results

The major results displayed by the edge angle tool are as follows:

Reference

The items to be measured may vary depending on the type of the inspection region. The result value for an item which is not measured is always 0.

Angle	Outputs the angle of the target by detecting two edge positions (-179.999° to 180.000°). <small>Available in the limits menu</small>
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 edge identified in segment 2.
Unit judgment value	When the measurement result is outside the specified tolerance range (between the upper and lower limits), it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).

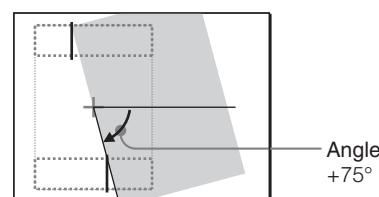
Reference

For a summary of available measurement output values and setting parameters, see "List of Setting Parameters/Result Data" in XG VisionEditor Reference Manual (Control/Data Edition).

Example

Example showing the results of an inspection performed under the following conditions:

- Edge Direction: both



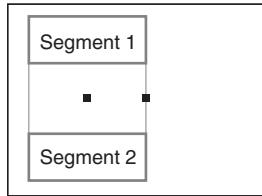
Reference

The edge angle measurement value is the angle between the horizontal and the straight line connecting the two identified edges in the two segments.

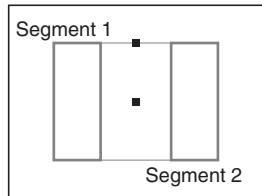
Definition of edge position 1 and edge position 2

This system labels an edge found in segment 1 as edge position 1 and the one found in segment 2 as edge position 2. When the rotation angle of the region is 0° (default), the upper rectangle is assumed as segment 1 and the lower rectangle is assumed as 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°



Top Menu Layout

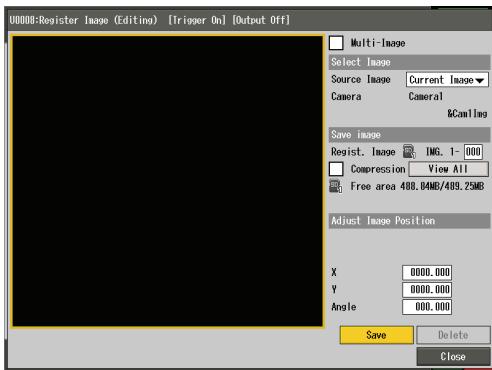
The edge angle unit has the following options.



Register Image	Registration of an image to be used as a template for settings.
(Page 4-101)	
Select Image	Selection of the registered or current image to be used for settings.
(Page 4-102)	
Inspect Region	Outline the region on the captured image to be used for the inspection.
(Page 4-103)	
Color	Color extraction and conversion settings for a color image to gray-scale or binary. (only available for color cameras)
(Page 4-104)	
Image Enhance	Selection and setting of pre-processing filters to apply to the image.
(Page 4-104)	
Edge Filter	Settings for detecting and filtering edges, including the scan direction and edge intensity change.
(Page 4-105)	
Parameters	Additional optional parameters for the inspection.
(Page 4-106)	
Limits	Pass / fail tolerance (upper and lower limits) settings for the inspection.
(Page 4-107)	
Dsp. Options	Inspection region and other display settings.
(Page 4-107)	
Save	Save edge angle tool settings.
(Page 4-108)	

Register Image

Registration of an image to be used as a template for settings. It is recommended to adjust lighting and other conditions completely before registering an image.



Multi-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 5-17).
- When multi-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.
- The image variable used for the select image of the vision tools unit should be the same as the image variable used for the capture unit being executed. When the image capture buffer is set to custom, the image variable which contains the image of the capture unit executed most recently will be displayed.

Select Image

Source Image

Select an image to register.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Save Image] is displayed.

Save Image

Number

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

Compression

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

There may be some deterioration in image quality due to compression. Inspection results when using a compressed image may differ from results when using an uncompressed image.

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 -2432.000 and 2432.000 pixels.

Y

Adjust the movement in the Y (vertical) direction between -2050.000 and 2050.000 pixels.

Angle

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

Reference

When you select [Current Image] as the source image for the unit for which the position adjustment ID has been specified in [Inspection Region] (Page 4-103), you can select [Pos. Adjust. value] as well as [Number Input]. This option is useful because even when the image capture position deviates, the current image is automatically adjusted using the adjustment value based on the reference unit. However, note that when [Pos. Adjust. value] is selected in the state where a proper adjustment value cannot be measured for the current image, the position used for registration may be incorrect.

▶ 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

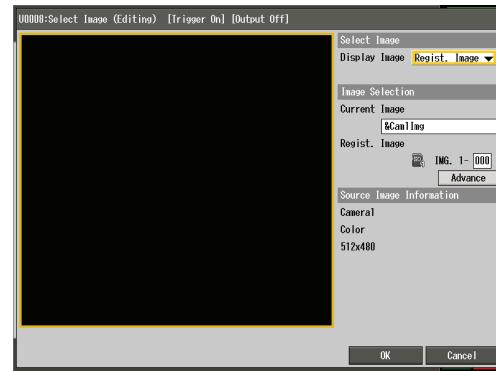
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Regist. Image] is selected for [Source Image], you can delete the registered image specified under [Save Image].

Select Image

Selection of the registered or current image to be used for settings.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Image Selection

Current Image

Set an image variable to be used as a current image for the unit.

Regist. Image

Specify the registered image to be used as a template.

- 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.

- **Assign variables to registered image No.:** To use a variable for the registered image No., check this box and assign a scalar or scalar 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. See the XG VisionEditor Reference Manual (Control/Data Edition) for more details.
- **Assign variables only when changing programs:** Use this option to switch 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

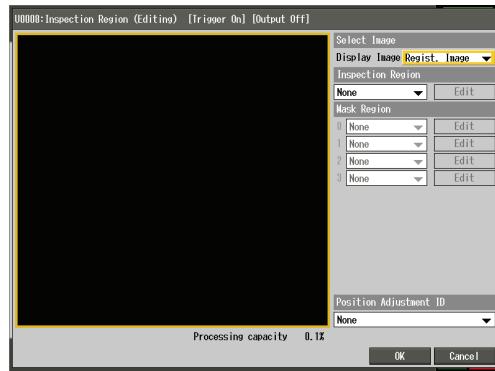
Note that the displayed registered image No. does not switch in accordance with a change in the variable.

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 measurement.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

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 8-2) 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

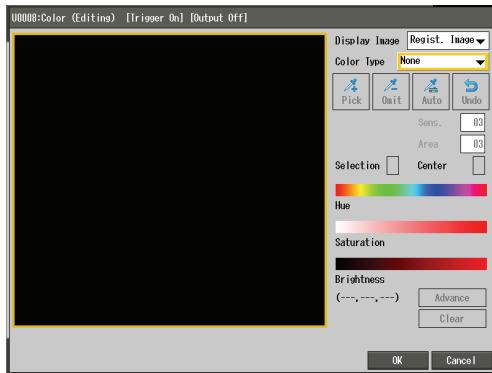
To apply position adjustment to the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).



▶ Note

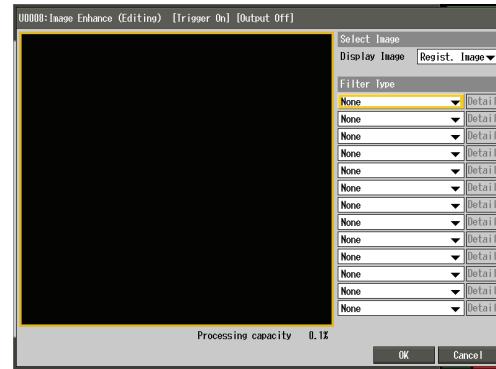
This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-253) is referenced as the current image.

See "Working with Color Images" (Page 8-13) for concepts involving color extraction and its operation.

Image Enhance

Selection and setting of pre-processing filters 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.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Filter Type

Select the [Filter Type] and then select the filter to apply.

See "Image Enhancement Filters" (Page 8-27) for more details of each filter processing.

▶ Note

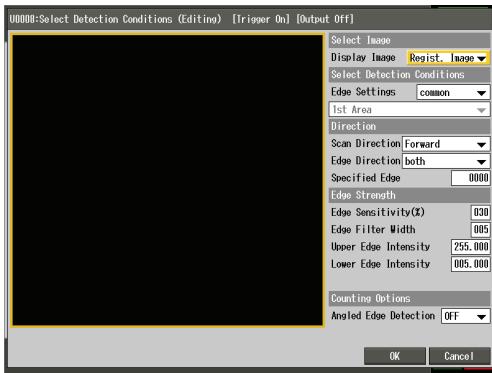
The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 21 types of filters can be set according to application requirements. When multiple filters are set, they are processed one by one from the top.
- You can change the order of the filters 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 up or down.

Detection Conditions

Settings for detecting and filtering edges, including the scan direction and edge intensity change.



Reference

See "What is an Edge?" (Page 8-41) for the technical description of the edge detection.

Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Edge Settings

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 (indicated by the arrow) of the inspection region.
- **Reverse:** Scan in the opposite direction of the rotation (indicated by the arrow) 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.

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 of the 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 8-41) for more details.

Counting Options

Angled Edge Detection

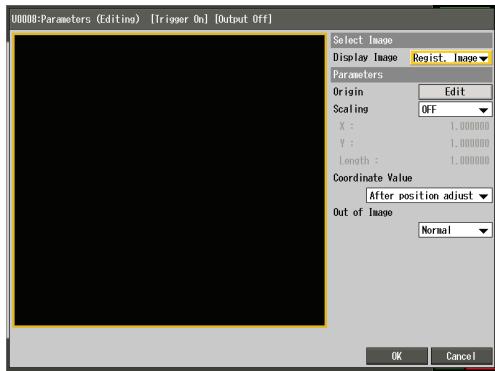
Set to [ON] to stabilize the detection of slanted edges in the inspection region. Using this option may affect the edge X, Y position accuracy.

Reference

The [Counting Options] parameters are applied to the both the 1st and 2nd segments.

Parameters

Additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Parameters

Origin

By default, the origin is set to the top left point of the camera but you can specify its position 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 4-314).
- 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 VisionEditor Reference Manual (Control/Data Edition).

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 system 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 changed 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.

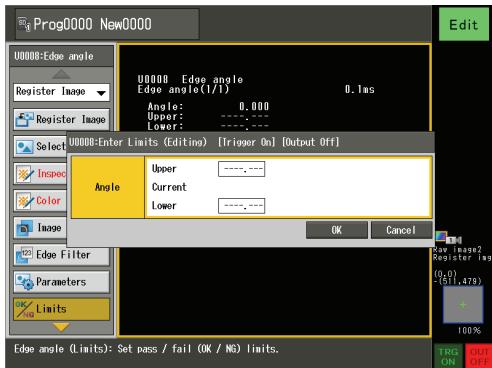
Reference

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.

Enter Limits

Pass / fail tolerance (upper and lower limits) settings for the inspection.

When the measurement result is outside of the specified tolerance range, it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).



Select [Direct Input] to set the tolerance and then enter a value.

Reference

- [----] indicates an empty state where no tolerance is set. In this state, judgment will not be performed after the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Angle

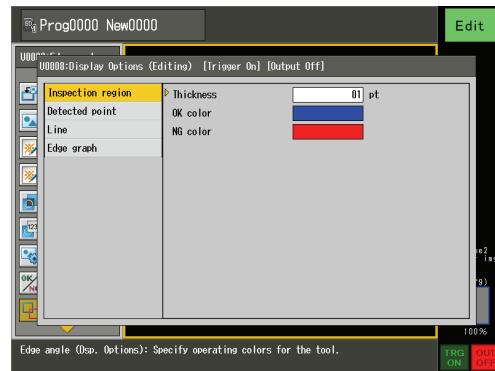
Set the tolerance of the angle from the two detected edges.

The unit of tolerance is the "angle" of the measured tilt.

Display Options

Inspection region and other display settings.

The display color can be changed based on the judgment result for that unit. The color can also be removed (transparent) by selecting [Setting] - [Select Color] - [None].



Inspection region

Specify the line width and display color of the inspection region.

Detected point

Specify the width and display color of the line indicating the detected edge.

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

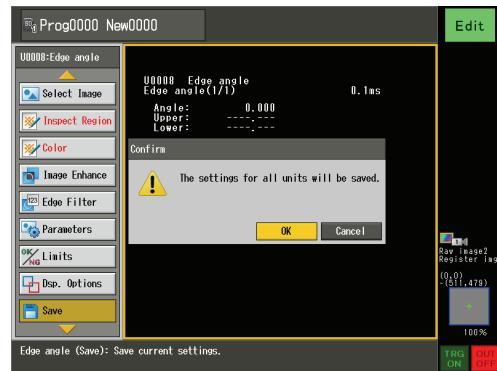
Setting [Edge graph] to [ON] consumes additional program memory. Check the amount of remaining program memory before enabling.

Save

Save the current unit changes the program file.

► Note

- If the controller is turned off before any settings are saved, all of those changes will be deleted.
 - Do not turn off the controller 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 screen display, and display parts, can be excluded when saving.

Edge Pairs

Edge Pairs Tool

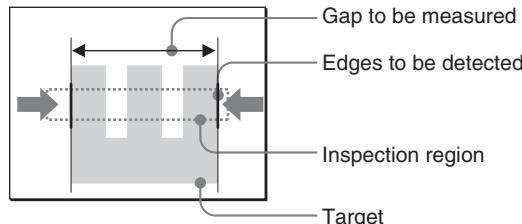
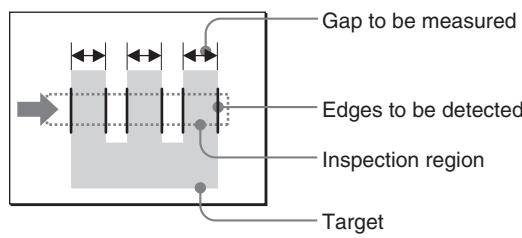
The edge pairs tool scans across a target twice in a user specified direction within a specified region detecting contrast changes. Based on these contrast changes (edges) gaps and widths can be measured. Due to the double scan method the edge detection criteria can be specified individually for a more 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.

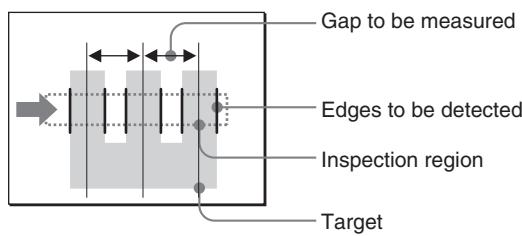
Image layout

When the inspection region is a rectangle or a rotated rectangle

- Example of measuring width and gap pitch

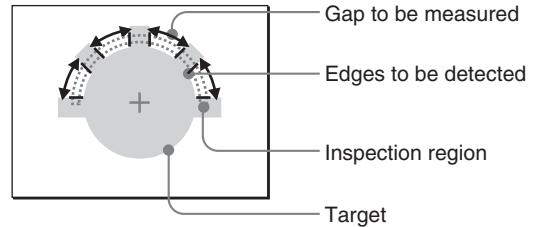


- Example of measuring the center pitch

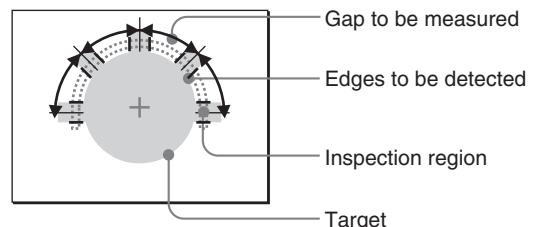


When the inspection region is a ring or an arc

- Example of measuring the gap pitch



- Example of measuring the center pitch



Major results

The major results displayed by the edge pairs tool are as follows:

Reference

The items to be measured may vary depending on the type of the inspection region. The result value for an item which is not measured is always 0

When the inspection region is not a ring or an arc

Number of pairs	Outputs the number of detected pairs. <small>Available in the limits menu</small>
Maximum width	Outputs the maximum width in pixels. <small>Available in the limits menu</small>
Minimum width	Outputs the minimum width in pixels. <small>Available in the limits menu</small>
Average width	Outputs the average width in pixels.
Width []	Outputs the widths of all detected pairs in pixels. <small>Available in the limits menu</small> <small>Available through outputs</small>
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. <small>Available through outputs</small>
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. <small>Available through outputs</small>
Intensity 1 []	Outputs the intensity differential of the edge at edge position 1. <small>Available through outputs</small>
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. <small>Available through outputs</small>
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 in pixels. <small>Available through outputs</small>
Intensity 2 []	Outputs the intensity differential of the edge at edge position 2. <small>Available through outputs</small>
Unit judgment value	When the measurement result is outside the specified tolerance range (between the upper and lower limits), it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).

When the inspection region is a ring or an arc

Number of pairs	Outputs the number of detected pairs. <small>Available in the limits menu</small>
Maximum width	Outputs the maximum width as an angle. <small>Available in the limits menu</small>
Minimum width	Outputs the minimum width as an angle. <small>Available in the limits menu</small>
Average width	Outputs the average width as an angle.
Width []	Outputs the widths of all detected pairs as angles. <small>Available in the limits menu</small> <small>Available through outputs</small>
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. <small>Available through outputs</small>
Angle 1 []	Outputs the first identified edge (typically the one nearest the start of the inspection region) of the edge width pair as an angle. <small>Available through outputs</small>
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. <small>Available through outputs</small>
Intensity 1 []	Outputs the intensity differential of the edge at edge position 1. <small>Available through outputs</small>
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. <small>Available through outputs</small>
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. <small>Available through outputs</small>
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. <small>Available through outputs</small>
Intensity 2 []	Outputs the intensity differential of the edge at edge position 2. <small>Available through outputs</small>
Unit judgment value	When the measurement result is outside the specified tolerance range (between the upper and lower limits), it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).

Reference

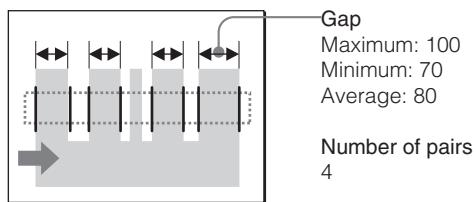
- When primary target (Page 4-118) is set to [All] (Default), the maximum pair width is used as the upper limit and the minimum pair width is used as the lower limit.
- For a summary of available measurement output values and setting parameters, see "List of Setting Parameters/Result Data" in XG VisionEditor Reference Manual (Control/Data Edition).

Example

When the inspection region is a rectangle or a rotated rectangle

Example 1: Results of a gap pitch measurement 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: 9999.999
- Minimum edge gap: 0050.000

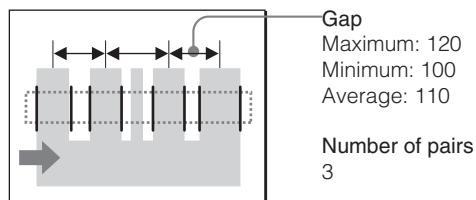


Reference

The central pin is below the minimum edge gap and is therefore excluded from the search.

Example 2: Results of a center pitch measurement 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: 9999.999
- Minimum edge gap: 0050.000



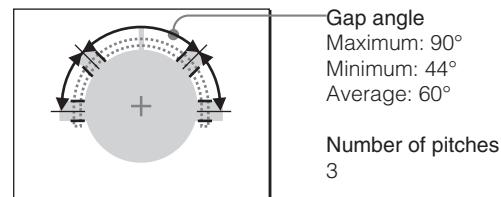
Reference

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 measurement 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: 9999.999
- Minimum edge gap: 0050.000



Reference

The third pin is below the minimum edge gap and is therefore excluded from the search.

Top Menu Layout

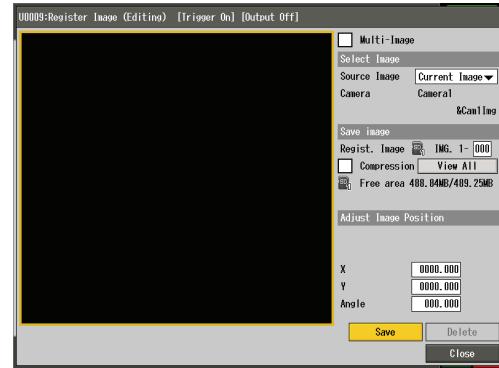
The edge pair unit has the following options.



Register Image (Page 4-112)	Registration of an image to be used as a template for settings.
Select Image (Page 4-114)	Selection of the registered or current image to be used for settings.
Inspect Region (Page 4-115)	Outline the region on the captured image to be used for the inspection.
Color (Page 4-116)	Color extraction and conversion settings for a color image to gray-scale or binary. (only available for color cameras)
Image Enhance (Page 4-116)	Selection and setting of pre-processing filters to apply to the image.
Edge Filter (Page 4-117)	Settings for detecting and filtering edges, including the scan direction and edge intensity change.
Parameters (Page 4-119)	Additional optional parameters for the inspection.
Limits (Page 4-120)	Pass / fail tolerance (upper and lower limits) settings for the inspection.
Dsp. Options (Page 4-120)	Inspection region and mask region display settings.
Save (Page 4-121)	Save edge pair tool settings.

Register Image

Registration of an image to be used as a template for settings. It is recommended to adjust lighting and other conditions completely before registering an image.



Multi-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 5-17).
- When multi-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.
- The image variable used for the select image of the vision tools unit should be the same as the image variable used for the capture unit being executed. When the image capture buffer is set to custom, the image variable which contains the image of the capture unit executed most recently will be displayed.

Select Image

Source Image

Select an image to register.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Save Image] is displayed.

Save Image

Number

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

Compression

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

There may be some deterioration in image quality due to compression. Inspection results when using a compressed image may differ from results when using an uncompressed image.

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 -2432.000 and 2432.000 pixels.

Y

Adjust the movement in the Y (vertical) direction between -2050.000 and 2050.000 pixels.

Angle

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

Reference

When you select [Current Image] as the source image for the unit for which the position adjustment ID has been specified in [Inspection Region] (Page 4-115), you can select [Pos. Adjust. value] as well as [Number Input]. This option is useful because even when the image capture position deviates, the current image is automatically adjusted using the adjustment value based on the reference unit. However, note that when [Pos. Adjust. value] is selected in the state where a proper adjustment value cannot be measured for the current image, the position used for registration may be incorrect.

▶ Note

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

Save

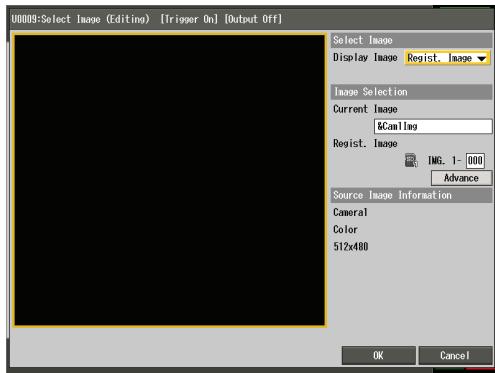
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Regist. Image] is selected for [Source Image], you can delete the registered image specified under [Save Image].

Select Image

Selection of the registered or current image to be used for settings.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Image Selection

Current Image

Set an image variable to be used as a current image for the unit.

Regist. Image

Specify the registered image to be used as a template.

- 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.

- **Assign variables to registered image No.:** To use a variable for the registered image No., check this box and assign a scalar or scalar 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. See the XG VisionEditor Reference Manual (Control/Data Edition) for more details.

- **Assign variables only when changing programs:** Use this option to switch 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

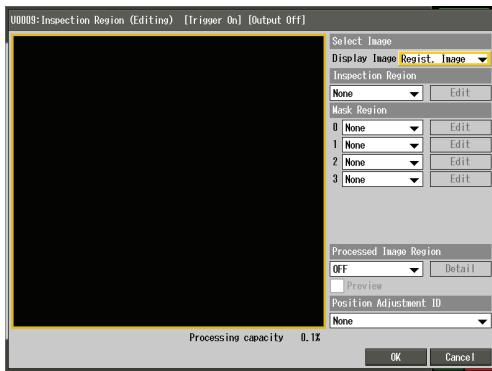
Note that the displayed registered image No. does not switch in accordance with a change in the variable.

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 the inspection.



▶ Note

Changing the shape of the region will initialize or clear some of the settings in the [Edge Filter] menu.

Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

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 8-2) 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 8-8) 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 8-7).

Processed Image Region

To use a processed region from a resultant image variable (Page 4-253), select [ON] and then select [Detail] for configuration.

Reference

See "Generating a Region from an Image" (Page 8-10) for more details on the image region.

Result

Specify the resultant image variable used for the processed image region.

Detect

Select the area and border color for the inspection region from the image data in the resultant image variable by selecting either [Black] (Level 0) or [White] (Level 255, default).

Preview

When this box is checked, the specified resultant image variable is displayed. When the checkmark is removed, the display returns to its normal state.

Position Adjustment ID

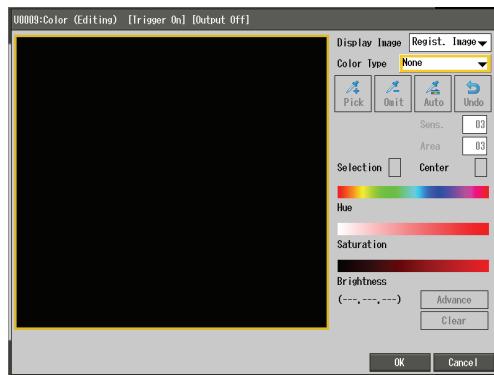
To apply position adjustment to the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).



▶ Note

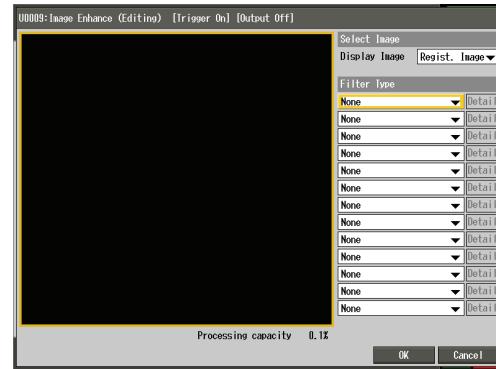
This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-253) is referenced as the current image.

Refer to "Working with Color Images" (Page 8-13) for concepts involving color extraction and its operation.

Image Enhance

Selection and setting of pre-processing filters 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.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Filter Type

Select the [Filter Type] and then select the filter to apply. See "Image Enhancement Filters" (Page 8-27) for more details of each filter processing.

▶ Note

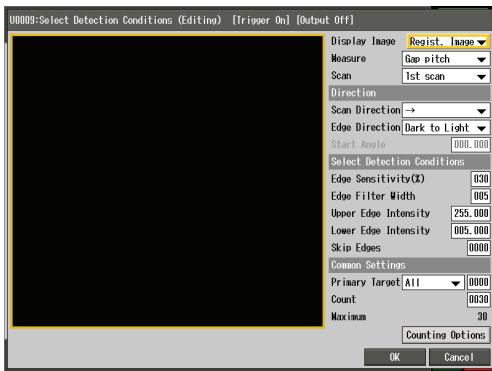
The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 21 types of filters can be set according to application requirements. When multiple filters are set, they are processed one by one from the top.
- You can change the order of the filters 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 up or down.

Detection Conditions

Settings for detecting and filtering edges, including the scan direction and edge in tensity change.



Reference

See "What is an Edge?" (Page 8-41) for the technical description on edge detection.

Display Image

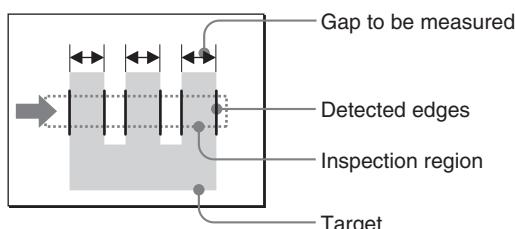
Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

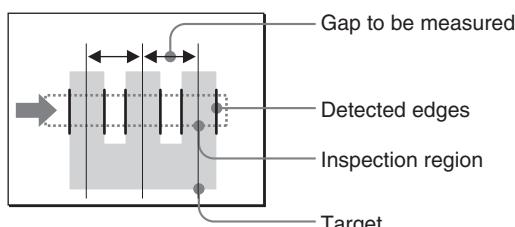
Measure

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°.

Select 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 of the 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 8-41) 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.

Maximum Pair Count

Specify the maximum number of edge pairs (0 to 3600) to be measured. The edge pair count cannot exceed the value set for [Maximum].

▶ Note

- The maximum number of edge pairs available for detection can change based on other settings.
- Based on specific settings, the maximum number of edge pairs is fixed and cannot be changed.

Reference

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.

Counting Options

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.

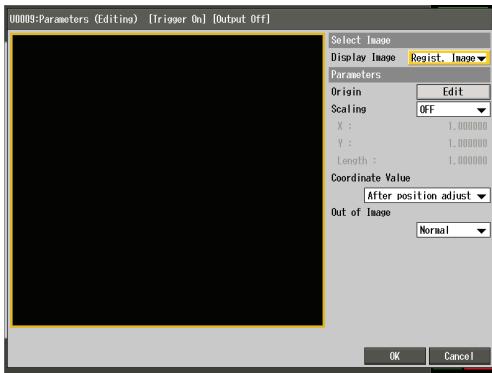
- **Angled Edge Detection:** Set to [ON] to stabilize the detection of slanted edges in the inspection region. Using this option may affect the edge X, Y position accuracy.

Reference

The maximum and minimum distances specified in the [Gap pitch] will apply to the results before the scaling operation, even if [Scaling] (Page 4-119) is set to [ON].

Parameters

Additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Parameters

Origin

By default, the origin is set to the top left point of the camera but you can specify its position 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 4-314).
- 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 VisionEditor Reference Manual (Control/Data Edition).

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 system 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 changed 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.

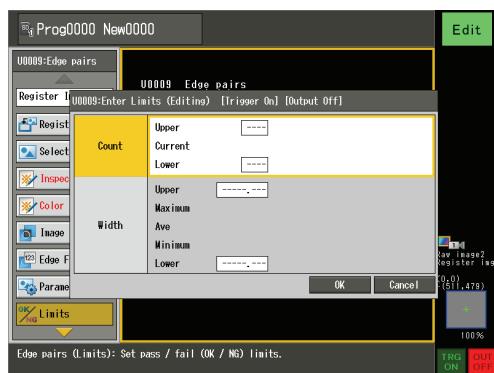
Reference

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.

Enter Limits

Pass / fail tolerance (upper and lower limits) settings for the inspection.

When the measurement result is outside of the specified tolerance range, it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).



Select [Direct Input] to set the tolerance and then enter a value.

Reference

- [-----] indicates an empty state where no tolerance is set. In this state, judgment will not be performed after the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Count

Set the tolerance of the edge pairs detection count.

The unit of tolerance is the "number of pairs" detected.

Width

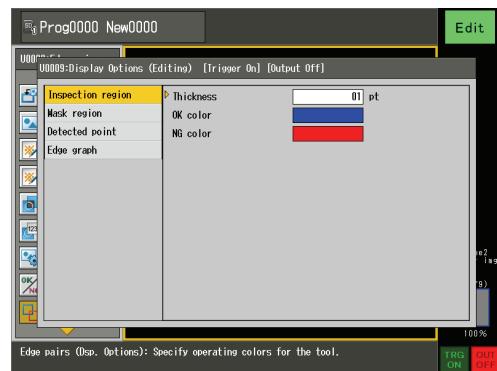
Set the tolerance of the width for the detected edge pairs.

The unit of tolerance 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

Inspection region and mask region display settings.

The display color can be changed based on the judgment result for that unit. The color can also be removed (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 4-118).

Edge graph

Edge graph

Select whether to display the edge graph.

- **OFF** (Default): Hide the edge graph.
- **Both**: Show the edge graphs of both the 1st and 2nd scans.
- **1st scan**: Show the edge graph of the 1st scan only.
- **2nd scan**: Show the edge graph of the 2nd scan only.

► Note

Setting [Edge graph] to [OFF] consumes additional program memory. Check the amount of remaining program memory before enabling.

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

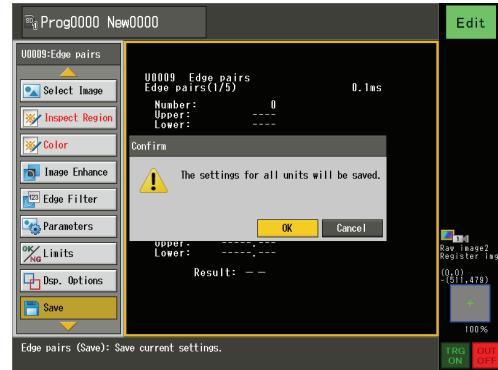
Specify the width and display color of the line representing the edge sensitivity threshold.

Save

Save the current unit changes the program file.

► Note

- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller 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 screen display, and display parts, can be excluded when saving.

Stain

Stain Tool

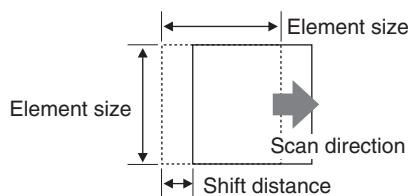
The stain tool is convenient when precise detection is required for detecting flaws on targets. With the inspection region a small group of pixels (element) is defined and the average intensity calculated. Nearby elements are compared with each other to check average intensity differences. Elements that have an intensity difference greater than the threshold specified when compared are identified as stains. Adjacent stains can be grouped together for blob based processing and subtraction image enhancement filters (Page 8-31) can also be used for detecting flaws on complex images.

Reference

- Because stain 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] (stain tool specific function) can be used to detect stains based on color and not intensity. Making the stain tool capable of detecting color stains only and ignoring intensity changes caused by lighting or changes in target reflectivity.

Image layout

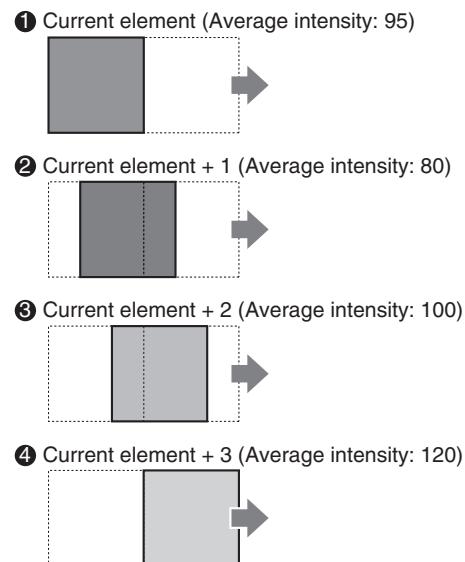
The stain tool indexes the element by the shift distance in the specified scan direction within the inspection region measuring the average intensity of each element.



Difference between stain level and stain area

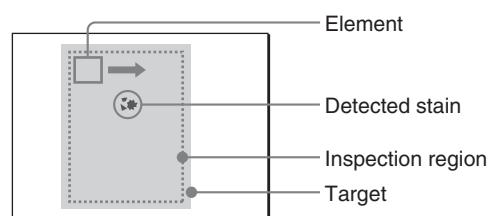
The [Stain Level] is the difference between the maximum and minimum intensities across the last 4 elements, including the current element.

In the following example, the stain level is obtained as follows: [Maximum intensity of 120] (Intensity of the element at position number 4) - [Minimum intensity of 80] (Intensity of the element at position number 2) = 40 (Stain level).

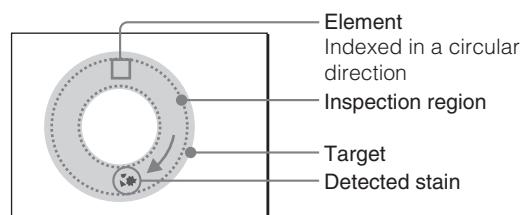


If the threshold set in the [Stain Level] is exceeded, the current element is judged to be a stain and is added to the [Stain Area] ([Stain Area] is the number of elements that exceed the stain level).

Example when the detection direction is either X or Y or XY



Example when the detection direction is circular



Major results

The major results displayed by the stain tool are as follows:

Reference

The items to be measured may vary depending on the [Group Setting] (Page 4-130). The value for an item which is not measured is always 0.

Detected Stain Level:	Outputs the intensity difference from the element with the highest stain level.
Total Area	Outputs the total number of elements with stain levels exceeding the stain level threshold in the inspection region. <small>Available in the limits menu</small>
Position (X, Y)	Outputs the position coordinates of the element with the highest stain level.
Groups	Outputs the number of groups detected by the stain grouping function (when the stain grouping function is ON). <small>Available in the limits menu</small>
Stain Area []	Outputs the total number of elements for each group which have stain levels exceeding the stain level threshold (when the stain grouping function is ON). <small>Available in the limits menu</small> <small>Available through outputs</small>
Group center (X, Y) []	Outputs the position coordinates of the center of all groups (when the stain grouping function is ON). If the stain tool is being used for position adjustment (Page 4-232), this is result that needs to be used for stable processing. <small>Available in the limits menu</small> <small>Available through outputs</small>
Unit judgment value	When the measurement result is outside the specified tolerance range (between the upper and lower limits), it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).

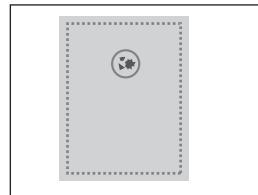
Reference

- The stain group used for tolerance judgment of the stain area and group center can be specified at [Primary Target] (Default: 0).
- For a summary of available measurement output values and setting parameters, see "List of Setting Parameters/Result Data" in the XG VisionEditor Reference Manual (Control/Data Edition).

Example

When a stain on the surface of a target is detected

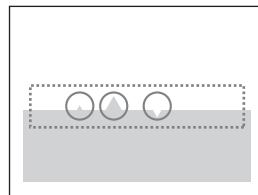
- Direction: XY



Total area
20

When a crack or burr on the surface of a target is detected

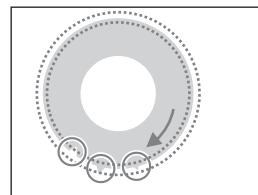
- Direction: X



Total area
55

When a crack or burr on the round surface of a target is detected

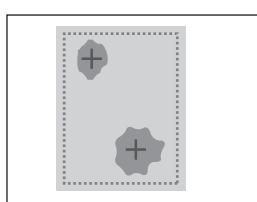
- Direction: Cir.



Total area
35

When the position of a stain on the surface of a target is detected

- Direction: XY
- Stain Grouping Function: ON
- Count: 2
- Detection Order: Y>X:Ascend



Result of the first stain
Stain area: 70
Center: X100, Y100

Result of the second stain
Stain area: 100
Center: X200, Y400

Top Menu Layout

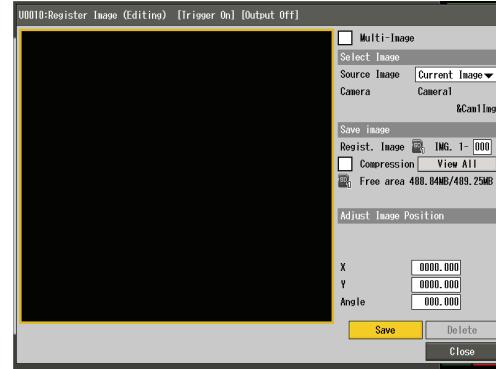
The stain unit has the following options.



Register Image (Page 4-124)	Registration of an image to be used as a template for settings.
Select Image (Page 4-126)	Selection of the registered or current image to be used for settings.
Inspect Region (Page 4-127)	Outline the region on the captured image to be used for the inspection.
Color (Page 4-128)	When a color image variable is used for a current image, specify whether to process the color information from the CCD directly with [Fine Color], or to convert the image into a black and white image through the desired extraction process.
Image Enhance (Page 4-128)	Selection and setting of pre-processing filters to apply to the image.
Condition (Page 4-129)	Conditions for detecting stains for measurement / inspection.
Parameters (Page 4-132)	Additional optional parameters for the inspection.
Limits (Page 4-133)	Pass / fail tolerance (upper and lower limits) settings for the inspection.
Dsp. Options (Page 4-134)	Inspection region and mask region display settings.
Save (Page 4-135)	Save stain tool settings.

Register Image

Registration of an image to be used as a template for settings. It is recommended to adjust lighting and other conditions completely before registering an image.



Multi-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 5-17).
- When multi-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.
- The image variable used for the select image of the vision tools unit should be the same as the image variable used for the capture unit being executed. When the image capture buffer is set to custom, the image variable which contains the image of the capture unit executed most recently will be displayed.

Select Image

Source Image

Select an image to register.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Save Image] is displayed.

Save Image

Number

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

Compression

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

There may be some deterioration in image quality due to compression. Inspection results when using a compressed image may differ from results when using an uncompressed image.

View All

You can 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 -2432.000 and 2432.000 pixels.

Y

Adjust the movement in the Y (vertical) direction between -2050.000 and 2050.000 pixels.

Angle

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

Reference

When you select [Current Image] as the source image for the unit for which the position adjustment ID has been specified in [Inspection Region] (Page 4-127), you can select [Pos. Adjust. value] as well as [Number Input]. This option is useful because even when the image capture position deviates, the current image is automatically adjusted using the adjustment value based on the reference unit. However, note that when [Pos. Adjust. value] is selected in the state where a proper adjustment value cannot be measured for the current image, the position used for registration may be incorrect.

▶ Note

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

Save

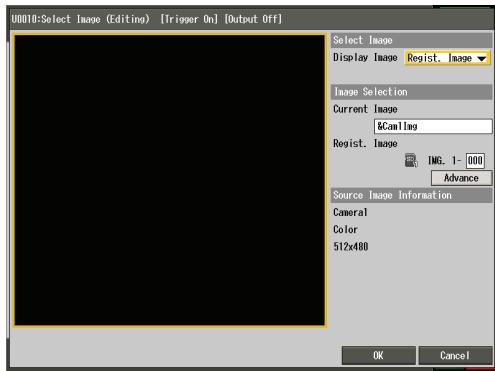
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Regist. Image] is selected for [Source Image], you can delete the registered image specified under [Save Image].

Select Image

Selection of the registered or current image to be used for settings.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Image Selection

Current Image

Set an image variable to be used as a current image for the unit.

Regist. Image

Specify the registered image to be used as a template.

- 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.

- **Assign variables to registered image No.:** To use a variable for the registered image No., check this box and assign a scalar or scalar 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. See the XG VisionEditor Reference Manual (Control/Data Edition) for more details.

- **Assign variables only when changing programs:** Use this option to switch 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

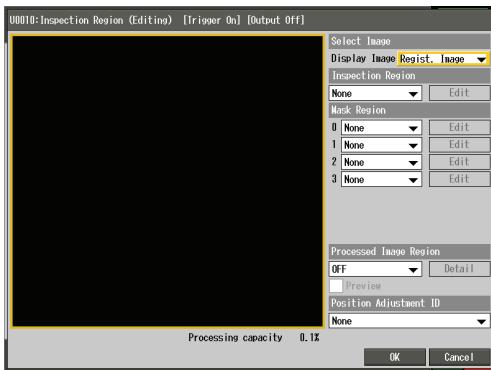
Note that the displayed registered image No. does not switch in accordance with a change in the variable.

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 the inspection.



▶ Note

Changing the shape of the region will initialize or clear some of the settings in the [Edge Filter] menu.

Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

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 8-2) 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 8-8) 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 8-7).

Processed Image Region

To use a processed region from a resultant image variable (Page 4-253), select [ON] and then select [Detail] for configuration.

Reference

See "Generating a Region from an Image" (Page 8-10) for more details on the image region.

Result

Specify the resultant image variable used for the processed image region.

Detect

Select the area and border color for the inspection region from the image data in the resultant image variable by selecting either [Black] (Level 0) or [White] (Level 255, default).

Preview

When this box is checked, the specified resultant image variable is displayed. When the checkmark is removed, the display returns to its normal state.

Position Adjustment ID

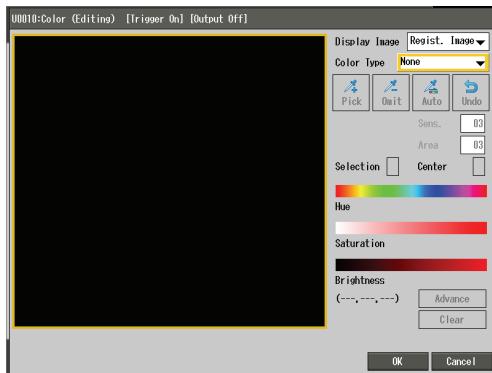
To apply position adjustment to the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

When a color image variable is used for a current image, specify whether to process the color information from the CCD directly with [Fine Color], or to convert the image into a black and white image through the desired extraction process.



▶ Note

This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-253) is referenced as the current image.

Refer to "Working with Color Images" (Page 8-13) for concepts involving color extraction and its operation.

Operation when [Fine Color] is selected for color extraction (color stain mode)

Selecting [Fine Color] will cause changes in color to be detected as stains, rather than specific colors.

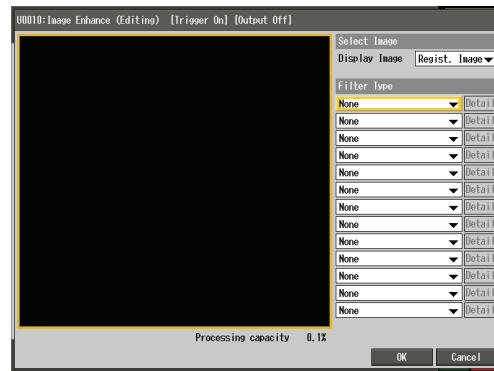
- As in the case where [Gray] or [RGB Gray] is selected, selecting [Fine Color] initializes the color extraction settings and no further settings are possible.
- Filter processing cannot be optimized in color stain mode.
- In color stain mode, the [Ignore Intensity] setting can be used in the [Select Detection Conditions] menu (Page 4-130).

See "What is Fine Color Mode?" (Page 8-44) for more details.

Image Enhance

Selection and setting of pre-processing filters to apply to the image.

When a color camera is used, the filter is applied to the images converted using color extraction.



▶ Note

Filter processing cannot be optimized if [Fine Color] is selected during color extraction.

Select Image

Display Image

Switch the image displayed on the screen.

- Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- Regist. Image:** The registered image specified under [Image Selection] is displayed.

Filter Type

Select the [Filter Type] and then select the filter to apply. See "Image Enhancement Filters" (Page 8-27) for more details of each filter processing.

▶ Note

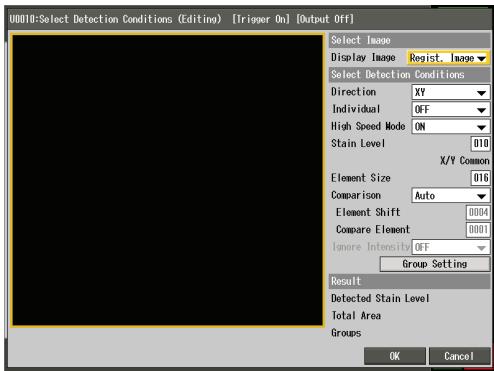
The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 21 types of filters can be set according to application requirements. When multiple filters are set, they are processed one by one from the top.
- You can change the order of the filters 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 up or down.

Detection Conditions

Conditions for detecting stains for measurement / inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Select Detection Conditions

Direction

Select the direction to search for stains.

- **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 stain grouping function is 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 stain grouping.

Individual

Select [ON] to set element parameters individually for each search direction.

- **OFF:** Use the same element parameters for different search directions.
- **ON:** Set element parameters individually for each search direction.

This allows the independent setting of the element 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

Select [ON] to increase the processing speed of the unit.

- **ON** (default): Increase the processing speed of the unit.
- **OFF:** Do not increase the measurement speed.

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 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 stain area: 9999999) will result and the contrast view within the inspection region will be cancelled.

Stain Level

Set the deviation from the average change in intensity for identifying a stain.

Stains that deviate from the average by less than this parameter will not be considered stains. The stain 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 segment size is larger than the inspection region, the measurement is disabled and the total stain area is shown as "9999999".

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 stain, select [Manual] and then make the necessary settings.

The stain 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 stains 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 segment 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 stains 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

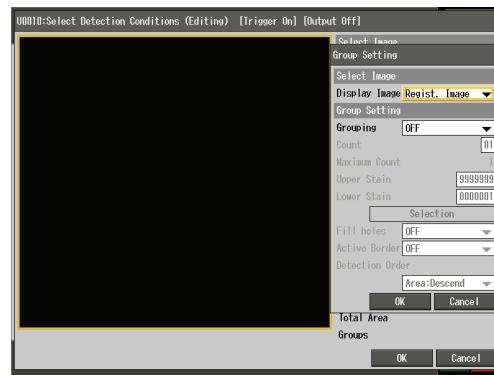
If [Compare Element] increase in the risk of a single stain being detected more than once. If using the grouping function (Page 4-130) to process stains as blobs, lower the value of [Compare Element].

Ignore Intensity

Detect only changes in the pure color information (hue and saturation) as stains, and exclude any brightness information.

- **OFF:** Changes in intensity are processed as part of the stain level measurement.
- **ON:** Hue and saturation are only used for the stain level measurement.

Group Setting



Grouping

If turned [ON], adjacent stains are grouped together so that the center point, area and size aspects of each group can be processed.

- **ON:** Group stains.
- **OFF:** Do not group stains.

▶ Note

- If grouping is disabled when the inspection region is an arc or ring and [Direction] (Page 4-129) 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 [Count] value is reset to 1. If the setting prohibits the change in [Count] value, it will not be possible to change the value from 1 even when grouping is reset from [OFF] to [ON].

Count

Specify the maximum number of groups (1 to 99) to be detected. The group count cannot exceed the [Maximum Count] value. 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 some settings, the number of groups is fixed and cannot be changed.

Reference

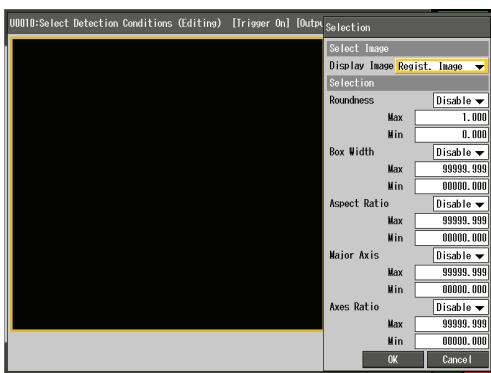
The value can be set higher count value can be set higher than the [Maximum] value (up to 99) depending on the account setting. Note this also increases the [Maximum] value, resulting in additional consumption of program memory.

Stain Area

- **Upper Stain:** Specify the maximum area for a stain 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 Stain:** Specify the minimum area for a stain 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.



• Select Image

Display Image: Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

• Selection: Specify whether to enable or disable each selection 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 stain groups.
- **Box Width:** Groups that have their box width values higher than the specified maximum value or groups that have box width values lower than the specified minimum value are not detected as stain groups.
- **Aspect Ratio:** Groups that have their aspect ratios (major axis / minor axis) higher than the specified maximum value (thinner groups) or groups that have aspect ratios lower than the specified minimum value (proportionally correct groups) are not detected as stain groups.

- **Major Axis:** Groups that have their major axis value of the equivalent oval of the group higher than the specified maximum value or groups that have their major axis value of the equivalent oval of the group lower than the specified minimum value are not detected as stain groups.

- **Axes Ratio:** Groups that have their axes ratio (major axis / minor axis) of the equivalent oval of the group higher than the specified maximum value (thinner groups) or groups that have their axes ratio (major axis / minor axis) of the equivalent oval of the group lower than the specified minimum value (proportionally correct groups) are not detected as stain groups.

► Note

The filter functions cannot be used when [Cir.] or [Rad.] is selected for [Direction] (Page 4-129).

Fill holes

Select whether to fill the holes inside a group to include them as part of a detected stain.



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 detect groups located on the border of the inspection region.

- **OFF:** Detect groups located on the border of the inspection region.
- **ON:** Exclude groups located on the border of the inspection region from detection.

► 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] or the detection direction is not radial, groups can be ordered accordingly.
 - **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 stain area to highest.
 - **Area:Descend** (default): Sort groups from the highest stain area to lowest.
- If the inspection region is set to [arc] and the detection direction is either radial or circular, groups can be ordered accordingly.
 - **Clockwise**: Sort groups based on angle, clockwise from the start of inspection region.
 - **Counter CW**: Sort groups based on angle, counter-clockwise 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 stain area to highest.
 - **Area:Descend** (default): Sort groups from the highest stain area to lowest.

▶ Note

When the inspection region is a rotated rectangle, the XY coordinates move according to the rotation of the region.

Parameters

Additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image**: The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image**: The registered image specified under [Image Selection] is displayed.

Parameters

Origin

By default, the origin is set to the top left point of the camera but you can specify its position 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 4-314).
- 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 VisionEditor Reference Manual (Control/Data Edition).

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 system 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 used for judgment from the detected groups. Although values from 0 to 98 can be set, set [0] for normal operation.

When [Grouping] is [OFF], this setting is disabled.

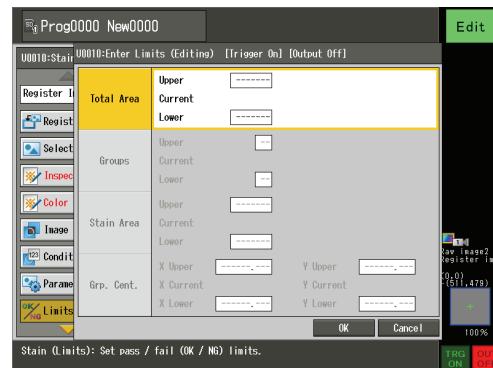
▶ Note

Only the data from the primary target will be used for judgment (excluding the total stain area and group count).

Enter Limits

Pass / fail tolerance (upper and lower limits) settings for the inspection.

When the measurement result is outside of the specified tolerance range, it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).



Select [Direct Input] to set the tolerance and then enter a value.

Reference

- [-----] indicates an empty state where no tolerance is set. In this state, judgment will not be performed after the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Total Area

Set the tolerance of the total stain area in the inspection region.

The unit of tolerance is the "stain area".

Groups

Set the tolerance of the stain group count.

The unit of tolerance is the "number of groups".

▶ Note

This limit is disabled when [Grouping] (Page 4-130) is set to [OFF].

Stain Area

Set the tolerance of the stain area of the group.

The unit of tolerance is the "stain area".

▶ Note

This limit is disabled when [Grouping] (Page 4-130) is set to [OFF].

Grp. Cent.

Set the tolerance of the center co-ordinate of the group. The unit of tolerance is the "number of pixels" indicating the center co-ordinates.

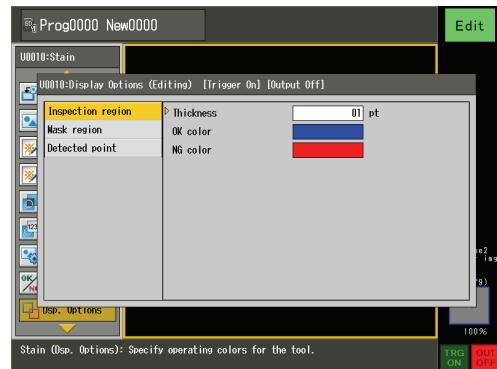
▶ Note

This limit is disabled when [Grouping] (Page 4-130) is set to [OFF].

Display Options

Inspection region and mask region display settings.

The display color can be changed based on the judgment result for that unit. The color can also be removed (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 stain.

Other target

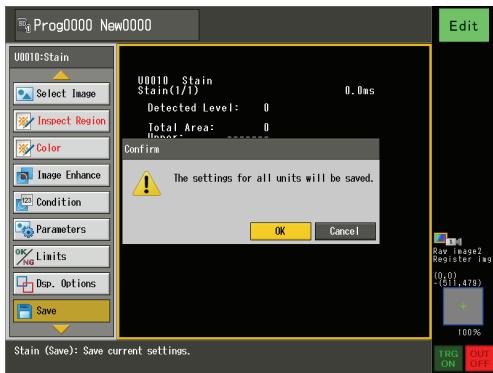
Specify the width and display color of the detected point (center) of the detected stain other than the one specified as the primary target (Page 4-133).

Save

Save the current unit changes the program file.

► Note

- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller 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 screen display, and display parts, can be excluded when saving.

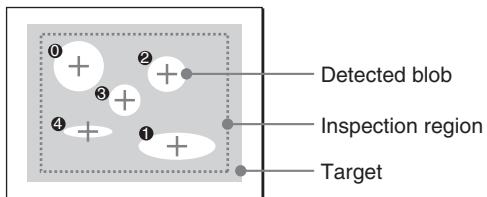
Blob

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 layout

Blobs are measured, filtered and identified based on numerous criteria. When identified they can be ordered based on size or detection direction.



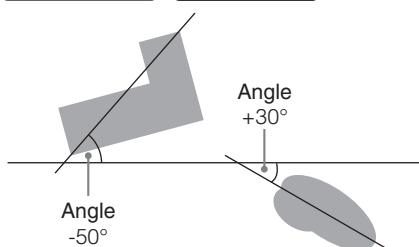
Major results

The major results displayed by the blob measurement are as follows:

Reference

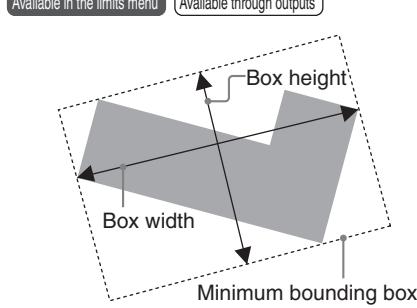
Items to be measured may vary depending on the shape of the inspection region. The value result for an item which is not measured is always 0.

Number	Outputs the number of detected blobs after filtering. Available in the limits menu
Pos. (X, Y) []	Outputs the center of gravity position coordinates for all detected blobs after filtering. Available in the limits menu Available through outputs
Pos. (X, Y) (max, min)	Outputs the maximum and minimum center of gravity position coordinates from the range of detected blobs in after filtering. Available in the limits menu
Angle (T) []	Outputs the major axis angle (with reference to the horizontal X axis) of all detected blobs after filtering. Available in the limits menu Available through outputs
Angle (T) (max, min)	Outputs the maximum and minimum angle of the major axis from the range of detected blobs after filtering. Available in the limits menu



Area []	Outputs the areas of all detected blobs after filtering in pixels. Available in the limits menu Available through outputs
Area (max, min)	Outputs the maximum and minimum area from the range of detected blobs after filtering in pixels. Available in the limits menu
Feret (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. Available in the limits menu Available through outputs
Feret (X, Y) (max, min)	Outputs the maximum and minimum feret diameter from the range of detected blobs after filtering in pixels. Available in the limits menu
Perim []	Outputs the perimeters of all detected blobs after filtering in pixels. Available in the limits menu Available through outputs
Perim (max, min)	Outputs the maximum and minimum perimeter from the range of detected blobs after filtering in pixels. Available in the limits menu
Round. []	Outputs the degree of similarity (1.000 to 0.000) to a perfect circle of all blobs 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. Available in the limits menu Available through outputs
	
Width of Min. Bounding Box []	Outputs the lengths of the longer sides (widths) of all minimum bounding boxes in pixels. A minimum bounding box is a rectangle which is drawn based on the longer sides parallel with the major axis of each blob (when the [Minimum Bounding Box] is set to [Enable] under [Detect Target]). Available in the limits menu Available through outputs
Width of Min. Bounding Box (max, min)	Outputs the maximum or minimum value of the minimum bounding box width in pixels (when the [Minimum Bounding Box] is set to [Enable] under [Detect Target]). Available in the limits menu
Minimum Bounding Box Height []	Outputs the lengths of the shorter sides (heights) of all minimum bounding boxes in pixels. A minimum bounding box is a rectangle which is drawn based on the longer sides parallel with the major axis of each blob (when the [Minimum Bounding Box] is set to [Enable] under [Detect Target]). Available in the limits menu Available through outputs
Height of Min. Bounding Box (max, min)	Outputs the maximum or minimum value of the minimum bounding box height (when the [Minimum Bounding Box] is set to [Enable] under [Detect Target]). Available in the limits menu

Aspect Ratio [] Outputs the aspect ratios of all minimum bounding boxes (when the [Minimum Bounding Box] is set to [Enable] under [Detect Target]). The aspect ratio is a value of the "Major axis/Minor axis," and a larger value represents a thinner shape.



[Available in the limits menu] [Available through outputs]

Aspect Ratio (max, min) Outputs the maximum or minimum aspect ratio among minimum bounding boxes (when the [Minimum Bounding Box] is set to [Enable] under [Detect Target]). The aspect ratio is a value of the "Major axis/Minor axis," and a larger value represents a thinner shape.

[Available in the limits menu]

Major Axis [] Outputs the lengths of the longer axes of all equivalent ovals in pixels (when the [Major/Minor Axis] is set to [Enable] under [Detect Target]).

[Available in the limits menu] [Available through outputs]

Major axis (max, min) Outputs the maximum or minimum length of the longer axes of equivalent ovals in pixels (when the [Major/Minor Axis] is set to [Enable] under [Detect Target]).

[Available in the limits menu]

Minor Axis [] Outputs the lengths of the shorter axes of all equivalent ovals in pixels (when the [Major/Minor Axis] is set to [Enable] under [Detect Target]).

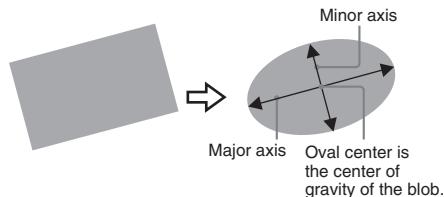
[Available in the limits menu] [Available through outputs]

Minor axis (max, min) Outputs the maximum or minimum length of the shorter axes of equivalent ovals in pixels (when the [Major/Minor Axis] is set to [Enable] under [Detect Target]).

[Available in the limits menu]

Axes Ratio [] Outputs the values of the "Major axis/Minor axis" of all equivalent ovals (when the [Major/Minor Axis] is set to [Enable] under [Detect Target]). A larger value represents a thinner shape.

[Available in the limits menu] [Available through outputs]



The equivalent oval of a blob is an approximate oval obtained from shape of the blob and is useful for stable measurement of shapes that have spikes or strands that skew major/minor axis measurements.

Axes Ratio (max, min) Outputs the maximum or minimum value of the "Major axis/Minor axis" among equivalent ovals (when the [Major/Minor Axis] is set to [Enable] under [Detect Target]). A larger value represents a thinner shape.

[Available in the limits menu]

Circumscribed rectangle position (Upper left, lower left, upper right, lower right) [] Outputs position coordinates of the vertices of the circumscribed rectangles used for feret diameter measurement of all detected blobs after filtering.

[Available through outputs]

Minimum Bounding Box (Upper left, lower left, upper right, lower right) [] Outputs position coordinates of the vertices of the circumscribed rectangles used for major/minor axis length measurement of all detected blobs after filtering. The position relationship (up/down/right/left) is based on the angle of the major axis.

[Available through outputs]

Unit judgment value When the measurement result is outside the specified tolerance range (between the upper and lower limits), or when the specified blob does not exist, it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).

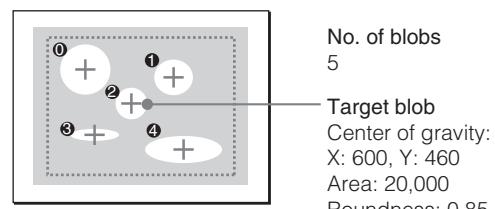
Reference

- 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.
- For a summary of available measurement output values and setting parameters, see "List of Setting Parameters/Result Data" in the XG VisionEditor Reference Manual (Control/Data Edition).

Example

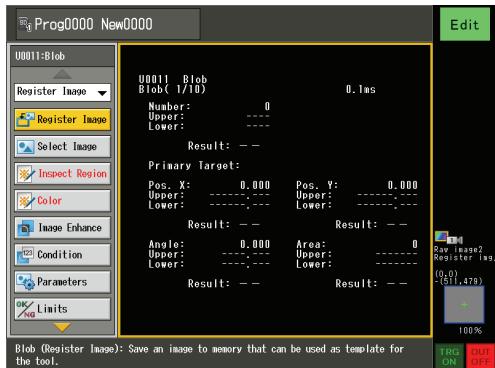
Example showing the results of an inspection performed under the following conditions:

- Detect. Order: Y > X: Ascend
- Primary Target: 2



Top Menu Layout

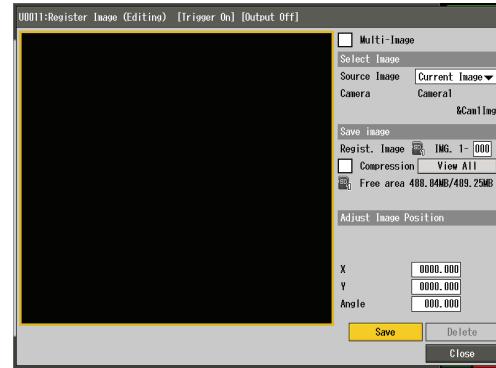
The blob unit has the following options.



Register Image (Page 4-138)	Registration of an image to be used as a template for settings.
Select Image (Page 4-140)	Selection of the registered or current image to be used for settings.
Inspect Region (Page 4-141)	Outline the region on the captured image to be used for the inspection.
Color (Page 4-142)	Color extraction and conversion settings for a color image to gray-scale or binary. (only available for color cameras)
Image Enhance (Page 4-142)	Selection and setting of pre-processing filters to apply to the image.
Condition (Page 4-143)	Conditions for detecting blobs for measurement / inspection.
Parameters (Page 4-145)	Additional optional parameters for the inspection.
Limits (Page 4-146)	Pass / fail tolerance (upper and lower limits) settings for the inspection.
Dsp. Options (Page 4-148)	Inspection region and mask region display settings.
Save (Page 4-148)	Save blob tool settings.

Register Image

Registration of an image to be used as a template for settings. It is recommended to adjust lighting and other conditions completely before registering an image.



Multi-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 5-17).
- When multi-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.
- The image variable used for the select image of the vision tools unit should be the same as the image variable used for the capture unit being executed. When the image capture buffer is set to custom, the image variable which contains the image of the capture unit executed most recently will be displayed.

Select Image

Source Image

Select an image to register.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Save Image] is displayed.

Save Image

Number

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

Compression

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

There may be some deterioration in image quality due to compression. Inspection results when using a compressed image may differ from results when using an uncompressed image.

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 -2432.000 and 2432.000 pixels.

Y

Adjust the movement in the Y (vertical) direction between -2050.000 and 2050.000 pixels.

Angle

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

Reference

When you select [Current Image] as the source image for the unit for which the position adjustment ID has been specified in [Inspection Region] (Page 4-141), you can select [Pos. Adjust. value] as well as [Number Input]. This option is useful because even when the image capture position deviates, the current image is automatically adjusted using the adjustment value based on the reference unit. However, note that when [Pos. Adjust. value] is selected in the state where a proper adjustment value cannot be measured for the current image, the position used for registration may be incorrect.

▶ Note

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

Save

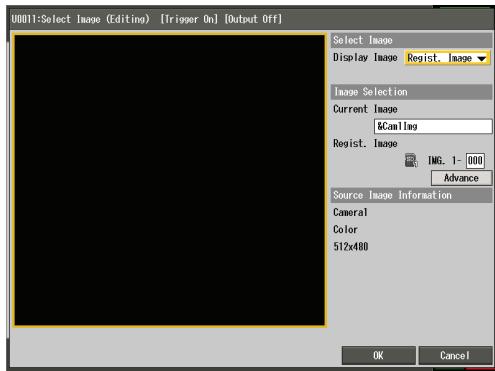
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Regist. Image] is selected for [Source Image], you can delete the registered image specified under [Save Image].

Select Image

Selection of the registered or current image to be used for settings.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Image Selection

Current Image

Set an image variable to be used as a current image for the unit.

Regist. Image

Specify the registered image to be used as a template.

- 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.

- **Assign variables to registered image No.:** To use a variable for the registered image No., check this box and assign a scalar or scalar 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. See the XG VisionEditor Reference Manual (Control/Data Edition) for more details.

- **Assign variables only when changing programs:** Use this option to switch 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

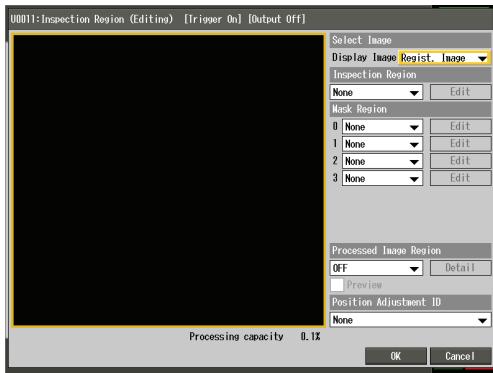
Note that the displayed registered image No. does not switch in accordance with a change in the variable.

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 the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

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 8-2) 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 8-8) 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 8-7).

Processed Image Region

To use a processed region from a resultant image variable (Page 4-253), select [ON] and then select [Detail] for configuration.

Reference

See "Generating a Region from an Image" (Page 8-10) for more details on the image region.

Result

Specify the resultant image variable used for the processed image region.

Detect

Select the area and border color for the inspection region from the image data in the resultant image variable by selecting either [Black] (Level 0) or [White] (Level 255, default).

Preview

When this box is checked, the specified resultant image variable is displayed. When the checkmark is removed, the display returns to its normal state.

Position Adjustment ID

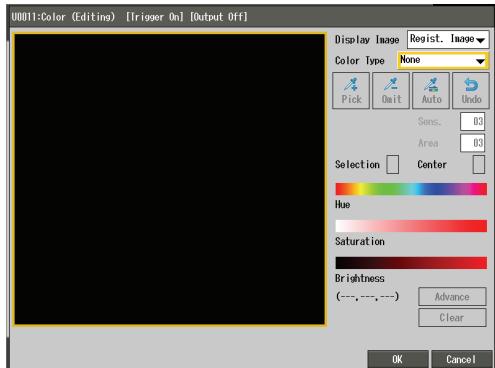
To apply position adjustment to the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

When a color image variable is specified, convert the captured color image into a black and white image through the desired extraction process.



▶ Note

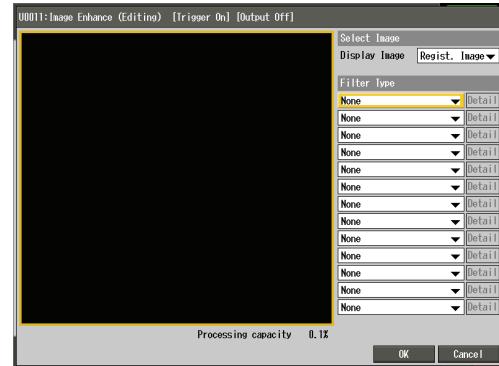
This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-253) is referenced as the current image.

Refer to "Working with Color Images" (Page 8-13) for concepts involving color extraction and its operation.

Image Enhance

Selection and setting of pre-processing filters 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.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Filter Type

Select the [Filter Type] field and then select the filter to apply. To perform blob measurement using a method other than color binary processing, you must select the [Binary] filter as the last filter. See "Image Enhancement Filters" (Page 8-27) for more details of each filter processing.

▶ Note

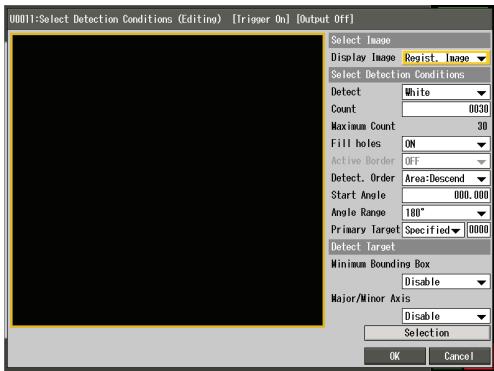
- For blob measurement, you must choose [Binary] unless you selected color extraction through color binary processing or the resultant image variable for a binary image is referenced as a current image.
- When the binary filter is not selected or another filter is applied after the binary filter, the 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 set according to application requirements. When multiple filters are set, they are processed one by one from the top.
- You can change the order of the filters 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 up or down.

Detection Conditions

Conditions for detecting the blobs for measurement / inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Select Detection Conditions

Detect

Specify the color of pixels (black/white) to be detected in the binary 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

The [Count] value can be set higher than the [Maximum Count] value (Maximum: 9999) depending on the account settings. Note this also increases the [Maximum] value, resulting in additional consumption of program memory.

Fill holes

Specify whether to fill holes inside of blobs with the binary color selected 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. To prevent this, the inside of blobs can be filled with the [Detect] color.



- **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 detect blobs located on the border of the inspection region.

- **OFF:** Detect blobs located on the border of the inspection region.
- **ON:** Exclude blobs located on the border of the inspection region from detection.

▶ Note

The active border ON/OFF setting can only be specified when the inspection region is a rectangle 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.

Detect. Order

Select the identification order of the detected blobs.

- **Y>X:Ascend:** Sort groups in ascending Y order. If Y values are the same, then sort the blobs in ascending X order.
- **X>Y:Ascend:** Sort groups in ascending X order. If X values are the same, then sort the blobs 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 blobs from the lowest area to the highest.
- **Area:Descend** (default): Sort blobs from the highest area to the lowest.
- **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 blobs based on angle, clockwise from the start angle.
- **Counter CW**: Sort blobs based on angle, counter-clockwise from the start angle.

Start 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.

Detect Target

Minimum Bounding Box

- **Enable**: Enable the [Min Bounding Box Width], [Min Bounding Box Height], and [Aspect Ratio] parameters for the blob measurement, OK / NG judgment, and filter settings.
- **Disable** (Default): Disable the [Min Bounding Box Width], [Min Bounding Box Height], and [Aspect Ratio] parameters for the blob measurement, OK / NG judgment, and filter settings. The measurement of [Min Bounding Box Width], [Min Bounding Box Height], and [Aspect Ratio] are defaulted to 0.

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 conditions, and filter settings. The results of the [Major Axis], [Minor Axis], and [Axes Ratio] are defaulted to 0.

▶ Note

Enabling [Minimum Bounding Box] and [Major/Minor Axis] increases the consumption of program memory slowing down the processing time.

Selection

Specify the maximum/minimum values for each parameter to detect a blob.



• Select Image

Display Image: Switch the image displayed on the screen.

- **Current Image**: The latest image captured with the specified camera (image variable) is displayed.

- **Regist. Image**: The registered image specified under [Image Selection] is displayed.

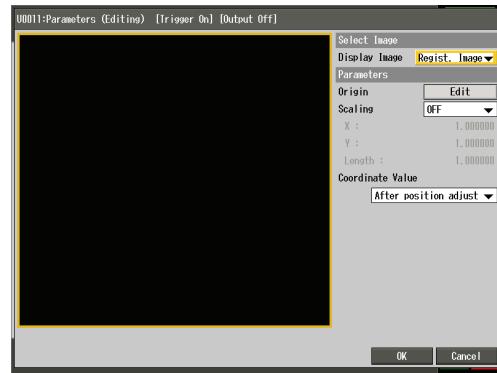
- **Selection:** Change the maximum and minimum values for each filter.
- **Area:** The blobs that are larger than the specified maximum value or smaller than the specified minimum value are not detected as blobs (Area filter).
- **Roundness:** The blobs that have roundness values higher than the specified maximum value (their shapes are closer to a perfect circle) or the blobs that have roundness values lower than the specified minimum value are not detected as blobs (Roundness filter).
- **Min Bounding Box Width:** The blobs that have minimum bounding box width values higher than the specified maximum value or the blobs that have values lower than the specified minimum value are not detected as blobs (Min bounding box width filter).
- **Aspect Ratio:** The blobs that have aspect ratios higher than the specified maximum value (their shapes are thinner) or the blobs that have aspect ratios lower than the specified minimum value are not detected as blobs (Aspect ratio filter).
- **Major Axis:** The blobs that have major axis values higher than the specified maximum value or the blobs that have major axis values lower than the specified minimum value are not detected as blobs (Major axis filter).
- **Axes Ratio:** The blobs that have axes ratios higher than the specified maximum value (their shapes are thinner) or the blobs that have axes ratios lower than the specified minimum value are not detected as blobs (Axes ratio filter).

► Note

- [Min Bounding Box Width] and [Aspect Ratio] cannot be set when the [Minimum Bounding Box] has been disabled.
- [Major Axis] and [Axes Ratio] cannot be set when the [Major/Minor Axis] has been disabled.

Parameters

Additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Parameters

Origin

By default, the origin is set to the top left point of the camera but you can specify its position 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 4-314).
- 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 VisionEditor Reference Manual (Control/Data Edition).

Coordinate Value

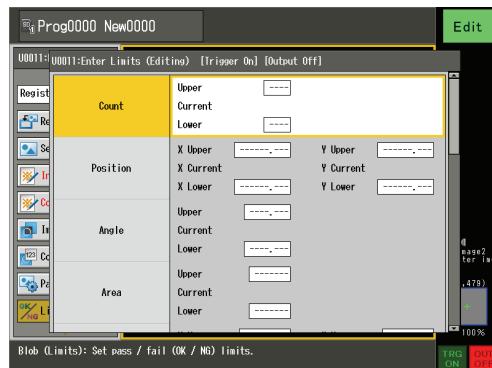
Select the coordinate system to be used after position adjustment. If position adjustment is not used, this setting will have no effect on the measurement.

- After position adjust:** The inspection uses the adjusted coordinate system determined after position adjustment.
- Before position adjust:** The distance from the position specified for the [Origin] of the inspection is used.

Enter Limits

Pass / fail tolerance (upper and lower limits) settings for the inspection.

When the measurement result is outside of the specified tolerance range, it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).



Select [Direct Input] to set the tolerance and then enter a value.

Reference

- [-----] indicates an empty state where no tolerance is set. In this state, judgment will not be performed after the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Note

- [Min Bounding Box Width], [Min Bounding Box Height], and [Aspect Ratio] cannot be set when the [Minimum Bounding Box] is disabled.
- [Major Axis], [Minor Axis], and [Axes Ratio] cannot be set when the [Major/Minor Axis] is disabled.

Count

Set the tolerance of the blob detection count.

The unit of tolerance is the "number of blobs" detected.

Position

Set the tolerance of the center of gravity of the blob.

The unit of tolerance is the "number of pixels" indicating the center of gravity coordinates.

Angle

Set the tolerance of the major axis angle of the blob.

The unit of tolerance is the "angle" of the major axis.

Area

Set the tolerance of the area of the blob.

The unit of tolerance is the "number of pixels".

Feret

Set the tolerance of the feret diameter of the blob.

The unit of tolerance is the "number of pixels" indicating the feret diameter.

Perimeter

Set the tolerance of the perimeter of the blob.

The unit of tolerance is the "number of pixels" indicating the perimeter.

Roundness

Set the tolerance of the roundness of the blob.

The unit of tolerance is the "roundness correlation" indicating the roundness (0.000 to 1.000, where 1.000 is a perfect circle).

Box Width

Set the tolerance of the minimum bounding box width of the blob.

The unit of tolerance is the "number of pixels" indicating the width.

Box Height

Set the tolerance of the minimum bounding box height of the blob.

The unit of tolerance is the "number of pixels" indicating the height.

Aspect Ratio

Set the tolerance of the aspect ratio (Major axis/Minor axis) of the blob.

The unit of tolerance is the "ratio" indicating the aspect ratio (0.000 to 99999.999).

Major Axis

Set the tolerance of the major axis of the equivalent oval of the blob.

The unit of tolerance is the "number of pixels" indicating the length.

Minor Axis

Set the tolerance of the minor axis of the equivalent oval of the blob.

The unit of tolerance is the "number of pixels" indicating the length.

Axes Ratio

Set the tolerance of the axes ratio (Major Axis/Minor Axis) of the equivalent oval of the blob.

The unit of tolerance is the "ratio" indicating the axes ratio (0.000 to 99999.999).

Display Options

Inspection region and mask region display settings. The display color can be changed based on the judgment result for that unit. The color can also be removed (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

Detected point

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 4-144).

Display target

Specify the blob(s) for which the center of gravity point is displayed.

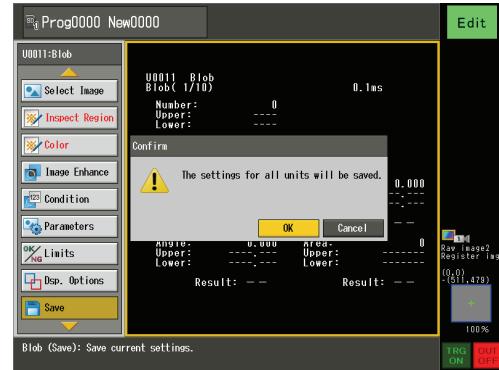
- **All:** Display the center of gravity for all blobs.
- **Primary Target:** Display the center of gravity only for the blob specified as the primary target.

Save

Save the current unit changes the program file.

▶ Note

- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller 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 screen display, and display parts, can be excluded when saving.

Trend Edge Position

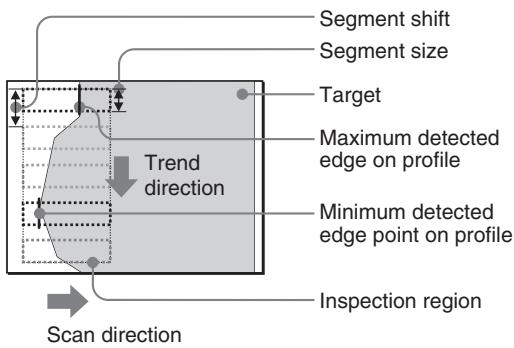
Trend Edge Position Tool

The trend edge 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 layout

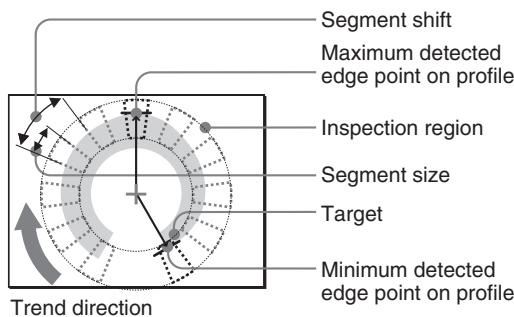
When the inspection region is a rectangle or a rotated rectangle

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]



Major results

The major results displayed by the trend edge position tool are as follows:

Reference

Items to be measured may vary depending on the shape of the inspection region. The value result for an item which is not measured is always 0.

When the inspection region is a rectangle or a rotated rectangle

No. of Segments	Outputs the number of set segments.
Det. Segments	Outputs the number of segments where contrast changes were detected and edges identified. <small>[Available in the limits menu]</small>
Num. []	Outputs the number edges in all segments. <small>[Available through outputs]</small>
Num.(max)	Outputs the number of edges in the segment with the maximum edge position.
Num.(min)	Outputs the number of edges in the segment with the minimum edge position.
Pos. X []	Outputs the X position coordinate of all the edge positions in pixels. <small>[Available in the limits menu]</small> (only when the inspection region is a rectangle and the trend direction is ↓) <small>[Available through outputs]</small>
Pos. X(max)	Outputs the X position coordinate of the maximum edge position in pixels. <small>[Available in the limits menu]</small> (only when the inspection region is a rectangle and the trend direction is ↓)
Pos. X(min)	Outputs the X position coordinate of the minimum edge position in pixels. <small>[Available in the limits menu]</small> (only when the inspection region is a rectangle and the trend direction is ↓)
Pos. X(ave)	Outputs the average X position coordinate from all the edge positions in pixels.
Pos. Y []	Outputs the Y position coordinate of all the edge positions in pixels. <small>[Available in the limits menu]</small> (only when the inspection region is a rectangle and the trend direction is →) <small>[Available through outputs]</small>
Pos. Y(max)	Outputs the Y position coordinate of the maximum edge position in pixels. <small>[Available in the limits menu]</small> (only when the inspection region is a rectangle and the trend direction is →)
Pos. Y(min)	Outputs the Y position coordinate of the minimum edge position in pixels. <small>[Available in the limits menu]</small> (only when the inspection region is a rectangle and the trend direction is →)
Pos. Y(ave)	Outputs the average Y 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). Available through outputs	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 [Circle/Line Detection] is [Line])
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).	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 [Circle/Line Detection] is [Line])
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).	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 [Circle/Line Detection] is [Line])
Pos. XY []	Outputs the position coordinates of all the edge positions in pixels. Available through outputs	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 [Circle/Line Detection] is [Line])
Pos. XY(max)	Outputs the position coordinates of the maximum edge position in pixels.	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 [Circle/Line Detection] is [Line])
Pos. XY(min)	Outputs the position coordinates of the minimum edge position in pixels.	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 [Circle/Line Detection] is [Line])
Pos. XY(ave)	Outputs the average position coordinates from all the edge positions in pixels.	Line Cent. X	Outputs the X position coordinate of the midpoint between the Line XY1 and Line XY2 positions. (when [Circle/Line Detection] is [Line])
Dist. []	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. Available in the limits menu (only when the inspection region is a rotated rectangle) Available through outputs	Line Cent. Y	Outputs the Y position coordinate of the midpoint between the Line XY1 and Line XY2 positions. (when [Circle/Line Detection] is [Line])
Dist.(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. Available in the limits menu (only when the inspection region is a rotated rectangle)	Line Cent. XY	Outputs the position coordinates of the midpoint between the Line XY1 and Line XY2 positions. (when [Circle/Line Detection] is [Line])
Dist.(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. Available in the limits menu (only when the inspection region is a rotated rectangle)	Line Angle	Outputs the angle of Line XY2 in reference to Line XY1. (°0 to 359.999°) (when [Circle/Line Detection] is [Line])
Dist.(ave)	Outputs the average distance from the start of the segments to the coordinate of the edge positions in pixels.	Max Seg.	Outputs the segment No. of the segment with the maximum edge position.
Int. []	Outputs the intensity differential of the edge at all the edge positions. Available through outputs	Min Seg.	Outputs the segment No. of the segment with the minimum edge position.
Int.(max)	Outputs the intensity differential of the edge at the maximum edge position.	Unit judgment value	When the measurement result is outside the specified tolerance range (between the upper and lower limits), it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).
Int.(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 [Circle/Line Detection] is [Circle])		
Circle Cent. X	Outputs the X position coordinate at the center of the best fit circle in pixels. (when [Circle/Line Detection] is [Circle])		
Circle Cent. Y	Outputs the Y position coordinate at the center of the best fit circle in pixels. (when [Circle/Line Detection] is [Circle])		
Circle Cent. XY	Outputs the position coordinates at the center of the best fit circle in pixels. (when [Circle/Line Detection] is [Circle])		

When the measurement area is a ring or an arc

No. of Segments	Outputs the number of set segments.
Det. Segments	Outputs the number of segments contrast changes were detected and edges identified. Available in the limits menu
Num. []	Outputs the number of edges in all segments. Available through outputs
Num.(max)	Outputs the number of edges in the segment with the maximum radius.
Num.(min)	Outputs the number of edges in the segment with the minimum radius.
Pos. X []	Outputs the X position coordinate of all the edge positions in pixels. Available through outputs
Pos. X(max)	Outputs the X position coordinate of the maximum radius.
Pos. X(min)	Outputs the X position coordinate of the maximum radius.
Pos. X(ave)	Outputs the average X position coordinate from all the edge positions in pixels.
Pos. Y []	Outputs the Y position coordinate of all the edge positions in pixels. Available through outputs
Pos. Y(max)	Outputs the Y position coordinate of the maximum radius.
Pos. Y(min)	Outputs the Y position coordinate of the minimum radius.
Pos. Y(ave)	Outputs the average Y position coordinate from all the edge positions in pixels.
Angle []	Outputs the angle of a measured segment. Available through outputs
Angle(max)	Outputs the angle of the segment with the maximum radius.
Angle(min)	Outputs the angle of the segment with the minimum radius.
Pos. XY []	Outputs the position coordinates of all the edge positions in pixels. Available through outputs
Pos. XY(max)	Outputs the position coordinates of the maximum radius.
Pos. XY(min)	Outputs the position coordinates of the minimum radius.
Pos. XY(ave)	Outputs the average position coordinates from all the edge positions in pixels.
Dist. []	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. Available through outputs
Dist.(max)	Outputs the distance from the start of the segment with the maximum radius to the position coordinate of the maximum radius in pixels.
Dist.(min)	Outputs the distance from the start of the segment with the minimum radius to the position coordinate of the minimum radius in pixels.
Dist.(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. Available in the limits menu Available through outputs
Radius(max)	Outputs the radius of the edge position with the maximum radius. Available in the limits menu
Radius(min)	Outputs the radius of the edge position with the minimum radius. Available in the limits menu
Radius(ave)	Outputs the average radius of all edge positions in pixels.
Int. []	Outputs the intensity differential of the edge at all the edge positions. Available through outputs
Int.(max)	Outputs the intensity differential of the edge at the maximum radius.
Int.(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 [Circle/Line Detection] is [Circle])
Circle Cent. X	Outputs the X position coordinate at the center of the best fit circle in pixels. (when [Circle/Line Detection] is [Circle])
Circle Cent. Y	Outputs the Y position coordinate at the center of the best fit circle in pixels. (when [Circle/Line Detection] is [Circle])
Circle Cent. XY	Outputs the position coordinates at the center of the best fit circle in pixels. (when [Circle/Line Detection] is [Circle])
Max Seg.	Outputs the segment No. of the segment with the maximum edge position.
Min Seg.	Outputs the segment No. of the segment with the minimum edge position.
Unit judgment value	When the measurement result is outside the specified tolerance range (between the upper and lower limits), it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).

Reference

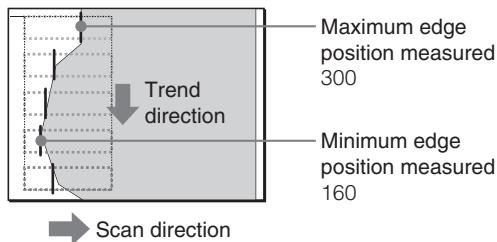
For a summary of available measurement output values and setting parameters, see "List of Setting Parameters/Result Data" in the XG VisionEditor Reference Manual (Control/Data Edition).

Example

When the inspection region is a rectangle or a rotated rectangle

Example showing the results of an inspection performed under the following conditions:

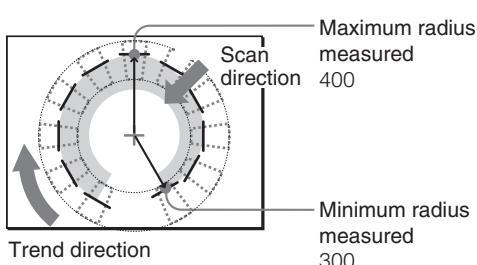
- [Trend Dir.]: ↓
- Scan Direction: →
- Edge Direction: both



When the inspection region is a ring or an arc

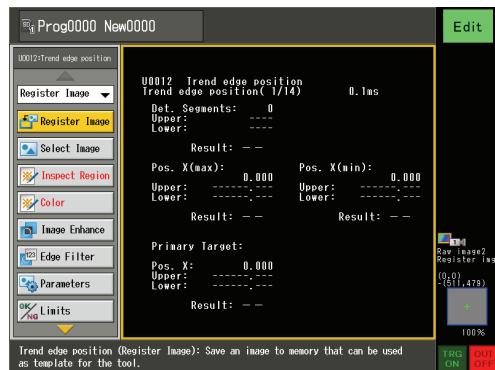
Example showing the results of a measurement performed under the following conditions:

- [Trend Dir.]: Clockwise
- Scan Direction: Out → Center
- Edge Direction: Both



Top Menu Layout

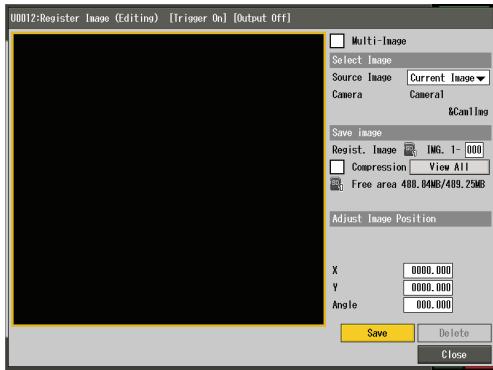
The trend edge position unit has the following options.



Register Image	Registration of an image to be used as a template for settings. (Page 4-153)
Select Image	Selection of the registered or current image to be used for settings. (Page 4-154)
Inspect Region	Outline the region on the captured image to be used for the inspection. (Page 4-155)
Color	Color extraction and conversion settings for a color image to gray-scale or binary. (Page 4-156) (only available for color cameras)
Image Enhance	Selection and setting of pre-processing filters to apply to the image. (Page 4-157)
Edge Filter	Settings for detecting and filtering edges, including the scan direction and edge intensity change. (Page 4-157)
Parameters	Additional optional parameters for the inspection. (Page 4-160)
Limits	Pass / fail tolerance (upper and lower limits) settings for the inspection. (Page 4-161)
Dsp. Options	Inspection region and mask region display settings. (Page 4-162)
Save	Save trend edge position tool settings. (Page 4-163)

Register Image

Registration of an image to be used as a template for settings. It is recommended to adjust lighting and other conditions completely before registering an image.



Multi-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 5-17).
- When multi-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.
- The image variable used for the select image of the vision tools unit should be the same as the image variable used for the capture unit being executed. When the image capture buffer is set to custom, the image variable which contains the image of the capture unit executed most recently will be displayed.

Select Image

Source Image

Select an image to register.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Save Image] is displayed.

Save Image

Number

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

Compression

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

There may be some deterioration in image quality due to compression. Inspection results when using a compressed image may differ from results when using an uncompressed image.

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 -2432.000 and 2432.000 pixels.

Y

Adjust the movement in the Y (vertical) direction between -2050.000 and 2050.000 pixels.

Angle

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

Reference

When you select [Current Image] as the source image for the unit for which the position adjustment ID has been specified in [Inspection Region] (Page 4-155), you can select [Pos. Adjust. value] as well as [Number Input]. This option is useful because even when the image capture position deviates, the current image is automatically adjusted using the adjustment value based on the reference unit. However, note that when [Pos. Adjust. value] is selected in the state where a proper adjustment value cannot be measured for the current image, the position used for registration may be incorrect.

▶ Note

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

Save

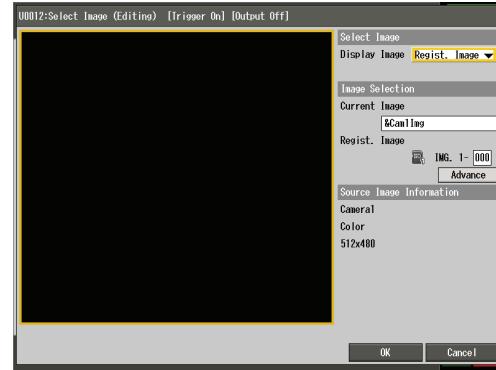
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Regist. Image] is selected for [Source Image], you can delete the registered image specified under [Save Image].

Select Image

Selection of the registered or current image to be used for settings.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Image Selection

Current Image

Set an image variable to be used as a current image for the unit.

Regist. Image

Specify the registered image to be used as a template.

- 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.

- **Assign variables to registered image No.:** To use a variable for the registered image No., check this box and assign a scalar or scalar 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. See the XG VisionEditor Reference Manual (Control/Data Edition) for more details.
- **Assign variables only when changing programs:** Use this option to switch 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

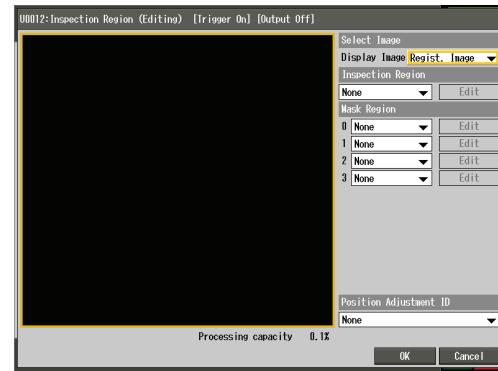
Note that the displayed registered image No. does not switch in accordance with a change in the variable.

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 the inspection.



► Note

Changing the shape of the region will initialize or clear some of the settings in the [Edge Filter] and [Limits] menus.

Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

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 8-2) 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 items change with the selected detection area.

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 8-8) 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 8-7).

Position Adjustment ID

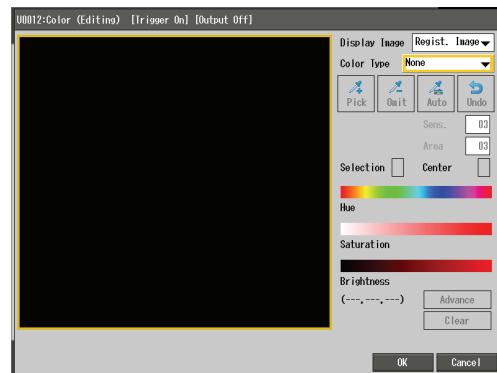
To apply position adjustment to the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).



▶ Note

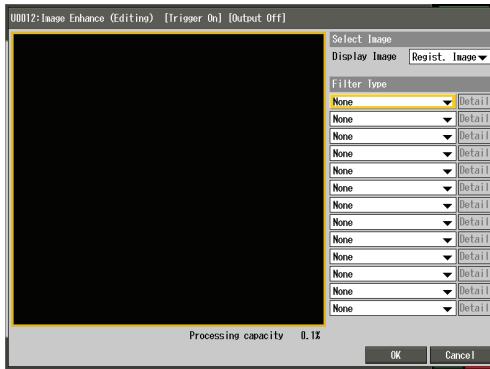
This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-253) is referenced as the current image.

Refer to "Working with Color Images" (Page 8-13) for concepts involving color extraction and its operation.

Image Enhance

Selection and setting of pre-processing filters 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.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Filter Type

Select the [Filter Type] and then select the filter to apply.

See "Image Enhancement Filters" (Page 8-27) for more details of each filter processing.

▶ Note

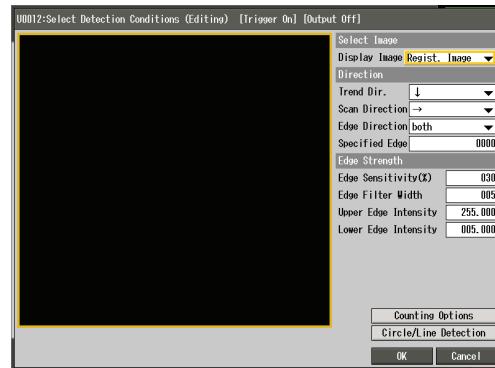
The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 13 types of filters can be set according to application requirements. When multiple filters are set, they are processed one by one from the top.
- You can change the order of the filters 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 up or down.

Detection Conditions

Settings for detecting and filtering edges, including the scan direction and edge intensity change.



Reference

See "What is an Edge?" (Page 8-41) for the technical description on edge detection.

Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Direction

Trend Dir.

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. The direction is based on the rotation of the region.
- **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) to be used within the segments.

If a value of 0 or higher is specified, the edge No. is assigned 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 of the edge intensity for detecting edges.

Reference

Adjusting the highest and lowest edge intensities, shown to the left of the graph, allows noisy edges to be excluded. See "What is an Edge?" (Page 8-41) for more details.

Counting Options

Display Image

Switch the image displayed on the screen.

- **Current Image**: The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image**: The registered image specified under [Image Selection] is displayed.

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.

Circle/Line Detection

Display Image

Switch the image displayed on the screen.

- Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- Regist. Image:** The registered image specified under [Image Selection] is displayed.

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 three segments inside the inspection region for a circle or less than two 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 Acceptance], or [Abnormal Size Max], the reference setting may be reset depending on the change in the [Circle/Line Detection] setting.

Correction

Correct any false detection for the best fit [Circle / Line] caused by noise.

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 Acceptance

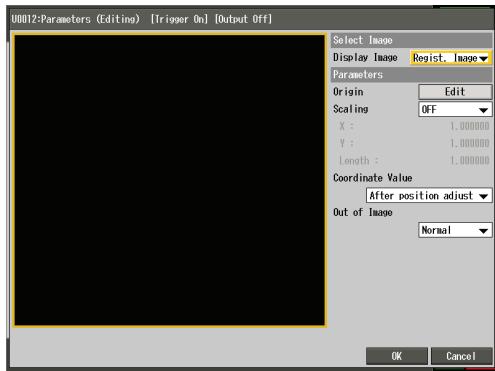
When [Circle/Line Detection] and [Correction] are selected, specify the allowable range of deviation (distance) between adjacent segments to remove abnormal detected edge points.

Abnormal Size Max

When [Circle/Line Detection] and [Correction] are selected, specify the upper edge sensitivity limit (%) for the abnormal detected points, in the segments.

Parameters

Additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Parameters

Origin

By default, the origin is set to the top left point of the camera but you can specify its position 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 4-314).
- 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 VisionEditor Reference Manual (Control/Data Edition).

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 system 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 changed 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.

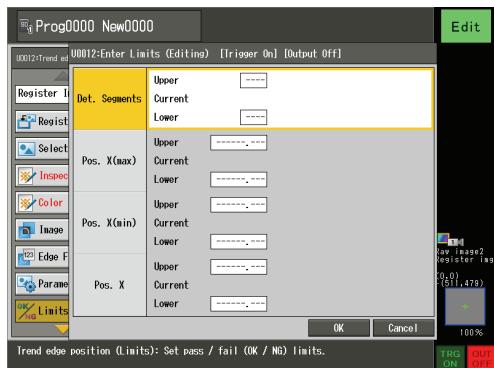
Reference

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.

Enter Limits

Pass / fail tolerance (upper and lower limits) settings for the inspection.

When the measurement result is outside of the specified tolerance range, it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).



Select [Direct Input] to set the tolerance and then enter a value.

Reference

- [- - -] indicates an empty state where no tolerance is set. In this state, judgment will not be performed after the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Det. Segments

Set the tolerance of the segment detection count.

The unit of tolerance is the "number of segments" detected.

Pos. X(max)

Set the tolerance of the maximum value of the detected X position (when the inspection region is a [Rectangle] and the trend direction is \downarrow).

The unit of tolerance is the "number of pixels" indicating the X coordinate of the edge position.

Pos. X(min)

Set the tolerance of the minimum value of the detected X position (when the inspection region is a [Rectangle] and the trend direction is \downarrow).

The unit of tolerance is the "number of pixels" indicating the X coordinate of the edge position.

Pos. X

Set the tolerance of the X edge position (when the inspection region is a [Rectangle] and the trend direction is \downarrow).

The unit of tolerance is the "number of pixels" indicating the X coordinate of the edge position.

Pos. Y(max)

Set the tolerance of the maximum value of the detected Y position (when the inspection region is a [Rectangle] and the trend direction is \rightarrow).

The unit of tolerance is the "number of pixels" indicating the Y coordinate of the edge position.

Pos. Y(min)

Set the tolerance of the minimum value of the detected Y position (when the inspection region is a [Rectangle] and the trend direction is \rightarrow).

The unit of tolerance is the "number of pixels" indicating the Y coordinate of the edge position.

Pos. Y

Set the tolerance of the Y position edge (when the inspection region is a [Rectangle] and the trend direction is \rightarrow).

The unit of tolerance is the "number of pixels" indicating the Y coordinate of the edge position.

Distance (max)

Set the tolerance of the maximum detected distance (when the inspection region is a [Rotated Rectangle]).

The unit of tolerance is the "number of pixels" indicating the distance.

Distance (min)

Set the tolerance of the minimum detected distance (when the inspection region is a [Rotated Rectangle]).

The unit of tolerance is the "number of pixels" indicating the distance.

Distance

Set the tolerance of the detected distance (when the inspection region is a [Rotated Rectangle]).

The unit of tolerance is the "number of pixels" indicating the distance.

Radius (max)

Set the tolerance of the maximum detected radius (when the inspection region is a [Ring/Arc]).

The unit of tolerance is the "number of pixels" indicating the radius.

Radius (min)

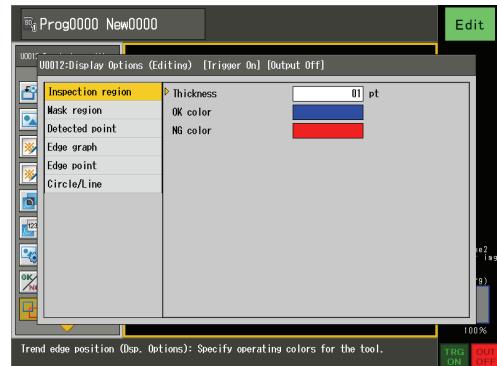
Set the tolerance of the minimum detected radius (when the inspection region is a [Ring/Arc]).
The unit of tolerance is the "number of pixels" indicating the radius.

Radius

Set the tolerance of detected radius (when the inspection region is a [Ring/Arc]).
The unit of tolerance is the "number of pixels" indicating the radius.

Display Options

Inspection region and mask region display settings.
The display color can be changed based on the judgment result for that unit. The color can also be removed (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 4-159).

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

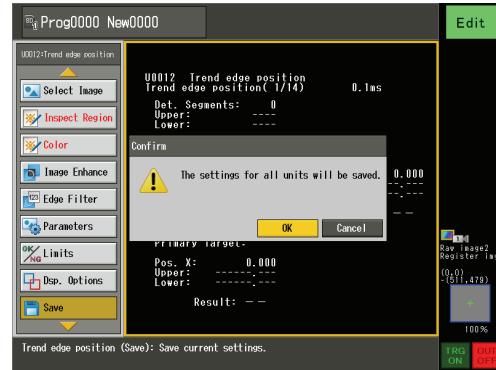
Specify the width and display color of the best fit line or circle determined from the detected points.

Save

Save the current unit changes the program file.

► Note

- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller 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 screen display, and display parts, can be excluded when saving.

Trend Edge Width

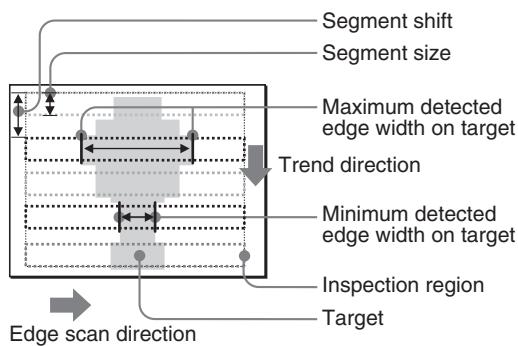
Trend Edge Width Tool

The trend edge 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 layout

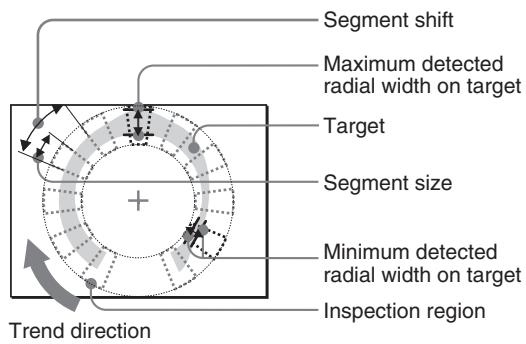
When the inspection region is a rectangle or a rotated rectangle

- In the instance the scan direction is [→] and trend direction is [↓]

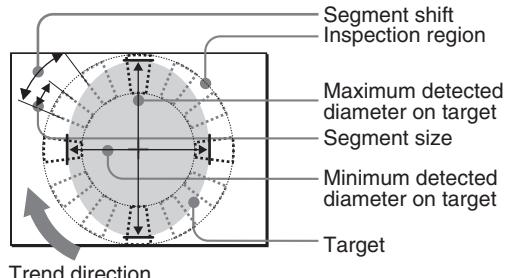


When the inspection region is a ring or an arc

- 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]



Major results

The major results displayed by the trend edge width tool are as follows:

Reference

Items to be measured may vary depending on the shape of the inspection region. The value result for an item which is not measured is always 0.

When the inspection region is a rectangle or a rotated rectangle

No. of Segments	Outputs the number of set segments.
Det. Segments	Outputs the number of segments where contrast changes were detected and edges identified. <small>[Available in the limits menu]</small>
Num. []	Outputs (1) if a pair is detected (0) if not for all segments. <small>[Available through outputs]</small>
Num.(max)	Outputs (1) if a pair is detected (0) if not for the segment with the maximum edge width.
Num.(min)	Outputs (1) if a pair is detected (0) if not for the segment with the minimum edge width.
Width []	Outputs the width of all the edge width pairs in pixels. <small>[Available in the limits menu]</small> <small>[Available through outputs]</small>
Width(max)	Outputs the maximum edge width from all the edge width pairs in pixels. <small>[Available in the limits menu]</small>
Width(min)	Outputs the minimum edge width from all the edge width pairs in pixels. <small>[Available in the limits menu]</small>
Width(ave)	Outputs the average edge width from all the edge width pairs in pixels.
Pos.1 (X/Y/XY) []	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. <small>[Available through outputs]</small>
Pos.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.
Pos.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.
Ang.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). <small>[Available through outputs]</small>
Ang.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).
Ang.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).
Dist.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. <small>[Available through outputs]</small>
Dist.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.

Dist.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.
Int.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. [Available through outputs]
Int.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.
Int.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.
Pos.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. [Available through outputs]
Pos.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.
Pos.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.
Ang.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). [Available through outputs]
Ang.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).
Ang.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).
Dist.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. [Available through outputs]
Dist.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.
Dist.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.
Int.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. [Available through outputs]
Int.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.
Int.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.
Max Seg.	Outputs the segment No. of the segment with the maximum edge position.
Min Seg.	Outputs the segment No. of the segment with the minimum edge position.
Unit judgment value	When the measurement result is outside the specified tolerance range (between the upper and lower limits), it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).

When the inspection region is a ring or an arc

No. of Segments	Outputs the number of set segments.
Det. Segments	Outputs the number of segments where contrast changes were detected and edges identified. [Available in the limits menu]
Num. []	Outputs (1) if a pair is detected (0) if not for all segments. [Available through outputs]
Num.(max)	Outputs (1) if a pair is detected (0) if not for the segment with the maximum edge width.
Num.(min)	Outputs (1) if a pair is detected (0) if not for the segment with the minimum edge width.
Width []	Outputs the width (diameter/radial width) of all the edge width pairs in pixels. [Available in the limits menu] [Available through outputs]
Width(max)	Outputs the maximum edge width (diameter / radial width) from all the edge width pairs in pixels. [Available in the limits menu]
Width(min)	Outputs the minimum edge width (diameter / radial width) from all the edge width pairs in pixels. [Available in the limits menu]
Width(ave)	Outputs the average edge width (diameter / radial width) from all the edge width pairs in pixels.
Pos.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. [Available through outputs]
Pos.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.
Pos.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.
Ang.1 []	Outputs the angle for the first identified edge (typically the one nearest the start of the segment) of all edge width pairs. [Available through outputs]
Ang.1(max)	Outputs the angle for the first identified edge (typically the one nearest the start of the segment) of the maximum edge width pair.
Ang.1(min)	Outputs the angle for the first identified edge (typically the one nearest the start of the segment) of the maximum edge width pair.
Dist.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. [Available through outputs]
Dist.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.
Dist.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.
Int.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. [Available through outputs]
Int.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.
Int.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.

Pos.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. [Available through outputs]
Pos.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.
Pos.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.
Ang.2 []	Outputs angle for the second identified edge (typically the one nearest the end of the segment) of all edge width pairs. (For the inner and outer gap measurements, this value is the same as Angle 1. For the inner and outer diameter measurements, this value is "Angle 1 + 180°".) [Available through outputs]
Ang.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 the inner and outer gap measurements, this value is the same as Angle 1. For the inner and outer diameter measurements, this value is "Angle 1 + 180°".)
Ang.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 the inner and outer gap measurements, this value is the same as Angle 1. For the inner and outer diameter measurements, this value is "Angle 1 + 180°".)
Dist.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. [Available through outputs]
Dist.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.
Dist.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.
Int.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. [Available through outputs]
Int.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.
Int.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.
Max Seg.	Outputs the segment No. of the segment with the maximum edge position.
Min Seg.	Outputs the segment No. of the segment with the minimum edge position.
Unit judgment value	When the measurement result is outside the specified tolerance range (between the upper and lower limits), it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).

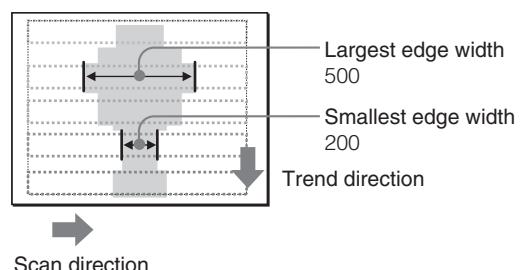
Reference

For the lists of available measurement output values and setting parameters, see "List of Setting Parameters/Result Data" in the XG VisionEditor Reference Manual (Control/Data Edition).

Example**When the inspection region is a rectangle or a rotated rectangle**

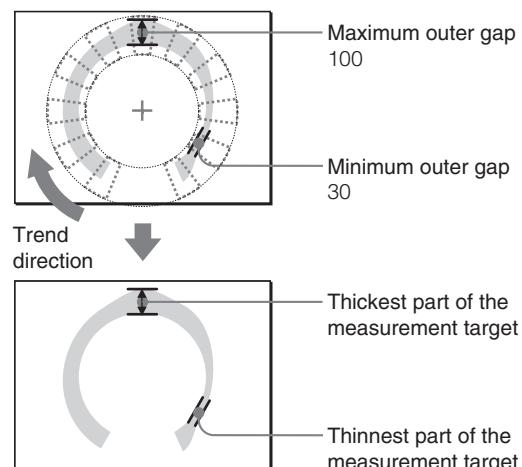
Example showing the results of an inspection performed under the following conditions:

- Measure: Outer Gap
- Trend Dir.: ↓
- Scan Direction: →
- Edge Direction: Both

**When the inspection region is a ring or an arc (1)**

Example showing the results of a measurement performed under the following conditions:

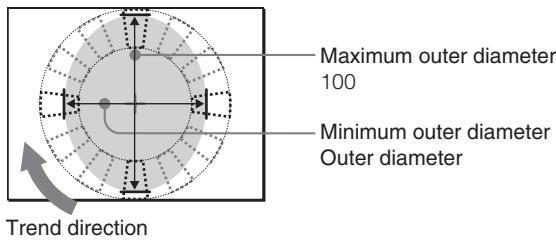
- Measure: Outer Gap
- Trend Dir.: Clockwise
- Scan Dir.: Center → Out
- Edge Direction: Both



When the inspection region is a ring or an arc (2)

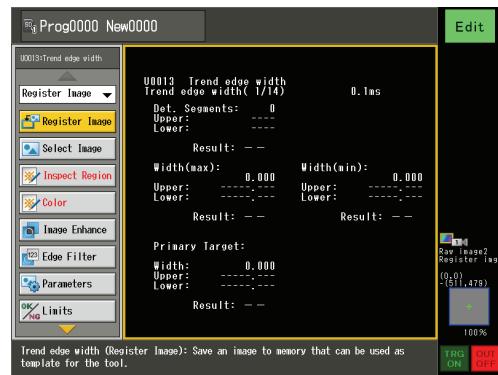
Example showing the results of a measurement performed under the following conditions:

- Measure: Diameter Outside
- Trend Dir.: Clockwise
- Scan Dir.: Center → Out
- Edge Direction: Both



Top Menu Layout

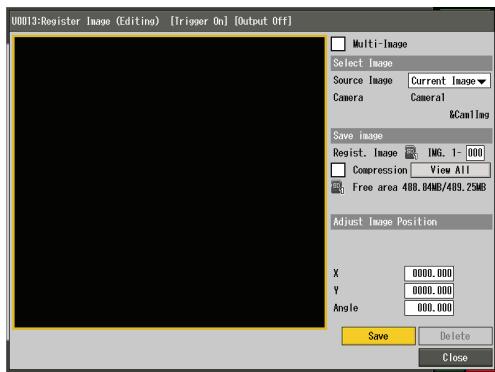
The trend edge width unit has the following options



Register Image (Page 4-168)	Registration of an image to be used as a template for settings.
Select Image (Page 4-169)	Selection of the registered or current image to be used for settings.
Inspect Region (Page 4-170)	Outline the region on the captured image to be used for the inspection.
Color (Page 4-171)	Color extraction and conversion settings for a color image to gray-scale or binary. (only available for color cameras)
Image Enhance (Page 4-172)	Selection and setting of pre-processing filters to apply to the image.
Edge Filter (Page 4-172)	Settings for detecting and filtering edges, including the scan direction and edge intensity change.
Parameters (Page 4-175)	Additional optional parameters for the inspection.
Limits (Page 4-176)	Pass / fail tolerance (upper and lower limits) settings for the inspection.
Dsp. Options (Page 4-177)	Inspection region and mask region display settings.
Save (Page 4-178)	Save trend edge position tool settings.

Register Image

Registration of an image to be used as a template for settings. It is recommended to adjust lighting and other conditions completely before registering an image.



Multi-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 5-17).
- When multi-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.
- The image variable used for the select image of the vision tools unit should be the same as the image variable used for the capture unit being executed. When the image capture buffer is set to custom, the image variable which contains the image of the capture unit executed most recently will be displayed.

Select Image

Source Image

Select an image to register.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Save Image] is displayed.

Save Image

Number

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

Compression

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

There may be some deterioration in image quality due to compression. Inspection results when using a compressed image may differ from results when using an uncompressed image.

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 -2432.000 and 2432.000 pixels.

Y

Adjust the movement in the Y (vertical) direction between -2050.000 and 2050.000 pixels.

Angle

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

Reference

When you select [Current Image] as the source image for the unit for which the position adjustment ID has been specified in [Inspection Region] (Page 4-170), you can select [Pos. Adjust. value] as well as [Number Input]. This option is useful because even when the image capture position deviates, the current image is automatically adjusted using the adjustment value based on the reference unit. However, note that when [Pos. Adjust. value] is selected in the state where a proper adjustment value cannot be measured for the current image, the position used for registration may be incorrect.

▶ Note

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

Save

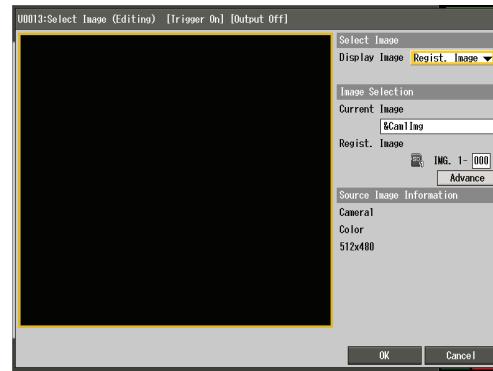
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Regist. Image] is selected for [Source Image], you can delete the registered image specified under [Save Image].

Select Image

Selection of the registered or current image to be used for settings.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Image Selection

Current Image

Set an image variable to be used as a current image for the unit.

Regist. Image

Specify the registered image to be used as a template.

- 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.

- **Assign variables to registered image No.:** To use a variable for the registered image No., check this box and assign a scalar or scalar 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. See the XG VisionEditor Reference Manual (Control/Data Edition) for more details.
- **Assign variables only when changing programs:** Use this option to switch 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

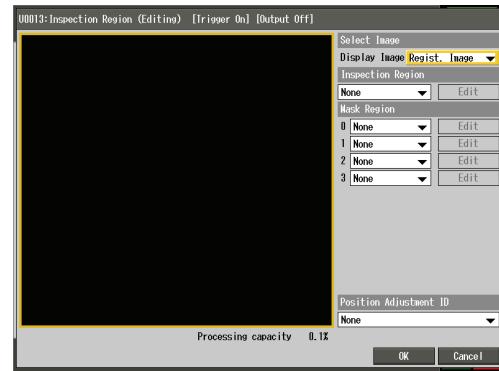
Note that the displayed registered image No. does not switch in accordance with a change in the variable.

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 the inspection.



▶ Note

Changing the shape of the region will initialize or clear some of the settings in the [Edge Filter] menu.

Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

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 8-2) for more details.

▶ Note

- The inspection regions available for the trend edge width measurement window are a rectangle, rotated rectangle, ring, and arc.
- The available functions and items change with the selected detection area.

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 8-8) for more details.

Position Adjustment ID

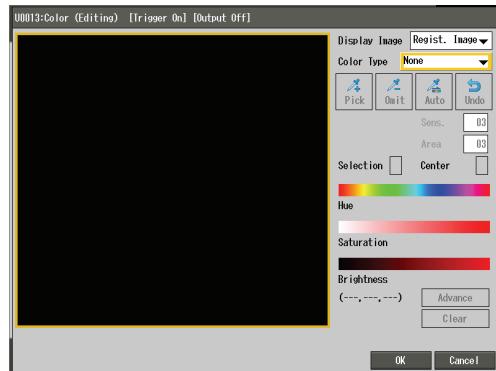
To apply position adjustment to the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).



▶ Note

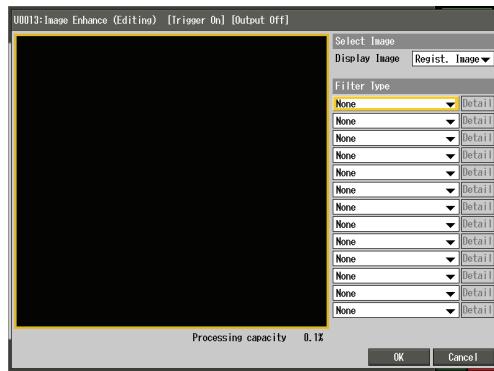
This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-253) is referenced as the current image.

Refer to "Working with Color Images" (Page 8-13) for concepts involving color extraction and its operation.

Image Enhance

Selection and setting of pre-processing filters 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.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Filter Type

Select the [Filter Type] and then select the filter to apply.

See "Image Enhancement Filters" (Page 8-27) for more details of each filter processing.

▶ Note

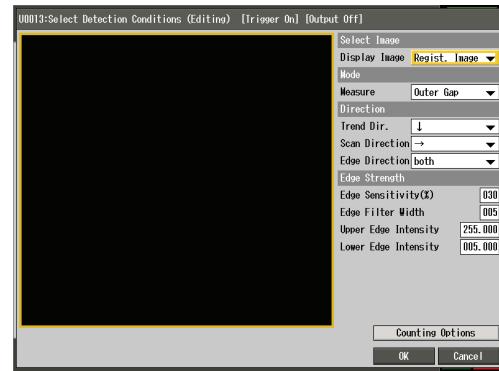
The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 21 types of filters can be set according to application requirements. When multiple filters are set, they are processed one by one from the top.
- You can change the order of the filters 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 up or down.

Detection Conditions

Settings for detecting and filtering edges, including the scan direction and edge intensity change.



Reference

See "What is an Edge?" (Page 8-41) for the technical description on edge detection.

Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

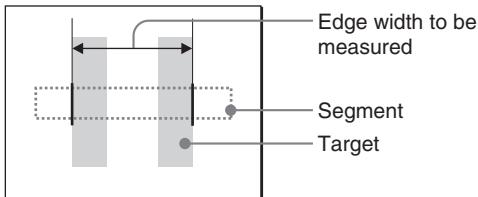
Mode

Measure

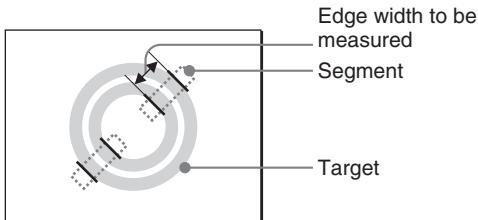
Select the type of edge width measurement.

- **Outer Gap**: Measure the distance between the outermost edges in the inspection region.

When the inspection region is a rectangle or a rotated rectangle:

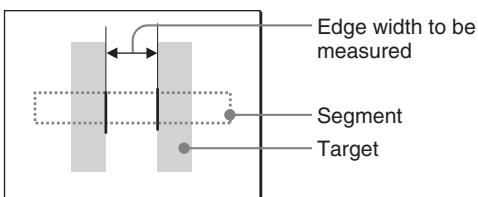


When the inspection region is a ring or an arc:

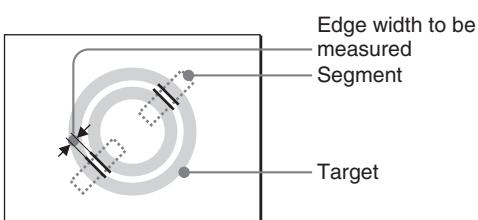


- **Inner Gap**: Measure the distance between the innermost edges in the inspection region.

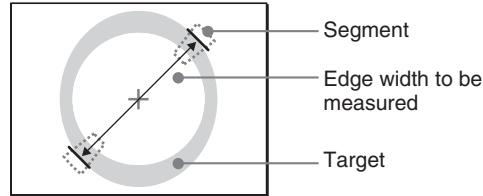
When the inspection region is a rectangle or a rotated rectangle:



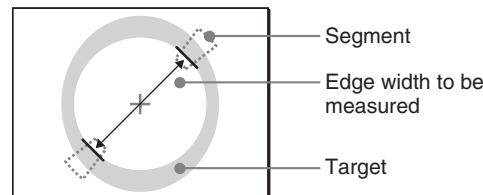
When the inspection region is a ring or an arc:



- **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 Dir.

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. The direction is based on the rotation of the region.
- **When the inspection region is a ring or an arc**: Clockwise only

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.

- **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.

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 of the edge intensity for detecting edges.

Reference

Adjusting the highest and lowest edge intensities, shown to the left of the graph, allows noisy edges to be excluded. See "What is an Edge?" (Page 8-41) for more details.

Counting Options

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** An image which has been registered is displayed.

Width

- **Upper:** Specify the upper limit of the detected edge width (0 to 9999.999 pixels).
- **Lower:** Specify the lower limit of the detected edge width (0 to 9999.999 pixels).

Reference

The upper/lower width limits specified for filtering the [Edge width] are applied before scaling, even if [Scaling] (Page 4-175) 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

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 a specific segments.

Reference

During operation, the screen displays the position, edge graph, edge intensity value, and measurement results of the segment specified as the primary target. Using the segment No. to select the primary target is useful for checking the detection status of a specific segment.

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

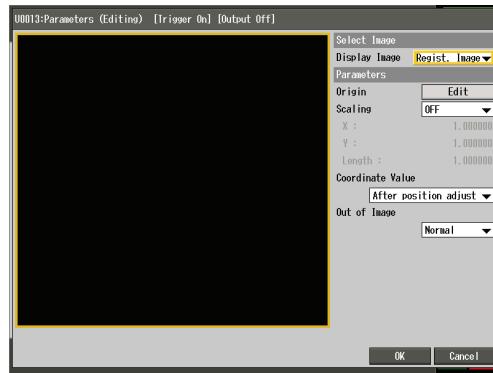
- The maximum number of segments available for detection can vary based on other settings.
- Based on specific settings, the maximum number of segments is fixed and cannot be changed.

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

Additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Parameters

Origin

By default, the origin is set to the top left point of the camera but you can specify its position 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 4-314).
- 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 VisionEditor Reference Manual (Control/Data Edition).

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 system 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 changed 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.

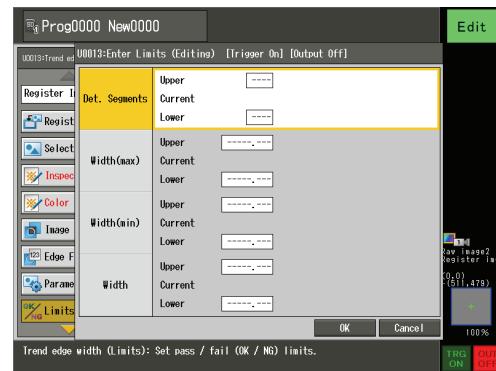
Reference

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.

Enter Limits

Pass / fail tolerance (upper and lower limits) settings for the inspection.

When the measurement result is outside of the specified tolerance range, it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).



Select [Direct Input] to set the tolerance and then enter a value.

Reference

- [-----] indicates an empty state where no tolerance is set. In this state, judgment will not be performed after the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Det. Segments

Set the tolerance of the segment detection count.

The unit of tolerance is the "number of segments" detected.

Width(max)

Set the tolerance of the maximum value of the detected width.

The unit of tolerance is the "number of pixels" indicating the maximum width.

Width(min)

Set the tolerance of the minimum value of the detected width.

The unit of tolerance is the "number of pixels" indicating the minimum width.

Width

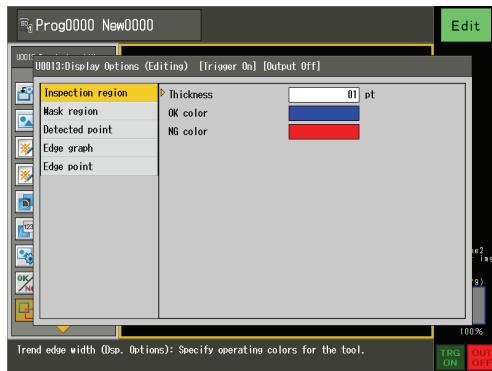
Set the tolerance of the detected width.

The unit of tolerance is the "number of pixels" indicating the width.

Display Options

Inspection region and mask region display settings.

The display color can be changed based on the judgment result for that unit. The color can also be removed (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 4-174).

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 [ON] 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

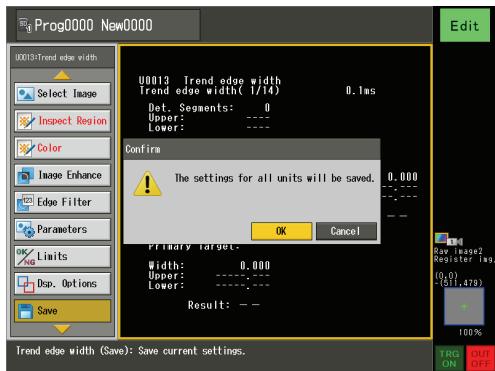
- This setting is not applied to the display when [Image Type] is set to [Raw image2].
- If the segment size is larger than the segment shift, the segments will not be displayed.

Save

Save the current unit changes the program file.

▶ Note

- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller 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 screen display, and display parts, can be excluded when saving.

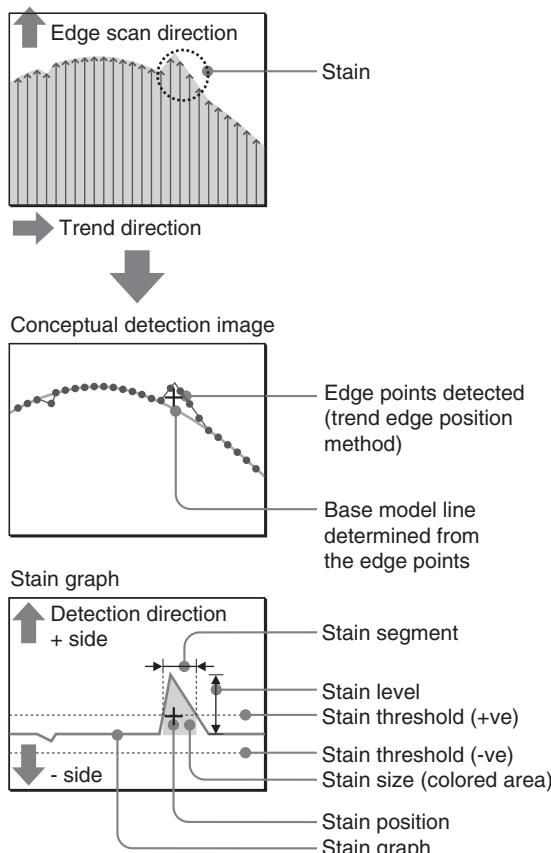
Trend Edge Stain

Trend Edge Stain Tool

The trend edge stain tool takes a target's edge points (similar to trend edge position) (Page 4-149) 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 stains and their position, level (height or depth), width and size (area) can all be measured.

Image layout

Example of an inspection region with a curved base model line



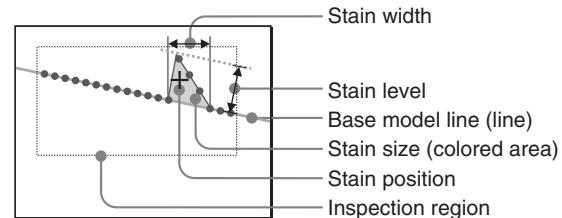
- Detection direction:** Based on the edge scan direction the detection direction of the stain. If the edge direction is from inside outwards then positive stains are considered protrusions, whereas negative stains are depressions.
- Stain level:** The maximum difference in distance between the base model line and the detected edge points which make up the stain by exceeding the detection threshold.
- Stain width:** The number of continuous edge points (segments) that exceed the detection threshold and thus make up the stain.

- Stain size:** The sum of the differences between the base model line and all edge points of the stain (stain levels) or the differences between the detection threshold value and all edge points of the stain. (The selection is available in [StainSize Calc.] in the [Parameters] menu.)
- Stain position:** The center of gravity of the stain. Defined by the base model line and the stain edge points.

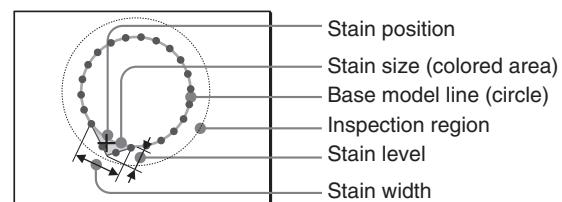
► Note

The measured results may differ depending on the segment size and shift specified in the [Edge Filter] menu. For example, even if the physical size is the same, increasing the segment size or shift may affect the stain segment count and measured stain size. If the inspection region is a ring or an arc, such changes may affect stain detection close to the border of the region.

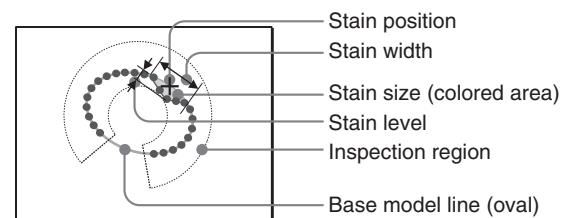
Example with a rectangle or rotated rectangle inspection region and a straight base model line



Example of a ring inspection region and a circle base model line



Example of an arc inspection region and an oval base model line



Major measurement results

The major results displayed by the trend edge stain measurement are as follows:

No. of Segments	Outputs the number of set segments.
Det. Segments	Outputs the number of segments where contrast changes were detected and edges identified. <small>[Available in the limits menu]</small>
Stain Count	Outputs the number of stains detected in the inspection region. <small>[Available in the limits menu]</small>
Total Size	Outputs the total size of all stains detected in the inspection region. <small>[Available in the limits menu]</small>
Stain Size []	Outputs the stain sizes (areas) of all individual stains detected in the inspection region. <small>[Available in the limits menu] [Available through outputs]</small>
Stain Size (max)	Outputs the maximum stain size (area) detected in the inspection region. <small>[Available in the limits menu]</small>
Stain Size (min)	Outputs the minimum stain (area) size detected in the inspection region. <small>[Available in the limits menu]</small>
Stain Pos. X []	Outputs the X position coordinate of all stains in pixels. <small>[Available in the limits menu] [Available through outputs]</small>
Stain Pos. X (max)	Outputs the maximum X position coordinate from the range of detected stains in the inspection region in pixels. <small>[Available in the limits menu]</small>
Stain Pos. X (min)	Outputs the minimum X position coordinate from the range of detected stains in the inspection region in pixels. <small>[Available in the limits menu]</small>
Stain Pos. Y []	Outputs the Y position coordinate of all stains in pixels. <small>[Available in the limits menu] [Available through outputs]</small>
Stain Pos. Y (max)	Outputs the maximum Y position coordinate from the range of detected stains in the inspection region in pixels. <small>[Available in the limits menu]</small>
Stain Pos. Y (min)	Outputs the minimum Y position coordinate from the range of detected stains in the inspection region in pixels. <small>[Available in the limits menu]</small>
Stain Pos. XY []	Outputs the XY position coordinates of all stains in pixels. <small>[Available through outputs]</small>
Stain Angle []	Outputs the angles of all stains 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). <small>[Available through outputs]</small>
Stain Level []	Outputs the stain levels (height / depth) of all individual stains detected in the inspection region. <small>[Available through outputs]</small>
Stain Level (max)	Outputs the maximum stain level (height / depth) detected in the inspection region.
Stain Level (min)	Outputs the minimum stain level (height / depth) detected in the inspection region.
Total Level	Outputs the sum of the maximum positive and negative (protrusions and depressions) stain level detected in the inspection region.
Total Width	Outputs the total number of edge points of all detected stains in the inspection region.

Stain Width []	Outputs the number of edge points for all individual stains detected in the inspection region stain. <small>[Available through outputs]</small>
Stain Width (max)	Outputs the number of edge points for the maximum stain width detected in the inspection region
Stain Width (min)	Outputs the number of edge points for the minimum stain width detected in the inspection region.
Stain Top Pos. X []	Outputs the X position coordinate of the top of the stain (the edge point with the maximum stain level in the stain) for all stains in pixels. <small>[Available through outputs]</small>
Stain Top Pos. Y []	Outputs the Y position coordinate of the top of the stain (the edge point with the maximum stain level in the stain) for all stains in pixels. <small>[Available through outputs]</small>
Stain Top Pos. XY []	Outputs the XY position coordinates of the top of the stain (the edge point with the maximum stain level in the stain) for all stains in pixels. <small>[Available through outputs]</small>
Stain Edge Pos. X1 []	Outputs the X position coordinate of the edge point located immediately before a stain begins (if the inspection region is a ring or an arc, the position before a stain in the clockwise direction) for all detected stains in the inspection region in pixels. <small>[Available through outputs]</small>
Stain Edge Pos. Y1 []	Outputs the Y position coordinate of the edge point located immediately before a stain begins (if the inspection region is a ring or an arc, the position before a stain in the clockwise direction) for all detected stains in the inspection region in pixels. <small>[Available through outputs]</small>
Stain Edge Pos. XY1 []	Outputs the XY position coordinates of the edge point located immediately before a stain begins (if the inspection region is a ring or an arc, the position before a stain in the clockwise direction) for all detected stains in the inspection region in pixels. <small>[Available through outputs]</small>
Stain Edge Pos. X2 []	Outputs the X position coordinate of the edge point located immediately after a stain ends (if the inspection region is a ring or an arc, the position after a stain in the clockwise direction) for all detected stains in the inspection region in pixels. <small>[Available through outputs]</small>
Stain Edge Pos. Y2 []	Outputs the X position coordinate of the edge point located immediately after a stain ends (if the inspection region is a ring or an arc, the position after a stain in the clockwise direction) for all detected stains in the inspection region in pixels. <small>[Available through outputs]</small>
Stain Edge Pos. XY2 []	Outputs the XY position coordinates of the edge point located immediately after a stain ends (if the inspection region is a ring or an arc, the position after a stain in the clockwise direction) for all detected stains in the inspection region in pixels. <small>[Available through outputs]</small>
Base Line Number	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 Cent. 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 Cent. 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 Cent. 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 Cent.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 Cent.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 Cent.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 Cent. 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 Cent. 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 Cent.	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]).
Stain Start Seg. []	Outputs the start segment No. of all detected stains in the inspection region. [Available through outputs]
Stain Top Seg. []	Outputs the segment No. of the segment showing the top of the stain (the edge point with the maximum stain level in the stain) for all detected stains in the inspection region. [Available through outputs]
Stain End Seg. []	Outputs the end segment No. of all detected stains in the inspection region. [Available through outputs]
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]). [Available through outputs]
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]). [Available through outputs]
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]). [Available through outputs]
Difference []	Outputs the difference between the base model line and the edge point in all the segments in pixels. [Available through outputs]
Edge Count []	Outputs the number of edges in all segments. [Available through outputs]
Edge Pos. X []	Outputs the X position coordinate of all the edge positions in pixels. [Available through outputs]
Edge Pos. Y []	Outputs the Y position coordinate of all the edge positions in pixels. [Available through outputs]
Edge Pos. XY []	Outputs the XY position coordinates of all the edge positions in pixels. [Available through outputs]
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). [Available through outputs]
Unit judgment value	When the measurement result is outside the specified tolerance range (between the upper and lower limits), it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).

Reference

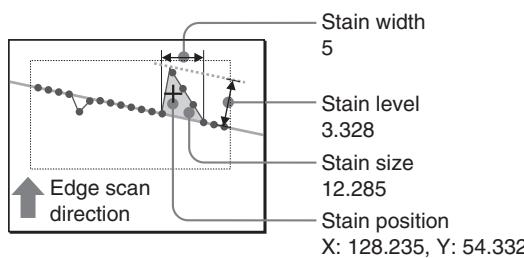
For a summary of available measurement output values and setting parameters, see "List of Setting Parameters/Result Data" in the XG VisionEditor Reference Manual (Control/Data Edition).

Example

Example of a rectangle or rotated rectangle inspection region and a straight base model line

Example showing results of an inspection performed under the following conditions:

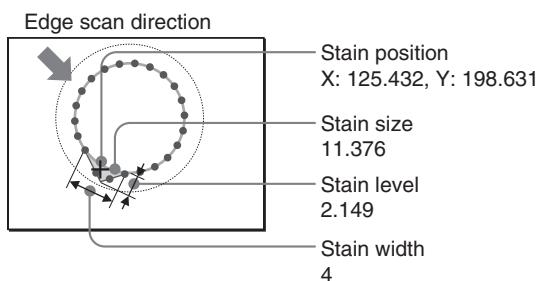
- Base model: Line
- Edge scan direction: ↑
- Stain detection direction: +



Example of a ring inspection region and a circle base model line

Example showing results of a measurement performed under the following conditions:

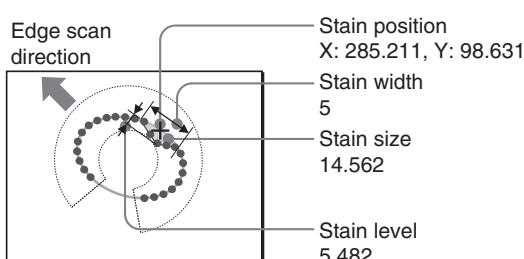
- Base model: Line
- Edge scan direction: Out to Center
- Stain detection direction: ±



Example of an arc inspection region and an oval base model line

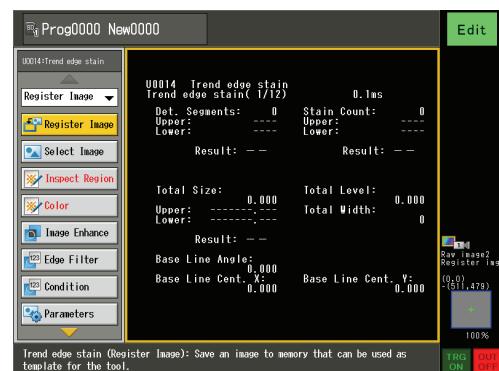
Example showing results of a measurement performed under the following conditions:

- Base model: Oval
- Edge scan direction: Center to Out
- Stain detection direction: -



Top Menu Layout

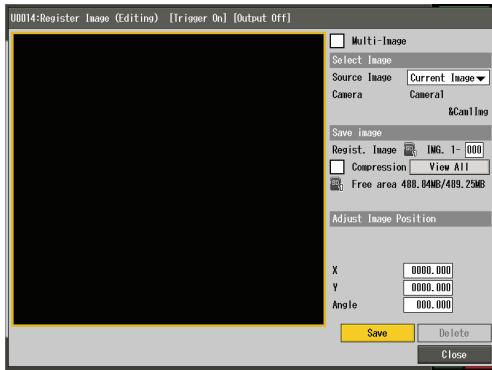
The trend edge position unit has the following options.



Register Image	Registration of an image to be used as a template for settings. (Page 4-183)
Select Image	Selection of the registered or current image to be used for settings. (Page 4-184)
Inspect Region	Outline the region on the captured image to be used for the inspection. (Page 4-185)
Color	Color extraction and conversion settings for a color image to gray-scale or binary. (only available for color cameras) (Page 4-186)
Image Enhance	Selection and setting of pre-processing filters to apply to the image. (Page 4-187)
Edge Filter	Settings for detecting and filtering edges, including the scan direction and edge intensity change. (Page 4-187)
Condition	Conditions for stain search, including a base model line, search direction and detailed conditions to detect as a stain. (Page 4-189)
Parameters	Additional optional parameters for the inspection. (Page 4-191)
Limits	Pass / fail tolerance (upper and lower limits) settings for the inspection. (Page 4-192)
Dsp. Options	Inspection region and mask region display settings. (Page 4-193)
Save	Save trend edge stain tool settings. (Page 4-194)

Register Image

Registration of an image to be used as a template for settings. It is recommended to adjust lighting and other conditions completely before registering an image.



Multi-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 5-17).
- When multi-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.
- The image variable used for the select image of the vision tools unit should be the same as the image variable used for the capture unit being executed. When the image capture buffer is set to custom, the image variable which contains the image of the capture unit executed most recently will be displayed.

Select Image

Source Image

Select an image to register.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Save Image] is displayed.

Save Image

Number

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

Compression

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

There may be some deterioration in image quality due to compression. Inspection results when using a compressed image may differ from results when using an uncompressed image.

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 -2432.000 and 2432.000 pixels.

Y

Adjust the movement in the Y (vertical) direction between -2050.000 and 2050.000 pixels.

Angle

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

Reference

When you select [Current Image] as the source image for the unit for which the position adjustment ID has been specified in [Inspection Region] (Page 4-185), you can select [Pos. Adjust. value] as well as [Number Input]. This option is useful because even when the image capture position deviates, the current image is automatically adjusted using the adjustment value based on the reference unit. However, note that when [Pos. Adjust. value] is selected in the state where a proper adjustment value cannot be measured for the current image, the position used for registration may be incorrect.

▶ Note

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

Save

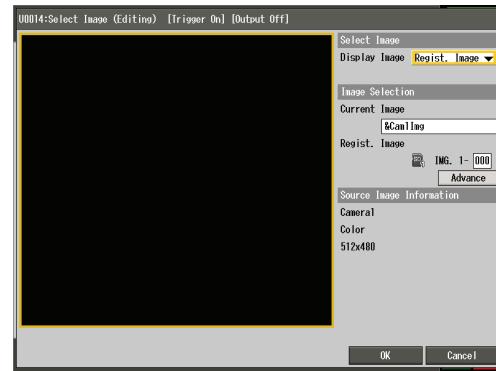
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Regist. Image] is selected for [Source Image], you can delete the registered image specified under [Save Image].

Select Image

Selection of the registered or current image to be used for settings.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Image Selection

Current Image

Set an image variable to be used as a current image for the unit.

Regist. Image

Specify the registered image to be used as a template.

- 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.

- **Assign variables to registered image No.:** To use a variable for the registered image No., check this box and assign a scalar or scalar 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. See the XG VisionEditor Reference Manual (Control/Data Edition) for more details.
- **Assign variables only when changing programs:** Use this option to switch 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

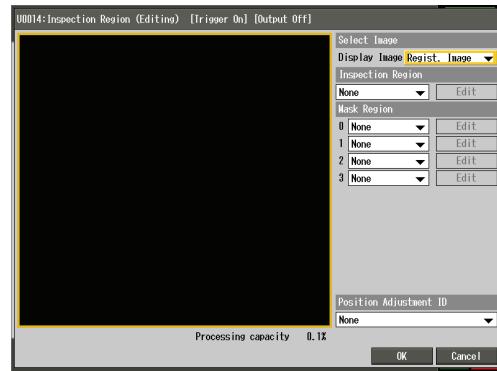
Note that the displayed registered image No. does not switch in accordance with a change in the variable.

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 the inspection.



► Note

Changing the shape of the region will initialize or clear some of the settings in the [Edge Filter] and [Condition] menus.

Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

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 8-2) for more details.

► Note

- The inspection regions available for the trend edge stain 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 8-8) 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 8-7).

Position Adjustment ID

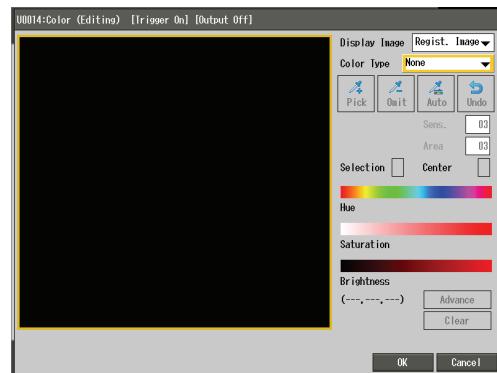
To apply position adjustment to the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).



▶ Note

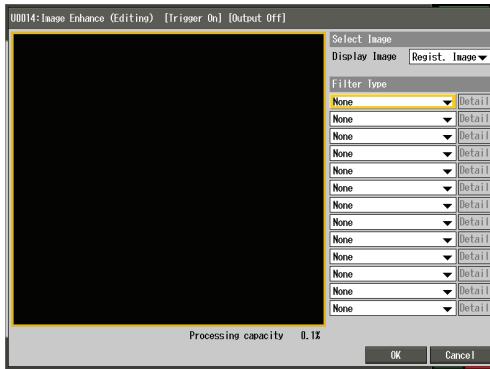
This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-253) is referenced as the current image.

Refer to "Working with Color Images" (Page 8-13) for concepts involving color extraction and its operation.

Image Enhance

Selection and setting of pre-processing filters 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.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Filter Type

Select the [Filter Type] and then select the filter to apply.

See "Image Enhancement Filters" (Page 8-27) for more details of each filter processing.

▶ Note

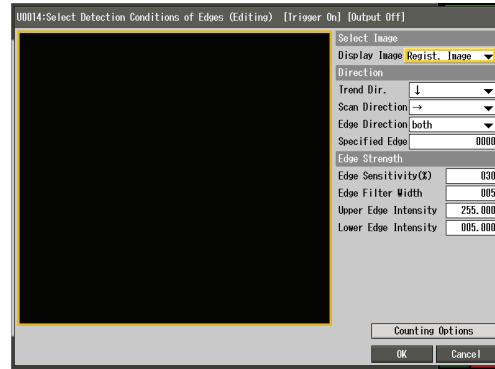
The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 21 types of filters can be set according to application requirements. When multiple filters are set, they are processed one by one from the top.
- You can change the order of the filters 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 up or down.

Detection Conditions of Edges

Settings for detecting and filtering edges, including the scan direction and edge intensity change.



Reference

See "What is an Edge?" (Page 8-41) for the technical description on edge detection.

Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Direction

Trend Dir.

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. The direction is based on the rotation of the region.
- **When the inspection region is a ring or an arc:** Clockwise only

▶ 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 segment.

- If a value of 0 or higher is specified, the edge No. is assigned 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.
- 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 of the 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 8-41) for more details.

Counting Options

Display Image

Switch the image displayed on the screen.

- **Current Image**: The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image**: The registered image specified under [Image Selection] is displayed.

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. on Edge Graph

Specify the segment No. (0 to 4999) to be shown on the edge graph. The segments edge position, edge graph, edge intensity value and measurement results will be displayed.

▶ 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 a 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

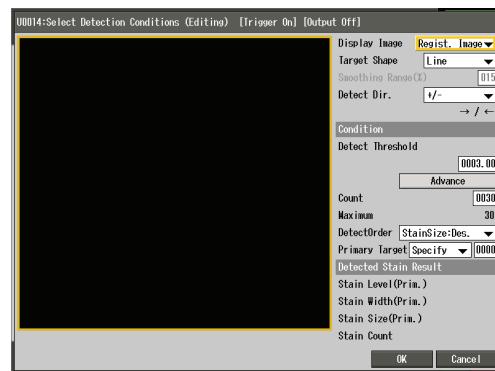
- The maximum number of segments available for detection can vary based on other settings.
- Based on specific settings, the maximum number of segments is fixed and cannot be changed.

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.

Select Detection Conditions

Conditions for stain search, including a base model line, search direction and detailed conditions to detect as a stain.



Display Image

Switch the image displayed on the screen.

- Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- Regist. Image:** The registered image specified under [Image Selection] is displayed.

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.

Detect Dir.

Select the direction to search for a stain.

- +**: 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 stains 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 deviation value (0 to 9999.99) from the profile as the threshold level (stain level) for identifying stains.

Advance

Use this option to specify the detection conditions in detail. Using the [Advance] menu options can help filter out falsely detected stains.

- **Display Image:** Switch the image displayed on the screen.
 - **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
 - **Regist. Image:** The registered image specified under [Image Selection] is displayed.
- **Stain Level Filter:**
 - **Upper:** Specify the upper limit of the stain level to detect stains (0.00 to 9999.99).
 - **Lower:** Specify the lower limit of the stain level to detect stains (0.00 to 9999.99).
- **Stain Width Filter:**
 - **Upper:** Specify the upper limit of the stain width to detect stains (0 to 9999).
 - **Lower:** Specify the lower limit of the stain width to detect stains (0 to 9999).
- **Stain Size Filter:**
 - **Upper:** Specify the upper limit of the stain size to detect stains (0.00 to 9999999.99).
 - **Lower:** Specify the lower limit of the stain size to detect stains (0.00 to 9999999.99).

Count

Specify the maximum number of stains (1 to 9999) to be detected. The number of stain cannot exceed the [Maximum] 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

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 stains.

- **Seg.:Ascend:** Sort stains based on smallest segment No. to largest.
- **Seg.:Descend:** Sort stains based on largest segment No. to smallest.
- **X:Ascend:** Sort stains in ascending X order.
- **X:Descend:** Sort stains in descending X order.
- **Y:Ascend:** Sort stains in ascending Y order.
- **Y:Descend:** Sort stains in descending Y order.
- **StainLevel:Asc.:** Sort stains from lowest stain level to highest.
- **StainLevel:Des.:** Sort stains from highest stain level to lowest.
- **StainWidth:Asc.:** Sort stains from lowest stain width to highest.
- **StainWidth:Des.:** Sort stains from highest stain width to lowest.
- **StainSize:Asc.:** Sort stains from lowest stain size to highest.
- **StainSize:Des.:** Sort stains from highest stain size to lowest.

Primary Target

Set the stain to be used for OK / NG judgment.

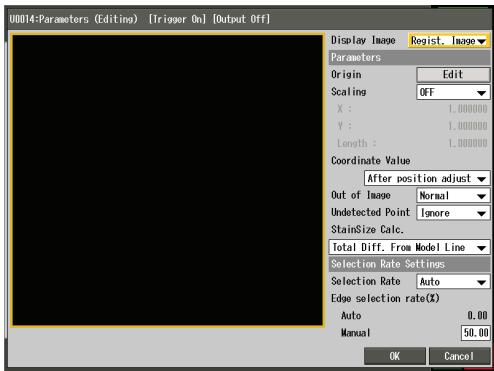
- **All:** Use the minimum and maximum values measured from all stains for the judgment.
- **Specify:** Select [Specify] for [Primary Target] and then specify the No. of the stain used in judgment (0 to 4999). Only the stain that is specified here becomes the target of judgment.

Reference

- During operation, the stain graph, position and stain level of the stain segment specified as the primary target are displayed. Changing the stain segment is useful for checking the detection status of a specific stain.
- If [Primary Target] is set to [All], all the stain edge points will be displayed in green.

Parameters

Additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Parameters

Origin

By default, the origin is set to the top left point of the camera but you can specify its position 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 4-314).
- 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 VisionEditor Reference Manual (Control/Data Edition).

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 system 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 changed 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 stain level for where no edge points are detected.

- **Ignore:** Undetected points are treated as having a stain 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 stain level of undetected points is determined from the surrounding area.

▶ Note

Selecting [Fill] increases processing time.

StainSize Calc.

Select a stain size calculation method.

- **Total Diff. From Model Line:** The total difference from the base model line is used as the stain size.
- **Total Diff. From Threshold:** The total difference from the [Detect Threshold] value set in the [Select Detection Conditions] menu is used as the stain 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 cull rate automatically.
 - **Manual:** Set the desired cull rate.

▶ Note

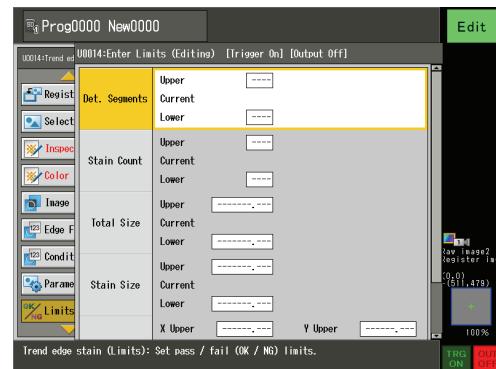
Setting the cull rate too high will make the base model line undetectable.

- **Edge selection rate(%):** When [Manual] is selected for the [Selection Rate], specify the cull rate between 0 and 99.99%.

Enter Limits

Pass / fail tolerance (upper and lower limits) settings for the inspection.

When the measurement result is outside of the specified tolerance range, it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).



Select [Direct Input] to set the tolerance and then enter a value.

Reference

- [-----] indicates an empty state where no tolerance is set. In this state, judgment will not be performed after the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Det. Segments

Set the tolerance of the segment detection count.

The unit of tolerance is the "number of segments" detected.

Stain Count

Set the tolerance of the detected stain count.

The unit of tolerance is the "number of stains" detected.

Total Size

Set the tolerance of the total size of all stains.

The unit of tolerance is the "number of pixels".

Stain Size

Set the tolerance of the stain size.

The unit of tolerance is the "number of pixels".

Stain Pos

Set the tolerance of the center of gravity of the stain.

The unit of tolerance is the "number of pixels" indicating the center of gravity coordinates.

Display Options

Inspection region and mask region display settings. The display color can be changed based on the judgment result for that unit. The color can also be removed (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 stain points.

- **OFF:** Hide the detected points.
- **Primary target:** Show the detected stain points for the primary target.
- **All** (Default): Show the detected points for all the stain defects.

Primary target

Specify the width and display color of the line indicating the detected stain.

Other target

Specify the width and display color of the line indicating the detected stain other than the one specified as the primary target (Page 4-190).

Stain graph

Stain graph

Specify whether to display the stain graph or not.

- **ON:** Display the stain graph.
- **OFF** (Default): Hide the stain graph.

Wave

Specify the width and display color of the stain graph waveform.

Frame

Specify the width and display color of the stain graph frame.

Detection 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 stain level filter.

► Note

Setting [Stain 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 stain 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 detected edge points.
- **Primary target**: Display the detected edge point of the segment specified at [Primary Target] which has the maximum stain level.
- **Primary target, Max/Min**: Display the detected edge points of the three segments: The segment specified at [Primary Target] and those with maximum stain 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

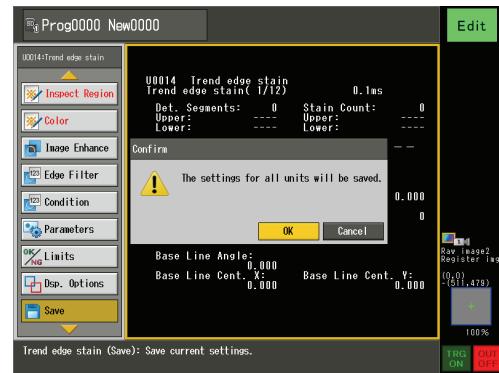
Specify the line width and display color of the base model line.

Save

Save the current unit changes the program file.

► Note

- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller 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 screen display, and display parts, can be excluded when saving.

Intensity

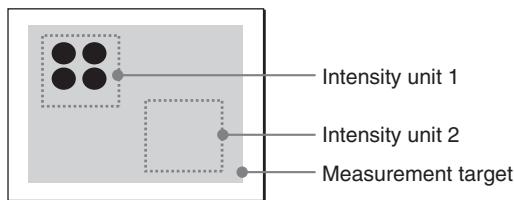
Intensity Tool

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.

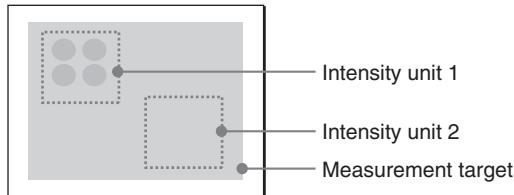
Image layout

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

Major results

The major results displayed by the intensity tool are as follows:

Ave.	Outputs the average intensity in the inspection region on a scale of 0 to 255 (levels). <small>[Available in the limits menu]</small>
Max.	Outputs the maximum intensity (the brightest part) in the inspection region. <small>[Available in the limits menu]</small>
Min.	Outputs the minimum intensity (the darkest part) in the inspection region. <small>[Available in the limits menu]</small>
Dev.	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. <small>[Available in the limits menu]</small>
Unit judgment value	When the measurement result is outside the specified tolerance range (between the upper and lower limits), it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).

Reference

- When the [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 a summary of available measurement output values and setting parameters, see "List of Setting Parameters/Result Data" in the XG VisionEditor Reference Manual (Control/Data Edition).

Top Menu Layout

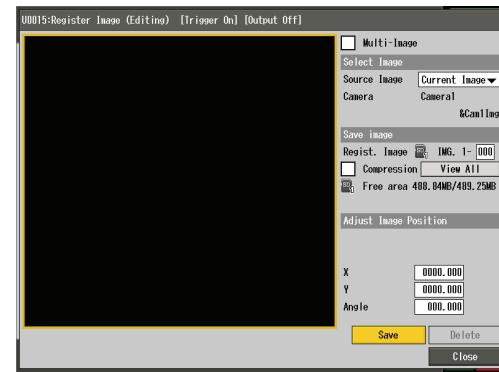
The intensity unit has the following options.



Register Image (Page 4-196)	Registration of an image to be used as a template for settings.
Select Image (Page 4-198)	Selection of the registered or current image to be used for settings.
Inspect Region (Page 4-199)	Outline the region on the captured image to be used for the inspection.
Color (Page 4-200)	Color extraction and conversion settings for a color image to gray-scale or binary. (only available for color cameras)
Image Enhance (Page 4-200)	Selection and setting of pre-processing filters to apply to the image.
Parameters (Page 4-201)	Additional optional parameters for the inspection.
Limits (Page 4-202)	Pass / fail tolerance (upper and lower limits) settings for the inspection.
Dsp. Options (Page 4-202)	Inspection region and mask region display settings.
Save (Page 4-203)	Save trend intensity tool settings.

Register Image

Registration of an image to be used as a template for settings. It is recommended to adjust lighting and other conditions completely before registering an image.



Multi-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 5-17).
- When multi-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.
- The image variable used for the select image of the vision tools unit should be the same as the image variable used for the capture unit being executed. When the image capture buffer is set to custom, the image variable which contains the image of the capture unit executed most recently will be displayed.

Select Image

Source Image

Select an image to register.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Save Image] is displayed.

Save Image

Number

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

Compression

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

There may be some deterioration in image quality due to compression. Inspection results when using a compressed image may differ from results when using an uncompressed image.

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 -2432.000 and 2432.000 pixels.

Y

Adjust the movement in the Y (vertical) direction between -2050.000 and 2050.000 pixels.

Angle

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

Reference

When you select [Current Image] as the source image for the unit for which the position adjustment ID has been specified in [Inspection Region] (Page 4-199), you can select [Pos. Adjust. value] as well as [Number Input]. This option is useful because even when the image capture position deviates, the current image is automatically adjusted using the adjustment value based on the reference unit. However, note that when [Pos. Adjust. value] is selected in the state where a proper adjustment value cannot be measured for the current image, the position used for registration may be incorrect.

▶ Note

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

Save

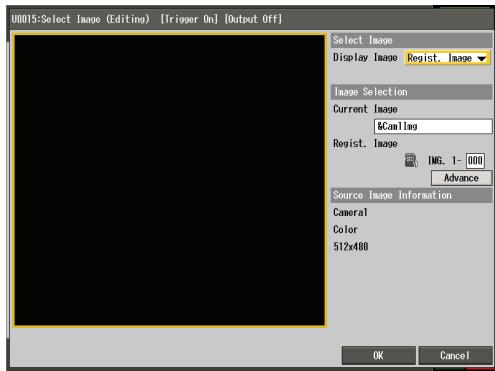
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Regist. Image] is selected for [Source Image], you can delete the registered image specified under [Save Image].

Select Image

Selection of the registered or current image to be used for settings.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Image Selection

Current Image

Set an image variable to be used as a current image for the unit.

Regist. Image

Specify the registered image to be used as a template.

- 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.

- **Assign variables to registered image No.:** To use a variable for the registered image No., check this box and assign a scalar or scalar 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. See the XG VisionEditor Reference Manual (Control/Data Edition) for more details.

- **Assign variables only when changing programs:** Use this option to switch 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

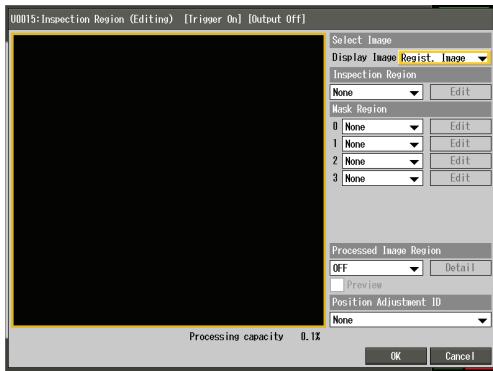
Note that the displayed registered image No. does not switch in accordance with a change in the variable.

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 the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

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 8-2) 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 8-8) 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 8-7).

Processed Image Region

To use a processed region from a resultant image variable (Page 4-253), select [ON] and then select [Detail] for configuration.

Reference

See "Generating a Region from an Image" (Page 8-10) for more details on the image region.

Result

Specify the resultant image variable used for the processed image region.

Detect

Select the area and border color for the inspection region from the image data in the resultant image variable by selecting either [Black] (Level 0) or [White] (Level 255, default).

Preview

When this box is checked, the specified resultant image variable is displayed. When the checkmark is removed, the display returns to its normal state.

Position Adjustment ID

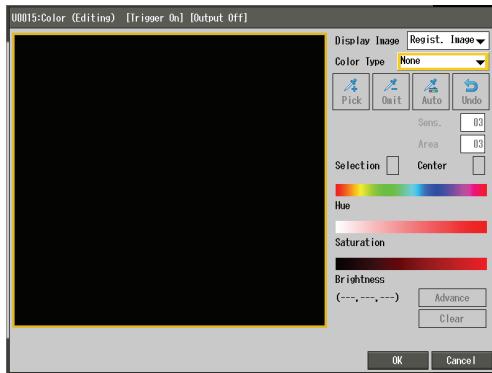
To apply position adjustment to the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).



► Note

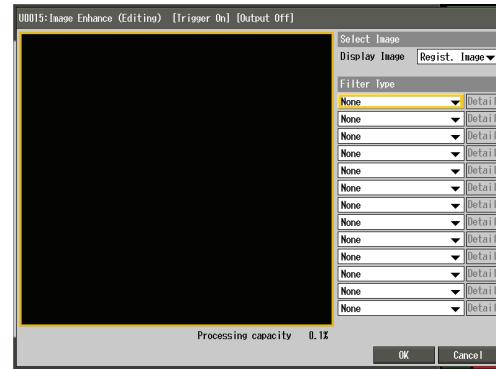
This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-253) is referenced as the current image.

Refer to "Working with Color Images" (Page 8-13) for concepts involving color extraction and its operation.

Image Enhance

Selection and setting of pre-processing filters 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.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Filter Type

Select the [Filter Type] and then select the filter to apply. See "Image Enhancement Filters" (Page 8-27) for more details of each filter processing.

► Note

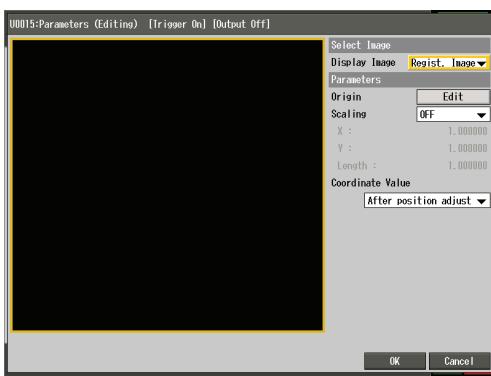
The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 21 types of filters can be set according to application requirements. When multiple filters are set, they are processed one by one from the top.
- You can change the order of the filters 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 up or down.

Parameters

Additional optional parameters for the inspection.



Reference

- The scaling factor can be changed from the [Option] menu of the Flowchart (Page 4-314).
- 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 VisionEditor Reference Manual (Control/Data Edition).

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 system determined after position adjustment.
- Before position adjust:** The distance from the position specified for the [Origin] of the inspection is used.

Select Image

Display Image

Switch the image displayed on the screen.

- Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- Regist. Image:** The registered image specified under [Image Selection] is displayed.

Parameters

Origin

By default, the origin is set to the top left point of the camera but you can specify its position 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

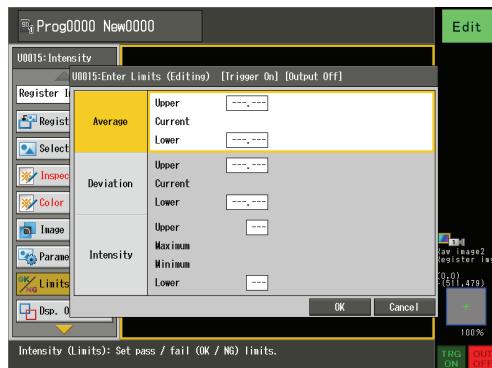
The controller processes image data in pixels. The result data and setting parameters used for display, judgement and calculations can be converted and scaled to real life values and dimensions by using the pre-set scaling factor option.

- OFF:** Do not use scaling.
- ON:** Use scaling.

Enter Limits

Pass / fail tolerance (upper and lower limits) settings for the inspection.

When the measurement result is outside of the specified tolerance range, it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).



Select [Direct Input] to set the tolerance and then enter a value.

Reference

- [-----] indicates an empty state where no tolerance is set. In this state, judgment will not be performed after the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Average

Set the tolerance of the detected average intensity.

The unit of tolerance is the "greyscale level" indicating the average intensity (0 to 255).

Deviation

Set the tolerance of the deviation of the detected intensity.

The unit of tolerance is the "greyscale level" indicating the deviation.

Intensity

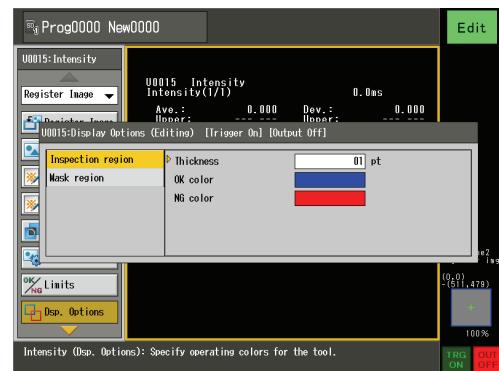
Set the tolerance of the maximum and minimum values of the detected intensity.

The unit of tolerance is the "greyscale level" indicating the intensity (0 to 255).

Display Options

Inspection region and mask region display settings.

The display color can be changed based on the judgment result for that unit. The color can also be removed (transparent) by selecting [Setting] - [Select Color] - [None].



Inspection region

Specify the line width and display color of the inspection region.

Mask region

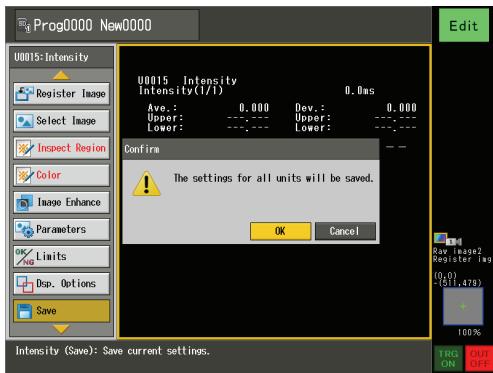
Specify the line width and display color of the mask region.

Save

Save the current unit changes the program file.

► Note

- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller 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 screen display, and display parts, can be excluded when saving.

Color

Color Tool

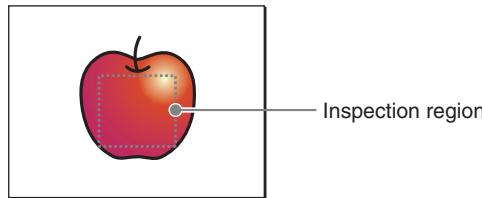
The color tool measures the average, deviation and intensity of the color information within the inspection region. The measurement can be based on Red/Green/Blue or Hue/Saturation/Brightness values. Acquiring the color information allows for the differentiation of targets and conditions through detailed, 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.

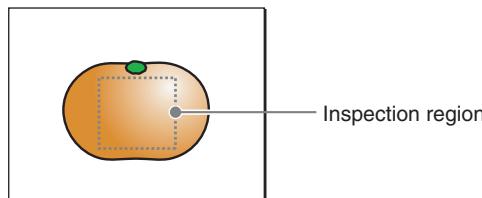
Image layout

Example of measuring a red object



- R-Ave: 200
- G-Ave: 50
- B-Ave: 50

Example of measuring a yellow object



- R-Ave: 250
- G-Ave: 200
- B-Ave: 40

Major results

Major results displayed by the color tool are as follows:

Ave.	Outputs the average RGB or HSB intensity in the inspection region on a scale of 0 to 255 (levels). <small>Available in the limits menu</small>
Dev.	Outputs the RGB or HSB 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 <small>Available in the limits menu</small>
Max.	Outputs the maximum RGB or HSB intensity in the inspection region. <small>Available in the limits menu</small>
Min.	Outputs the minimum RGB or HSB intensity in the inspection region. <small>Available in the limits menu</small>
Unit judgment value	When the measurement result is outside the specified tolerance range (between the upper and lower limits), it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).

Reference

- See "The HSB Color System" (Page 8-19) for color information parameters for the HSB mode.
- For a summary of available measurement output values and setting parameters, see "List of Setting Parameters/Result Data" in the XG VisionEditor Reference Manual (Control/Data Edition).

▶ Note

The maximum and minimum intensity values of H in HSB mode will be fixed to 0.

Top Menu Layout

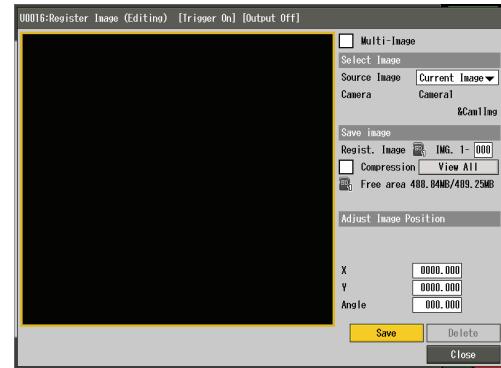
The color unit has the following options.



Register Image (Page 4-205)	Registration of an image to be used as a template for settings.
Select Image (Page 4-207)	Selection of the registered or current image to be used for settings.
Inspect Region (Page 4-208)	Outline the region on the captured image to be used for the inspection.
Condition (Page 4-209)	Specify the color measurement parameters.
Parameters (Page 4-209)	Additional optional parameters for the inspection.
Limits (Page 4-210)	Pass / fail tolerance (upper and lower limits) settings for the inspection.
Dsp. Options (Page 4-211)	Inspection region and mask region display settings.
Save (Page 4-212)	Save color tool settings.

Register Image

Registration of an image to be used as a template for settings. It is recommended to adjust lighting and other conditions completely before registering an image.



Multi-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 5-17).
- When multi-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.
- The image variable used for the select image of the vision tools unit should be the same as the image variable used for the capture unit being executed. When the image capture buffer is set to custom, the image variable which contains the image of the capture unit executed most recently will be displayed.

Select Image

Source Image

Select an image to register.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Save Image] is displayed.

Save Image

Number

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

Compression

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

There may be some deterioration in image quality due to compression. Inspection results when using a compressed image may differ from results when using an uncompressed image.

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 -2432.000 and 2432.000 pixels.

Y

Adjust the movement in the Y (vertical) direction between -2050.000 and 2050.000 pixels.

Angle

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

Reference

When you select [Current Image] as the source image for the unit for which the position adjustment ID has been specified in [Inspection Region] (Page 4-208), you can select [Pos. Adjust. value] as well as [Number Input]. This option is useful because even when the image capture position deviates, the current image is automatically adjusted using the adjustment value based on the reference unit. However, note that when [Pos. Adjust. value] is selected in the state where a proper adjustment value cannot be measured for the current image, the position used for registration may be incorrect.

▶ Note

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

Save

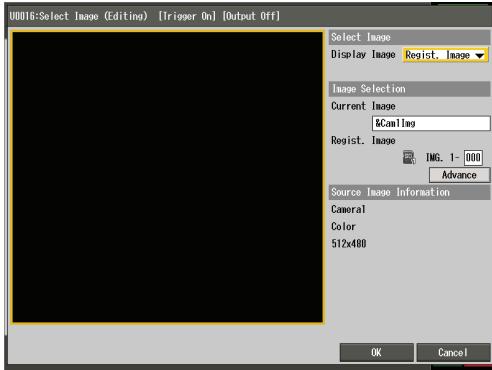
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Regist. Image] is selected for [Source Image], you can delete the registered image specified under [Save Image].

Select Image

Selection of the registered or current image to be used for settings.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Image Selection

Current Image

Set an image variable to be used as a current image for the unit.

Regist. Image

Specify the registered image to be used as a template.

- 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.

- **Assign variables to registered image No.:** To use a variable for the registered image No., check this box and assign a scalar or scalar 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. See the XG VisionEditor Reference Manual (Control/Data Edition) for more details.

- **Assign variables only when changing programs:** Use this option to switch 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

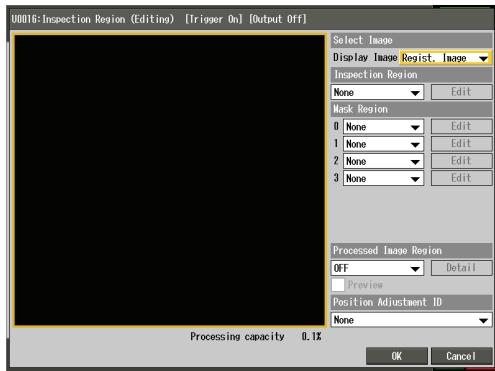
Note that the displayed registered image No. does not switch in accordance with a change in the variable.

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 the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

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 8-2) 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 8-8) 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 8-7).

Processed Image Region

To use a processed region from a resultant image variable (Page 4-253), select [ON] and then select [Detail] for configuration.

Reference

See "Generating a Region from an Image" (Page 8-10) for more details on the image region.

Result

Specify the resultant image variable used for the processed image region.

Detect

Select the area and border color for the inspection region from the image data in the resultant image variable by selecting either [Black] (Level 0) or [White] (Level 255, default).

Preview

When this box is checked, the specified resultant image variable is displayed. When the checkmark is removed, the display returns to its normal state.

Position Adjustment ID

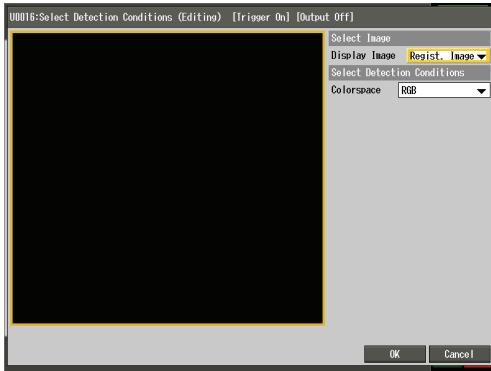
To apply position adjustment to the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Detection Conditions

Specify the color measurement parameters.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Select 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) is fixed to 0.
- When an achromatic target is measured in [HSB] mode, the measured value of H (Hue) may be unstable due to the calculation principle.

Parameters

Additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Parameters

Origin

By default, the origin is set to the top left point of the camera but you can specify its position 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 4-314).
- 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 VisionEditor Reference Manual (Control/Data Edition).

Coordinate Value

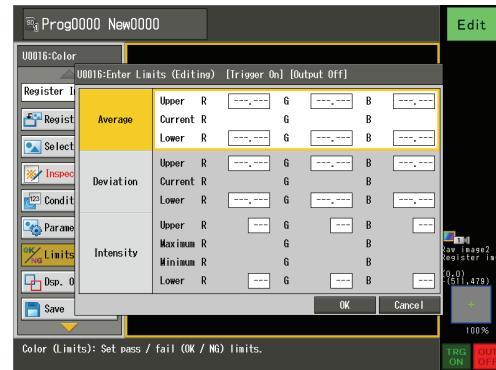
Select the coordinate system to be used after position adjustment. If position adjustment is not used, this setting will have no effect on the measurement.

- **After position adjust:** The inspection uses the adjusted coordinate system determined after position adjustment.
- **Before position adjust:** The distance from the position specified for the [Origin] of the inspection is used.

Enter Limits

Pass / fail tolerance (upper and lower limits) settings for the inspection.

When the measurement result is outside of the specified tolerance range, it is judged as [NG] (binary 1). When the result is within the tolerance range, it is judged as [OK] (binary 0).

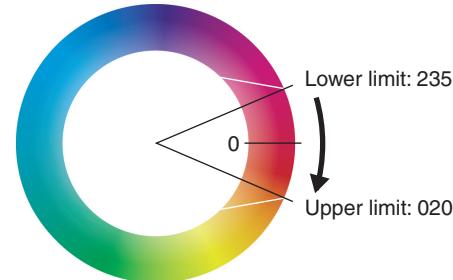


Select [Direct Input] to set the tolerance and then enter a value.

Reference

- [-----] indicates an empty state where no tolerance is set. In this state, judgment will not be performed after 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 (+/- 20) around R (hue value: 0) is judged OK



For more details about hue, see "The HSB Color System" (Page 8-19).

Average

Set the tolerance of the average detected intensity. The unit of tolerance is the "color level" indicating the average intensity (0 to 255).

Deviation

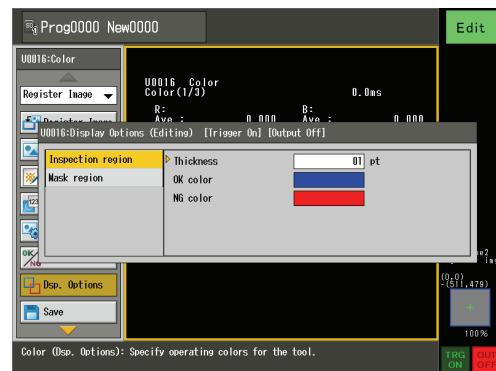
Set the tolerance of the deviation of the detected intensity. The unit of tolerance is the "color level" showing the deviation.

Intensity

Set the tolerance of the maximum and minimum values of the detected intensity. The unit of tolerance is the "color level" showing the intensity (0 to 255).

Display Options

Inspection region and mask region display settings. The display color can be changed based on the judgment result for that unit. The color can also be removed (transparent) by selecting [Setting] - [Select Color] - [None].



Inspection region

Specify the line width and display color of the inspection region.

Mask region

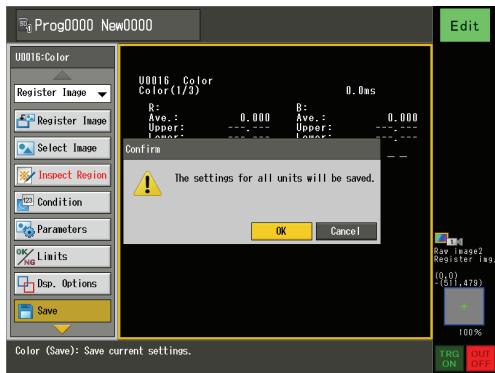
Specify the line width and display color of the mask region.

Save

Save the current unit changes the program file.

▶ Note

- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller 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

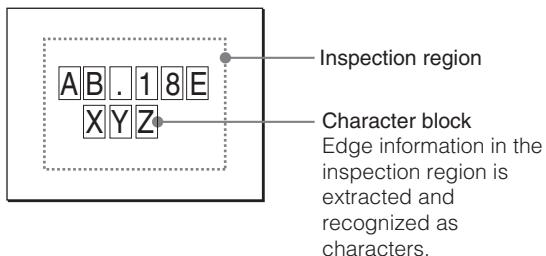
Items specified not to be saved in XG VisionEditor are excluded from the saving operation. For example, variable values changed in the current program or the default screen display, and display parts, can be excluded when saving.

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 layout



Major Results

The major results displayed by the OCR tool are as follows:

L1 String	Outputs the character string recognized on the first line. [Available in the limits menu]
L2 String	Outputs the character string recognized on the second line. [Available in the limits menu]
L1 Regist String	Outputs the registered character string that is used as judgment criteria for the first line.
L2 Regist String	Outputs the registered character string that is used as judgment criteria for the second line.
Det. Char []	Outputs all recognized characters. [Available in the limits menu] [Available through outputs]
Reg. Char []	Outputs all registered characters which can be used as judgment criteria. [Available through outputs]
1st Cand Char []	Outputs all characters selected as first candidates from the recognition process. [Available through outputs]
2nd Cand Char []	Outputs all characters selected as second candidates from the recognition process. [Available through outputs]
1st Cand Corr []	Outputs correlation level (%) of all first candidate characters from the recognition process based on the library data. [Available through outputs]
2nd Cand Corr []	Outputs correlation level (%) of all second candidate characters from the recognition process based on the library data. [Available through outputs]
Stability []	Outputs the individual character differences in correlation level (%) between the first and second candidates for all the detected characters. [Available through outputs]
Char Contrast []	Outputs the character contrast level (%) in all the extracted regions. [Available through outputs]
Line Num	Outputs the number of lines which have been extracted.
L1 Char Num	Outputs the number of characters on the first line which have been extracted.
L2 Char Num	Outputs the number of characters on the second line which have been extracted.
L1 Corr(max)	Outputs the maximum correlation value of characters recognized on the first line.
L1 Corr(min)	Outputs the minimum correlation value of characters recognized on the first line. [Available in the limits menu]
L1 Stbl(max)	Outputs the maximum stability value of characters recognized on the first line.
L1 Stbl(min)	Outputs the minimum stability value of characters recognized on the first line. [Available in the limits menu]
L2 Corr(max)	Outputs the maximum correlation value of characters recognized on the second line.

L2 Corr(min)	Outputs the minimum correlation value of characters recognized on the second line.
	<small>Available in the limits menu</small>
L2 Stbl(max)	Outputs the maximum stability value of characters recognized on the second line.
L2 Stbl(min)	Outputs the minimum stability value of characters recognized on the second line.
	<small>Available in the limits menu</small>
Block position	Outputs the positions of all extraction blocks in pixels. <small>Available through outputs</small>
Inspection region position	Outputs the position of the inspection region in pixels. (Available only for reference from calculation)
Unit judgment value	When the measurement result is less than the specified tolerance (lower limit), or when the detected string does not match the registered string, it is judged as [NG] (binary 1). When the result is the same or higher than the tolerance and the detected string matches the registered string, it is judged as [OK] (binary 0).

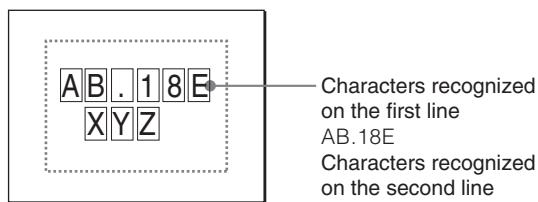
Reference

For the lists of available measurement output values and setting parameters, see "List of Setting Parameters/Result Data" in the XG VisionEditor Reference Manual (Control/Data).

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



Top Menu Layout

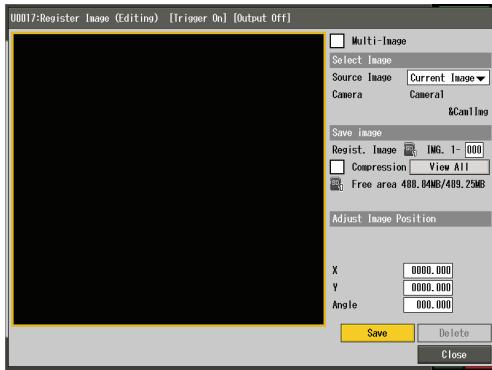
The OCR unit has the following options.



Register Image (Page 4-215)	Registration of an image to be used as a template for settings.
Select Image (Page 4-216)	Selection of the registered or current image to be used for settings.
Inspect Region (Page 4-217)	Outline the region on the captured image to be used for the inspection.
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 4-219)	Selection and setting of pre-processing filters to apply to the image.
Block Set (Page 4-219)	Select the mode used for identifying and extracting individual characters in the inspection region.
Library (Page 4-221)	Register, add, update and delete the libraries of characters used for recognition.
Setup Calendar (Page 4-222)	Setup the allowable date / time (year, month, day, hour, minute, second) offset and error to the actual date / time of the controller.
Parameters (Page 4-223)	Additional optional parameters for the inspection.
Limits (Page 4-225)	Pass / fail tolerance (upper and lower limits) settings for the inspection.
Dsp. Options (Page 4-227)	Inspection region and mask region display settings.
Save (Page 4-228)	Save OCR tool settings.

Register Image

Registration of an image to be used as a template for settings. It is recommended to adjust lighting and other conditions completely before registering an image.



Multi-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 5-17).
- When multi-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.
- The image variable used for the select image of the vision tools unit should be the same as the image variable used for the capture unit being executed. When the image capture buffer is set to custom, the image variable which contains the image of the capture unit executed most recently will be displayed.

Select Image

Source Image

Select an image to register.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Save Image] is displayed.

Save Image

Number

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

Compression

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

There may be some deterioration in image quality due to compression. Inspection results when using a compressed image may differ from results when using an uncompressed image.

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 -2432.000 and 2432.000 pixels.

Y

Adjust the movement in the Y (vertical) direction between -2050.000 and 2050.000 pixels.

Angle

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

Reference

When you select [Current Image] as the source image for the unit for which the position adjustment ID has been specified in [Inspection Region] (Page 4-217), you can select [Pos. Adjust. value] as well as [Number Input]. This option is useful because even when the image capture position deviates, the current image is automatically adjusted using the adjustment value based on the reference unit. However, note that when [Pos. Adjust. value] is selected in the state where a proper adjustment value cannot be measured for the current image, the position used for registration may be incorrect.

▶ Note

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

Save

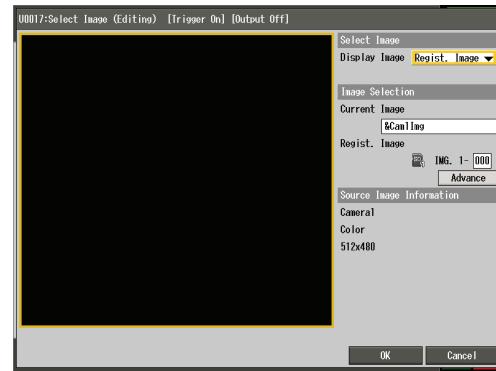
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Regist. Image] is selected for [Source Image], you can delete the registered image specified under [Save Image].

Select Image

Selection of the registered or current image to be used for settings.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Image Selection

Current Image

Set an image variable to be used as a current image for the unit.

Regist. Image

Specify the registered image to be used as a template.

- 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.

- **Assign variables to registered image No.:** To use a variable for the registered image No., check this box and assign a scalar or scalar 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. See the XG VisionEditor Reference Manual (Control/Data Edition) for more details.
- **Assign variables only when changing programs:** Use this option to switch 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 displayed 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 the 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.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Inspection Region

Select [Rectangle] and then draw the region, or select [Edit] and specify the region with numerical values. See "Inspection Region Menu" (Page 8-2) for more details.

▶ Note

- You can only use a rectangle as an inspection region for the OCR measurement.
- Image regions cannot be used.

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 8-8) for more details.

Position Adjustment ID

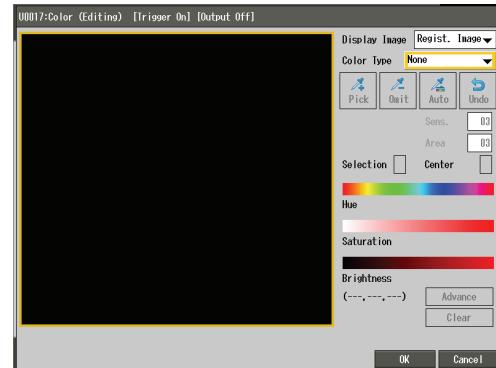
To apply position adjustment to the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

When a color image variable is specified, convert the captured color image into a black and white image through the desired extraction process.



▶ Note

This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-253) is referenced as the current image.

Reference

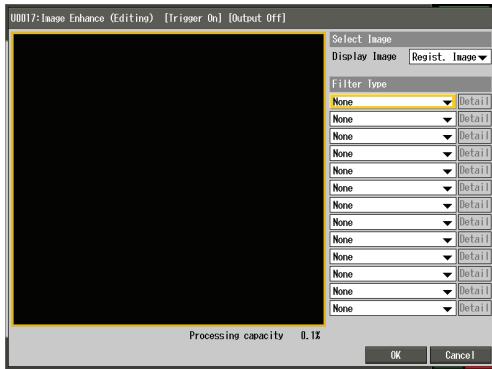
When the characters are black and the background is white, selecting [Gray] or [RGB Gray] for [Color Type] ensures stable extraction of the character string.

Refer to "Working with Color Images" (Page 8-13) for concepts involving color extraction and its operation.

Image Enhance

Selection and setting of pre-processing filters 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.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Filter Type

Select the [Filter Type] and then select the filter to apply.

See "Image Enhancement Filters" (Page 8-27) for more details of each filter processing.

▶ Note

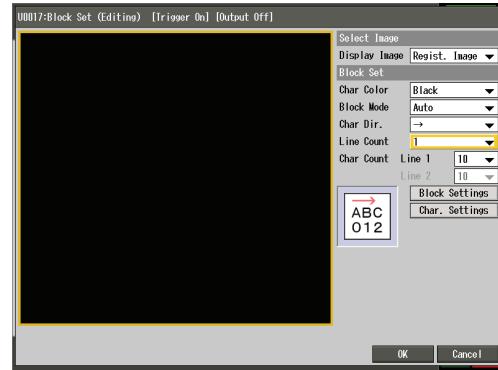
- The subtract filter cannot be selected for the OCR measurement.
- The binary and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 21 types of filters can be set according to application requirements. When multiple filters are set, they are processed one by one from the top.
- You can change the order of the filters 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 up or down.

Block Set

Select the mode used for identifying and extracting individual characters in the inspection region.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Block Set

Char 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 Set] menu.

Settings when [Auto] is selected**Reference**

If the characters are not properly extracted with [Auto], configure the detailed [Auto] settings by selecting [Block Settings] and [Char. Settings] or change the block mode to [Fixed] (Page 4-220). See "Stabilizing Character Recognition" (Page 4-228) for more details.

Char Dir.

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 the string is not horizontal or vertical, use the position adjustment unit to adjust the inspection region.

Line Count

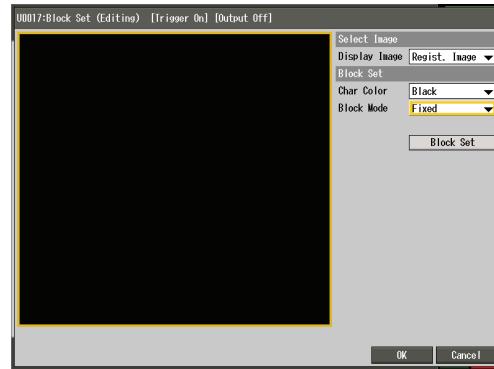
Specify the number of lines (1 or 2) of characters to be extracted from the inspection region.

Char Count

Specify the number of characters (1 to 20) to be extracted from each line.

Settings when [Fixed] is selected

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 Set

When you select [Block Set] and [Add], a block region is added. Draw the region so that it encloses a single character.

Reference

- See "Inspection Region Menu" (Page 8-2) for more details on drawing a region.
- The shape of the region is limited to a rotated rectangle only.
- 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.
- You can change the order of the blocks by selecting 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 the blocks region. Proper recognition cannot be achieved if two or more characters are included.
- 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

Delete the selected block from the list.

Fine Adjustment

Use to adjust to the character size in the individual region.

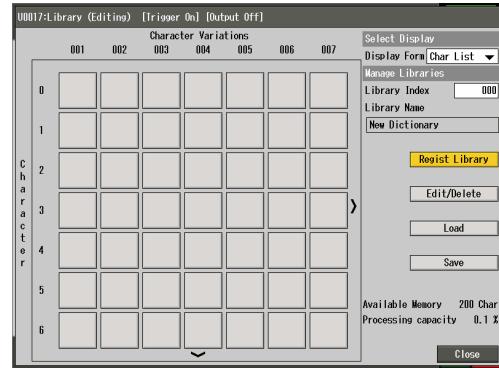
- **ON** (Default): Adjust to the actual character size in the region to allow for changing character sizes and a stable comparison.
- **OFF**: Extract characters in the region of a specified fixed size.

Reference

The [Fine Adjustment] setting is applied to all blocs in the inspection region.

Library

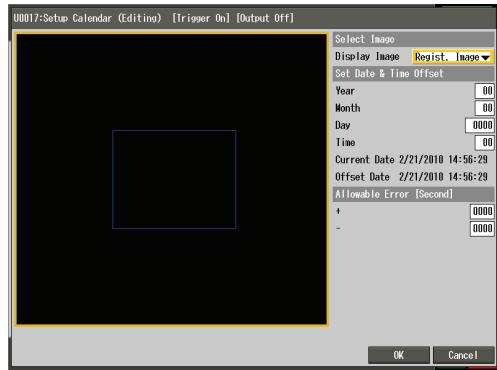
Select the library where the character patterns used for character recognition are registered. You can also create or edit libraries. In addition to alphanumeric characters (0-9, A-Z) and symbols (dash, period, colon and forward slash), up to 20 user-defined characters can be registered in a single library setting.



See "Registering Characters for Optical Character Recognition" (Page 8-20) for more details about the library setting.

Setup Calendar

Setup 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.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Set Date & Time Offset

Add an offset to the value or encoded value of the calendar OK / NG tolerance (Page 4-225). 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 [Time].

Allowable Error

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) are used as an additional offset to the value or encoded value of the calendar OK / NG tolerance (Page 4-225).

Example: Judgment results when the allowable error is set to ± 60 seconds at the turn of the day

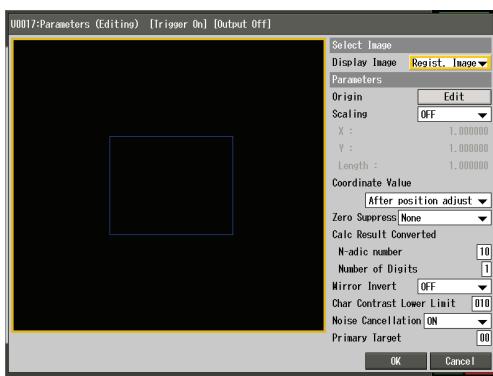
	2007.12.31	2008.1.1
Current internal calendar time	to 23:58:59 23:59:00 to 23:59:59	0:00:00 to 0:01:00 0:01:01 to
Printing 2007/12/31	OK	OK
Printing 2008/1/1	NG	OK



 Allowable error
 -60 seconds +60 seconds

Parameters

Additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** An image which has been registered is displayed.

Parameters

Origin

By default, the origin is set to the top left point of the camera but you can specify its position 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** (Default): Do not use scaling.
- **ON**: Use scaling.

Reference

- The scaling factor can be changed from the [Option] menu of the Flowchart (Page 4-314).
- 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 VisionEditor Reference Manual (Control/Data Edition).

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** (Default): The inspection uses the adjusted coordinate system 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 the space is recognized when using [Fixed] or [Auto (Specify 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	Calendar tolerance	Calculation tolerance	Note
None	08/08/25	00350	
Space forward	08/_8/25	_350	Use either of these two options when [Fixed] or [Auto (Specify Ratio)] is used.
Space backward	08/8/_26	0035_	
Remove zeros	08/8/25	35	

Note

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.

- **N-adic number:** set the number base (10 to 36) (Default: 10).

Example: Numerical conversion when N-adic set to base 36.

Numerical Value	0	to	9	10	to	35
OCR Recognized Character	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

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 Set] menu. (Page 4-219).

▶ Note

When [Mirrored CCD] is used in the capture unit (Page 4-16), this mirror inversion is applied to the mirrored image resulting in a normalized image.

Char 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 4-221) to work incorrectly.

- **ON** (Default): Exclude noises on the border during fine adjustment.
- **OFF:** Include noises on the border during fine adjustment.

Primary Target

Specify the primary target to be used for single judgment from all the recognized characters based on a number reference between 0 (default) and 39.

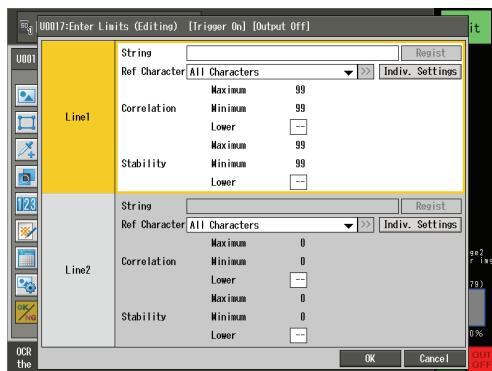
Reference

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.

Enter Limits

Pass / fail strings and tolerances (lower limit) settings for the 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 verification against the string made up of the detected characters. Select [String] and enter up to 20 characters or symbols as a fixed string.

- You can combine fixed characters with other tolerances that automatically change such as date and time.
- REG (registered string) can only be used by itself.

Special characters

The following special characters can be used in the string.

- **SPACE**: Indicates a space.
- *****: Any character except those that cannot be recognized.
- **#**: Any character including ones that can't be recognized.

Example: Differences in results when using "*" versus "#"

Recognition result	String	
	ABC*	ABC#
ABC D	→ OK	OK
ABC 8	→ 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 current 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 current image is selected for the display image and there is no previous results, SPACE (empty) is used for REG.

Date & time tolerances

The following date time functions from the internal calendar can be used in the string.

- **Year4**: Four digit year
- **Year2**: Two digit 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.

String	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. Refer to "Allowable Error" (Page 4-222) for more details.
- Zero suppression (Page 4-223) 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 is used in the string. The number used in parentheses represent the encryption table.

- **eYear ()**: Correlates to the year in the encryption table.
- **eMonth ()**: Correlates to the day in the encryption table.
- **eDay ()**: Correlates to the hour 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" (Page 4-222) for more details.

Note

The encrypted table cannot be changed directly on the controller.

Ref Character

Typically, all the character registered in the library are used for character recognition, however the range of characters can be limited. Limiting can help resolve incorrect character recognition such as an "E" and a "F" and may also increase processing speed.

- **All Characters**: Use all the characters registered in the library for recognition.
- **Character Groups**: Use only the character type in the registered string for recognition. The character 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 registered string for recognition.
- **Specified Char**: Use only selected characters for recognition.

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 correlation value is

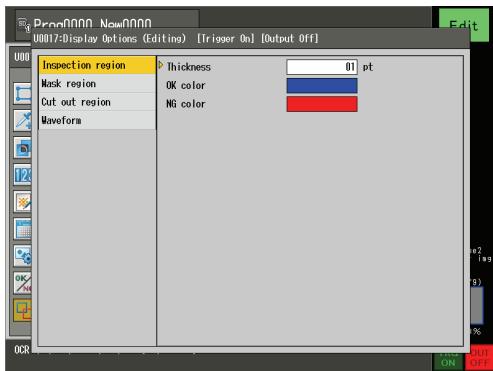
below the lower limit after cross referencing with the library, "?" is output to indicate that the character is unrecognizable and the inspection result is NG.

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

Inspection region and mask region display settings. The display color can be changed based on the judgment result for that unit. The color can also be removed (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.

Detecting 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 4-221) is set to [ON].

Detecting region (when auto extraction is used)

Block region

Specify the line width and display color of the block region.

Character region

Specify the line width and display color of the character region.

Waveform

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.

Block threshold

Specify the width and display color of the line representing the block threshold.

Minimum wave height

Specify the width and display color of the line representing the minimum wave height.

► Note

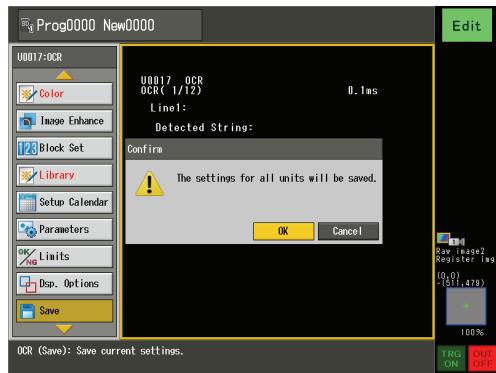
Displaying the Waveform consumes program memory, check the program memory before enabling.

Save

Save the current unit changes in the program file.

▶ Note

- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller 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 screen 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.

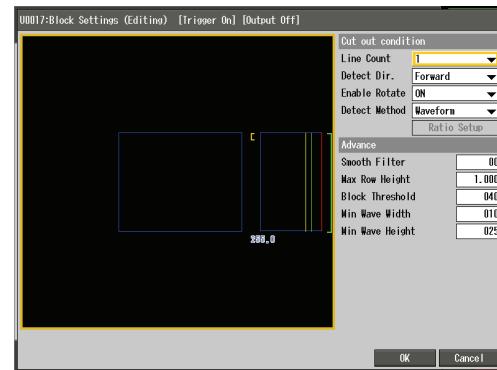
To make character extraction possible and stable, the extraction method can be set to [Fixed] or the detailed auto extraction settings can be adjusted in [Block Setup].

Changing the [Line Settings]

Adjustments can be made to the methods used for line extraction.

1 Select [Line Settings] on the [Block Setup] menu.

The [Line Settings] menu appears.



2 For [Line Count], 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 line 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 [Angled Line] on for rotation correction.

- **ON**: Enable 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.
- **Specify Ratio**: Extracting lines based on a ratio of the overall line extraction waveform, useful when the space between lines is narrow, but the ratio is constant.

▶ Note

If the number of lines changes, do not use [Specify Ratio], as it forces the OCR tool to extract a specified number of lines.

Specifying the ratio

When [Specify 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 [Line Count] is set to 2): Specify the separation point 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 [Line Count] setting is changed.

6 Change detailed waveform generation and line extraction settings.

Typically the line extraction waveform generation method does not need to be changed, however adjusting the generation method may improve the line extraction result.

Smoothing Filter

To aid proper line extraction of dot based strings 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

If two lines are being accidentally 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 Det.

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 line extraction waveform.

Reference

This setting is displayed as an orange bracket next to the line extraction waveform.

Line Extract

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 Select [OK].

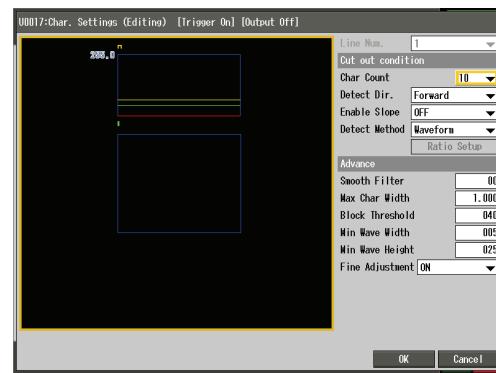
The [Block Setup] menu reappears.

Changing the [Char. Settings] options

Adjustments can be made to the methods used for character extraction.

1 Select [Char. Settings] on the [Block Setup] menu.

The [Character Settings] menu appears.



2 For [Line Num.], select the line number (1 or 2) to change the settings for.

▶ Note

This cannot be selected when [Line Count] is set to 1.

3 For [No. Char], specify the number of characters (1 to 20) to extract from the selected line.

4 For [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 [Sloped Char] to on.

- **OFF:** No sloped character correction.
- **ON:** Sloped character correction.

▶ Note

The sloped character correction is suitable for approximately $\pm 20^\circ$ of tilt to a character, 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.
- **Specify Ratio:** Extracting characters based on a ratio of the overall character extraction waveform, useful when the space between characters is narrow, but the ratio is constant.

▶ Note

If the number of characters changes, do not use [Specify Ratio], as it forces the OCR tool to extract a specified number of characters.

Specifying the ratio

When [Specify 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 point 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 [Char Count] 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 accidentally 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.

Char. Det.

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.

Char. Extract.

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 Select [OK].

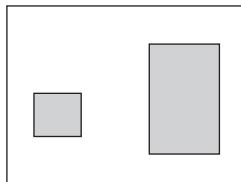
The [Block Setup] menu reappears.

Position Adjustment

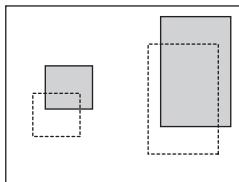
The position adjustment unit allows the configuration and allocation of settings relating to part tracking and region movement for correct inspection of a target that could be misaligned or is not repeatable when presented to the camera.

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.

Measurement results

The major results output by the position adjustment unit are as follows:

Offset (X, Y)	Outputs the X Y deviation in pixels between the registered reference position and the current reference position.
Rot. Center (X, Y)	Outputs the X Y center co-ordinates used for rotation angle deviation results.
Rot. 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 in pixels. In the 2-point position adjustment mode the coordinates of position 1 and 2 are output individually.
Base 1	Outputs the registered reference angle.

Reference

For the list of available measurement output values, refer to "List of result data" in the XG VisionEditor Reference Manual (Control/Data Edition).

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.

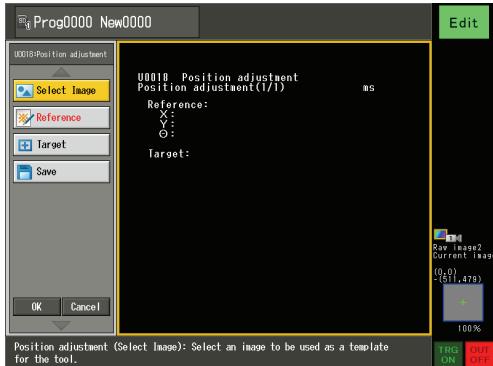
Unit type	Result data (item)	
Pattern Search	Position, angle	
ShapeTrax2	Position, angle	
Edge Position	Position, angle	
Edge Angle	Center, angle	
Stain	When grouping is OFF	Position
	When grouping is ON	Center of gravity
Blob		Center of gravity, major axis angle
Trend Edge Position	When best fit circle / line is OFF	Position, angle
	When best fit circle is ON	Circle center
	When best fit line is ON	Line Center, line angle
Trend Edge Stain		Stain position, stain 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.

Top Menu Layout

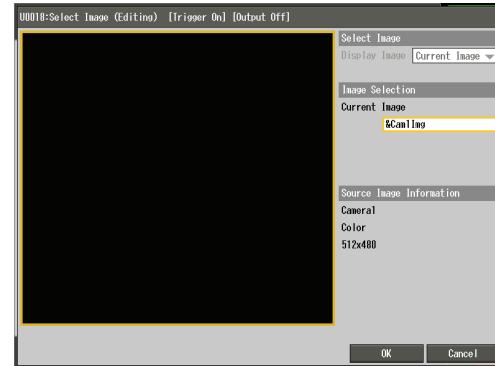
The position adjustment unit menu have the options.



Select Image (Page 4-233)	Selection of the current image to be used for settings.
Reference (Page 4-234)	Select the reference information (such as unit result X Y position) for the position adjustment deviation information to be taken from.
Target (Page 4-234)	Specify the units for which the position adjustment will be reflected to.
Save (Page 4-235)	Save position adjustment settings

Select Image

Selection of the current image to be used for settings.



Select Image

Display Image

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.

Image Selection

Current Image

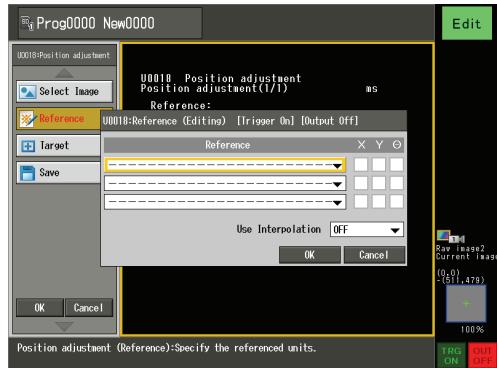
Set an image variable to be used as a current image for the unit.

Source Image Information

The camera No., type (color / monochrome), and resolution of the camera associated to the image variable specified is displayed.

Reference

Select 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 4-232) for more information on units and items which can be selected for the position adjustment reference.

Use Interpolation

Use interpolation on the target image.

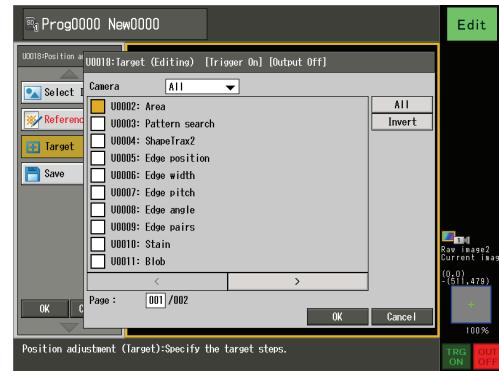
- **ON**: Use interpolation.
- **OFF** (Default): Do not use interpolation.

▶ Note

Interpolation is only valid when a monochrome image variable is used disabled for color image variables.

Target

Select 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

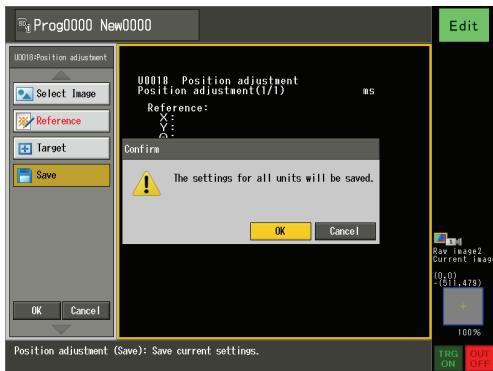
Units with different image variables can also be selected.

Save

Save the current unit changes in the program file.

► Note

- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller 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 screen display, and display parts, can be excluded when saving.

Branch/Join

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.

Major results

The major results provided by the branch unit are as follows:

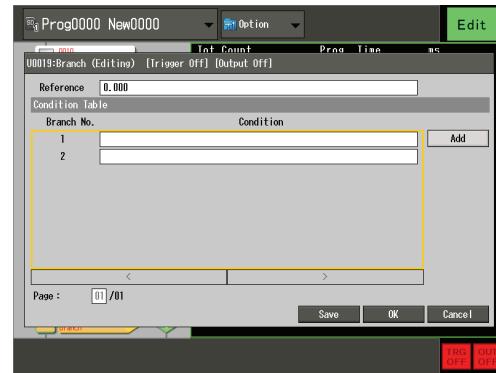
Reference	The reference value used in the evaluation for the branch processing is stored.
Destination	The branch number that the process follows based on the evaluation of the reference and conditions is stored. If no conditions are satisfied then 0 is stored.

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.

Condition

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.

Save

Save the current unit changes in the program file. 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 screen display, and display parts can be excluded when saving.
- 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.

Other Operations

Adding additional branches

Additional branches can be added on to an existing branch from the flowchart. Up to a maximum of 64 branches can be used in a branch unit.

- 1 **On the flowchart select the branch to add a branch to, and display the edit 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

Removing selected branches from a branch 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 removing branches expand and edit the branch to avoid accidental deletion of units.

- 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/Loop End

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.

Major results

The major results provided by the loop function/end units are as follows:

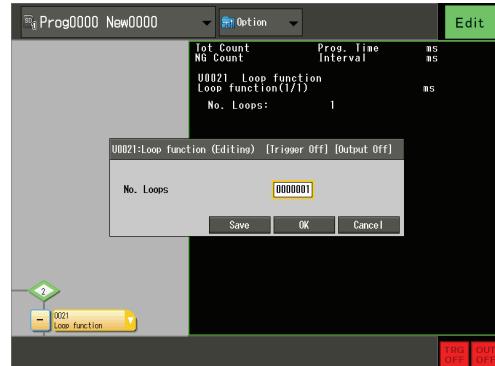
No. Loops	The current loop number being processed by the loop function. This value is 0 when the flowchart starts and increases by +1 when the process returns to the loop function unit after reaching the loop end unit.
------------------	---

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 loops (0 to 9999999, default: 1) to perform.

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

Save the current unit changes in the program file.

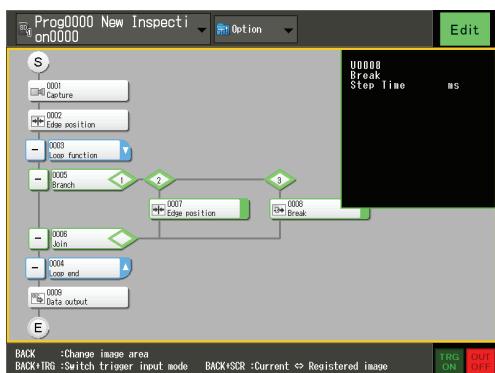
The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

▶ 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.
- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller while you are saving the settings. Doing so may cause errors in the internal data.

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 4-236) 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. The 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.

Measurement results

The major results output by the calculation unit are as follows:

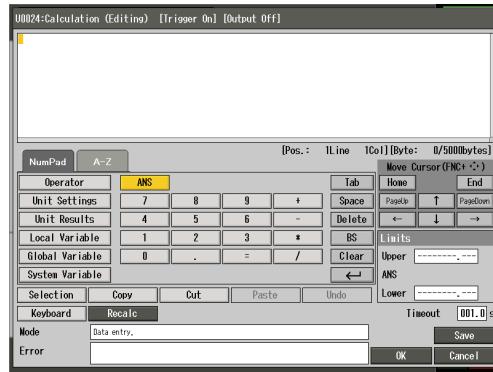
Calculation result	The result of the calculation when ANS (default 0) is referenced as the output location for a function processed in the script. Available in the limits menu
Error Code	The reference error code (default 0) used when an error occurs in the processing of the script in the unit. Note The 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 VisionEditor Reference Manual (Control/Data Edition).

Calculation

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 (including comments) can be used to write a script a single calculation unit 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 8-45).

Note

- If the number of characters exceed the upper limit due to changes in unit ID number (Page 4-13) 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 Settings

Use this option to select parameters from units already configured in the program.

When the [Unit Settings] menu is displayed, select the appropriate unit and move to the right selecting the desired option to filter to the desired parameter.

Unit Results

Use this option to select result data from units already configured in the program.

When the [Unit Data] menu is displayed, select the appropriate unit and move to the right selecting the desired option to filter to the desired result.

Local Variables

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 move to the right selecting the desired option or variable value to be used.

Global Variables

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 move to the right selecting the desired option or variable value to be used.

System Variables

Use this option to select a list of system variables.

When the [System Variable] menu is displayed, select the variable to be used.

Copy

Copy selected characters.

Cut

Cut selected characters.

Paste

Paste selected characters.

Selection

Select consecutive characters specifying the first and last character.

Undo

Undo the last operation.

Recalc

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.

Error

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). See the XG VisionEditor Reference Manual (Control/Data Edition) for more details on error codes.

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 #Area_count which contains a processed value.

ANS=#Area_count

▶ Note

ANS is reset to 0 every time before the calculation starts.

Upper

To set an upper limit pass / fail criteria, check the checkbox and input the upper limit. When the ANS value exceeds the specified upper limit, the unit is judged as NG.

Lower

To set lower limit criteria, check the checkbox and 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 handling time sensitive situations where processing of a calculation string may take too long a time-out value (1.0 to 600.0s) can be specified.

If a time-out occurs the result of the calculation is set the same as if an error had occurred.

▶ Note

As functions in the calculation script may be finished before the time-out occurs these results may affect the processing of other units.

Save

Save the current unit changes in the program file.

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

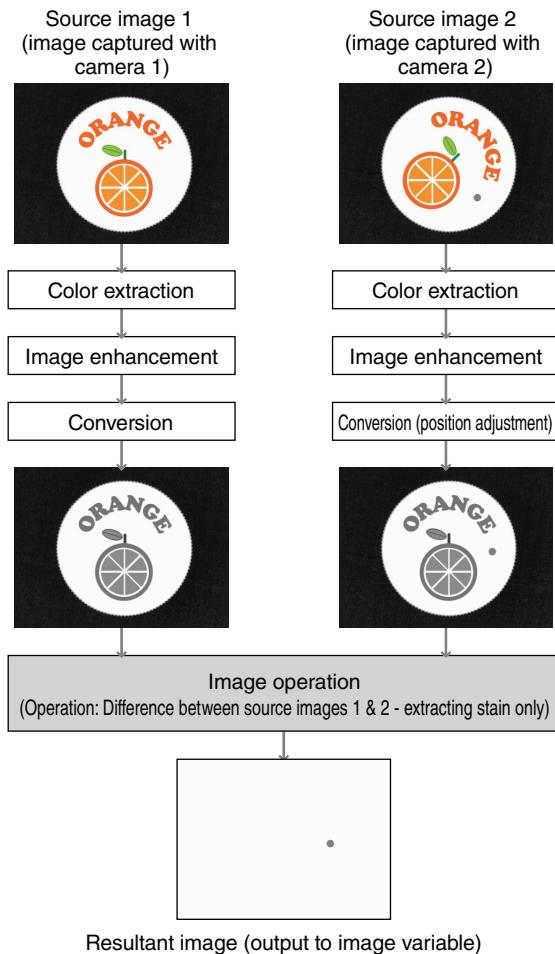
▶ Note

- 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.
- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller while you are saving the settings. Doing so may cause errors in the internal data.

Image Operation

Image operation creates and stores a resultant image in a user specified image variable. This image is the result of a process or calculation being performed on a single source image or across multiple source images.

Image Operation Flow



Reference

- Registered and current 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.

Top Menu Layout

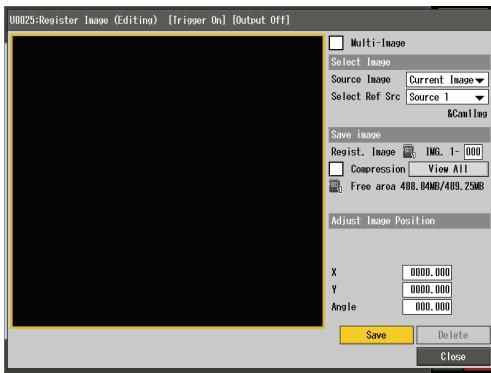
The image operation unit menu has the following options.



Register Image (Page 4-245)	Registration of an image to be used as a template for settings.
Operation (Page 4-246)	Outline the operation to be performed using source images 1 and 2 after individual processing.
Source 1 (Page 4-248)	Selection and processing of a registered or current image to be used as image 1 in the operation.
Source 2 (Page 4-252)	Selection and processing of a registered or current image to be used as image 2 in the operation.
Inspect Region (Page 4-253)	Outline the region on the captured image to be used for the inspection.
Result Image (Page 4-253)	Outline the settings for the resultant image.
Dsp. Options (Page 4-255)	Region display settings.
Save (Page 4-255)	Save image operation settings.

Register Image

Registration of an image to be used as a template for settings. It is recommended to carefully adjust lighting and other conditions before registering an image.



Multi-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 5-17).
- When multi-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.
- The image variable used for the select image of the vision tools unit should be the same as the image variable used for the capture unit being executed. When the image capture buffer is set to custom, the image variable which contains the image of the capture unit executed most recently will be displayed.

Select Image

Source Image

Select an image to register.

- **Current Image:** The latest image for the specified source image (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Save Image] is displayed.

▶ Note

When a registered image has been set in [Image] as either [Source 1] or [Source 2], selecting [Current Image] displays the specified registered image.

Select Ref Src

Select a source image to register.

Only the source image No. set in the operation can be selected from.

Save Image

Number

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

Compression

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

There may be some deterioration in image quality due to compression. Inspection results when using a compressed image may differ from results when using an uncompressed image.

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 -2432.000 and 2432.000 pixels.

Y

Adjust the movement in the Y (vertical) direction between -2050.000 and 2050.000 pixels.

Angle

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

Reference

When you select [Current Image] as the source image for the unit for which the position adjustment ID has been specified in [Conversion] (Page 4-251), you can select [Pos. Adjust. value] as well as [Number Input]. This option is useful because even when the image capture position deviates, the current image is automatically adjusted using the adjustment value based on the reference unit. However, note that when [Pos. Adjust. value] is selected in the state where a proper adjustment value cannot be measured for the current image, the position used for registration may be incorrect.

▶ Note

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

Save

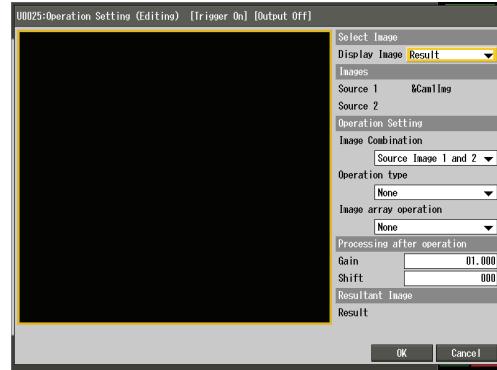
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Regist. Image] is selected for [Source Image], you can delete the registered image specified under [Save image].

Operation Settings

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 Manipulation" (Page 8-75) for more details.

Select Image

Display Image

- **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 current 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 current 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 Settings

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

Set the type of operation to apply to the source image(s).

See "Functional Explanation of Operations" (Page 8-84) 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 on a normalized scale.
- **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 8-84) for more details on individual operations.

- **None** (Default): No image operation.
- **Add**: Create an image by adding the pixel of the target images together.
- **Average**: Create an image by averaging the pixel 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 pixel of the target images.
- **OR**: Obtain the logical (OR) sum for the pixel values of the target images.
- **XOR**: Obtain the exclusive logical (XOR) sum of the pixel of the target images.
- **NAND**: Obtain the negative logical (NAND) product of the pixel 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

Grayscale adjustment of the resultant image after the operation has been performed.

Gain

Multiplies the pixel value in the resultant image 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

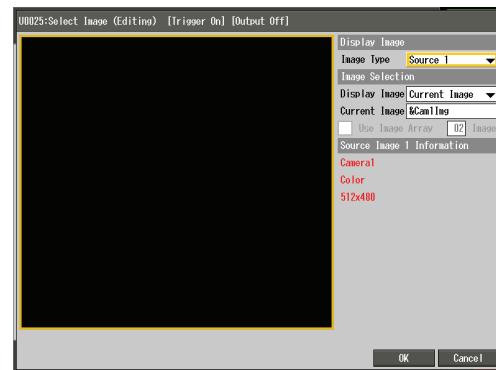
The resultant image variable and specifications for the image set in [Result] under [Resultant Image] are displayed.

Source 1

Selection and processing of a registered or current image to be used as image 1 in the operation.

Select 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 2 must be of the same resolution.

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 Only] is selected in [Image Combination], [Source 2] or [Source 2 4 scr.] can not be selected.

Display Image

Select whether to use the current image or a registered image for the image operation.

Current Image

This option can be enabled when the current image has been set to source image 1.

- Use Image Array: You can change the number of images to be specified for image variable array. This setting cannot be changed when an image array variable is not set as the current image.

Regist. Image

This option can be set when a registered image has been set to source image 1.

You can change the registered image No.

- **Advance:** Set advance options for the switching of registered images as necessary.

- **Assign variables to registered image No.:** To use a variable for the registered image No., check this box and assign a scalar or scalar 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. See the XG VisionEditor Reference Manual (Control/Data Edition) for more details.

- **Assign variables only when changing programs:**

Use this option to switch 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

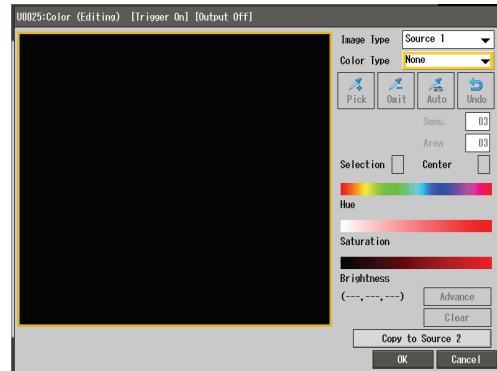
Note that the displayed registered image No. does not switch in accordance with a change in the variable.

Reference

The camera No., number of colors, and number of pixels for the camera applicable to the image variable specified in the [Current Image] or [Regist. Image] field are displayed in [Source Image 1 Information].

Color

Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).



► Note

This setting is disabled when a monochrome image variable is used for a current image or registered image.

See "Working with Color Images" (Page 8-13) 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.

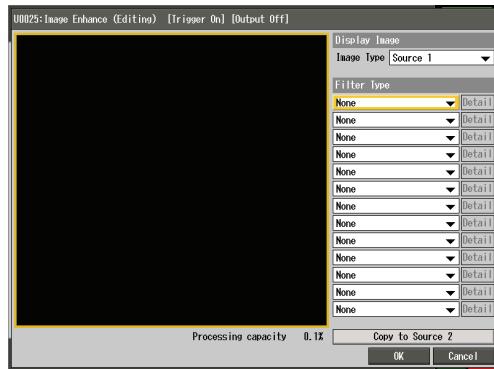
Select [OK] to confirm.

► 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 for the current image, 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 in [Image Combination], [Source 2] or [Source 2 4 scr.] cannot be selected.

Filter Type

Select the [Filter Type] and then select the filter to apply.

See "Image Enhancement Filters" (Page 8-27) for more details of each filter processing.

▶ Note

- The subtract filter cannot be used.
- The binary and blob filters cannot be used more than once in the same source image.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 13 types of filters can be set according to application requirements. When multiple filters are set, they are processed one by one from the top.
- You can change the order of the filters 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 up or down.

Copy to Source 2

Copy the image enhancement settings from source image 1 to source image 2.

Select [OK] to confirm.

▶ 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 processing, further conversion image processing can be applied.

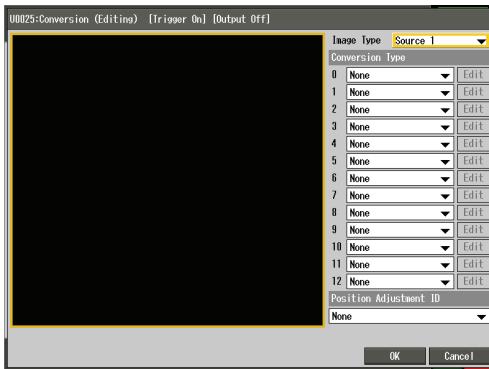


Image Type

- **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 Only] is selected in [Image Combination], [Source 2] or [Source 2 4 scr.] cannot be selected.

Conversion Type

Select [Conversion Type] and then select the processing function to apply.

See "Functional Explanation of Conversions" (Page 8-76) 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 pixel 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 8-76) for more details.

Reference

You can change the order of conversion by selecting a conversion type in one of the [Conversion Type] fields, holding down the No.1 (FUNCTION) button on the handheld controller, and then moving up or down.

Position Adjustment ID

To apply position adjustment to source image 1, select the position adjustment unit to be referenced.

Source 2

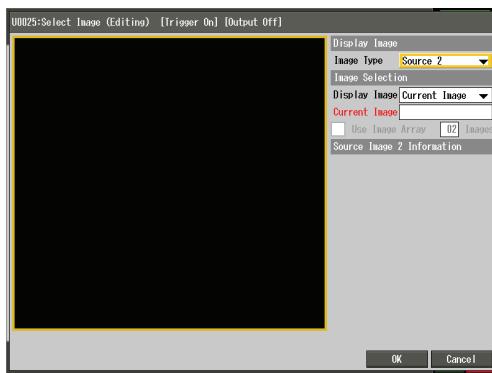
Selection and processing of a registered or current image to be used as image 2 in the operation.

► 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.

Select Image

The setting options for [Source 2] are the same as [Source 1].

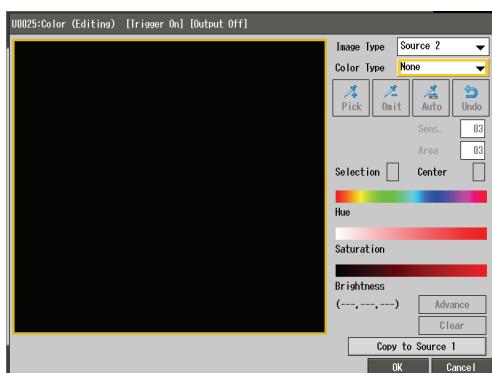


Reference

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

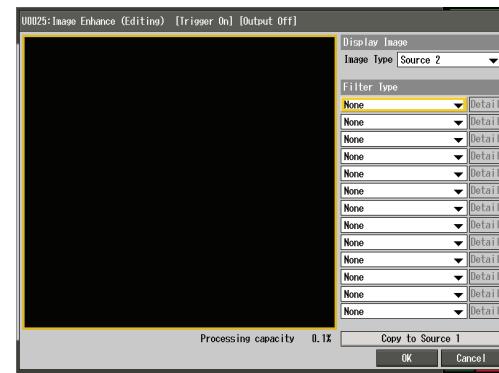
Selecting [Copy to Source 1] applies the specified color extraction information to the color extraction setting of [Source 1].

► 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.

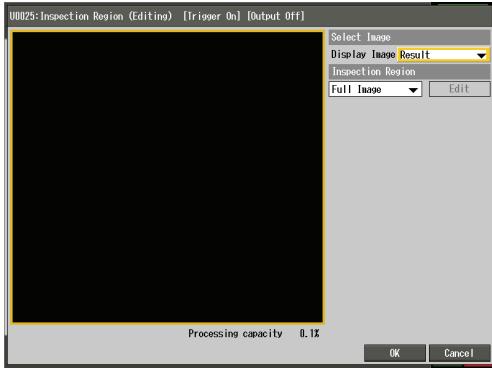
Conversion

The setting options for [Source 2] are the same as [Source 1].



Inspection Region

Set a region to use a specific area as the process area. When this setting is omitted, the entire image is processed using a rectangle region.



Select Image

Display Image

- **Source 1:** Display source image 1.
- **Source 2:** Display source image 2.
- **Result:** Display the resultant image.

Inspection Region

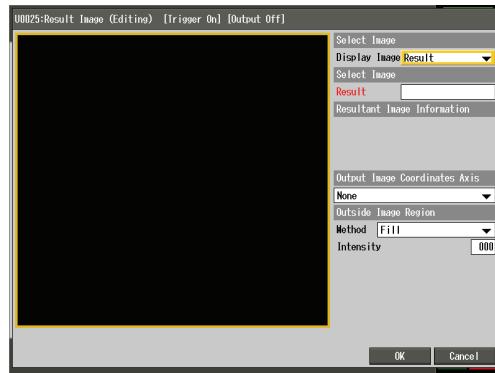
Select [Rectangle] and then draw the region, or select [Edit] and specify the region with numerical values. See "Inspection Region Menu" (Page 8-2) for more details.

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

Outline the settings for the resultant image.



Select Image

Display Image

- **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.

Resultant Image Information

Result

Specify the resultant image variable.

► 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.

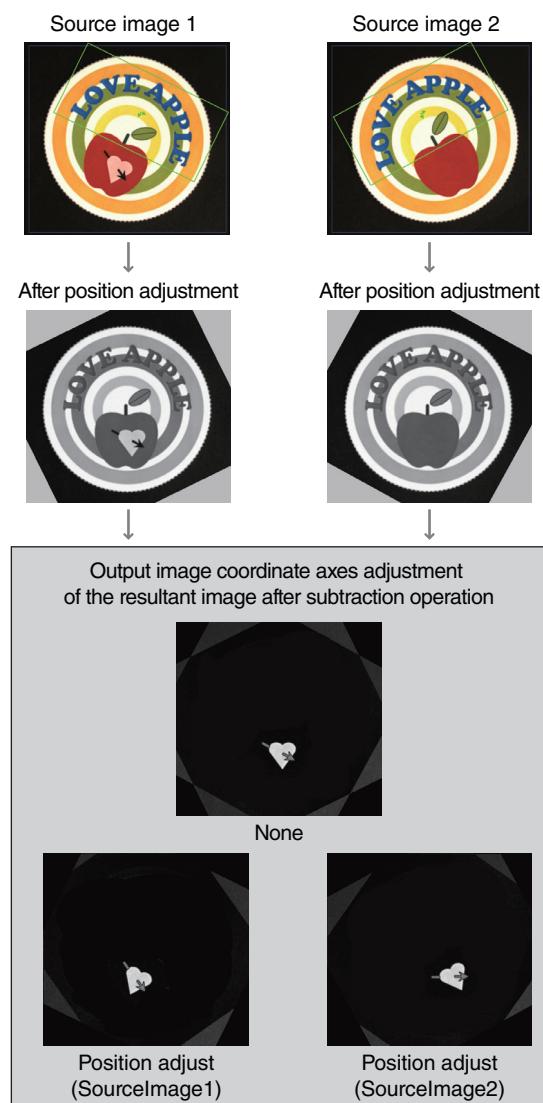
- Camera No.
- Color
- Image size

Output Image Coordinates Axis

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 [Output Image Coordinates Axis] setting



Outside Image 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 (0: Black to 255: White, default: 0).

Display Options

Region display settings.



Region

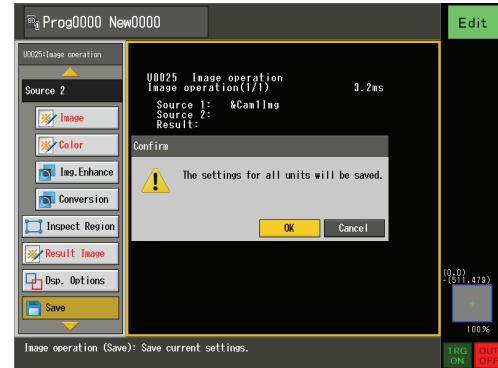
Specify the line width and display color of the region.

Save

Save the current unit changes in the program file.

► Note

- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller 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 screen display, and display parts, can be excluded when saving.

Calibration

The calibration unit enables the correction of captured images for linear and non-linear distortion caused by lens distortion and camera mounting. Using the calibration function enables the generation of a corrected image and numerical conversion of measurement values from other units (Page 4-241) into a real world co-ordinate system. Actual dimensions can also be easily calculated from the scale factor values generated through calibration (Page 4-314).

► Note

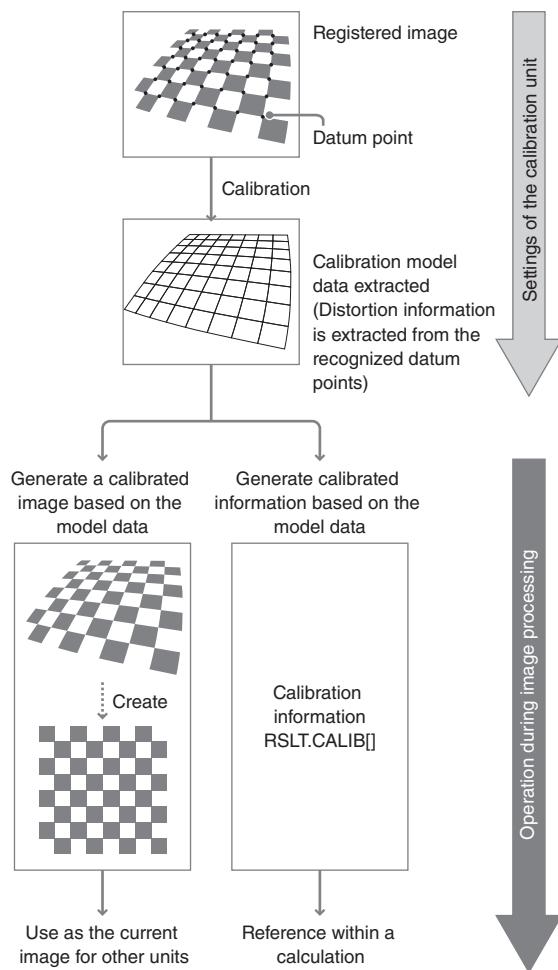
- For calibration to be performed correctly the calibration pattern needs to be registered under installation conditions. If the installation conditions change the calibration will need to be performed again.
- Errors in inspection / measurement may occur if the target is at a different height or angle to the calibration pattern plane.

Reference

To correct for trapezoid distortion by selecting four reference points on the image use the conversion option in the image operation unit (Page 4-244).

Calibration

In the initial unit setup a "calibration model" is built from registered coordinate datum points obtained via the captured image of a chess board or dot pattern calibration grid (which can be printed from XG VisionEditor). During normal operation the "calibration model" can be used as a base to create a "calibrated image" or "calibrated data" for coordinate conversion.



Reference

- Calibration patterns can be printed by selecting [Print Calibration Pattern] from [Tools] menu of the XG VisionEditor. The pattern accuracy depends on the printer performance, and errors in calibration can occur from the how the pattern is presented when registered as an image. If sub-pixel order accuracy is required, it is recommended to use a calibration grid (such as a glass) with a known associated accuracy standard. For more details, refer to the XG VisionEditor Reference Manual (Programming Edition).
- To perform calibration the image of the calibration pattern needs to be saved as a registered image.

Major results

The major results displayed by the calibration unit are as follows:

Src. Origin (X, Y)	The coordinates of the origin based on the calibration grid before image calibration in pixels.
Dst. Origin (X, Y)	The coordinates of the origin based on the calibration grid after image calibration in pixels (Valid only when a calibrated image is generated).
Spacing Val.	The spacing in-between calibration datum points after calibration in pixels (Valid only when a calibrated image with [Lens & Angled Camera] distortion correction is generated).
Corrected Angle	The correction angle from the calibration (Valid only when a calibrated image with [Lens & Angled Camera] distortion correction is generated).
X Scale Val.	The X scaling factor to be used for scaling (Page 4-314) of measurement values in other units (Valid only when a calibrated image with [Lens & Angled Camera] distortion correction is generated).
Y Scale Val.	The Y scaling factor to be used for scaling (Page 4-314) of measurement values in other units (Valid only when a calibrated image with [Lens & Angled Camera] distortion correction is generated).
Len. Scale Val.	The length scaling factor to be used for scaling (Page 4-314) of measurement values in other units (Valid only when a calibrated image with [Lens & Angled Camera] distortion correction is generated).
Model Param. []	The internal parameters to be used for conversion of measurement values into the real world co-ordinate system using the conversion function (ConvPixTo Wld) (Page 4-241). The information stored is the either the conversion information from the current image (when a calibration image is not generated) or the conversion image from a calibrated image (when a calibration image is generated)

▶ Note

The value of Model Param [] (RSLT.CALIB[]) is only to be used in the calculation unit. When this value changes the result of the calculation may fail.

Reference

For a summary of available measurement output values, refer to "List of Result Data" in the XG VisionEditor Reference Manual (Control/ Data Edition).

Top Menu Layout

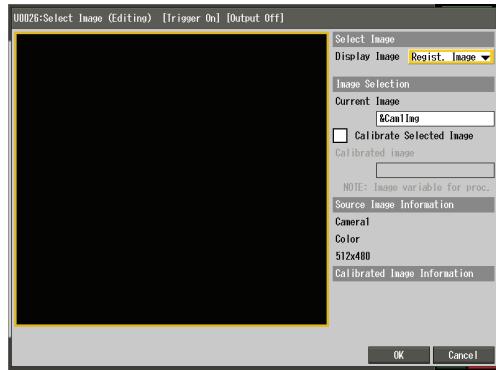
Settings for calibrating from a calibration grid and obtaining the calibration model including lens distortion and angled camera options.



Select Image (Page 4-258)	Specify the current image to be calibrated. To create a calibrated image, specify the resultant image variable in which to contain it.
Settings (Page 4-259)	Set options for teaching with a calibration pattern in order to obtain the calibration model, including the lens and angled camera distortion.
Calibrated Img. (Page 4-263)	Options and settings for generating a calibrated image from the calibration model (This menu is active only when [Calibrate Selected Image] is selected in the [Select Image] menu).
Origin & Axis (Page 4-264)	Set the relationship between the pixel and world coordinate systems (based on calibration image No. 1).
Dsp. Options (Page 4-266)	Calibration display settings.
Save (Page 4-266)	Save calibration settings

Select Image

Specify the current image to be calibrated. To create a calibrated image, specify the resultant image variable in which to contain it.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under settings image No. 1 is displayed.

Image Selection

Current Image

Set an image variable to be used as a current image for the unit.

Calibrate Selected Image

Check this option and specify the resultant image variable to calibrate the captured image.

Calibrated image

If [Calibrate Selected Image] is selected, input an image variable for storing the calibrated image.

► Note

- Only an image variable can be entered in [Calibrated image].
- An image variable for storing the calibrated image should be setup in advance in the [Variables] menu (Page 4-306). The camera specified in the image variable must be the same as the camera used for the current image of the calibration unit.

Source Image Information

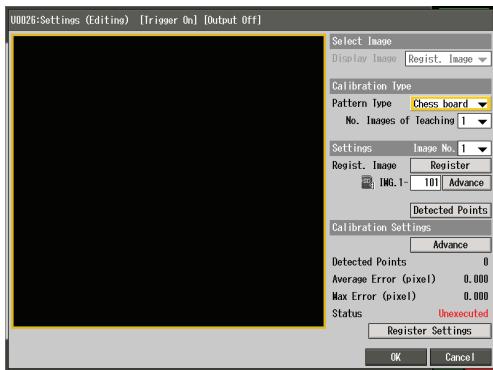
The camera No., type (color / monochrome), and resolution of the camera associated to the image variable specified is displayed.

Calibrated Image Information

The camera No., type (color / monochrome), and resolution of the camera associated to the resultant image variable specified in the [Calibrated image] field are displayed.

Settings

Set options for teaching with a calibration pattern in order to obtain the calibration model, including the lens and angled camera distortion.



Select Image

Display Image

- **Regist. Image:** The registered image specified at [Image No.] next to [Settings] is displayed.

Calibration Type

Pattern Type

Select the type of pattern used for teaching.

- **Chess board** (Default): Use a black-and-white chess board pattern.
- **Dot pattern:** Use a dot pattern.

► Note

- For calibration set the field of view and calibration grid size so that the pattern spacing is 15 pixels or more for the chess board pattern, and the dot size is 10 pixels or more for the dot pattern.
- Calibration maybe unsuccessful if the angle of the camera is too shallow when using the dot pattern. When the angle is very shallow use the chess board calibration pattern for improved calibration performance.

Reference

Calibration patterns can be printed by selecting [Print Calibration Pattern] from [Tools] menu of the XG VisionEditor. The pattern accuracy depends on the printer performance, and errors in calibration can occur from the how the pattern is presented when registered as an image. If sub-pixel order accuracy is required, it is recommended to use a calibration grid (such as a glass) with a known associated accuracy standard. For more details, refer to the XG VisionEditor Reference Manual (Programming Edition).

No. Images of Teaching

Use this option to create a calibration model from several images (1 to 16, default: 1) captured on the same plane but have different pattern layouts. This ensures that the calibration model is as accurate as possible when a single calibration grid cannot cover the full image.

► Note

- Increasing the number of images for calibration may significantly increase the calibration time.
- The position and angle of the calibration grid can be changed for each image as long as all images are captured on the same plane.

Settings

Set the options for each of the images determined in [No. Images of Teaching].

Image No.

Select the calibration image No.

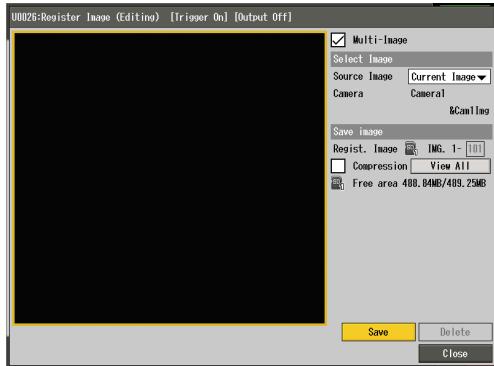
Regist. Image

Specify the registered image No. for the registered image to be used.

- Registered images are managed as "Image (Camera No.)-(Registered image No. 0 to 999)".
- The camera No. is fixed to camera of the image variable specified in the [Current Image].

Register Image

Display the [Register Image] menu.



- **Multi-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 5-17).
- When multi-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.
- The image variable used for the select image of the vision tools unit should be the same as the image variable used for the capture unit being executed. When the image capture buffer is set to custom, the image variable which contains the image of the capture unit executed most recently will be displayed.
- **Source Image:** Select an image to register.
 - **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
 - **Regist. Image:** The registered image specified at [Image No.] next to [Settings] is displayed.
- **Compression:** 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).

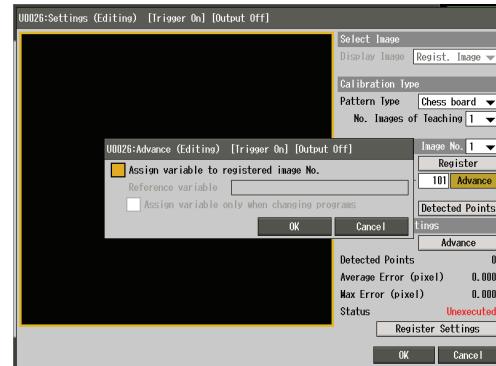
► Note

There may be some deterioration in image quality due to compression. Inspection results when using a compressed image may differ from results when using an uncompressed image.

- **View All:** View all registered images in a list.
- **Save:** Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.
- **Delete:** When [Regist. Image] is selected for [Source Image], you can delete the registered image specified under [Save Image].

Advance

Set advance options for the switching of registered images.



- **Assign variable to registered image No.:** To use a variable for the registered image No., check this box and assign a scalar or scalar 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.
 - To apply the image change to teaching, you need to select [Register Settings] or issue the TG command. See the XG VisionEditor Reference Manual (Control/ Data Edition) for more details.

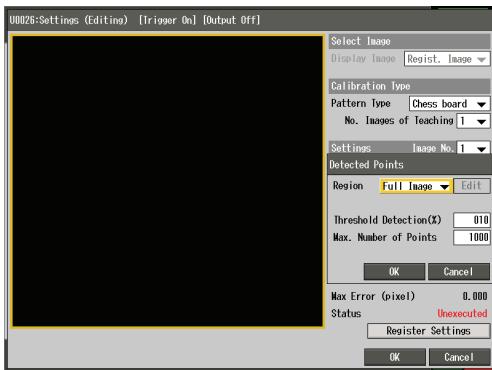
- **Assign variable only when changing programs:** Use this option to switch to the registered image based on the initial value of the variable referenced when the program is changed or the controller is next turned on.

► Note

Note that the displayed registered image No. does not switch in accordance with a change in the variable.

Detected Points

Use the [Detected Points] menu to change settings relating to the datum point detection during calibration.



- **Region:** If detection is unstable due to information other than the calibration pattern the region can be specified for detecting datum points.
 - **Full Image** (Default): Use the entire image as the detection region.
 - **User Set:** A user-specified rectangle as the detection region.
- **Threshold Detection(%):** A threshold value to for detecting datum points (1 to 100, default: 10).
- **Max. Number of Points:** Set the maximum number of datum points to be detected (100 to 4000, default: 1000).

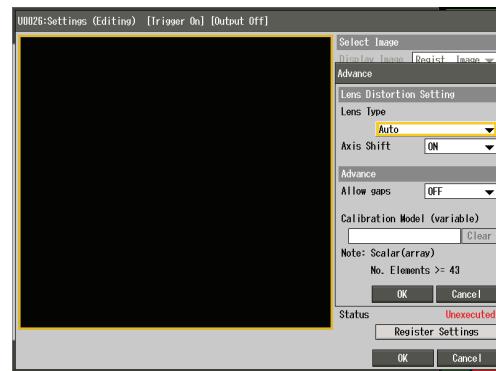
► Note

- Setting a low detection threshold value to detect more datum points may result in improper calibration due to noise being detected.
- Increasing the number of datum points to be detected may greatly increase the time required for detection and calibration.

Calibration settings

Advance

Display the [Advance] menu for changing other parameters relating to calibration.



• Lens Type:

- **None:** Do not take into account lens distortion and calibrate for camera angle (linear distortion) only.
- **Low order:** Calibrate using one set of parameters, the information used is minimal, but processing is fast.
- **High order:** Calibrate using two sets of parameters, accuracy is higher than low order, but the processing time is also increased.
- **Asymmetry:** Use four sets of parameters to correct asymmetrical distortion. Accuracy is improved for asymmetrical distortion in the XY directions, but the processing time is also increased.
- **Auto** (Default): Use a range of parameters to minimize errors and result in stable calibration.

• Axis Shift:

Select whether to include axis shifting in the calibration parameters.

- **ON** (Default): Correct for axis shift in calibration.
- **OFF:** Do not correct for axis shift in calibration.
- **Allow gaps:** When using two or more images choose whether to allow calibration to support different size calibration grids in each image.
 - **ON:** Allow different sizes between calibration grids across multiple images.
 - **OFF** (Default): Do not allow different calibration grid sizes.

Reference

Small calibration grid spacing allows for high accuracy calibration; however the range across which datum points can be taken is limited. A large calibration grid spacing though allows for a large range to be calibrated across, but with an associated decrease in accuracy. "Allow Gaps" enables the use of the multi size calibration grids at different locations so the calibration accuracy can be maintained across the range of the image needing to be calibrated.

Calibration Model (variable)

Reference a numerical variable which contains previous model data from another calibration unit or use this option to share the model data with other calibration units. This function helps ensure that the same calibration model data can be used across numerous programs with calibration only needing to be performed once.

► Note

- The variable referenced has to be a numerical variable with 43 or more elements.
- If the variable is setup without the [Copy current value to initial value at save] checkbox checked, saving the program will not save the calibration data.

Register Settings

Perform calibration based on the specified registered image and settings. The result of the calibration is shown below and stored as part of the unit result settings.

Detected Points

The number of detected datum points used for calibration is displayed.

Average Error (pixel)

The average pixel value error from the calibration is displayed.

Max Error (pixel)

The maximum pixel value error from the calibration is displayed.

Status

The current status of the calibration is displayed.

- **Unexecuted:** No calibration has been performed yet.
- **Success:** Calibration was successful.
- **Fail:** Calibration failed due to improper extraction of datum points or unexpected distortion.
- **Illegal:** The size of the current image is different from the size from the previous image when performing multi image calibration.

Reference

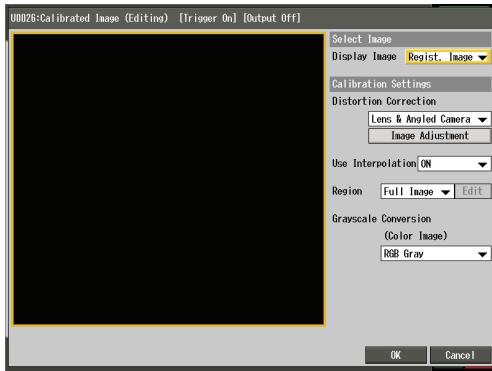
Calibration can also be performed by using the TG command. Refer to the XG VisionEditor Reference Manual (Control/Data Edition) for more details.

► Note

- The error shown relates to the accuracy of the calibration grid used. The error is intended to be used as a guide, and does not guarantee accuracy of the actual calibration result.
- The error display indicates the error at the feature point. Areas other than the detected feature points are not considered. As a result, the image may not be calibrated properly around undetected points or the teaching may fail if, for example, feature points are concentrated in a certain area in all teaching images.
- If no datum points are found in the image for image No. 1, the calibration fails.
- Two or more images are used and no datum points are found in the image, those images are ignored in the calibration.
- The change of settings in the [Settings] menu are not applied to the calibration model data until [Register Settings] is selected.
- When lots of datum points and images are specified for calibration, calibration may require several minutes to execute following the 50% mark of the progress bar

Calibrated Image

Options and settings for generating a calibrated image from the calibration model (This menu is active only when [Calibrate Selected Image] is selected in the [Select Image] menu).



▶ Note

This menu is only available when [Calibrate Selected Image] is checked in the [Select Image] menu.

Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under settings image No. 1 is displayed.

Calibration Settings

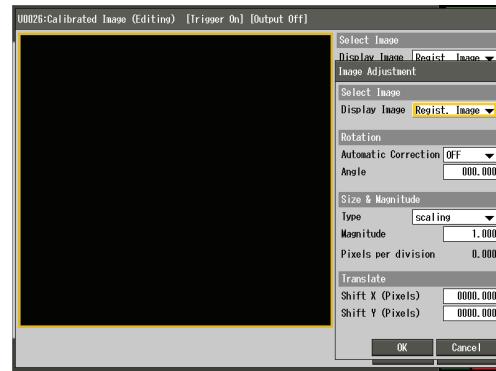
Distortion Correction

Select the type of distortion to correct.

- **Lens Only:** Correct lens distortion only.
- **Lens & Angled Camera** (Default): Correct both lens distortion and angled camera distortion.

Image Adjustment

Display the [Image Adjustment] menu for adjusting the calibrated image.



Rotation

- **Automatic Correction:** Parameters for rotation of the calibrated image.
 - **ON:** Rotation based on the calibration grid used in image No. 1.
 - **OFF** (Default): Do not correct rotation.
- **Angle:** Specify the angle to adjust the calibrated image by. When [Automatic Correction] is [ON], this angle is applied to the image after rotation correction.

Size & Magnitude:

- **scaling:** Specify the scale factor to be applied to the calibrated image (0.200 to 5.000, default: 1.000).
- **pixel value:** Specify the calibration grid spacing (pixels) to be applied to the calibrated image (5.000 to 1000.000, default: 50.000).
- **Pixels per division:** The current calibration grid spacing is displayed in pixels.

Translate:

- **Shift X (Pixels):** Specify the X translation of the calibrated image in pixels (-9999.999 to 9999.999, default: 0.000).
- **Shift Y (Pixels):** Specify the Y translation of the calibrated image in pixels (-9999.999 to 9999.999, default: 0.000).

Use Interpolation

Select whether to interpolate the calibrated image.

Although interpolation requires additional processing time, it can reduce the generation of jaggies in the calibrated image.

- **ON** (Default): Use interpolation.
- **OFF:** Do not use interpolation.

Region

Use this option to select the region for the generated calibrated image. Limiting the region can reduce processing time for the image calibration.

- **Full Image** (Default): Calibrate across the full image.
- **Rectangle**: Calibrate inside the specified rectangle region only.

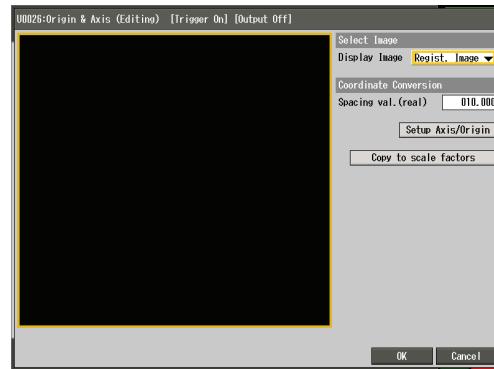
Grayscale Conversion

When the current image is a color image, select the grayscale conversion method for the calibrated image.

- **Gray**: Take the maximum R, G and B intensity values for each pixel and convert them into grayscale information (producing a relatively bright grayscale image).
- **RGB Gray** (Default): Take the average R, G and B intensity values for each pixel and convert them into grayscale information (producing a gray image that similar to one from a monochrome camera).

Origin & Axis

Set the relationship between the pixel and world coordinate systems (based on calibration image No. 1).



Select Image

Display Image

Switch the image displayed on the screen.

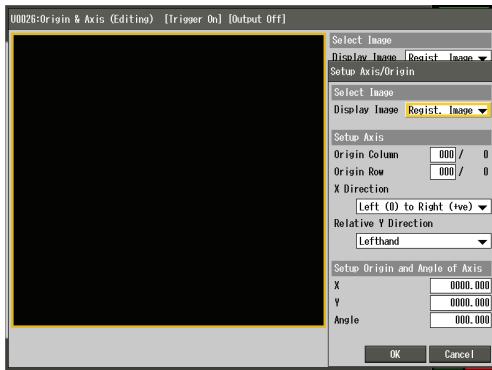
- **Current Image**: The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image**: The registered image specified under settings image No. 1 is displayed.

Spacing val. (real)

Specify the spacing of the calibration grid as an actual dimension in order to convert measurement results in pixels into actual dimension values (0.001 to 999.999, default: 10.000).

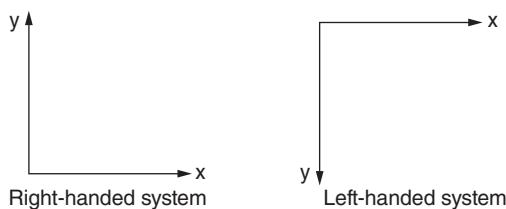
Setup Axis/Origin

Display the [Setup Axis/Origin] menu to change the origin and axis used as references for calibration (coordinate conversion) of the measurement value with a calculation unit.



Setup Axis

- **Origin Column:** Specify the column No. based on the datum points of image No. 1 and set the origin point of the axis (0 to 255, default: 0).
- **Origin Row:** Specify the row No. based on the datum points of image No. 1 and set the origin point of the axis (0 to 255, default: 0).
- **X Direction:** Select the direction of the X axis with respect to the origin point
 - **Right (0) to Left(+ve):** Set the X axis to increase when moving to the left of the origin point.
 - **Bottom (0) to Top (+ve):** Set the X axis to increase when moving upwards from the origin point.
 - **Left (0) to Right (+ve):** The X axis to increase when moving to the right of the origin point.
 - **Top (0) to Bottom (+ve):** Set the X axis to increase when moving downwards from the origin point.
- **Relative Y Direction:** Select the coordinate system of the Y axis with respect to the origin of the axis.
 - **Righthand:** Use the right-handed system.
 - **Lefthand (Default):** Use the left-handed system.



Setup Origin and Angle of Axis

Specify adjustments in the world coordinate system based on the [Setup Axis] settings for changing the origin position with numerical values.

- **X:** X origin coordinate adjustment (-9999.999 to 9999.999, default: 0.000).
- **Y:** Y origin coordinate adjustment (-9999.999 to 9999.999, default: 0.000).
- **Angle:** Angle adjustment (0 to 359.999, default: 0.000).

▶ Note

- If the origin deviates significantly from the detected datum points, the error between the world and pixel coordinate systems may increase.
- Depending on the calibration pattern layout and or camera settings, the initial origin may greatly deviate from the screen during calibration. In this instance, adjust the values of [Origin Column] and [Origin Row] to move the origin to an appropriate position.

Copy to scale factors

Copy the calculated calibration scale factor to the scale factor setting (Page 4-314). This setting is effective units which use the calibrated image as the current image and when the scaling is set to convert measured values into actual dimensions.

Reference

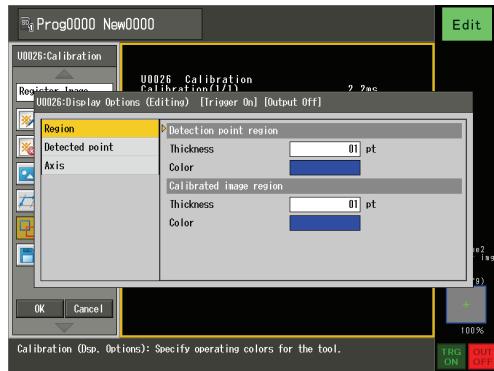
As the calibration scale factor changes with each calibration, the new coefficient will need to be applied to the scale factor setting after each calibration. If a variable is referenced in the scale factor settings this process can be eliminated by a calculation populating the variable with the scale factors.

▶ Note

Before using this option, a calibrated image needs to be generated through the [Lens & Angled Camera] option in the [Calibrated Image] menu. To perform calibration (coordinate conversion) of the measurement value using a calculation instead of having to generate a calibrated image, use the coordinate conversion function (ConvPixToWorld) in a calculation unit.

Display Options

Calibration display settings.



Region

Detection point region

Specify the line width and display color of the region specified in [Detected Points] (Page 4-261) in the [Settings] menu.

Calibrated image region

Specify the line width and display color of the region specified in the [Calibrated Image] menu.

Detected point

Specify the width and display color of the detected datum points for calibration.

Axis

Horizontal axis

Specify the line width and display color of the X axis displayed at the origin.

Vertical axis

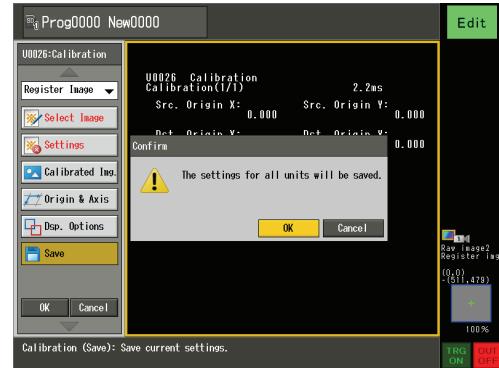
Specify the line width and display color of the Y axis displayed at the origin.

Save

Save the current unit changes in the program file.

► Note

- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller 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.

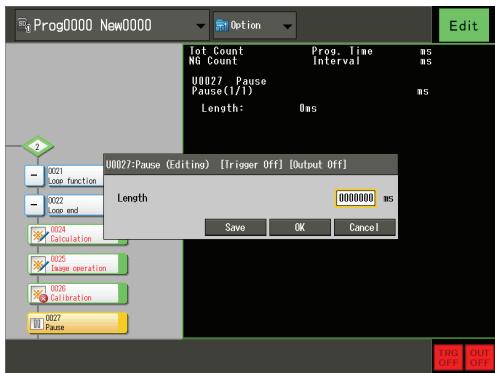
For example, variable values changed in the current program or the default screen display, and display parts, can be excluded when saving.

Pause

The pause unit stops the flowchart operation for a specified period of time.

Pause

Specify the condition for the pause.



Length

The length of time (0 to 3600000ms, default 0) of the pause.

Save

Save the current unit changes the program file.

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

▶ Note

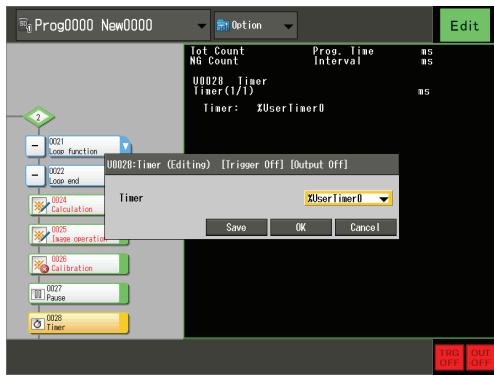
- Items specified not to be saved in XG VisionEditor are excluded from the saving operation.
- For example, variable values changed in the current program or the default screen display, and display parts, can be excluded when saving.
- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller while you are saving the settings. Doing so may cause errors in the internal data.

Timer

The timer unit starts counting up a specified timer (%UserTimer0 to 7) and is used with the timer setup unit (Page 4-269) to control processing based on elapsed time.

Timer

Specify the timer.



Timer

Specify the timer (system variable) to be used %UserTimer0 to 7.

The timer activates with execution of the timer unit. The elapsed time (in ms) of the timer once activated can be checked by referencing a specified variable.

▶ Note

- The timer is reset by the following operations:
 - Turning off the controller
 - Changing program No.
 - Resetting the inspection
 - Executing another timer unit in which the same timer is specified
- When the timer reaches 1073741824 ms after activation, its value returns to 0 and the time monitoring continues.

Save

Save the current unit changes the program file.

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 screen display, and display parts, can be excluded when saving.
- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller while you are saving the settings. Doing so may cause errors in the internal data.

Timer Setup

The timer setup unit stops the flowchart operation until the value of the activated timer (setup in the timer unit (Page 4-268)) reaches a set duration. These two units combined can be used to keep the processing time of sections of the flowchart to a constant.

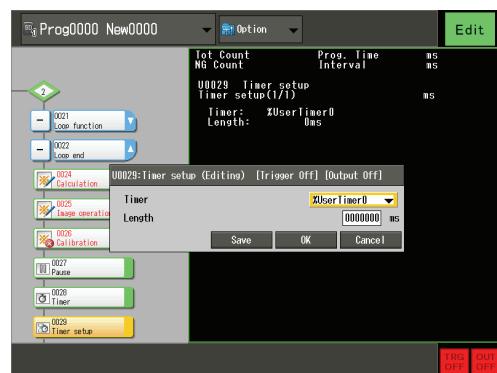
Major results

The major results provided by the timer setup unit are as follows:

Status	The status of the specified timer can be referenced, 1 being output when the timer has been activated and the expiration passed, 0 at all other times.
---------------	--

Timer Setup

Specify the conditions for timer expiration.



Timer

Specify the timer (system variable) used in the timer unit to be associated with this timer setup unit.

Length

The length of time (0 to 3600000ms, default 0) for the timer expiration.

Reference

If the timer value is greater than the length specified when the timer setup unit is processed, processing of the rest of the flowchart continues.

Save

Save the current unit changes the program file.

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 screen display, and display parts, can be excluded when saving.
- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller while you are saving the settings. Doing so may cause errors in the internal data.

Wait Terminal I/O

The terminal I/O delay unit delays the flowchart operation until the status of the input terminal(s) matches the set conditions. This unit can be used to synchronize the processing with external devices and inputs.

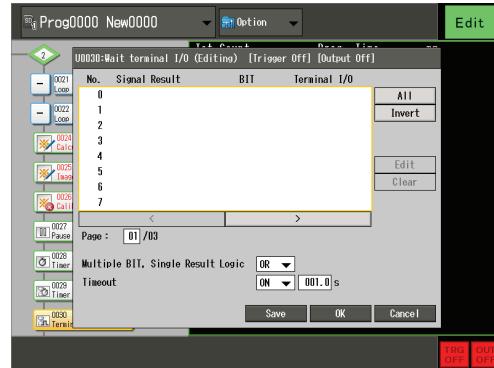
Major Results

The major results provided by the wait terminal I/O unit are as follows:

Status	The status of the unit based on the time-out condition can be referenced, 1 being output when the time-out has occurred and the delay function cancelled, 0 at all other times.
Judge No.	The output No. of the matched condition can be referenced. When [AND] is selected, the smallest condition No. is output.
Logical OR of Satisfied Conditions	The decimal equivalent of the logical bit sum of the conditions can be referenced. With the LSB set to condition No. 0, MSB set to condition No. 19, and a matched condition equalling a binary 1.

Wait Terminal I/O

Specify conditions for the status matching of specified terminals.



Terminal setting

Assign a condition No. (0-19) for pausing the operation unless the parameters set are satisfied.

Edit

Specify the parameters for the condition No.

Signal Result

Select the system variable to be evaluated

Reference

Selectable system variables are those assigned to input (IN) terminals or to CC-Link bit devices (RY). Refer to the XG VisionEditor Reference Manual (Control/Data Edition) for more details.

BIT

Select the bit of the system variable to be used in evaluation.

Terminal I/O

If the system variable specified in [Signal Result] is assigned to a bit device (RY) in the [CC-Link] settings (Page 5-30) or to a terminal in the [Parallel Port] settings (Page 5-22), the name of the assigned terminal is displayed.

► Note

The system variable has to be pre-assigned to an input (IN) terminal or CC-Link bit device (RY) otherwise an error will occur.

Signal Type/Direction

Select the type of signal to be evaluated in [Signal Type], and then specify the state in [Direction].

- **Rising / Falling Edge:** Select the signal transition type as the condition:
 - **OFF → ON:** Use the rising edge of the signal.
 - **ON → OFF:** Use the falling edge of the signal.
 - **Both:** Use both rising and falling edges of the signal.
- **Level:** Select the current signal state as the condition.
 - **ON:** Use the ON state of the signal.
 - **OFF:** Use the OFF state of the signal.

Multiple BIT, Single Result Logic

If several terminals are specified in the conditions to delay the processing, select a compound condition for final judgment.

- **OR** (Default): Use the logical (OR) sum of the specified conditions. If at least one condition is satisfied, the flowchart processing continues.
- **AND**: Obtain the logical (AND) product of the specified conditions. If all conditions are satisfied, the flowchart processing continues. (If at least one condition is not satisfied, the delay is still in effect.)

▶ Note

The multiple BIT, single result logic setting is fixed to [OR] if there are two or more conditions using [Rising / Falling Edge] in [Signal Type].

Timeout

For time sensitive processing a time-out can be used to specify a time (0.1 to 600.0s) to wait for the conditions to be satisfied.

- **ON** (Default): Wait for the 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**: 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

Save the current unit changes the program file.

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 screen display, and display parts, can be excluded when saving.
- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller while you are saving the settings. Doing so may cause errors in the internal data.

Variable Delay

The variable delay unit delays the flowchart operation until the value of the specified variable(s) matches the set conditions. This unit can be used to synchronize processing with the changing of variables externally.

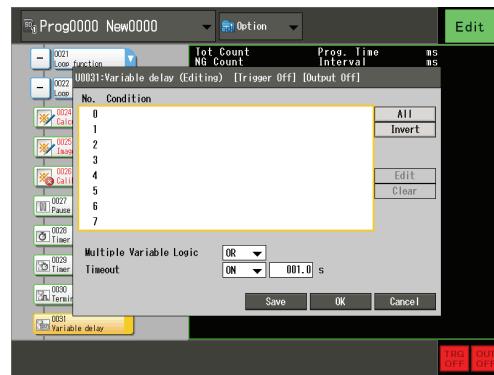
Major results

The Major results provided by the variable delay unit are as follows:

Status	The status of the unit based on the time-out condition can be referenced, 1 being output when the time-out has occurred and the delay function cancelled, 0 at all other times.
Judge No.	The output No. of the matched condition can be referenced. When [AND] is selected, the smallest condition No. is output.
Logical OR of Satisfied Conditions	The decimal equivalent of the logical bit sum of the conditions can be referenced. With the LSB set to condition No. 0, MSB set to condition No. 7, and a matched condition equalling a binary 1.

Variable Delay

Specify conditions for the matching of specified variables.



Edit

Specify the parameters for the condition No.

Condition

Select from the one of the 14 different condition equations for the variable to match:

- Variable = Cond.1
- Variable <> Cond.1
- Variable > Cond.1
- Variable < Cond.1
- Variable >= Cond.1
- Variable <= Cond.1
- Cond.1 < Variable < Cond.2
- Cond.1 <= Variable < Cond.2
- Cond.1 < Variable <= Cond.2
- Cond.1 <= Variable <= Cond.2
- Variable < Cond.1 OR Cond.2 < Variable
- Variable <= Cond.1 OR Cond.2 < Variable
- Variable < Cond.1 OR Cond.2 <= Variable
- Variable <= Cond.1 OR Cond.2 <= Variable

Variable

Select a variable to be evaluated against the conditions.

► Note

A numerical value can not be entered directly in the variable setting.

Cond.1/Cond.2

Select a variable or input a numerical value to be used for [Cond.1] and or [Cond.2] as specified in [Condition].

Multiple Variable Logic

If several variables are specified in the conditions to delay the processing, select a compound condition for final judgment.

- **OR** (Default): Use the logical (OR) sum of the specified conditions. If at least one condition is satisfied, the flowchart processing continues.
- **AND**: Use the logical (AND) product of the specified conditions. If all conditions are satisfied, the flowchart processing continues. (If at least one condition is not satisfied, the delay is still in effect.).

Timeout

For time sensitive processing a time-out can be used to specify a time (0.1 to 600.0s) to wait for the conditions to be satisfied.

- **ON** (Default): Wait for the 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 variable(s).
- **OFF**: 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

Save the current unit changes the program file.

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 screen display, and display parts, can be excluded when saving.
- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller while you are saving the settings. Doing so may cause errors in the internal data.

User menu

The user menu unit delays the flowchart operation until the specified menu is closed. This unit can be used to synchronize the processing of the flowchart with user interaction for such operations like re-writing setting values.

Reference

When the menu specified is opened, the result of flowchart processing so far is applied to the screen display. After that, the screen display is updated every time a value is changed in the menu.

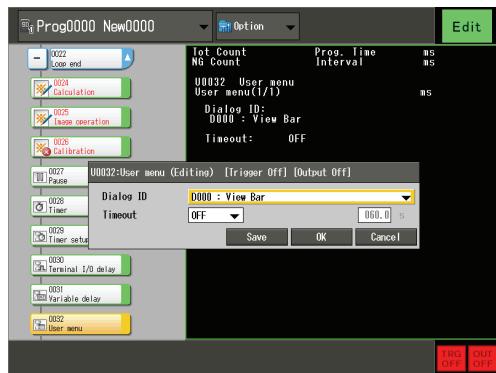
Major results

The major results provided by the user menu unit are as follows:

Status	The status of the unit based on the time-out condition can be referenced, 1 being output when the time-out has occurred and the delay function cancelled, 0 at all other times.
---------------	---

User Menu

Specify conditions for the menu.



Menu ID

Select the menu ID of the menu to be referenced.

Note

If a menu is selected that cannot be closed with the handheld controller, the menu needs to be closed with a command or via the time-out setting. For more details on the menu setting, refer to the XG VisionEditor Reference Manual (Programming Edition).

Timeout

For time sensitive processing a time-out can be used to specify a time (0.1 to 600.0s) to wait for the conditions to be satisfied.

- **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

Save the current unit changes the program file.

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 screen display, and display parts, can be excluded when saving.
- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller while you are saving the settings. Doing so may cause errors in the internal data.

On-screen Graphics

On-screen Graphics Unit

The on-screen graphics unit allows up to 32 graphics / text to be displayed on screen based on the 8 different types of graphic and 4 types of text available.

As this unit supports the referencing of result data and or variables (including arrays) it can be used to display results of other units or numerical data contained in a variable or an array at a specified position on the screen.

Reference

For details on the graphics display using an array variable, refer to "Using arrays for display multiple graphics" (Page 4-288).

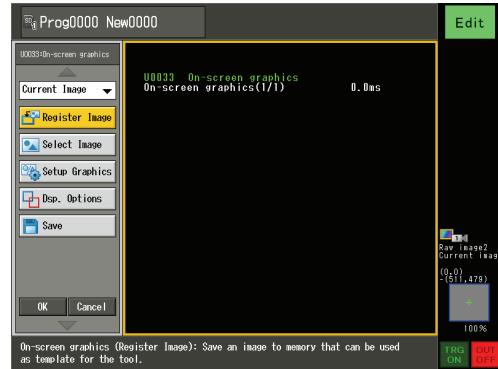
Sample display



Example of result data being displayed for several stains detected by the stain unit (Page 4-122) at various positions in accordance with the detected stain position using the [Value] style (Page 4-285).

Top Menu Layout

The on-screen graphics unit menus have the following structure. Change the settings as required.



Register Image
(Page 4-276)

Registration of an image to be used as a template for on-screen graphics display.

Select Image
(Page 4-277)

Specify a current image and a registered image used for on-screen graphics display.

Setup Graphics
(Page 4-278)

Set the graphics and text to display.

Dsp. Options
(Page 4-279)

Graphics and text display settings.

Save
(Page 4-290)

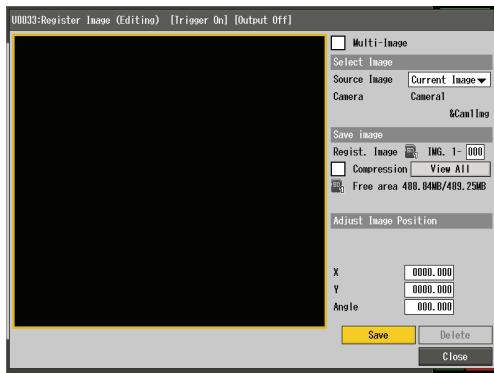
Save on-screen graphic settings.

Reference

You can change the image to display as a background at the upper left section of the screen. (The on-screen graphics unit displays [Current Image] as the initial image.)

Register Image

Registration of an image to be used as a template for on-screen graphics display. It is recommended to carefully adjust lighting and other conditions before registering an image.



Multi-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 5-17).
- When multi-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.
- The image variable used for the select image of the vision tools unit should be the same as the image variable used for the capture unit being executed. When the image capture buffer is set to custom, the image variable which contains the image of the capture unit executed most recently will be displayed.

Select Image

Source Image

Select an image to register.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Save Image] is displayed.

Save Image

Number

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

Compression

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

There may be some deterioration in image quality due to compression. Inspection results when using a compressed image may differ from results when using an uncompressed image.

Adjust Image Position

Adjust the position of the image being captured.

X

Adjust the movement in the X (horizontal) direction between -2432.000 and 2432.000 pixels.

Y

Adjust the movement in the Y (vertical) direction between -2050.000 and 2050.000 pixels.

Angle

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

Reference

When you select [Current Image] as the source image for the unit for which the position adjustment ID has been specified in [Inspect Region] (Page 4-31), you can select [Pos. Adjust. value] as well as [Number Input]. This option is useful because even when the image capture position deviates, the current image is automatically adjusted using the adjustment value based on the reference unit. However, note that when [Pos. Adjust. value] is selected in the state where a proper adjustment value cannot be measured for the current image, the position used for registration may be incorrect.

▶ Note

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

Save

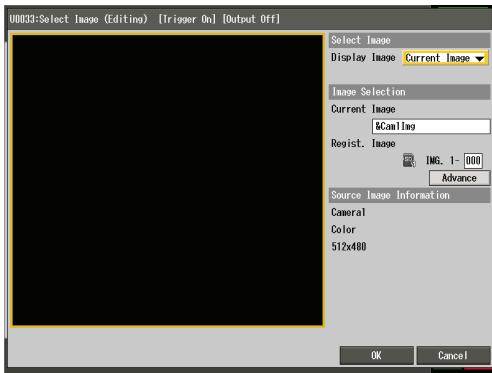
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Regist. Image] is selected for [Source Image], you can delete the registered image specified under [Save Image].

Select Image

Specify a current image and a registered image used for on-screen graphics display.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Image Selection

Current Image

Set an image variable to be used as a current image for the unit.

Regist. Image

Specify the registered image to be used as a template.

- 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.

- **Assign variables to registered image No.:** To use a variable for the registered image No., check this box and assign a scalar or scalar 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. See the XG VisionEditor Reference Manual (Control/Data Edition) for more details.

- **Assign variables only when changing programs:** Use this option to switch 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

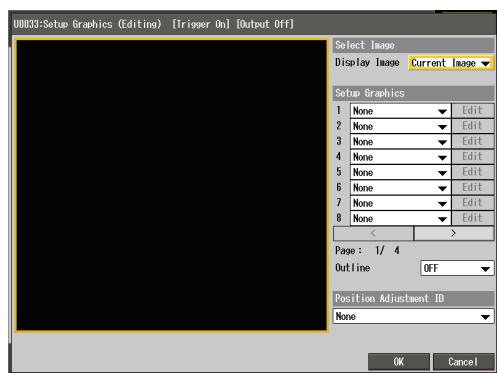
Note that the displayed registered image No. does not switch in accordance with a change in the variable.

Source Image Information

The camera No., type (color / monochrome), and resolution of the camera associated to the image variable specified is displayed.

Setup Graphics

Set the graphics and text to display.



Select Image

Display Image

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Setup Graphics

Specify up to 32 graphics or text blocks to be displayed from the following:

- **None:** No on-screen graphics.
- **Rectangle:** Display a rectangle, select [Edit] to specify parameters such as position and size (Page 4-280).
- **Rotated Rectangle:** Display a rotated rectangle, select [Edit] to specify parameters such as position, size, and angle (Page 4-281).
- **Circle:** Display a circle, select [Edit] to specify parameters such as position and size (Page 4-281).
- **Oval:** Display an oval, select [Edit] to specify parameters such as position, size, and angle (Page 4-282).
- **Ring:** Display a ring, select [Edit] to specify parameters such as position and size (Page 4-282).
- **Arc:** Display an arc, select [Edit] to specify parameters such as position, size, and start/end angles (Page 4-283).

- **Point:** Display a point / crosshair, select [Edit] to specify parameters such as display, size, and angle (Page 4-283).
- **Line:** Display a line, select [Edit] to specify parameters such as position and tilt angle (Page 4-284).
- **Text:** Display specified text, select [Edit] to specify parameters such as position and contents (Page 4-285).
- **Value:** Display a numerical value, select [Edit] to specify parameters such as position and contents (Page 4-285).
- **Active Text:** Display text from a predefined table based on matching conditions, select [Edit] to specify parameters such as position and contents (Page 4-286).
- **OCR:** Display a character string converted from ASCII codes (decimal), select [Edit] to specify parameters such as position and contents (Page 4-287).

Reference

You can change the line of the currently selected graphic or text one line upward or downward by holding down the No.1 (FUNCTION) button on the handheld controller and moving up or down.

Edit

Set the display parameters for the selected graphic or text. Refer to "Individual Graphic Settings" (Page 4-280) for more details.

Reference

As graphics and text are displayed in sequence based on the line number, so the graphic or text on the bottom line is displayed on top of the others.

Outline

Specify whether to show the outline of the area of the graphic. This option is useful for the alignment of graphics as the display range of a text or value is shown based on the maximum number of characters / digits.

Note

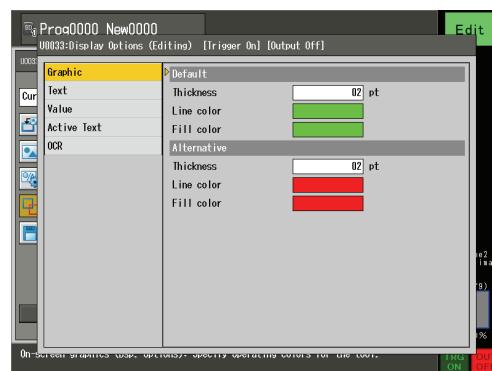
The outline is only shown when changing settings in the [Setup Graphics] menu.

Position Adjustment ID

To use position adjustment, specify the unit to be referenced.

Display Options

Graphics and text display settings.



Reference

The enlarging / reducing (zooming) of the image affects the displaying of the graphics and text as follows:

- Text: The size remains fixed regardless of the level of magnification.
- Point / Crosshair: The size of the point can be associated to enlarge / reduce with the level of magnification or remain fixed.
- Other graphics: The size of the graphic is associated to enlarge / reduce with the level of magnification.

For more details on the zoom function, refer to the XG VisionEditor Reference Manual (Programming Edition).

Graphic

Specify the line width, display, and fill color of the on-screen graphics.

Text

Specify the size, normal and alternative display color, and character edge color for the text displayed (Page 4-285).

Use these settings for other on-screen text graphics.

With this option checked, the settings for the text will also be applied to Value, Active Text, and OCR on-screen graphics (Default: ON).

Value

Specify the size, normal and alternative display color, and character edge color for the value displayed (Page 4-285).

Active Text

Specify the size, normal and alternative display color, and character edge color for the text displayed (Page 4-286).

▶ Note

Style settings made in the [Display Options] menu override the style settings (normal, alternative and outline color) in the active text display table.

OCR

Specify the size, normal and alternative display color, and character edge color for the text displayed (Page 4-287).

Individual Graphic Settings

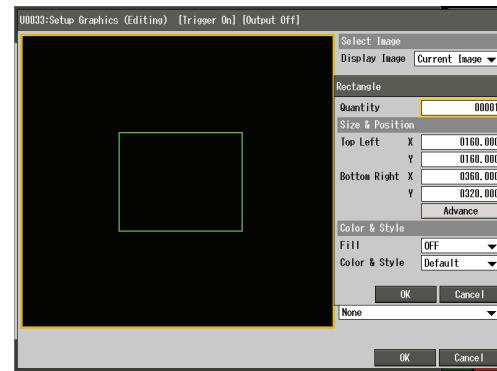
To change the display settings of each graphic or text, select [Edit] in the [Setup Graphics] menu (Page 4-278).

Reference

[Advance] allows the setting of position offsets and rotation for each graphic or text individually (Page 4-288).

Rectangle

Rectangle display settings.



Quantity

Specify the number of rectangles to display at the same time (0 to 10000).

Top Left

Specify the X,Y position coordinates of the top left corner of the rectangle.

Bottom Right

Specify the X,Y position coordinates of the bottom right corner of the rectangle.

Fill

Choose whether to fill the inside of the rectangle and make it solid.

- **ON:** Fill the rectangle. The fill color can be specified in the [Display Options] menu (Page 4-279).
- **OFF (Default):** Display outline only.

Color & Style

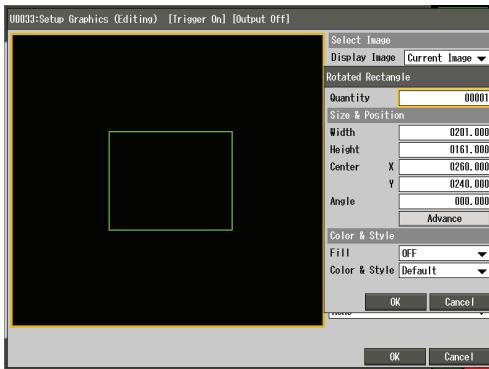
Choose the display style specified in the [Display Options] menu (Page 4-279) from [Default] or [Alternative].

Reference

If the unit is assigned to the system variable %JgAll, the display style will be switched according to the total judgment status: [Default] for OK (Pass) and [Alternative] for NG (Fail).

Rotated Rectangle

Rotated rectangle display settings.



Quantity

Specify the number of rotated rectangles to display at the same time (0 to 10000).

Width

Specify the width of the rotated rectangle.

Height

Specify the height of the rotated rectangle.

Center

Specify the center X,Y position coordinates of the rotated rectangle.

Angle

Specify the rotation angle of the rotated rectangle.

Fill

Choose whether to fill the inside of the rotated rectangle and make it a solid.

- **ON**: Fill the rotated rectangle. The fill color can be specified in the [Display Options] menu (Page 4-279).
- **OFF** (Default): Display outline only.

Color & Style

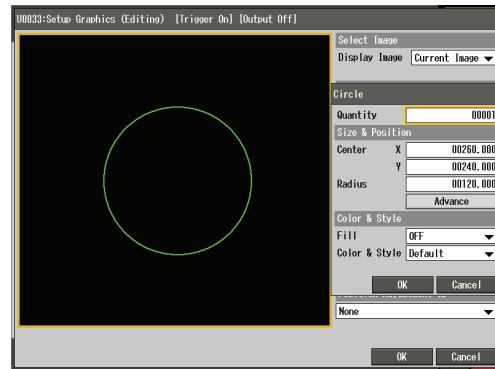
Choose the display style specified in the [Display Options] menu (Page 4-279) from [Default] or [Alternative].

Reference

If the unit is assigned to the system variable %JgAll, the display style will be switched according to the total judgment status: [Default] for OK (Pass) and [Alternative] for NG (Fail).

Circle

Circle display settings.



Quantity

Specify the number of circles to display at the same time (0 to 10000).

Center

Specify the center X,Y position coordinates of the circle.

Radius

Specify the radius of the circle.

Fill

Choose whether to fill the inside of the circle and make it a solid.

- **ON**: Fill the inside of the circle. The fill color can be specified in the [Display Options] menu (Page 4-279).
- **OFF** (Default): Display outline only.

Color & Style

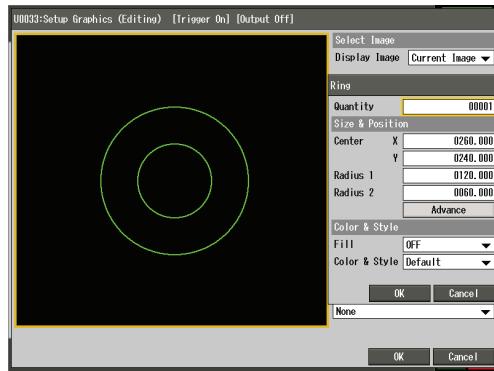
Choose the display style specified in the [Display Options] menu (Page 4-279) from [Default] or [Alternative].

Reference

If the unit is assigned to the system variable %JgAll, the display style will be switched according to the total judgment status: [Default] for OK (Pass) and [Alternative] for NG (Fail).

Ring

Ring display settings.



Quantity

Specify the number of rings to display at the same time (0 to 10000).

Center

Specify the center X,Y position coordinates of the ring.

Radius 1

Specify the radius of the outer ring.

Radius 2

Specify the radius of the inner ring.

Reference

Radius 1 and Radius 2 are interchangeable and can be used for either the inner or outer ring.

Fill

Select whether to fill the inside of the ring and make it a solid.

- **ON**: Fill the inside of the ring. The fill color can be specified in the [Display Options] menu (Page 4-279).
- **OFF** (Default): Display outline only.

Color & Style

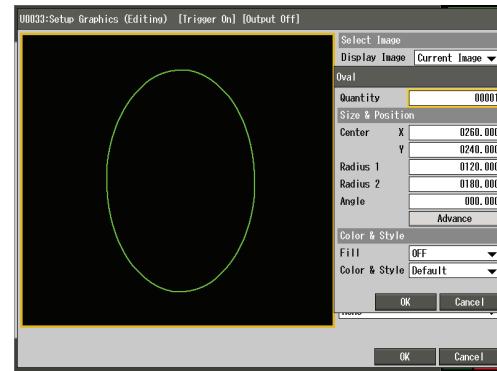
Choose the display style specified in the [Display Options] menu (Page 4-279) from [Default] or [Alternative].

Reference

If the unit is assigned to the system variable %JgAll, the display style will be switched according to the total judgment status: [Default] for OK (Pass) and [Alternative] for NG (Fail).

Oval

Oval display settings.



Quantity

Specify the number of ovals to display at the same time (0 to 10000).

Center

Specify the center X,Y position coordinates of the oval.

Radius 1

Specify either the major radius or minor radius of the oval.

Radius 2

Specify either the major radius or minor radius of the oval.

Angle

Specify the rotation angle of the oval.

Fill

Select whether to fill the inside of the oval and make it a solid.

- **ON**: Fill the inside of the oval. The fill color can be specified in the [Display Options] menu (Page 4-279).
- **OFF** (Default): Display outline only.

Color & Style

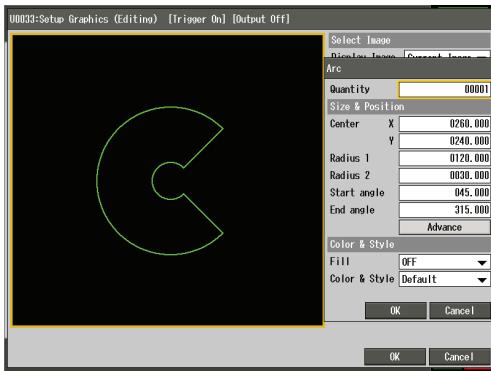
Choose the display style specified in the [Display Options] menu (Page 4-279) from [Default] or [Alternative].

Reference

If the unit is assigned to the system variable %JgAll, the display style will be switched according to the total judgment status: [Default] for OK (Pass) and [Alternative] for NG (Fail).

Arc

Arc display settings.



Quantity

Specify the number of arcs to display at the same time (0 to 10000).

Center

Specify the center X,Y position coordinates of the arc.

Radius 1

Specify the radius of the outer arc.

Radius 2

Specify the radius of the inner arc.

Reference

Radius 1 and Radius 2 are interchangeable and can be used for either the inner or outer arc.

Start angle

Specify the start angle of the arc.

End angle

Specify the end angle of the arc.

Fill

Select whether to fill the inside of the arc and make it a solid.

- **ON:** Fill the inside of the arc. The fill color can be specified in the [Display Options] menu (Page 4-279).
- **OFF** (Default): Display outline only.

Color & Style

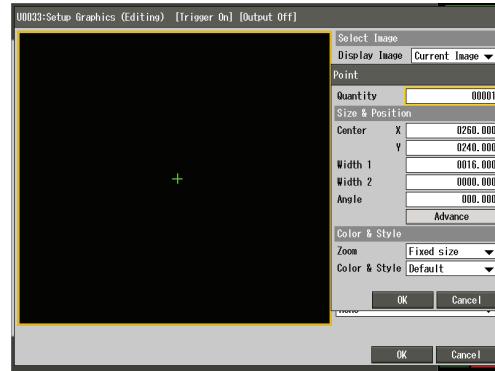
Choose the display style specified in the [Display Options] menu (Page 4-279) from [Default] or [Alternative].

Reference

If the unit is assigned to the system variable %JgAll, the display style will be switched according to the total judgment status: [Default] for OK (Pass) and [Alternative] for NG (Fail).

Point

Point / Crosshair display settings.



Quantity

Specify the number of points / crosshairs to display at the same time (0 to 10000).

Center

Specify the center X,Y position coordinates of the point / crosshair.

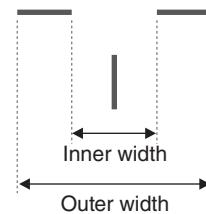
Width 1

Specify the outer width of the point / crosshair.



Width 2

Specify the inner width of the point / crosshair.



Reference

Width 1 and Width 2 are interchangeable and can be used for either the inner or outer width.

Angle

Specify the rotation angle of the point / crosshair.

Zoom

Choose whether to change the size of the point / crosshair to the image magnification.

- **ON:** Correlate with image magnification.
- **Fixed size** (Default): Fixed size.

Color & Style

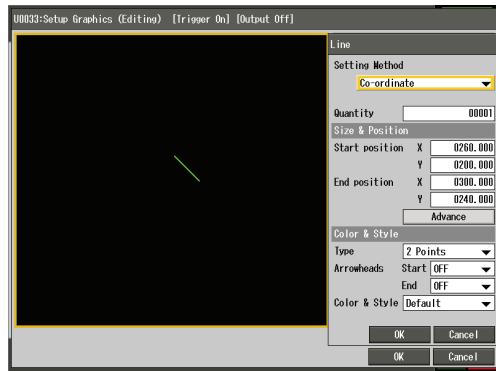
Choose the display style specified in the [Display Options] menu (Page 4-279) from [Default] or [Alternative].

Reference

If the unit is assigned to the system variable %JgAll, the display style will be switched according to the total judgment status: [Default] for OK (Pass) and [Alternative] for NG (Fail).

Line

Line display settings.



Setting Method

Choose the method for making a line.

- **Co-ordinate** (Default): Specify the line from two X,Y coordinates.
- **Rotation about origin**: Specify the line using the distance and angle with respect to the origin.

Quantity

Specify the number of lines to display at the same time (0 to 10000).

Start position

Specify X,Y position coordinates for the start position of the line (when [Co-ordinate] is used for the [Setting Method]).

End position

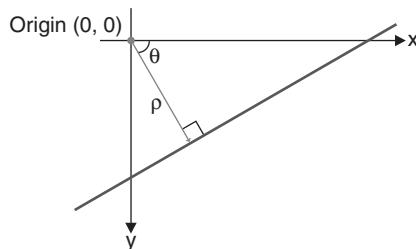
Specify X,Y position coordinates for the end position of the line (when [Co-ordinate] is used for [Setting Method]).

Origin Offset, Angle / Rotation

Specify the origin offset and rotation angle of the line (when [Rotation about origin] is used for the [Setting Method]).

Reference

- **Origin Offset**: The length of a perpendicular line connecting the line to the origin (0, 0)
- **Angle / Rotation**: The clockwise angle of the perpendicular line between the origin and the line (origin offset parameter) (0 to 359.999°, 3 o'clock being 0°).



Type

Select the type of line (when [Co-ordinate] is used for the [Setting Method]).

- **2 Points** (Default): The line goes between the start and end position.
- **Continuous**: The line passes through the start and end position.

Arrowheads

Select ON to add an arrowhead to the start point, end point, or both (when [Co-ordinate] is used for the [Setting Method]).

Color & Style

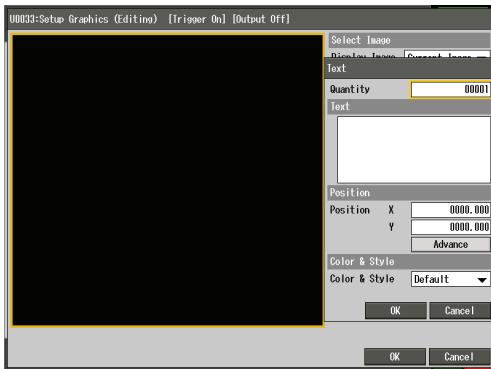
Choose the display style specified in the [Display Options] menu (Page 4-279) from [Default] or [Alternative].

Reference

If the unit is assigned to the system variable %JgAll, the display style will be switched according to the total judgment status: [Default] for OK (Pass) and [Alternative] for NG (Fail).

Text

Text display settings.



Quantity

Specify the number of text strings to display at the same time (0 to 10000).

Text

Input characters (up to 100 single byte, 50 double byte) to be displayed.

Reference

- Tab and line feed cannot be used.
- Spaces can be used and count as one character.

Position

Specify the X,Y position coordinates of the top left corner of the text display area.

Color & Style

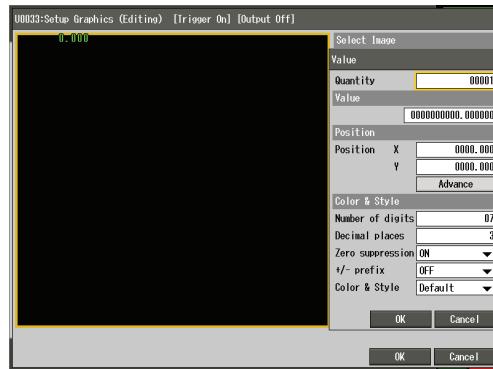
Choose the display style specified in the [Display Options] menu (Page 4-279) from [Default] or [Alternative].

Reference

If the unit is assigned to the system variable %JgAll, the display style will be switched according to the total judgment status: [Default] for OK (Pass) and [Alternative] for NG (Fail).

Value

Value display settings.



Quantity

Specify the number of values to display at the same time (0 to 10000).

Value

Specify the numerical value to display as a graphic.

Position

Specify the X,Y position coordinates of the top left corner of the value display area.

Number of digits

Specify the number of digits (10 digits max.).

Decimal places

Specify the number of decimal places (6 digits max.).

Note

Due to other processes, displaying all 16 digits (10 digits and 6 decimal places) may cause an error in the displayed value.

Zero suppression

Choose whether to remove preceding zeros from the number.

- **ON** (Default): Remove the preceding zeros.
- **OFF**: Include preceding zeros.

Example, when the number of digits is set to 5 and the value is 500, "00500" will be displayed when zero suppression is [OFF], and "500" will be displayed when zero suppression is [ON].

+/− prefix

Choose whether to show a "+" symbol before a positive value.

- **ON**: Show a "+" symbol.
- **OFF** (Default): Hide the "+" symbol.

Color & Style

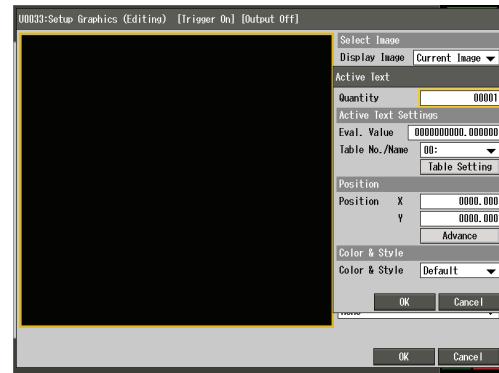
Choose the display style specified in the [Display Options] menu (Page 4-279) from [Default] or [Alternative].

Reference

If the unit is assigned to the system variable %JgAll, the display style will be switched according to the total judgment status: [Default] for OK (Pass) and [Alternative] for NG (Fail).

Active Text

Text display settings for text based on a lookup table.



Quantity

Specify the number of active text strings to display at the same time (0 to 10000).

Eval. Value

Specify a value to be referenced against the table settings.

Table No./Name

Choose a table to be used from the predefined tables.

Table Setting

Show the [Table List] menu for editing a table which stores the different strings of text and associated displaying conditions. Refer To "Creating the active text table" (Page 4-289) for more details.

Position

Specify the X,Y position coordinates of the top left corner of the text display area.

Color & Style

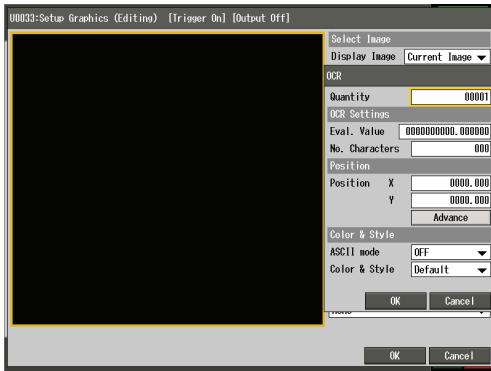
Choose the display style specified in the [Display Options] menu (Page 4-279) from [Default] or [Alternative].

Reference

If the unit is assigned to the system variable %JgAll, the display style will be switched according to the total judgment status: [Default] for OK (Pass) and [Alternative] for NG (Fail).

OCR

Text display settings for text based on decimal to ASCII conversion (Page 4-213).



Quantity

Specify the number of text strings to display at the same time (0 to 10000).

Eval. Value

Specify a decimal number or variable to be converted.

Reference

To display two or more characters, assign a scalar array variable containing the ASCII code (decimal) of each character.

No. Characters

Specify the number of characters to be displayed in the text.

Position

Specify the X,Y position coordinates of the top left corner of the text display area.

ASCII mode

Choose whether to convert decimal numbers to ASCII characters based on the OCR tool conversion which supports user specified characters (1-20) or by using the conventional decimal to ASCII conversion.

- **OFF** (Default): Use the conversion rules of the OCR vision tool.
- **ON**: Use the conventional conversion rules.

Reference

- For more details on the conversion rules of the OCR vision tool refer to the XG VisionEditor Reference Manual (Control/Data Edition). When 32 is specified and the OCR vision tool conversion rules are used * _ is displayed rather than the standard * * (space).
- The supported decimal to ASCII conversion range is 32 to 126 (hex 0x20 to 0x7e). If any other decimal is used a space is displayed.
- When set to [OFF], a single character is displayed in 2 byte fashion and 1 byte is added to numbers, whereas bytes are added when set to [ON]. Thus the displayed length becomes shorter with the [ON] setting even if the contents are the same.

Color & Style

Choose the display style specified in the [Display Options] menu (Page 4-279) from [Default] or [Alternative].

Reference

If the unit is assigned to the system variable %JgAll, the display style will be switched according to the total judgment status: [Default] for OK (Pass) and [Alternative] for NG (Fail).

Using arrays for display multiple graphics

Multiple graphics can be displayed by using data from an array. This is useful for easily displaying of multiple similar or connected items (such as points / crosshairs or converted characters) at once

1 In the [Quantity] field, set the number of graphics to display.

Reference

If the number of graphics fluctuates, assign a local or global variable which contains the quantity from a unit or calculation.

2 In the [Position] field, assign array result data or an array variable which contains the position coordinates to display the graphics.

Note

- When using an array the index should be empty (Example: #A[]). To make an index empty, select [Variable] or [Unit Results] in the [Data Reference] menu (Page 4-312) and specify [*] for the index.
- If the [Quantity] specified is more than one, but no array result data or array variable has been set for the position, all graphics will be displayed at the same position.

3 If necessary, assign array result data or an array variable which contains any data to be referenced to [Eval. Value] or other fields in the same way as in step 2.

Reference

- If an array is assigned, the number of displayed graphics will either be the number of elements of the assigned array or the number specified in [Quantity] whichever is the smaller.
- To display all results of a vision unit even if the detection count fluctuates, assign the result data of the detection count (number of targets detected) in the [Quantity] field.

Applying an offset or rotation to the display position

An offset or rotation can be applied to the specified display position. As the on-screen graphics supports the displaying of multiple graphics, so it is useful to apply the same level of offset to each.

Reference

- The assignment of an array variable for the offset function is also supported. When using an array the index should be empty (Example: #A[]). To make an index empty, select [Variable] or [Unit Results] in the [Data Reference] menu (Page 4-312) and specify [*] for the index.
- If an array is assigned the number of displayed graphics will either be the number of elements of the assigned array or the number specified in [Quantity] which is the smaller.

Offset

Specify the offset from the display position in pixels.

Rotation Center

Set the X,Y absolute position coordinates of the rotation center to apply [Rotation] to before the offset or any position adjustment is applied.

Rotation

Specify the rotation angle around the [Rotation Center].

Reference

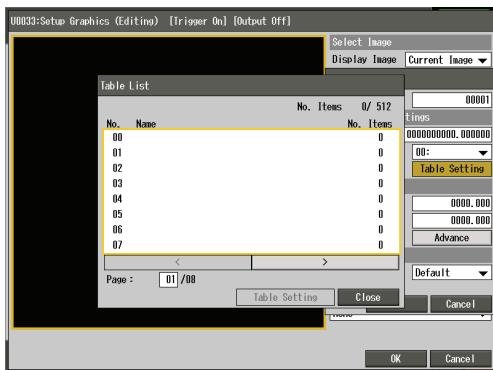
Text, Value, Active Text and OCR do not support rotated display and will remain horizontal regardless of the rotation setting.

Creating the active text table

In the [Table List] menu, you can edit tables which store the different strings of text and associated displaying conditions.

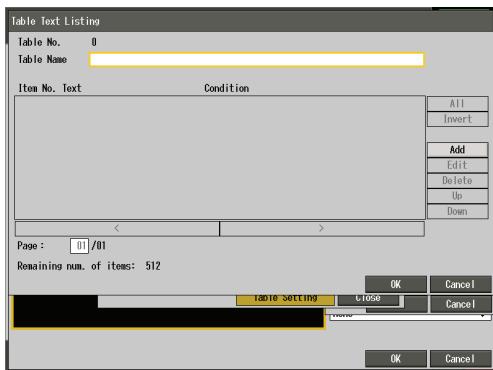
1 In the active text edit menu, select [Table Setting].

The [Table List] menu appears.



2 Select the line of the table No. to edit and then select [Table Setting].

The [Table Text Listing] menu of the selected table appears.



3 Select [Add].

The [Display Condition] menu appears.

4 Edit the conditions for text display.

Text

Input the text (up to 64 single byte, 32 double byte characters) to be displayed when the condition is satisfied.

Lower Limit

Choose either [Enable] or [Disable] and then set the lower limit for the reference value to be greater than or equal to for the text to be displayed.

Upper Limit

Choose either [Enable] or [Disable] and then set the upper limit for the reference value to be less than or equal to for the text to be displayed.

Reference

When a value meets several conditions, such as "Display text "A" when the result is between lower limit 2 and upper limit 2" is set for condition 1" and "Display text "B" when the result is between lower limit 1 and upper limit 10 is set for condition 2" and the measurement value is "2", the smaller condition No. is used. In this example, "Display text "A" when the result is between lower limit 2 and upper limit 2" has higher priority therefore "A" is displayed. However, if the measurement value was not "2" but a value within the range 1 to 10, "B" would be displayed.

5 Select [OK].

The condition specified in step 4 is added.

6 Edit the table details as required.

- **Table Name:** Enter a table name (up to 32 characters).
- **All:** Select all conditions.
- **Invert:** Invert the current selection.
- **Edit:** Edit the selected condition.
- **Delete:** Delete the selected condition.
- **Move Up:** Move the selected condition up one line.
- **Move Down:** Move the selected condition down one line.

Reference

You can change the order of conditions by selecting one condition, holding down the No.1 (FUNCTION) button or No. 7 Back button and then moving up or down.

► Note

Two or more conditions cannot be moved simultaneously.

7 When editing is complete, select [OK].

The changes made to the [Table Text Listing] are reflected and the display returns to the [Table List] menu

8 To edit other tables, repeat steps 2 to 7.

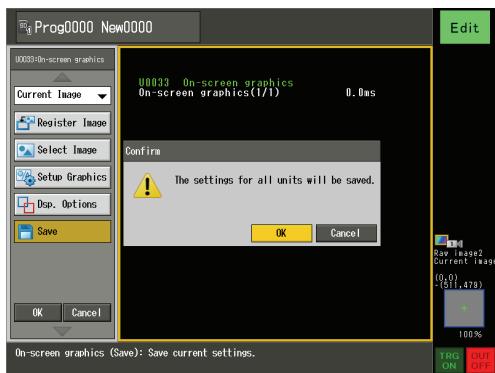
9 When the editing of all tables is complete, select [Close].

Save

Save the current unit changes the program file.

▶ Note

- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller 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 screen display, and display parts, can be excluded when saving.

Parallel Terminal Output

Parameters and settings for outputting data on the parallel I/O connector and terminal block.

Major results

The major results provided by the parallel terminal output unit are as follows:

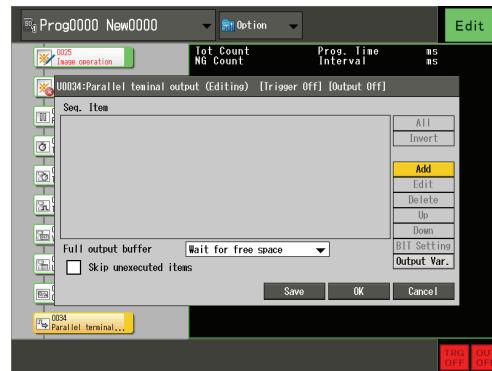
Out Buf.	The remaining space (0 to 100%) of the output buffer after unit execution.
Rest	
Out Buf.	The overflow status of the output buffer can be referenced, 1 being output when the buffer is full during execution of the unit.
Overflow	The behavior of the unit when the buffer overflows is dependent on the unit settings.
Data Transferred	
Data Transferred	The status of the transfer of data to the output buffer can be referenced, 1 being output when the transfer has been completed and 0 if the transfer fails.

▶ Note

If the remaining buffer decreases every time a flowchart unit is executed, the buffer may eventually overflow.

Parallel Terminal Output

Specify the settings for outputting data on the parallel and or terminal I/O. Terminal assignment and settings are linked to the [Parallel Port] settings (Page 5-22). Adjust the parallel port settings first before setting up the parallel terminal output unit.



Output list

Displays a list (8 lines maximum) of the current output data setup in the unit.

Add

Add an item to be output.

When the [Output Item] menu is displayed, choose the type of data or variable to be output and then select the output item or variable.

Reference

If two or more output system variables (%OutDataA to H) are assigned in the [Parallel Port] settings (Page 5-22), the [Output Item Setting] menu is displayed before the [Output Item] menu. Select the output system variable to be used in the [Output Item Setting] menu and then set the appropriate settings in the [Output Item] menu.

Edit

Edit the settings of the selected output item.

When the [Output Item] menu is displayed, choose the type of data or variable to be output and then select the output item or variable.

Delete

Delete the selected output item.

Select [OK] on the confirmation message.

Up/Down

Move the selected output item up / down to change the order of items being output.

Reference

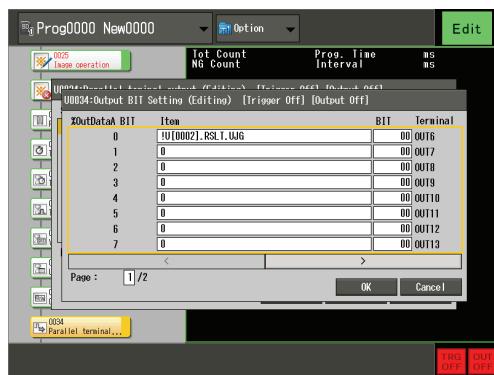
You can change the order of the output data by holding down the No.1 (FUNCTION) button or No. 7 Back button and then moving up or down.

Note

Two or more output items can not be moved simultaneously.

BIT Setting

Use the [Output BIT Setting] menu to set the output data and output system variable bit assignment.



- (System variable name) BIT:** The output system variable assigned to the terminal and its bit position.
- Item:** Specify the result data, variable, or numerical value to be output with reference to the bit of the output system variable.
- BIT:** Specify the data bit of the item to be output with reference to the bit of the output system variable.
- Terminal:** The physical names of the terminals assigned to the specified output variable and bits from the [Global Setting]. For more details on the terminal names and assignment, refer to "Terminal Output Settings (Parallel Port)" (Page 5-22).

Reference

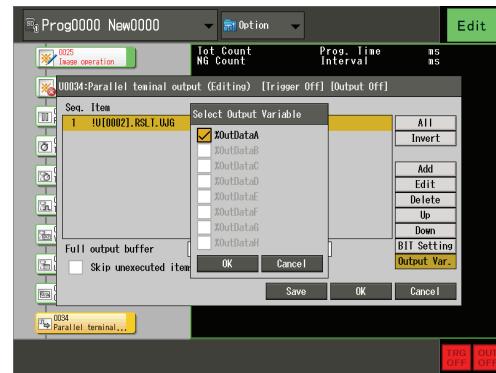
When two or more output system variables (%OutDataA to H) are assigned in the [Parallel Port] settings (Page 5-22), the [BIT Setting] menu is displayed before the [Output BIT Setting] menu. Select the output system variable to be used in the [BIT Setting] menu and then set the appropriate settings in the [Output BIT Setting] menu.

Note

- An output that hasn't been assigned to a terminal cannot be specified.
- Two or more combinations of the same output variable or bit assignment cannot be specified in the same unit.
- If referencing arrays in the [item] field, specify the element of the array to be output (Example: #a[1] for scalar variable data and #b.X for non-scalar variable data).
- Floating point values referenced in the [item] field will be converted into an integer.
- If the [item] field is empty, 0 is used.
- An execution error will occur if invalid result data is specified in the [item] field, and the value of the output with the invalid result data is set to 0.

Output Var.

Use the [Select Output Variable] menu to specify the system variable to be output.



Check the system variable to be output.

Full output buffer

Choose which should have priority when the output buffer becomes full: Image processing or data output.

- Skip output item:** Give priority to image processing and skip the current data waiting to be output.
- Wait for free space:** Give priority to the waiting data and resume image processing after data output is complete.

Reference

The skipping of data can be checked with the [Data Transferred] if the result remains 0 after the output unit execution data was skipped.

Skip unexecuted items

Skip outputting data for items referencing units which were not executed. Refer to "Unit Execution" (Page 5-5) for more details on the [Never Execute] setting of a unit.

Save

Save the current unit changes the program file.

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 screen display, and display parts, can be excluded when saving.
- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller while you are saving the settings. Doing so may cause errors in the internal data.

Data Output

Parameters and settings for outputting data through the following means:

- **SD card**: Specify data to be saved to an SD card.
- **RS-232C**: Specify data to be output via RS-232C.
- **Ethernet**: Specify data to be output via Ethernet (TCP/IP).
- **PLC link**: Specify data to be output via PLC link.
- **CC-Link**: Specify data to be output via CC-Link.
- **PC program**: Specify data to be output to XG VisionTerminal software or for ActiveX Control use.

Major results

The major results provided by the data output unit are as follows:

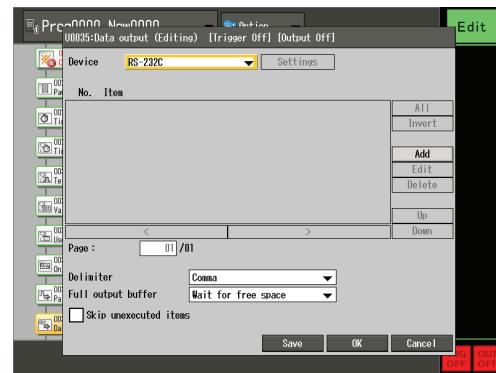
Out Buf.	The remaining space (0 to 100%) of the output buffer after unit execution.
Rest	
Out Buf.	Outputs 1 when the output buffer of the destination becomes full during execution of the data output unit. Behavior of the data output unit when the output buffer becomes full depends on the unit settings.
Data Transferred	Outputs 1 when the data output unit completes data transmission to the output buffer. Outputs 0 when data transmission fails.

▶ Note

If the remaining buffer decreases every time a flowchart unit is executed, the buffer may eventually overflow.

Data Output

Specify the settings for outputting data.



▶ Note

- An execution error will occur if invalid result data is specified in the [Item] field, and the value of the output with the invalid result data is set to 0.
- When [PLC-Link] or [CC-Link] is used for [Device] and [Ln: String] and [Ln: Regist String] result data from the OCR unit (Page 4-213), are specified, changing the character count of the block mode in the Edit Unit menu may change the destination address of the output item.

Device

Choose the destination of the data output.

- **SD Card**: Output data to an SD card.
- **RS-232C**: Output data via RS-232C.
- **Ethernet**: Output data via Ethernet (TCP/IP).
- **PLC-Link**: Output data via PLC link.
- **CC-Link**: Output data via CC-Link.
- **PC Program**: Output data to XG VisionTerminal software or for ActiveX Control use.

▶ Note

- The available destination varies depending on the System Configuration setting (Page 5-1).
- To use the CC-Link, you need to attach the CA-NCL10E CC-Link module to the controller. Refer to "CC-Link Interface" (Page 6-17) for more details.

Reference

Some setting items in the [Data output] menu change depending on the specified destination.

Settings

Displays detailed settings in the [Settings] menu for configuring the data output destination when [SD Card] (Page 4-297), [PC Program] (Page 4-298), [CC-Link] (Page 4-298) or [PLC-Link] (Page 4-297) is selected in [Device].

Output List

Displays a list (256 lines maximum) of the current output data setup in the unit.

Add

Add an item to be output.

When the [Output Item] menu is displayed, choose the type of data or variable to be output and then select the output item or variable.

Edit

Edit the settings of the selected output item.

When the [Output Item] menu is displayed, choose the type of data or variable to be output and then select the output item or variable.

Item

Specify the data to be output such as a variable, unit result data, a string or special characters. To assign a variable or unit result data from an array, specify the index number of the item.

Format

Choose the format for data to be output.

- **Auto**: Output the data using the format of the item specified.
- **Format 1 to 16**: Output the data using a pre-defined format set in the [Data output format setting] menu.
- **Printable Char.**: Output a fixed string.
- **Control Char.**: Output special characters.

▶ Note

If [PLC-Link] or [CC-Link] are selected for [Device], settings are limited as follows:

- If [Printable Char.] or [Control Char.] are selected as the format, the item line is grayed out and the data excluded from the output.
- If [Format 1 to 16] is selected as the format, data is output but not using the pre-determined format setting.

Reference

- If [Auto] is selected, variables are set to "use +/- prefix", "zero suppression: OFF", and "7 integer digits, 3 decimal places".
- For a summary of system variables, setting parameters, and result data, refer to the XG VisionEditor Reference Manual (Control/Data Edition).

Format Setting

Choose the format for data to be output.

When the [Format Setting] menu is displayed, combine the following setting items to define format 1 to 16.

- **+/- prefix**: Use this option to add a + sign to a positive value for output.
- **Zero suppress**: Use this option to suppress leading zeros.
- **Integer digits**: Specify the number of digits (1 to 10) to use.
- **Decimal places**: Specify the number of decimal places (0 to 6) to use.

Quantity

If array data is specified, specify the number of items to be output.

Preview (only available for options other than [PLC-Link] or [CC-Link])

Check the data that will be output based on the quantity and format settings.

DM Address ([PLC-Link] only)

Displays the data memory address of the output device.

RWr Address ([CC-Link] only)

Displays the register address of the destination.

Item Name ([SD Card] or [PC Program] only)

Add a identification header to the output data as desired (40 bytes maximum).

Auto ([SD Card] or [PC Program] only)

Use the definition in [Item] as the [Item Name].

Clear ([SD Card] or [PC Program] only)

Clear settings in [Item Name].

Delete

Delete the selected output item.

Select [OK] on the confirmation message.

Up/Down

Move the selected output item up / down to change the order of items being output.

Reference

You can change the order of the output data by holding down the No.1 (FUNCTION) button or No. 7 Back button and then moving up or down.

▶ Note

Two or more output items can not be moved simultaneously.

Delimiter

Choose the character for separating output data from either a comma, tab, space, or none (no delimiter).

Reference

- A delimiter is not used when [Printable Char.] or [Control Char.] is selected for [Format] (Page 4-295).
- If it is necessary to use a delimiter for [Printable Char.] or [Control Char.], specify a delimiter (TAB, CR, LF, or CR+LF) as a separate item in the output data

Full output buffer

Choose which should have priority when the output buffer becomes full: Image processing or data output.

- **Skip output item:** Give priority to image processing and skip the current data waiting to be output.
- **Wait for free space:** Give priority to the waiting data and resume image processing after data output is complete.

Skip unexecuted items

Skip outputting data for items referencing units which were not executed. Refer to "Unit Execution" (Page 5-5) for more details on the [Never Execute] setting of a unit.

▶ Note

Skip unexecuted items is disabled when [PC Program] is chosen for [Device].

Save

Save the current unit changes the program file.

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

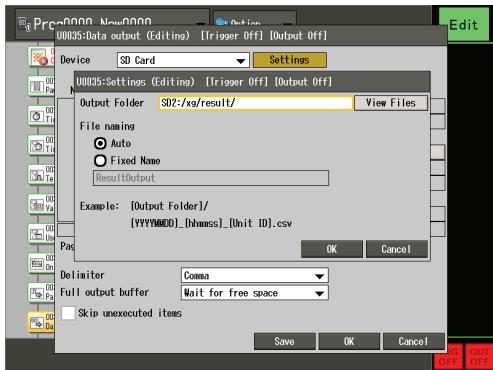
▶ Note

- 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 screen display, and display parts, can be excluded when saving.
- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller while you are saving the settings. Doing so may cause errors in the internal data.

Settings

SD Card

If [SD Card] is chosen for [Device] in the [Data output] menu (Page 4-294), additional settings can be set for controlling the data.



Output Folder

Input the folder path to save the data to.

File naming

Choose the file naming rule for the file saved.

- **Auto** (Default): Name the file as "Data output day (YYYYMMDD)_Time (hhmmss)_Unit ID.csv".
- **Fixed Name**: Name the file with a user-specified file name. If this option is selected, the most recent data is added to the file every time data output is repeated. If [Fixed Name] is selected, input the filename (up to 64 characters).

▶ Note

Illegal filename characters (such as space or period) can not be specified at the beginning of the filename.

Reference

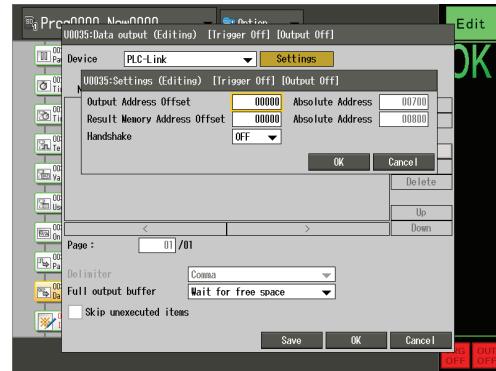
If [Fixed Name] is selected, the file naming rule can be changed via a command. For more details, refer to the description of the OW command in the XG VisionEditor Reference Manual (Control/Data Edition).

PLC-Link

If [PLC-Link] is chosen for [Device] in the [Data output] menu (Page 4-294), additional settings can be set for controlling the data.

Reference

For more details on the PLC link, refer to "PLC-Link Settings (PLC-Link)" (Page 5-25) and "Control/Data Output via PLC-Link" in the XG VisionEditor Reference Manual (Control/Data Edition).



Output Address Offset

Specify the offset from "Data Memory Address" (Page 5-28) for the address to output the result data to. The address which the result data is output to is displayed in the [Absolute Address] field.

▶ Note

If this address is the same as the output address of other data output units, the data will be overwritten.

Result Memory Address Offset

Specify the offset from "Result Memory Address (bit)" (Page 5-28) for the address to output the completion data to. The address which the completion data is output to is displayed in the [Absolute Address] field.

▶ Note

If this address is the same as the output address of other data output units, the data will be overwritten.

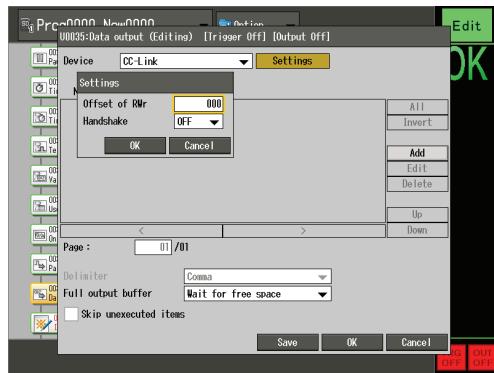
Handshake

Choose whether to use handshaking before outputting result data.

- **ON**: Output result data after the completion of data transfer is confirmed from handshaking.
- **OFF** (Default): Output result data without waiting for completion of data transfer to be confirmed.

CC-Link

If [CC-Link] is chosen for [Device] in the [Data output] menu (Page 4-294), additional settings can be set for controlling the data.



Offset of RWr

Specify the offset from RWr address (RWr000) to output the result data to.

► Note

If this address is the same as the address used by the other data output units or commands used, the operation may be affected. Refer to "Control/Data Output via CC-Link" in the XG VisionEditor Reference Manual (Control/Data Edition) for more details.

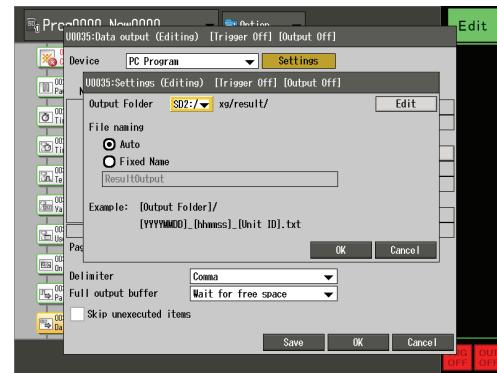
Handshake

Choose whether to use handshaking before outputting result data.

- **ON**: Output result data after the completion of data transfer is confirmed from handshaking.
- **OFF** (Default): Output result data without waiting for the completion of data transfer to be confirmed.

PC Program

If [PC Program] is chosen for [Device] in the [Data output] menu (Page 4-294), additional settings can be set for controlling the data.



Output Folder

Input the folder path to save the data to.

File naming

Choose the file naming rule for the file saved.

- **Auto** (Default): Name the file as "Data output day (YYYYMMDD)_Time (hhmmss)_Unit ID.txt".
- **Fixed Name**: Name the file with a user-specified file name. If this option is selected, the most recent data is added to the file every time data output is repeated. If [Fixed Name] is selected, input the filename (up to 64 characters).

► Note

Illegal filename characters (such as space or period) can not be specified at the beginning of the filename.

Reference

If [Fixed Name] is selected, the file naming rule can be changed via a command OW command. For more details, refer to the description of the OW command in the XG VisionEditor Reference Manual (Control/Data Edition).

Image Output

Parameters and settings for outputting images.

Major processing results

The major results provided by the image output unit are as follows:

Out Buf. Rest The remaining space (0 to 100%) of the output buffer after unit execution.

► Note

Since the image output unit always occupies the output buffer for each unit, this value is always 0%.

Out Buf. Overflow Outputs 1 when the image output unit is executed while another image from the image output unit with the same unit ID is being output through the output port. Behavior of the image output unit outputting an image, depends on the unit settings.

Data Transferred Outputs 1 when the image output unit completes data transmission to the destination. Outputs 0 when the data transmission fails.

Image Output

Specify the settings for outputting images.

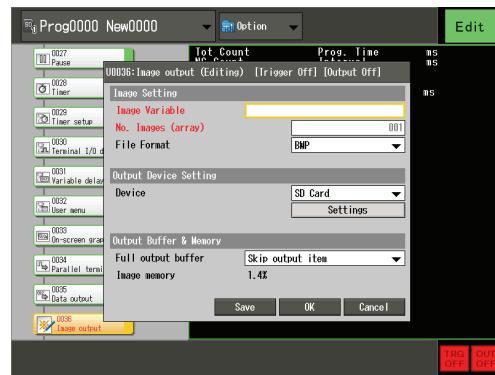


Image Setting

Image Variables

Specify the image variable to be output.

To specify an image from an array specify the index of the image.

No. Images (array)

If an image array is selected, specify the number of images to be output sequentially from the index number specified.

► Note

- If this number exceeds the number of elements of the array an error will occur.
- If the memory is insufficient specifying a number exceeding the capacity will result in an error.

File Format

Choose the file format of the image to be output.

- **BMP** (Default): Output the image in Windows bitmap format (24-bit color for a color camera, 8-bit grayscale for a monochrome camera).
- **BMP(1/2 Resolution)**: Shrink the image to 50% (reducing the number of pixels to half), and then output the image in Windows bitmap format (24-bit color for a color camera, 8-bit grayscale for a monochrome camera).
- **BMP(1/4 Resolution)**: Shrink the image to 25% (reducing the number of pixels to one quarter), and then output the image in Windows bitmap format (24-bit color for a color camera, 8-bit grayscale for a monochrome camera).
- **BMP(1/8 Resolution)**: Shrink the image to 12.5% (reducing the number of pixels to one eighth), and then output the image in Windows bitmap format (24-bit color for a color camera, 8-bit grayscale for a monochrome camera).
- **JPEG**: Compress and output the image in JPEG format.

Output Device Setting

Device

Choose the destination of the image output.

- **SD Card** (Default): Output the image to an SD card.
- **PC Program**: Output the image to the XG VisionTerminal or for use with the ActiveX Control.

▶ Note

An output device has to be selected.

Settings

Displays detailed settings in the [Settings] menu for configuring the image output destination. Refer to "Settings" (Page 4-301) for more details.

Output Buffer & Memory

Full output buffer

Choose which should have priority when the output buffer becomes full: Image processing or data output.

- **Skip output item**: Give priority to image processing and skip the current data waiting to be output.
- **Wait for free space**: Give priority to the waiting data and resume image processing after data output is complete.

Image memory

The current image memory usage is displayed.

Save

Save the current unit changes the program file.

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

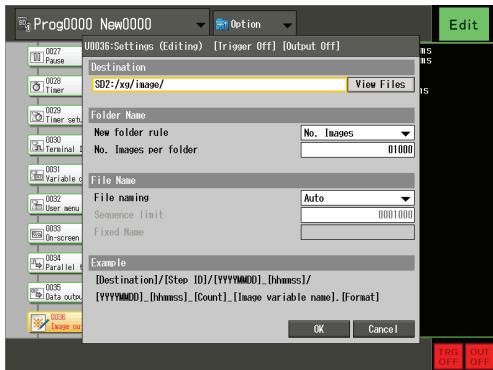
▶ Note

- 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 screen display, and display parts, can be excluded when saving.
- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller while you are saving the settings. Doing so may cause errors in the internal data.

Settings

SD Card

If [SD Card] is chosen for [Device] in the [Image output] menu (Page 4-299), additional settings can be set for controlling the image.



Destination

Input the folder path to save the image to.

New folder rule

Choose the method creating folders for storing batches of images.

- **None:** Save all images to the specified destination folder.
- **No. Images** (Default): When image output starts, a new folder is created and named as "Unit ID_YYYYMMDD_hhmmss" in the folder specified in [Destination]. Images are saved here until [No. Images per folder] is reached. When the number of files stored in the folder exceeds the value specified in [No. Images per folder], a new folder is created and the destination of the image output changes accordingly.
- **Date:** When image output starts a new folder is created and named "Unit ID_YYYYMMDD" in the folder specified in [Destination]. Images are saved here until the date changes. When the date changes, a new folder is created and the destination of the image output changes accordingly.

File naming

Choose the file naming rule for the files saved.

- **Auto** (Default): Name the file as "Image output day (YYYYMMDD)_Time (hhmmss)_Measurement count_Image variable.Format".
- **Sequential:** Name the file as "Sequential number_Fixed name_Image variable.Format". Specify the maximum sequential number in the [Sequence limit] field and the name in [Fixed Name] (up to 64 characters) respectively. When the sequential number exceeds the maximum value, the number returns to 0. If [New folder rule] is set to [None] or [Date], and the value set for [No. Images] is larger than the maximum sequential number, images maybe overwritten.

► Note

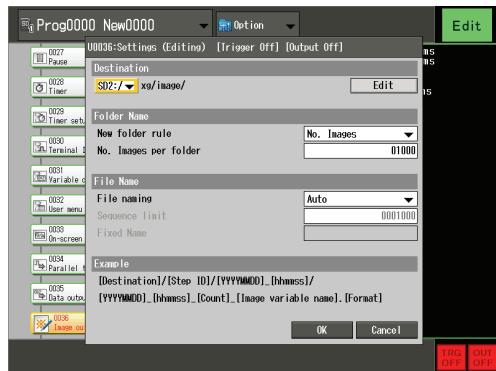
- If [Auto] is selected and the image output is repeated within 1 s, the output file is overwritten.
- If the [Sequence limit] is smaller than the value set for [No. Images] of [New folder rule], a new folder will not be created regardless of the [New folder rule] setting.

Reference

If [Sequential] is selected, the fixed name for the file naming rule can be changed via a command. For more details, refer to the description of the OW command in the XG VisionEditor Reference Manual (Control/Data Edition).

PC Program

If [PC Program] is chosen for [Device] in the [Image output] menu (Page 4-299), additional settings can be set for controlling the image.



Reference

Settings in the [Settings] menu are applied to the virtual SD drive, controlled by the PC programs: XG VisionTerminal and ActiveX Control.

Destination

Input the folder path to save the image to.

New folder rule

Choose the method creating folders for storing batches of images.

- **None:** Save all images to the specified destination folder.
- **No. Images** (Default): When image output starts, a new folder is created and named as "Unit ID_YYYYMMDD_hhmmss" in the folder specified in [Destination]. Images are saved here until [No. Images per folder] is reached. When the number of files stored in the folder exceeds the value specified in [No. Images per folder], a new folder is created and the destination of the image output changes accordingly.
- **Date:** When image output starts a new folder is created and named "Unit ID_YYYYMMDD" in the folder specified in [Destination]. Images are saved here until the date changes. When the date changes, a new folder is created and the destination of the image output changes accordingly.

File naming

Choose the file naming rule for the files saved.

- **Auto** (Default): Name the file as "Image output day (YYYYMMDD)_Time (hhmmss)_Measurement count_Image variable.Format".
- **Sequential:** Name the file as "Sequential number_Fixed name_Image variable.Format". Specify the maximum sequential number in the [Sequence limit] field and the name in [Fixed Name] (up to 64 characters) respectively. When the sequential number exceeds the maximum value, the number returns to 0. If [New folder rule] is set to [None] or [Date], and the value set for [No. Images] is larger than the maximum sequential number, images maybe overwritten.

Note

- If [Auto] is selected and the image output is repeated within 1 s, the output file is overwritten.
- If the [Sequence limit] is smaller than the value set for [No. Images] of [New folder rule], a new folder will not be created regardless of the [New folder rule] setting.

Reference

If [Sequential] is selected, the fixed name for the file naming rule can be changed via a command. For more details, refer to the description of the OW command in the XG VisionEditor Reference Manual (Control/Data Edition).

Command

The command unit is used to issue commands from the flowchart to cause a controller based operation.

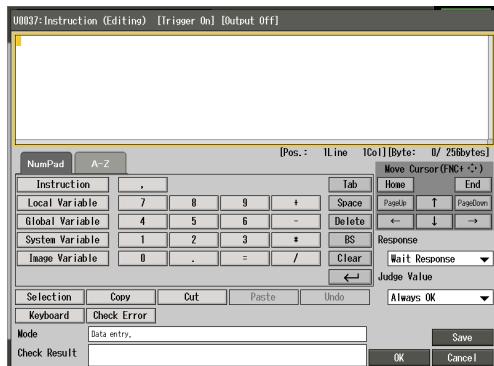
Major results

The major results provided by the command unit are as follows:

Command	If an error occurs during processing a command 1 is generated, all other times 0 is generated.
► Note	
	The output is only available when [Response] is set to [Wait Response] and [Judge Value] is set to [Command Result]. When other settings are used the output is always 0.

Instruction

Specify the command and condition for the response.



Command Area

Select a command.

- A standard instruction or a user-defined custom instruction can be used. Refer to the XG VisionEditor Reference Manual (Control/Data Edition) for more details.
- Numerical values or variables can be specified as arguments for instructions.
- To use two or more standard instructions, separate them with a line feed.
- In a single command unit, up to 16 standard instructions or one custom instruction can be issued.
- The overall command can be a maximum of 256 characters. A line feed is counted as two characters.

Reference

- For more details on the commands/instructions available with the command unit, refer the XG VisionEditor Reference Manual (Control/Data Edition).
- For details default custom commands, refer to "List of Custom Commands" (Page 8-89).

Instruction

Select this option to enter a command.

When the [Instruction] menu is displayed, select the type of command required. For more details on the setting parameters associated with this command, refer to the XG VisionEditor Reference Manual (Control/Data Edition).

Local Variable

Select this option to use a local variable in the command. When the [Local Variable] menu is displayed, select the local variable to be used.

Global Variable

Select this option to use a global variable in the command. When the [Global Variable] menu is displayed, select the global variable to be used.

System Variable

Select this option to use a system variable in the command.

When the [System Variable] menu is displayed, select the system variable to be used.

Image Variable

Select this option to use an image variable in the command.

When the [Image Variable] menu is displayed, select the image variable to be used.

Copy

Copy selected characters.

Cut

Cut selected characters.

Paste

Paste selected characters.

Selection

Highlight characters to be edited by selecting the first and last characters.

Undo

Undo the last operation.

Check Error

Check and locate any errors. If several errors are found, the cursor moves to the first character of the error closest to the start of the command.

Response

Choose whether to wait for the completed processing of the command unit before moving on and processing the next unit in the flowchart.

- **Wait Response** (Default): Wait for a completed response from all the commands in the unit before continuing to process the flowchart. Use [Wait Response] for conditional based processing and branching of the operation.
- **Not Wait Response**: Move to the next unit in the flowchart without waiting for a response from the command being processed.

Judge Value

If [Wait Response] is specified for [Response], choose the judgment value to be output from the command unit.

- **Always OK** (Default): Set the judgment value of the command unit to be [OK] regardless of results of the command execution.
- **Command Result**: Set the judgment value of the command unit according to results of the actual command execution. Select [Command Result] for conditional processing and branching of the flowchart.

Reference

If two or more commands are set in the command unit, they are executed in the order in which they are specified. If a command execution error occurs midstream, subsequent commands are cancelled and the process moves to the next unit.

If the result of the command execution affects subsequent image processing, it is recommended to set [Response] to [Wait Response] and [Judge Value] to [Command Result].

Save

Save the current unit changes the program file.

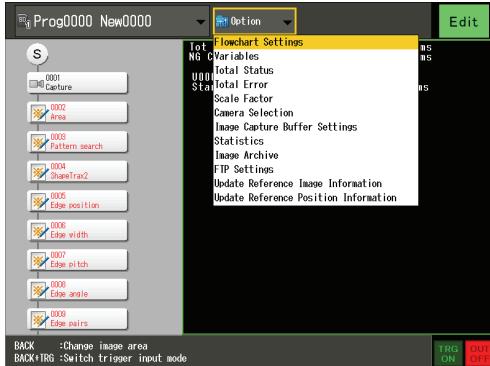
The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

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 screen display, and display parts, can be excluded when saving.
- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller while you are saving the settings. Doing so may cause errors in the internal data.
- Setting changes in the command unit will not be applied immediately but will be applied when [OK] or [Save] is selected.

Program Options

The following settings can be changed via the [Option] menu at the top of the main edit screen.



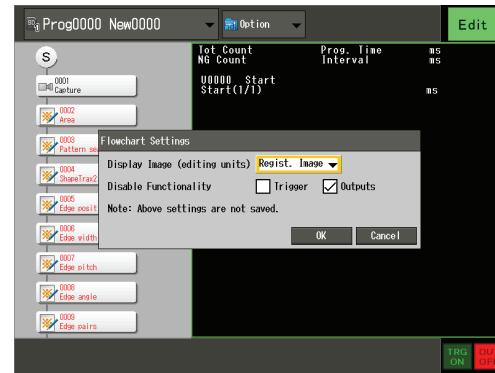
- Controller operation during edit mode (Flowchart Settings) (Page 4-305)
- Variable settings (Variables) (Page 4-306)
- Total status output unit processing (Total Status) (Page 4-313)
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- Camera scale factor (Scale Factor) (Page 4-314)
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- Re-registration of image information from the registered image (Update Reference Image Information) (Page 4-317)
- Re-registration of position information for position adjustment units (Update Reference Position Information) (Page 4-318)
- Locking/unlocking a group (Lock/Unlock Group-Lock) (Page 4-318)

Controller Operation During Edit Mode (Flowchart Settings)

Set the default image used when setting up units and the trigger input / output operation.

1 from the [Option] menu select [Flowchart Settings].

The [Flowchart Settings] menu appears.



2 Change the settings as required.

Display Image

In the [Display Image] field, switch the image to be displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is shown.
- **Regist. Image:** A previously registered image is shown.

Limiting the Controller Operation while the Unit Setting Is Changed

- Disabling Trigger Inputs: Check [Trigger] for [Disable Functionality].
- Disabling Outputs: Check [Outputs] for [Disable Functionality].

Reference

The setting to control the I/O operation is enabled when the flowchart is edited and disabled when the flowchart is closed. The setting is disabled when [Show Flowchart] or [Hide Flowchart] is selected during the [Run] operation.

3 Select [OK].

Variable Settings (Variables)

Variables are used for referencing result data from units results or for setting parameters and controlling a units operation.

- Variables can also be used to process data between units, programs and to store calculation results.
- Variables also cover system inputs, outputs and image control in the system.

XG-7000 Series Variable Types

The following are the categories and types of variables supported by the controller along with their naming convention and processing rules.

System variables

These are pre-defined, read only variables managed by the system. These variables include I/O and some values can be controlled through the command functions. Refer to the XG VisionEditor Reference Manual (Control/Data Edition) for the list of system variables provided in the controller.

User variables

These are user definable variables, divided into two categories depending on the scope of use.

- **Local variables:** Variables that are only defined and available in the program. Up to 10000 can be defined and used.
- **Global variables:** Variables that are defined and usable across multiple programs on a single controller. Up to 1024 can be defined and used.

Image Variables

These are user definable variables for storing image data. Up to 512 image variables can be defined and used per program.

- **System image variables** (&Cam1Img to &Cam4Img): These are image variables managed by the system. A variable is pre-assigned to each camera and used in the capture unit (Page 4-16) and cleared at the start of the flowchart.
- **User image variables:** These are user managed image variables and the stored image is kept until it is overwritten or the system is reset.

By using a user defined image variable as a resultant image in an image operation unit (Page 4-244) the process performed in the unit can be checked.

Temporary variables

A temporary variable can only be used in a calculation unit (Page 4-241), and does not require definition in the [Variables] menu. Refer to "Operator and Function List" (Page 8-45) for more details.

► Note

- The number of variables available varies depending on the amount of resources currently used.
- The maximum number of image variables depends on the type of connected cameras set in the capture unit and the amount of free image memory. As the amount of image memory varies depending on the type of camera (color and resolution, capture range, and scanning method), changes to the type of connected camera set with the capture unit may result in an error due to insufficient image memory.
- The number of user defined image variables maybe changed through unit properties, image archive criteria, or other settings.

Types of variables

User variables

The type of user variables are as follows. All types also have the functionality to be set as an array.

Type	Notation method	Internal storage type
Scalar	Variable name	64-bit floating point number
Position	Variable name.X (X coordinate)	64-bit floating point number
	Variable name.Y (Y coordinate)	64-bit floating point number
Line*	Variable name.T (θ)	64-bit floating point number
	Variable name.RH (ρ)	64-bit floating point number
Circle	Variable name.CX (center of circle X coordinate)	64-bit floating point number
	Variable name.CY (center of circle Y coordinate)	64-bit floating point number
	Variable name.CR (circle radius)	64-bit floating point number

* The following is the line-type notation.

- T(θ): Clockwise angle where the three o'clock direction of the perpendicular line of RH (ρ) is 0 degrees
- RH(ρ): Length (pixels) of the perpendicular line connecting the straight line from the origin (0,0)

Image Variables

Image variables are associated by camera type and image area along with connected camera number. Image variables also have the functionality to be set as an array.

Reference

The camera type information is automatically determined by the camera settings (Page 5-6).

Initial Value

- The initial value of a variables can be defined when the variable is setup.
- The initial values are stored together with all variable settings in the following files.

Type	Save location
Local variables	Program files (inspect.dat) within each program folder
Global variables	Global variable files (gvar.dat) on SD1

- An initialization is performed whenever the controller is turned on, reset, or a program is switched. The initialization of a variable on a reset or program switch can be set when defining the variable.

Reference

When a program is saved, the current variable value can be copied over the initial value so when the program is used again the previous current value is used.

Variable naming rules

- A variable name can contain up to 32 alphanumeric characters (including the variable prefix).
- Variable prefixes are shown in the table below.

Variable type	Naming rule prefix
System variables	%
User variables	Local variables #
	Global variables \$
Image variable	&
Temporary variables (used in calculation units (Page 4-241) only)	@

- Variable names are case sensitive.
- Each variable name must be unique within its scope of use.
- Symbols other than the prefix symbols and underscore (_) cannot be used.

Save location of variables

Defined variables are saved in the program files in the locations based on type.

Type	Save location
Local variables	Program files (inspect.dat) within each program folder
Global variables	Global variable files (gvar.dat) on SD1

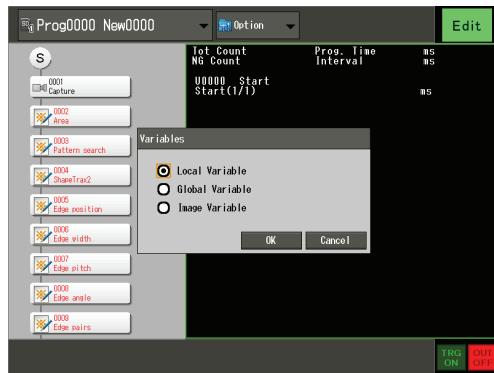
► Note

As program filenames are fixed, if a filename is changed the system will not be able to reference the file and operate.

Defining and editing local variables

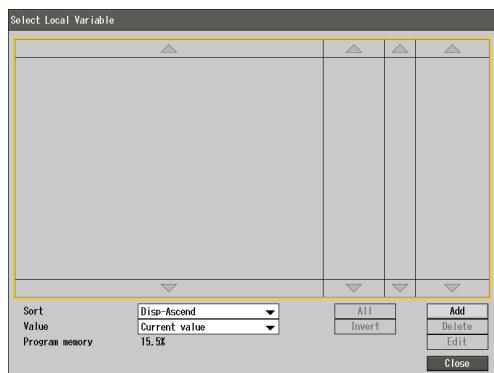
1 From the [Option] menu select [Variables].

The [Variables] menu appears.



2 Select [Local Variable] and then select [OK].

The [Select Local Variable] menu appears.



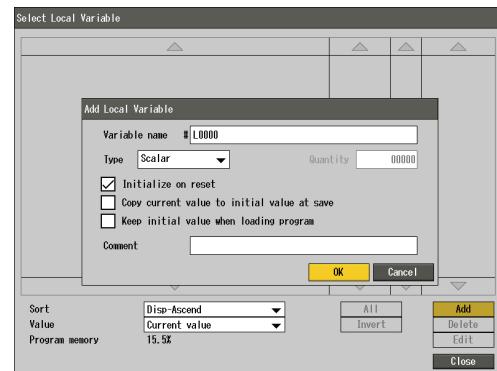
- **Sort:** Choose the order to display the local variables.
- **Value:** Choose the variable value to be displayed.
- **Program memory:** Shows the current program memory usage.

► Note

If the program memory usage exceeds 100% after defining a variable the definition is cancelled.

3 Select [Add].

The [Add Local Variable] menu appears.



4 Defining a local variable.

- **Variable name:** Specify the name of the local variable.
- **Type:** Choose the local variable type (Page 4-306).
- **Quantity:** Specify the number of elements in an array based variable.
- **Initialize on reset:** Choose whether to reset the variable value on reset.
- **Copy current value to initial value at save:** Choose whether to copy the current value to the initial value when the program is saved.
- **Keep initial value when loading program:** Choose whether to keep the initial value of the variable on the controller when uploading a program from XG VisionEditor.
- **Comment:** Enter any comments (up to 64 characters) to associate with the variable. To aid developments comments are shown when variables are referenced in unit parameters and calculations (Page 4-241).

► Note

If the variable is edited and [Copy current value to initial value at save] is selected, the current value is set as the initial value.

5 Select [OK].

Editing a local variable

Select the local variable to edit and select [Edit].

To edit the current value or initial value, change the item shown in the [Value] field and then change the value in the right column.

► Note

Two or more variables can not be selected simultaneously.

Deleting a local variable

Select the local variable to delete and select [Delete].

Select [OK] on the confirmation message.

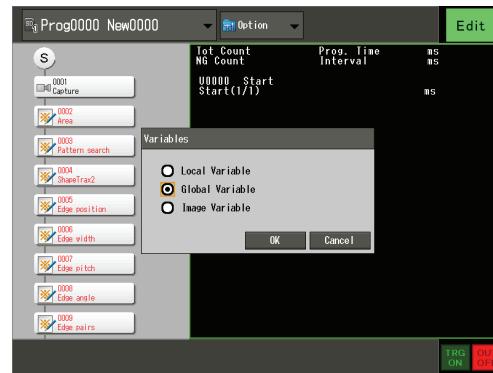
Reference

Two or more variables can be selected for mass deletion.

Defining and editing global variables

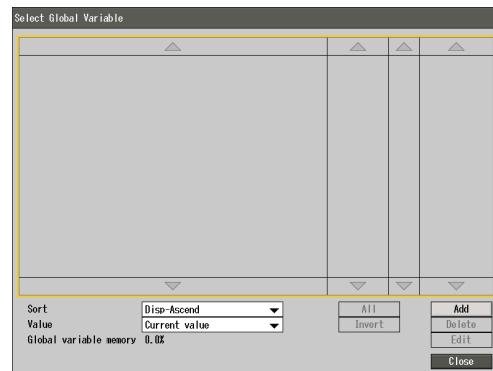
1 From the [Option] menu select [Variables].

The [Variables] menu appears.



2 Select [Global Variable] and then select [OK].

The [Select Global Variable] menu appears.



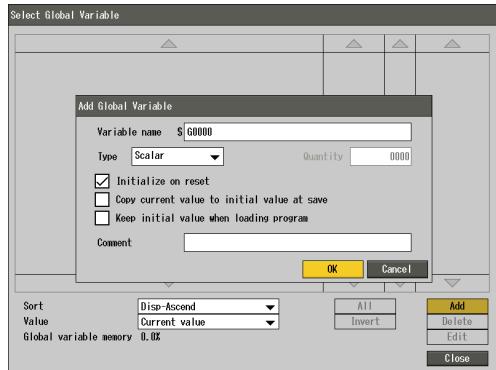
- **Sort:** Choose the order to display the global variables.
- **Value:** Choose the variable value to be displayed.
- **Global variable memory:** Shows the current global variable memory usage.

► Note

If the global variable memory usage exceeds 100% defining a variable the definition is cancelled.

3 Select [Add].

The [Add Global Variable] menu appears.



4 Defining a global variable.

- **Variable name:** Specify the name of the global variable.
- **Type:** Choose the global variable type (Page 4-306).
- **Quantity:** Specify the number of elements in an array based variable.
- **Initialize on reset:** Choose whether to reset the variable value on reset.
- **Copy current value to initial value at save:** Choose whether to copy the current value to the initial value when the program is saved.
- **Keep initial value when loading program:** Choose whether to keep the initial value of the variable on the controller when uploading a program from XG VisionEditor.
- **Comment:** Enter any comments (up to 64 characters) to associate with the variable. To aid developments comments are shown when variables are referenced in unit parameters and calculations (Page 4-241).

► Note

If the variable is edited and [Copy current value to initial value at save] is selected, the current value is set as the initial value.

5 Select [OK].

Editing a global variable

Select the global variable to edit and select [Edit].

To edit the current value or initial value, change the item shown in the [Value] field and then change the value in the right column.

► Note

Two or more variables can not be selected simultaneously.

Deleting a global variable

Select the global variable to delete and select [Delete].

Select [OK] on the confirmation message.

Reference

Two or more variables can be selected for mass deletion.

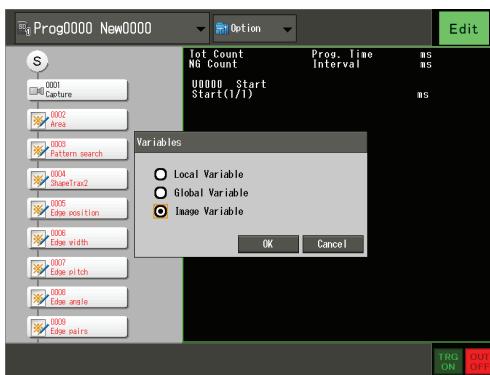
Defining and editing image variables

▶ Note

In image variables, &Cam1Img to &Cam4Img are defined as system image variables by default and cannot be edited.

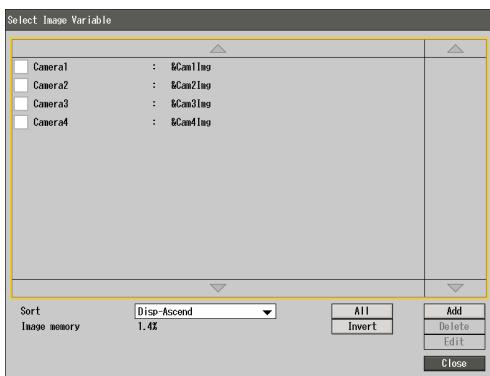
1 From the [Option] menu select [Variables].

The [Variables] menu appears.



2 Select [Image Variable] and then select [OK].

The [Select Image Variable] menu appears.



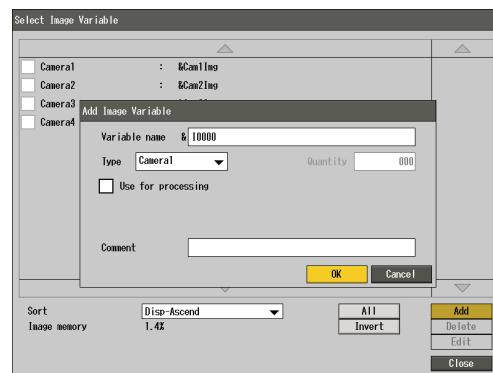
- **Sort:** Choose the order to display the image variables.
- **Image memory:** Shows the current image memory usage.

▶ Note

If the image memory usage exceeds 100%, after defining a variable the definition is cancelled.

3 Select [Add].

The [Add Image Variable] menu appears.



4 Define an image variable as required.

- **Variable name:** Specify the name of the image variable.
- **Type:** Choose the camera No. associated with the image variable.
- **Quantity:** Specify the number of elements in an array based variable.
- **Use for processing:** Choose whether to use this image variable as a resultant image for image operation (Page 4-244) and calibration (Page 4-256) for other units to process off of. Refer to "Generating a Region from an Image" (Page 8-10) for more details.
- **Comment:** Enter any comments (up to 64 characters) to associate with the variable. To aid development comments are shown when image variables are referenced in image operation (Page 4-244).

5 Select [OK].

Editing a image variable

Select the image variable to edit and select [Edit].

Deleting a image variable

Select the image variable to delete and select [Delete].

Select [OK] on the confirmation message.

Assigning variables to Parameters

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.

Reference

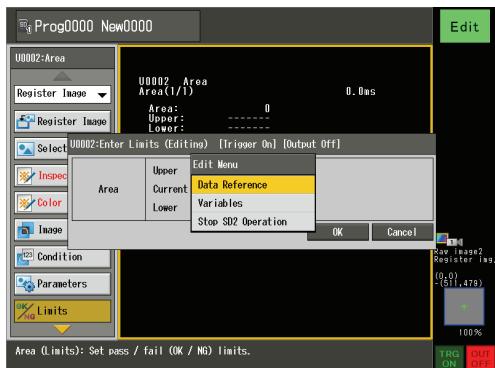
Refer to "List of Setting Parameters" in the XG VisionEditor Reference Manual (Control/Data Edition) for more details about the parameters that can be assigned and the supported variables.

1 Select the value input field of the setting parameter to assign a variable.

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

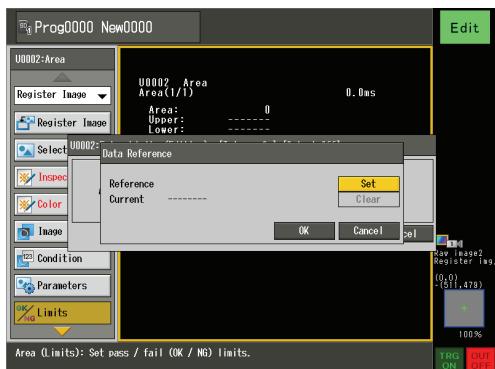
The [Edit Menu] is displayed.

Example when the input field for [Upper] in the [Enter Limits] menu is selected



3 Select [Data Reference].

The [Data Reference] menu appears.



Reference

The [Data Reference] menu can be also displayed by pressing the No. 7 button or No. 1 + No. 0 buttons.

4 Select [Set].

5 Choose the type of variable to assign and then select [OK].

6 Select the variable to assign.

Notes on assigning variables to setting parameters

Each parameter has a set input range, if the value of the variable is invalid, an error will occur in the processing of that unit.

Reference

Refer to "List of Setting Parameters" in the XG VisionEditor Reference Manual (Control/Data Edition) for more details about the input range of setting parameters.

Cancelling the variable assignment

Select [Clear] in the [Data Reference] menu.

Reference

If the assignment is canceled, the definition of the variable is not deleted.

Assigning an image variable

An image variable can be assigned to the current image of a unit and used as a reference for image processing or image display.

Reference

The image variable can only be used to store image data from the capture, image operation and calibration units. To set an image variable to store a captured image from the capture unit, refer to the capture unit section (Page 4-16). To set an image variable as a resultant image from the image operation unit, refer to the image operation unit section (Page 4-244).

Assigning image variables

To reference an image variable, assign it to the [Current Image] field in the [Select Image] menu of the unit.

Note

A blank image variable assignment will result in a setting error.

Reference

Units which support the assignment of the image variable are limited to the vision tools, on-screen graphics, image operation, and position adjustment units.

1 Open the [Select Image] menu for the unit.

[&Cam1Img] (the system image variable used for captured images from Camera1) is assigned to the current image by default.

2 To change the image variable, choose the image variable which contains the desired image.

The image display, camera No., number of colors, and number of pixels for [Source Image Information] are updated based on information of the image variable.

Notes on changing the image variable assignment

Changing the image variable may reset some settings of the unit and result in errors. After changing the image variable, confirm that there are no errors.

Reference

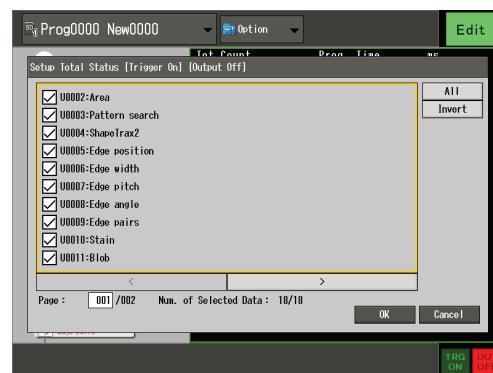
If no capture units in the flowchart are used to assign an image to an image variable, processing is performed using a black image.

Total Status Output

Choose the units to be associated with the total status output (%JgAll and %JAHold).

1 From the [Option] menu select [Total Status].

The [Setup Total Status] menu appears.



2 Select the unit or units to be used by checking the box of each unit.

The logical sum (OR function) of the judgment values of the selected units are used as the result for %JgAll and %JAHold.

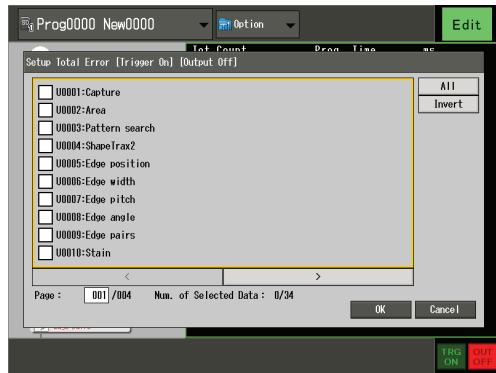
3 Select [OK].

Total Error Output

Choose the units to be associated with the total error output (%UnitError).

1 From the [Option] menu select [Total Error].

The [Setup Total Error] menu appears.



2 Select the unit or units to be used by checking the box of each unit.

The logical sum (OR function) of the errors of the selected units are used as the result for %UnitError.

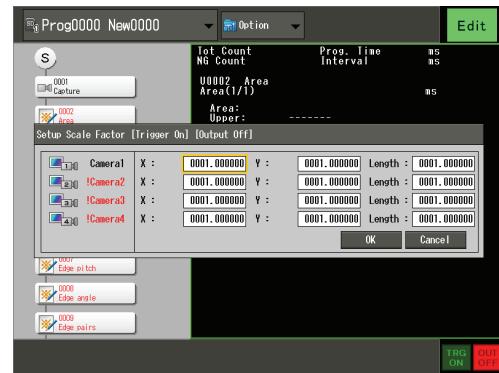
3 Select [OK].

Scale Factor

Specify the scale factors used for each camera.

1 From the [Option] menu select [Scale Factor].

The [Setup Scale Factor] menu appears.



2 Specify the scale factor that can be used for measurement data from the vision tool units.

X

Input the scale factor to be applied in the X direction.

Y

Input the scale factor to be applied in the Y direction.

Length

Input the scale factor to be applied for length measurements.

Reference

For more details on the result data for which scaling can be used refer to "List of Result Data" in the XG VisionEditor Reference Manual (Control/Data Edition).

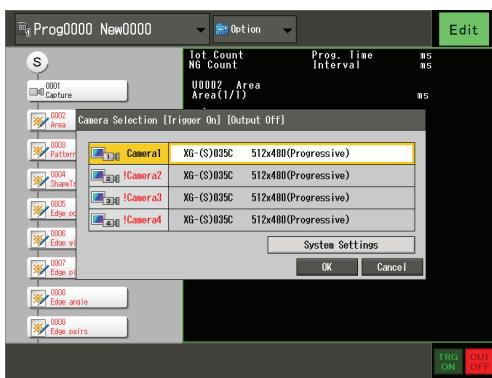
3 Select [OK].

Camera Selection

Choose the model and specifications for the camera connected to the controller.

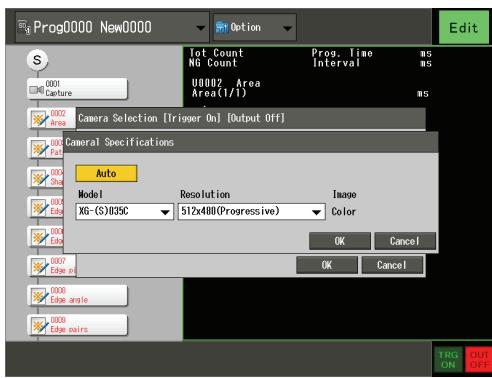
1 From the [Option] menu select [Camera Selection].

The [Camera Selection] menu appears.



2 Select the camera No. ([Camera1] to [Camera4]) to be set.

The setting menu for the selected camera appears.



3 Choose the model of the connected camera.

For digital cameras

- The port will be configured according to the camera type and resolution set.
- If the connected camera is XG-200C/200M/S200C/S200M/H200C/H200M: the resolution can be set to [1600x1200] or [1024x960].
- If the connected camera is XG-035C/035M/S035C/S035M/H035C/H035M the resolution can be set to [640x480] or [512x480].

For analog cameras

- If an analog camera is connected, select the manufacturer of the camera connected to the port.
- If the controller supports analog cameras, the image area and scanning method can be set.
- If the camera settings for an analog camera are modified, the controller must be restarted for changes to take effect. Some camera settings may also require the DIP switches on the camera to be configured. For more details, refer to "Changing the DIP switches on an analog camera" (Page 2-9) or contact KEYENCE.

Reference

- Selecting [Auto] will only automatically configure the digital connected camera.
- For more details on analog camera models, refer to "Cameras (CA-CM20: for XG-7001A)" (Page 7-14).

4 Change the camera settings, then click [OK].

Note

- Connect the camera before turning on the controller.
- When using analog cameras, the same model has to be set for all cameras 1 through 4.
- If the selected camera uses a non-square CCD, the aspect ratio of the captured image will be incorrect. Measurements and inspections will also potentially be incorrect due to this incorrect CCD ratio. 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, the settings of each capture unit, which depend on that camera model, are reset to their default settings.
- When the model or resolution is changed, the operation stops and all image variables and archived data is cleared.

Image Capture Buffer Settings

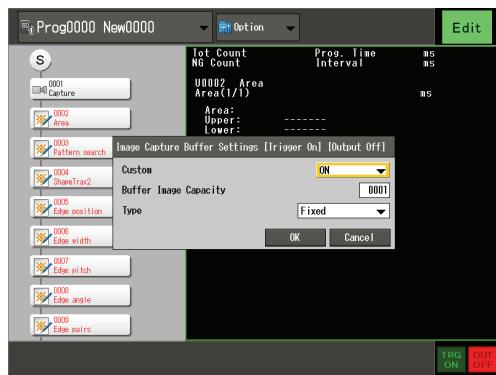
Set the image capture buffer according to the vision inspection requirements.

Reference

- The image capture buffer settings are common for all capture units in the flowchart.
- Refer to the XG VisionEditor Reference Manual (Control/Data Edition) for more details on the image capture buffer.

1 From the [Option] menu select [Image Capture Buffer Settings].

The [Image Capture Buffer Settings] menu appears.



2 Set options for the image capture buffer operation.

Custom

- ON** (Default): Use the image capture buffer and allocate image memory for image capture.
- OFF**: Do not use the image capture buffer.

► Note

If there is insufficient image memory errors will occur.

Buffer Image Capacity

Specify the number of images to be stored in the buffer between 1 to 1024 (Default: 1). The number of images that can be stored depends on the type and number of cameras used and the amount of free image memory.

Type

Choose how the buffer handles images.

- Fixed** (Default): When the buffer is full with unprocessed images additional captured images are ignored.
- Overwriting**: When the buffer is full with unprocessed images additional captured images overwrite existing images starting at the oldest unprocessed image.

3 Select [OK].

► Note

- The image capture buffer memory is reserved for each camera.
- The capture unit processes the oldest unprocessed image in the image capture buffer allocating it to the assigned image variable. If several capture units are used, multiple images can be captured with a variety of different settings.

FTP Settings

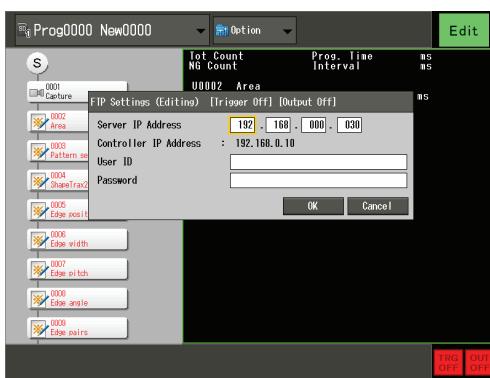
When using [FTP] for outputting archived information "Output Location" (Page 3-26) set the FTP server settings.

1 From the [Option] menu select [FTP Settings].

A confirmation screen appears.

2 Select [Edit].

The [FTP Settings] menu appears.



3 Input the FTP server details.

Server IP Address

Specify the IP address of the FTP server to output the data to.

Controller IP Address

The current IP address of the controller is displayed.

User ID

Input the user name for logging into the FTP server (up to 32 characters).

Password

Input the password for logging into the FTP server (up to 32 characters).

► Note

The folder for storing the archived data depends on the FTP server settings.

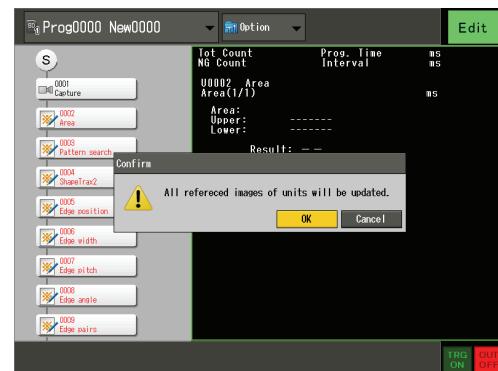
4 Select [OK].

Update Reference Image Information

Registered image information used by pattern search, ShapeTrax2 and or image operation units can be registered/updated simultaneously. If several units in a program use registered image information, this eliminates the need to change each individual set of settings.

1 From the [Option] menu select [Update Reference Image Information].

A confirmation screen appears.



2 Select [OK].

The registered image information is registered to all relevant units simultaneously.

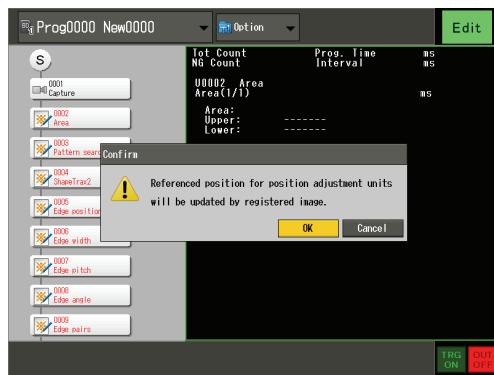
3 Click [Close].

Update Reference Position Information

Positioning information for position adjustment units in a program can be registered/updated simultaneously. If there are several position adjustment units in a program, this eliminates the need to change each individual set of settings.

1 From the [Option] menu select [Update Reference Position Information].

A confirmation screen appears.



2 Select [OK].

Positioning information is updated for all position adjustment units simultaneously.

3 Click [Close].

► Note

- If there are no position adjustment units that allow the updating of the reference position, a message "There is no units to be updated." appears and the settings are not updated.
- Using [Update Reference Position Information] under the following circumstances may result in accurate positions:
 - An inspection region for a unit that is linked to position adjustment was setup on the current image.
 - A unit that is linked to position adjustment does not have the same associated registered image.

Lock / Unlock Group-Lock

If a group has been locked via XG VisionEditor the group can be unlocked edited and locked again.

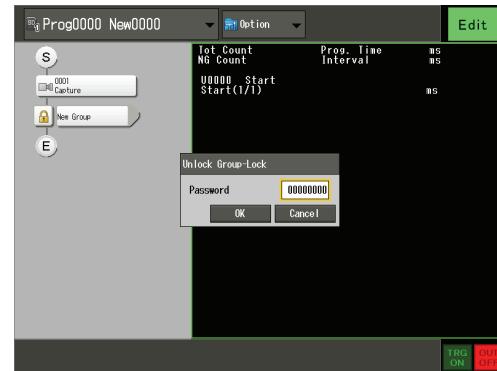
► Note

If the allow editing on the controller has not been set via XG Vision Editor [Lock Group Lock] and [Unlock Group Lock] are not displayed.

Unlocking a group

1 From the [Option] menu select [Unlock Group Lock].

The [Unlock Group-Lock] menu appears.



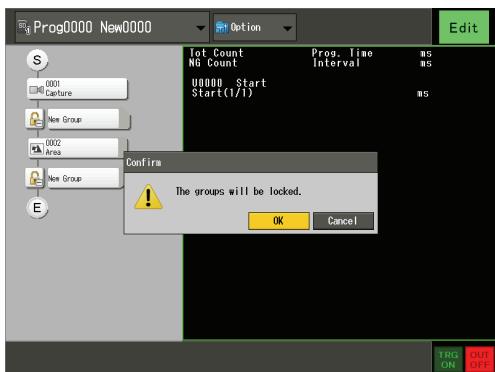
2 Input the password and then select [OK].

If the password is correct, the group is unlocked.

Locking a group

- 1 From the [Option] menu select [Lock Group Lock].

A confirmation screen appears.



- 2 Click [OK].

The group is locked.

Program File Management

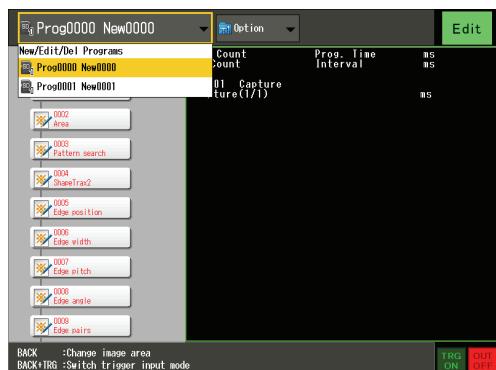
Changing Programs

► Note

- Changing the program will stop the inspection in progress and clear all archive and statistics data in the controller's memory. Any unsaved variables being used in the current program will also be cleared and returned to their initial values.
- If data is being output (terminal I/O, data output, image output) when the request to change programs is made the program change is not completed until the data output is finished. Depending on the data being output the output, the program changeover could take up to a minute. During this time, the controller will be inoperable. For more details, refer to "Output Units" in the XG VisionEditor Reference Manual (Programming Edition).
- During the program change, the controller will read from and write to the SD card where the program data is stored. The flash memory used as in the SD card has a read/write life. Corruption and/or loss of data may result if programs are frequently changed. It is strongly recommended that data stored on the SD card is backed up regularly to other storage media.

1 Select [Program No.]

The Program No. menu appears, displaying the available programs.



Reference

- The icon to the left of the program indicates the program is stored on either SD Card 1 or SD Card 2.
- SD Card 1 and SD Card 2 can individually manage up to 1000 programs from 0000 to 0999 where as the actual number of programs that can be stored depends on the available space on the SD card.

2 Select the desired program No. from the menu.

The controller changes to the selected program.

Reference

Program changes can also be made via an external command.

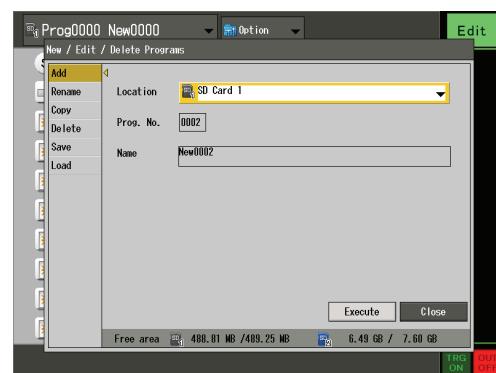
Adding a New Program

Programs can be easily added and named as required for the operation of the system.

1 From the [Program No.] menu select [New/Edit/Del Programs].

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

2 Select [Add].



3 To add a Program to SD Card 2, change the default selection in the [Location] field from [SD Card 1] to [SD Card 2].

Reference

[Location] cannot be set to SD Card 2 if no SD card exists. When adding a Program No. to SD Card 2, be sure to first insert the SD card into the SD2 slot.

4 Select [Prog. No.] and specify the program number for the program.

The name of the newly created program defaults to "New****", where **** represents the program number.

► Note

You cannot specify a Program No. that is already being used.

5 Select [Name].

The [Rename Program] menu appears.

6 Input the program name and select [OK].

Refer to "Inputting Characters" (Page 3-7) for more details on inputting characters.

7 Select [Execute].

The Program is added and the system is switched to that program.

Reference

- Selecting [Close] will cancel the creation of a new program.
- The available free area on each SD card is displayed at the bottom of the [New/Edit/Delete Program] menu as "Free area/total area in SD Card 1" and "Free area/total area in SD Card 2".

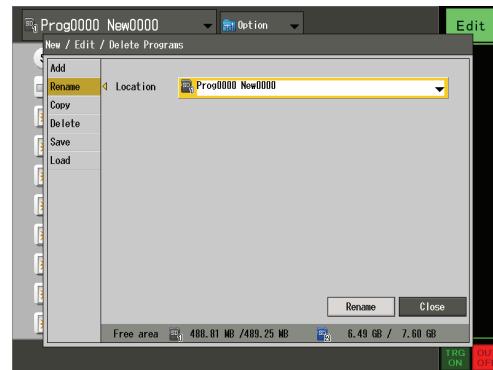
Renaming a Program

Programs can be renamed for easy identification.

1 From the [Program No.] menu select [NEW/Edit/Del Programs].

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

2 Select [Rename].



3 Select the program to change its name and select [Rename].

The [Rename] menu appears.

4 Input a new name for the program and then select [OK].

Refer to "Inputting Characters" (Page 3-7) for more details on inputting characters.

5 Click [Close].

The program name is changed.

Copying/Deleting a Program

Copying a program

All the settings contained under one program can be copied across to another program.

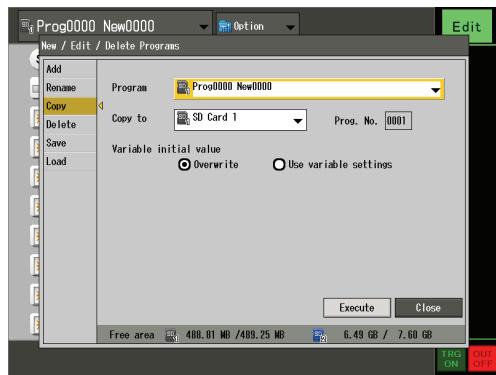
► Note

- When a program is copied, the previous settings in the destination program will be overwritten with the settings of the source program.
- To use a program stored in SD Card 2 as the source or destination for copying, make sure an SD card is in slot 2 beforehand.
- Copies cannot be made if the copy destination has insufficient space to store the program.

1 From the [Program No.] menu select [New/Edit/Del Programs].

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

2 Click [Copy].



3 Select [Program] and choose the source program.

4 Select [Copy to] and choose the location and program number.

5 If necessary, choose how the copying / overwriting of variables should be handled.

- Overwrite** (Default): Overwrite the initial value of the variables with the values in the source program.
- Use variable settings**: Do not overwrite the initial value of the variables that have [Keep initial value when loading program] selected. The variable settings are also copied across to the destination program.

Reference

For more details on keeping initial values of the variables, refer to the XG VisionEditor Reference Manual (Programming Edition).

6 Select [Execute].

After copying is complete, "File(s) copied" is displayed.

Reference

If the selected program number already exists in the destination location, conformation is required to overwrite the program.

7 Click [Close].

To exit the copying menu, select [Close].

Deleting a program

Existing programs can be deleted.

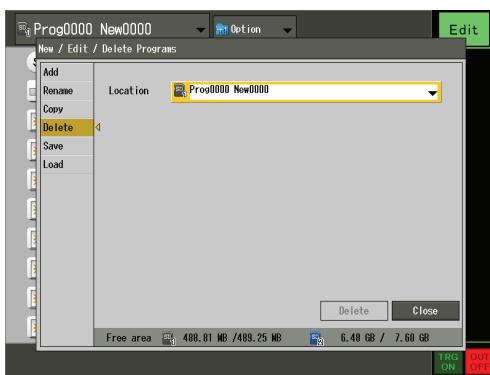
► Note

If a program is deleted, all related settings (such as units, local variables etc) are also deleted.

1 From the [Program No.] menu select [New/Edit/Del Programs].

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

2 Click [Delete].



3 Select [Location], and then select a program to delete.

4 Click [Delete].

A confirmation screen appears.

5 Select [OK].

The program selected is deleted.

6 Click [Close].

Saving/Loading Programs

Saving individual program settings

Choose what settings and image data for a specified program to be saved.

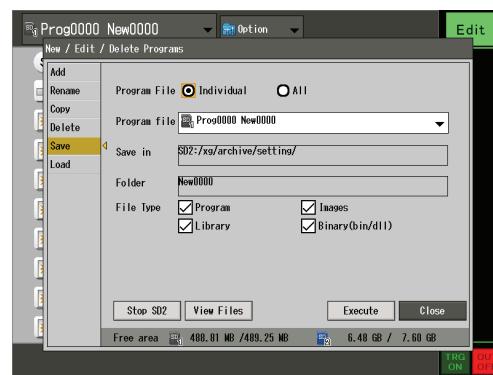
► Note

The following operations cannot be performed if an appropriate SD card is not inserted.

1 From the [Program No.] menu select [New/Edit/Del Programs].

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

2 Click [Save].



3 Choose [Individual] for [Program File].

4 Select [Program file] and choose the program to save.

5 Under [File Type], check the individual files / settings to be saved.

- **Program**: Save the program data from the selected program.
- **Images**: Save the image data from the selected program.
- **Library**: Save the library data from the selected program.
- **Binary(bin/dll)**: Save the bin/dll files from the selected program.

6 Select [Save in] and specify where to save the data.

Specify a path as necessary where programs are managed.

► Note

Folders under "SD1:/xg/setting" and "SD2:/xg/setting" cannot be used as the [Save in] location.

7 Select [Folder] and specify the folder to which the data will be saved.

8 Select [Execute].

The controller starts saving the selected program files / settings.

When complete, a confirmation screen appears.

9 Click [Close].

Reference

The available free area on each SD card is displayed at the bottom of the [New/Edit/Delete Program] menu as "Free area/total area in SD Card 1" and "Free area/total area in SD Card 2".

Saving all program and system settings

Choose what settings and image data to be saved for all programs.

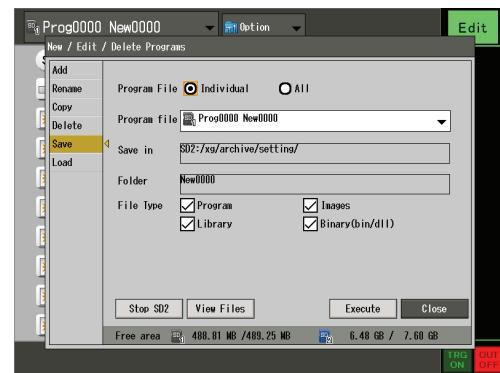
Note

The following operations cannot be performed if an appropriate SD card is not inserted.

1 From the [Program No.] menu select [New/Edit/Delete Programs].

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

2 Click [Save].



3 Choose [All] for [Program File].

4 Select [Program file] and choose the location for all the programs.

- **SD Card 1:** Save all program settings stored on SD Card 1.
- **SD Card 2:** Save all program settings stored on SD Card 2.

5 Under [File Type], check the files / settings to be saved.

- **Program**: Save the program data from the location specified in [Program file].
- **Image**: Save the image data from the location specified in [Program file].
- **Library**: Save the library data from the location specified in [Program file].
- **Binary(bin/dll)**: Save the bin/dll files from the location specified in [Program file].
- **Global Setting**: Save the system setting data.
- **GlobalVariable**: Save the global variable settings.
- **Logo**: Save the logo image files.

Reference

For more details on the global variable files and logo image files, refer to the XG VisionEditor Reference Manual (Programming Edition).

6 Select [Save in] and specify where to save the data.

Specify a path as necessary where all programs are managed.

▶ Note

Folders under "SD1:/xg/setting" and "SD2:/xg/setting" cannot be used as the [Save in] location.

7 Select [Folder] and specify the folder to which the data will be saved.

8 Select [Execute].

When complete, a confirmation screen appears.

9 Click [Close].

Reference

The available free area on each SD card is displayed at the bottom of the [New/Edit/Delete Program] menu as "Free area/total area in SD Card 1" and "Free area/total area in SD Card 2".

Loading individual programs

Load program settings and image data saved in a folder on an SD card into a specified program.

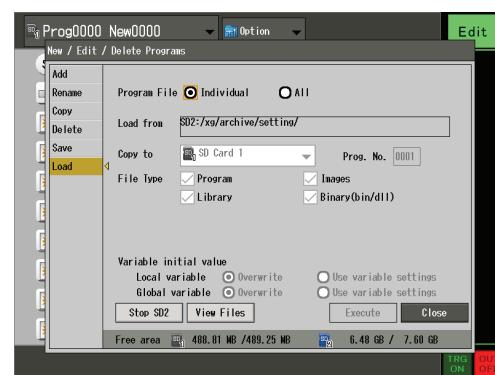
▶ Note

The following operations cannot be performed if an appropriate SD card is not inserted.

1 From the [Program No.] menu select [New/Edit/Del Programs].

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

2 Select [Load].



3 Choose [Individual] for [Program File].

4 Select [Load from] and specify the location of the desired program files.

Specify a path as necessary where the program is stored.

▶ Note

- Folders under "SD1:/xg/setting" and "SD2:/xg/setting" cannot be used as the [Load from] location.
- The load operation cannot be performed if the folder with the program files / settings is not specified properly.

Reference

Folders which contain program files / settings are shown by the following icons: (when the folder is not selected) and (when the folder is selected).

5 Under [File Type], check the files / settings to be loaded.

- **Program**: Load the program data.
- **Image**: Load the image data.
- **Library**: Load the library data.
- **Binary(bin/dll)**: Load the bin/dll files.

6 Select [Copy to] and choose where to load the data.

- **SD Card 1**: Load the data to SD Card 1.
- **SD Card 2**: Load the data to SD Card 2.

7 Select [Prog. No.] and then choose the program number to load the data to.

8 If necessary, choose how the copying / overwriting of variables should be handled.

- **Overwrite** (Default): Overwrite the initial value of the variables with the values in the source program.
- **Use variable settings**: Do not overwrite the initial value of the variables that have [Keep initial value when loading program] selected. The variable settings are also copied across to the destination program.

Reference

For more details on initial values and settings of the variables, refer to the XG VisionEditor Reference Manual (Programming Edition).

9 Select [Execute].

The controller loads the selected program files / settings.

When complete, a confirmation screen appears.

10 Click [Close].

Reference

The available free area on each SD card is displayed at the bottom of the [New/Edit/Delete Program] menu as "Free area/total area in SD Card 1" and "Free area/total area in SD Card 2".

Loading all program and system settings

Load program settings, image data, and system settings for all programs from an SD card.

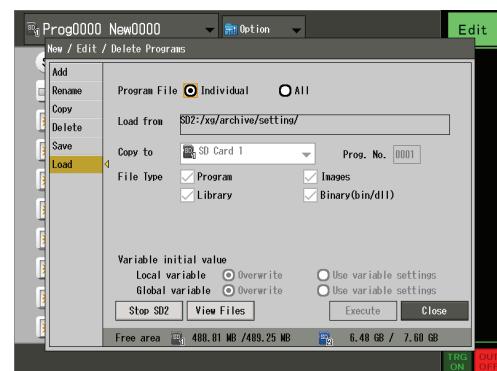
Note

- The following operations cannot be performed if an appropriate SD card is not inserted.
- This operation overwrites all the existing program settings and system settings. Save the current program settings and system settings to an SD card or other media before performing this operation.

1 From the [Program No.] menu select [New/Edit/Delete Programs].

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

2 Select [Load].



3 Choose [All] for [Program File].

4 Select [Load from] and specify the location of the desired files.

Specify a path as necessary where the files are stored.

Note

- Folders under "SD1:/xg/setting" and "SD2:/xg/setting" cannot be used as the [Load from] location.
- The load operation cannot be performed if the folder above the folder with the program files / settings is not specified properly.

Reference

Folders which contain program files / settings are shown by the following icons: (when the folder is not selected) and (when the folder is selected).

5 Under [File Type], check the files / settings to be loaded.

- **Program**: Load the program data.
- **Image**: Load the image data.
- **Library**: Load the library data.
- **Binary(bin/dll)**: Load the bin/dll files.
- **Global Setting**: Load the system setting data.
- **GlobalVariable**: Load the global variable setting data.
- **Logo**: Load the logo image files.

Reference

For more details on the global variable files and logo image files, refer to the XG VisionEditor Reference Manual (Programming Edition).

6 Select [Copy to] and choose where to load the data.

- **SD Card 1**: Load the data to SD Card 1.
- **SD Card 2**: Load the data to SD Card 2.

7 If necessary, choose how the copying / overwriting of variables should be handled.

- **Overwrite** (Default): Overwrite the initial value of the variables with the values in the source program.
- **Use variable settings**: Do not overwrite the initial value of the variables that have [Keep initial value when loading program] selected. The variable settings are also copied across to the destination program.

Reference

For more details on initial values and settings of the variables, refer to the XG VisionEditor Reference Manual (Programming Edition).

8 Select [Execute].

The controller loads the selected files / settings.

When complete, a confirmation screen appears.

Reference

If [Global Setting] or [GlobalVariable] is checked for [File Type], the system setting data and global variable settings are not applied until the controller is restarted. The controller can be restarted by selecting [Restart now] from the confirmation menu.

9 Click [Close].

Reference

The available free area on each SD card is displayed at the bottom of the [New/Edit/Delete Program] menu as "Free area/total area in SD Card 1" and "Free area/total area in SD Card 2".

Chapter 5

Offline Mode Settings

System Configuration

If the controller is offline, the screen displays the [System Configuration] menu. This section explains the functions available in the System Configuration menu.



Functions available from the System Configuration menu

System Settings

- **Controller Name:** Assign and edit the controllers name (Page 5-3).
- **Date & Time:** Set the date and time of the controllers internal clock. This function is also available on the function menu in run mode (Page 3-41).
- **Language:** Changes the language between Japanese and English (Page 5-3).
- **Registered Image File Type:** Set the initial file format for registered images. Registered images are saved in this format when saved via a command from an external device (Page 5-4).
- **Overall Menu Opacity:** Choose the initial opacity when displaying menu (Page 5-4).
- **Unit Execution:** Choose unit execution [Never Execute] processing level (Page 5-5).
- **Startup Mode:** Choose whether to display the flowchart at startup (Page 5-5).
- **Reboot:** Restarts the controller.

Cameras

- **Settings:** Set the default settings for cameras and lights (when the light controller CA-DC20E is attached). This option also allows the live image from the camera to be viewed and saved to an SD card (Page 5-6).
- **White Balance** (XG-7701/7501/7001 only): If a color camera is connected, the RGB levels (white balance) can be adjusted to match the lighting environment of the target area (Page 5-21).

Communications & I/O

- **Parallel Port:** Set the default settings for data input and output through the controller's terminals (parallel I/O connector and terminal block) (Page 5-22).
- **Ethernet (TCP/IP):** Set the default settings for data input/output over the controller's Ethernet port using TCP/IP (Page 5-23).
- **RS-232C (no protocol):** Set the default settings for RS-232 communication (Page 5-24).
- **PLC-Link:** Set the default settings for data input/output over PLC-Link (Page 5-25).
- **CC-Link:** Set the default settings for data input/output over CC-Link (Page 5-30).

Utility

- **View Files:** Shows the [View Files] menu, which is used for viewing and editing existing files as well as initializing SD cards. This function is also available on the function menu in run mode (Page 3-31).
- **I/O Diagnostic:** Shows the [I/O Diagnostic] menu, which is used to check the real time input and output status of the terminals on the controller. In Offline mode outputs can be forced to checking wiring and functionality. This function is also available on the function menu in run mode (Page 3-37).
- **RS-232C Diagnostic:** Shows the [RS-232C Diagnostic] menu, which is used to check the real time input and output data of the RS-232C port on the controller. This function is also available on the function menu in run mode (Page 3-38).

Program

- **Save/Load Program Settings:** Saves or loads a user specified program from a SD card. This function is also available on the function menu in run mode (Page 4-323).
- **Save/Load Global Settings:** Saves the current global settings or loads global settings from an SD card (Page 5-34).

System Information

Shows information about the controller, including the name, version program files, and available space on the SD card (Page 5-36).

Go Online (run)

Changes to online (run) mode (Page 5-1).

Stop SD2 Operation

Stops any SD Card 2 operation so that it can be safely ejected (Page 2-35).

▶ Note

The [White Balance] setting is not shown on controllers (XG-7xxxA) for analog cameras.

Reference

When an option is selected in the System Configuration menu some of the items, such as Settings and White Balance allow, the VIEW bar (Page 3-9) to be displayed by clicking the [View] button.

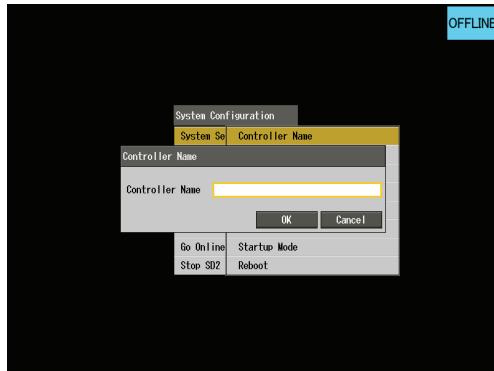
Changing the Controller Settings

Controller Name

Use this function to assign or edit a controllers name. The assigned name is displayed in the [System Information] menu (Page 5-36).

1 From the System Configuration menu, select [System Settings] - [Controller Name].

The [Controller Name] menu appears.



2 Enter a name in the [Controller Name] field.

A text string of up to 32 characters can be entered for the controller name.

3 Click [OK].

► Note

The following characters cannot be used in the controller name:

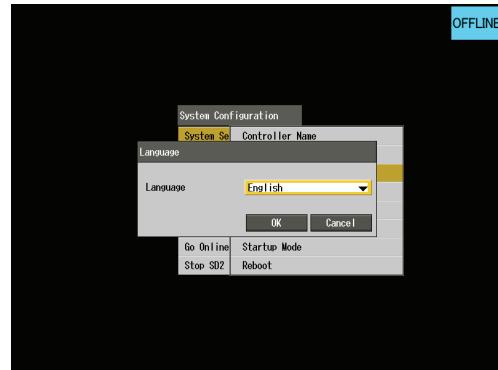
/,\,|,?,*,@,<,>,:,~.

Language

The language used on the controller can be changed between Japanese and English.

1 From the System Configuration menu, select [System Settings] - [Language].

The [Language] menu appears.



2 Choose the settings as required.

- **Japanese (J)**: Use Japanese.
- **English (E)** (default): Use English.

3 Click [OK].

► Note

To initiate the language change, the controller must be restarted.

Registered Image File Type

Use this function to set the initial file format for registered images. Registered images are saved in this format when saved via a command from an external device.

► Note

Saving the registered images in JPEG format has the following advantages and disadvantages. Select the save format that best suits the intended use.

- Advantages:

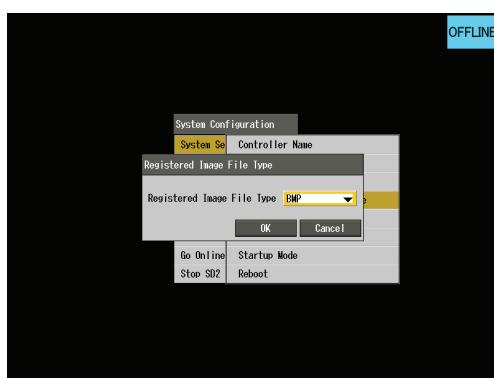
The images are compressed. Smaller files mean more registered images and program Nos. can be saved on the SD card.

- Disadvantages:

- As the image is compressed, so the measurement results for the compressed image may differ to results from uncompressed (BMP format) images.
- When switching program Nos., the controller takes extra time to expand compressed images. Thus it takes more time to switch program Nos. with JPEG v BMP images.
- The compression rate varies depending on the image. Thus the image file size and max number of images that can be stored can vary.

1 From the System Configuration menu, select [System Settings] - [Register Image File Type].

The [Register Image File Type] menu appears.



2 Change the settings as required.

- **BMP** (default): Saves images in bitmap format.
- **JPEG**: Saves images in JPEG format.

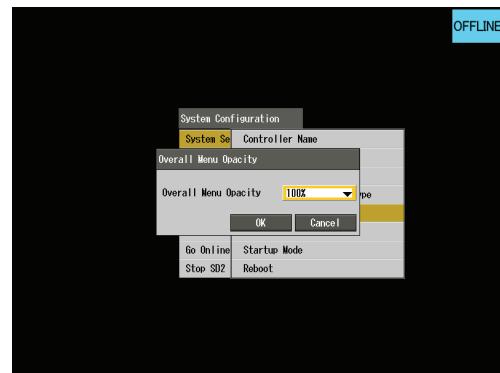
3 Click [OK].

Menu Opacity

Use this function for setting the initial opacity to use when displaying the controller's menus.

1 From the System Configuration menu, select [System Settings] - [Overall Menu Opacity].

The [Overall Menu Opacity] menu appears.



2 Change the settings as required.

Select any transparency from 25% to 100% (default). Menus are opaque at 100% and gradually become transparent as the percentage decreases.

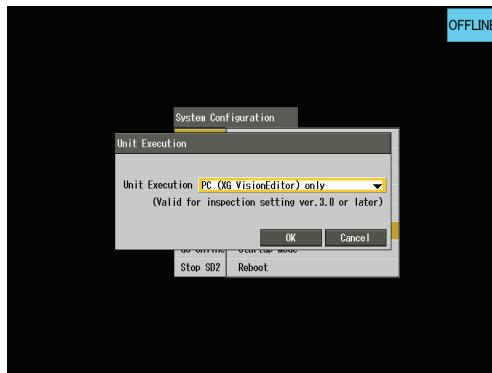
3 Click [OK].

Unit Execution

Use this function to choose to execute units on the controller with properties set to properties [Never Execute] (Page 4-14).

1 From the System Configuration menu, select [System Settings] - [Unit Execution].

The [Unit Execution] menu appears.



2 Change the settings as required.

- **PC (XG VisionEditor) only** (default): Units with the [Execute] item on the [Properties] menu set to [Never Execute] will not be processed in the VisionEditor simulation, but will be processed on the controller.
- **PC & XG Controller**: Units with the [Execute] item on the [Properties] menu set to [Never Execute], will not be processed on either the controller or PC software VisionEditor.

3 Click [OK].

Reference

Results data for units that are not processed on the controller defaults to "0", along with branches and loop functions being skipped (Page 4-236). To determine a unit executed for a given measurement, check the count in the executed count (RSLT.EXCT) results for that unit. (The count will be 0 if it has never been executed.)

Startup Mode

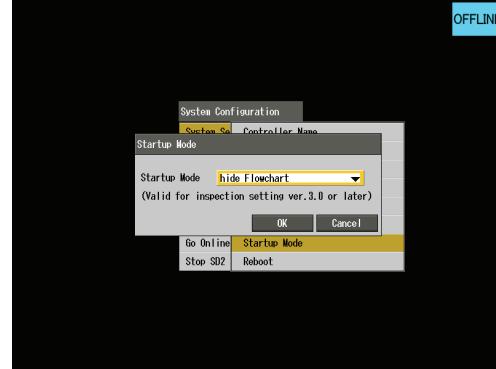
Use this function for choosing whether to show the flowchart at startup.

Reference

The flowchart can be shown or hidden via the function menu as well (Page 4-2).

1 From the System Configuration menu, select [System Settings] - [Startup Mode].

The [Startup Mode] menu appears.



2 Change the settings as required.

- **Hide Flowchart** (default): Hide the flowchart when the controller starts up.
- **Show Flowchart**: Show the flowchart when the controller starts up.

3 Click [OK].

Obtaining and Checking Images with Camera Settings

Changes can be made to the default camera settings used by the system. Default camera settings set in [System Configuration] are reflected directly to capture units when the [Use System Settings] checkbox is checked. Refer to "Capture" (Page 4-16) for more details.

This option also allows for images coming in from the camera to be checked and saved to an SD card.

Individual Camera Settings

- Camera (Page 5-6)
- Trigger (Page 5-8)
- Shutter Speed (Page 5-9)
- CCD Settings (Page 5-9)
- Light (Page 5-11)
- CCD Imaging Region (Page 5-12)
- Scan (Page 5-14)
- Mirrored CCD (Page 5-15)

Camera Preview

- Display Types (Page 5-16)
- Saving Images (Page 5-16)

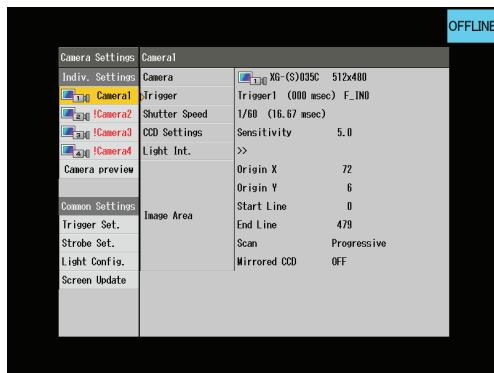
Common Camera Settings

- Trigger Settings (Page 5-17)
- Strobe Settings (Page 5-17)
- Light Config (Page 5-18, Page 5-19)
- Screen Update (Page 5-20)

Display the [Camera Settings] screen

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

The [Camera Settings] screen appears.



Note

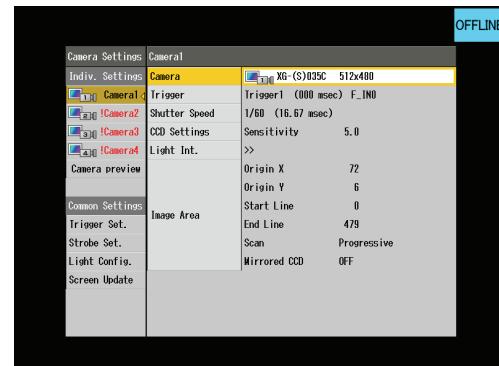
When the [Camera Settings] screen is displayed, any unsaved settings, results and archive data will be cleared (Page 3-24).

Camera Specifications

If multiple cameras are connected to the controller, The individual shutter speed, gain adjustment, process area, image area, trigger, and camera type for each camera can be set. If the camera can be set is an analog camera, the image area and scanning method when configuring the camera settings can be set. When setting individual items for each camera, be sure to choose the correct camera type in [Camera] before setting the parameters.

- 1 Select the camera number (Camera 1 to Camera 4) connected to the controller from [Indiv. Settings] on the [Camera Settings] screen.

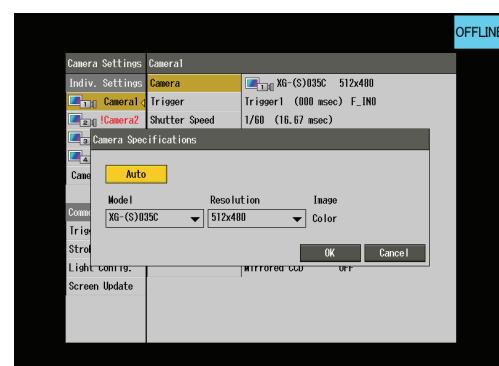
The settings screen for the selected camera appears.



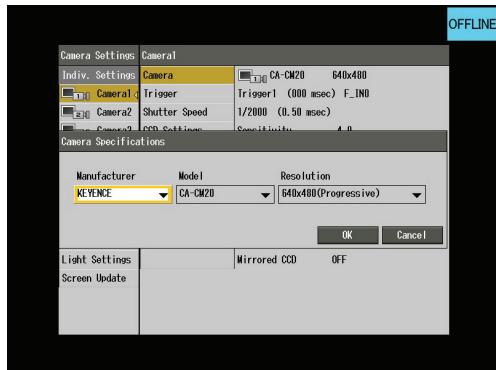
- 2 Select [Camera].

The [Camera Specifications] menu appears.

For digital cameras



For analog cameras



▶ Note

- Connect the camera before turning on the controller.
- When using analog cameras, the same model has to be set for all cameras 1 through 4.
- If the selected camera uses a non-square CCD, the aspect ratio of the captured image will be incorrect. Measurements and inspections will also potentially be incorrect due to this incorrect CCD ratio. For details on the CCD types used in your camera, refer to the instruction manual provided with the camera.

3 Change the camera settings, then click [OK].

For digital cameras

- The camera connection will be configured according to the color/monochrome selection and resolution.
- If the connected camera is XG-200C/200M/S200C/S200M/H200C/H200M: the resolution can be set to [1600x1200] or [1024x960].
- If the connected camera is XG-035C/035M/S035C/S035M/H035C/H035M: the resolution can be set to [640x480] or [512x480].

For analog cameras

- If an analog camera is connected, select the manufacturer of the camera connected.
- Depending on the camera the number of pixels in the imaging region and the scanning method can also be set.
- If the camera settings for an analog camera are modified, the controller needs to be restarted for changes to take effect. Note, some changes may also require you to change the DIPP switches on the camera. For more details, refer to "Changing the DIP switches on an analog camera" (Page 2-9), or contact Keyence directly.

Reference

- Selecting [Auto] with a digital camera connected will automatically detect and set the connected camera.
- For more details on analog camera models, refer to "Cameras (CA-CM20: for XG-7001A)" (Page 7-14).

Camera Trigger

Choose which trigger to be used for each camera.

Reference

The trigger can be set individually for each camera.

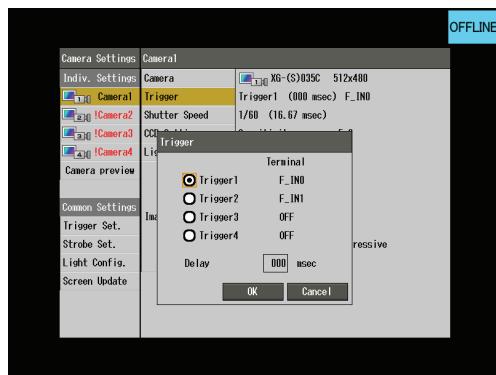
- 1 Select the camera number (Camera 1 to Camera 4) connected to the controller from [Indiv. Settings] on the [Camera Settings] screen (Page 5-6).

The settings screen for the selected camera appears.

- 2 Select [Trigger].

The [Trigger] menu appears.

The terminal assignment for the trigger (if assigned) is shown.



- 3 Select the trigger to be used as the camera input trigger.

► Note

- A trigger can still be selected even if a terminal hasn't assigned. However that trigger will be non-functional, until it has been assigned.
- Inputting a trigger from the handheld controller acts as a single trigger for all cameras.

- 4 To set a delay between the trigger input signal and the capturing of an image, select [Delay] and then specify a delay time.

The delay can be set from 0 to 999 ms (Default value: 000 ms).

- 5 When the setting is complete, click [OK].

► Note

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 between 0 and 200 μ s. For more details, refer to the XG VisionEditor Reference Manual.

Shutter Speed

Select a shutter speed suitable for the line speed and lighting conditions. Before using a fast shutter speed, make sure there is sufficient light to produce the desired image.

Reference

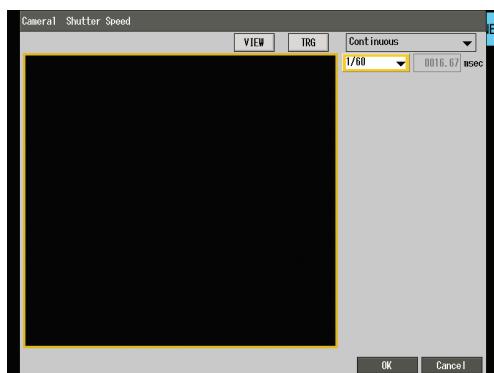
The shutter speed can be individually set for each camera.

1 Select the camera number (Camera 1 to Camera 4) connected to the controller from [Indiv. Settings] on the [Camera Settings] screen (Page 5-6).

The settings screen for the selected camera appears.

2 Select [Shutter Speed].

The [Shutter Speed] menu appears.



3 Select a shutter speed, then click [OK].

As different shutter speeds are selected the camera image on the left changes accordingly.

Reference

To enter the shutter speed numerically, choose [Custom], then input the shutter speed. For a digital cameras input a value in the range of 0.05 to 9000.00 ms.

The range allowed for analog cameras varies depending on model type. For more details, refer to "Capture Units" in the XG VisionEditor Reference Manual.

Note

When using a fast shutter speed with a high intensity light, a smear effect (vertical streaks on the image) may occur. To adjust and compensate for this, adjust the aperture ring and lighting settings.

CCD Settings

Image quality and contrast can be adjusted by changing the cameras CCD sensitivity and gain-adjustment settings. This functionality is useful when needing to optimize an images brightness and adjust for black / white saturation.

Note

Adjusting the CCD settings may cause a pre-programmed unit to process incorrectly. Be sure to check the processed result after making such adjustments.

Reference

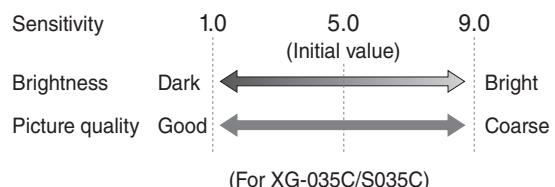
The CCD settings can be set separately for each camera as well as being available as an image enhance filter (contrast conversion) for individual unit processing. See the "Preprocessing" explanation of each unit for more details.

Adjusting the Overall Brightness

Typically to adjust the brightness of an image the lens aperture, lighting and shutter speed are all adjusted accordingly. However the cameras CCD's sensitivity to light can also be adjusted to help improve image quality.

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.

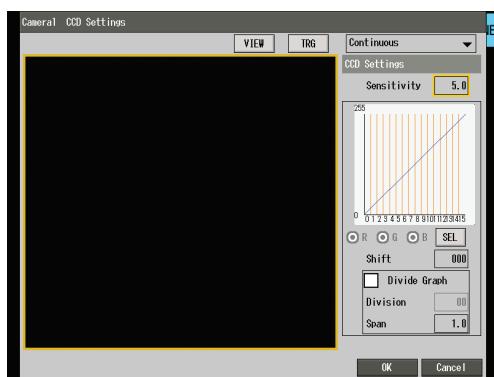
- XG-H035C/H035M/H100C/H100M/S200C/S200M/ H200C/H200M/H500C/H500M: 1.0 to 7.0
- All other cameras (including analog cameras): 1.0 to 9.0

- 1 **Select the camera connection (Camera 1 to Camera 4) connected to the controller from [Indiv. Settings] on the [Camera Settings] screen (Page 5-6).**

The settings screen for the selected camera appears.

- 2 **Select [CCD Settings].**

The [CCD Settings] menu appears.



- 3 **Select [Sensitivity], then specify the desired sensitivity level.**

The larger the number, the brighter the image; the smaller the number, the darker the image. As the sensitivity is changed the image display updates accordingly.

The default camera sensitivity is values are:

- 3.0: for XG-H035C/H035M/H100C/H100M
- 4.0: for XG-H200C/H200M/H500C/H500M, or an analog camera
- 5.0: for all other cameras not listed above

- 4 **When the settings are complete, click [OK].**

► **Note**

When increasing camera sensitivity and using a fast shutter speed, it may be necessary to open the lens aperture to let in more light. Allowing intense light to enter with the aperture wide open may cause a smear effect (vertical streaks on the image). To adjust and compensate for this, adjust the aperture and lighting.

Adjusting the Image Balance

This setting is used in conjunction with the sensitivity setting to adjust the range of brightness and improve image quality. The adjustment allows for the shift (offset) and span of the intensity for monochrome cameras and RGB elements for color cameras.

Reference

The gain setting can be adjusted for each measurement unit through the [Contrast conversion] filter (image enhancement) (for offset and span adjustment only). However, be aware that filter processing will increase the measurement processing time.

- 1 **Select the camera connection (Camera 1 to Camera 4) connected to the controller from [Indiv. Settings] on the [Camera Settings] screen (Page 5-6).**

The settings screen for the selected camera appears.

- 2 **Select [CCD Settings].**

The [CCD Settings] menu appears.

- 3 **To adjust the RGB elements individually, use [SEL], and then select the color (R, G or B) (color cameras only).**

The graph on the screen will be displayed for the selected color.

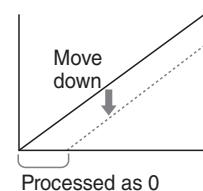
Reference

To return be able to adjust all RGB elements at once again, select [ALL]. After selecting [All], individual settings will be used until the settings are changed in [ALL] mode.

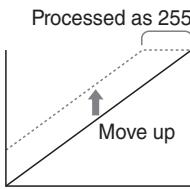
- 4 **Select [Shift], then specify the shift level for the entire signal.**

The range of values you can specify 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).



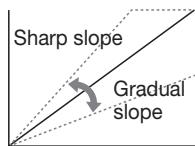
As the value is shifted the displayed image is updated accordingly.

Reference

Using shift, ranges of values can be set to be 0 or 255.

5 Select [Span], then specify the rate of contrast change.

The rate of change can be set from 0.0 to 8 (default 1).



- **To increase the contrast in images:** Use a high value so there is a greater rate of change.
- **To decrease the contrast in images:** Use a low value so there is a lesser rate of change.

As the span is changed, the displayed image is updated accordingly.

Note

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).

6 When the settings are complete, click [OK].

Setting different rates in change for different shades.

Using the checkbox next [Divide Graph], individual rates of change can be specified for 16 different shades.

Select [Division] to choose a particular range of the graph and then adjust the span accordingly.

Light Intensity

If a light controller CA-DC20E is connected to the controller, the light intensity can be adjusted. Use this in conjunction with the shutter speed setting to correctly illuminate images.

Note

The FLASH terminal associated with the camera selected in lighting configuration (Page 5-18) must be used to control the light for that camera in order to adjust the light intensity for the light.

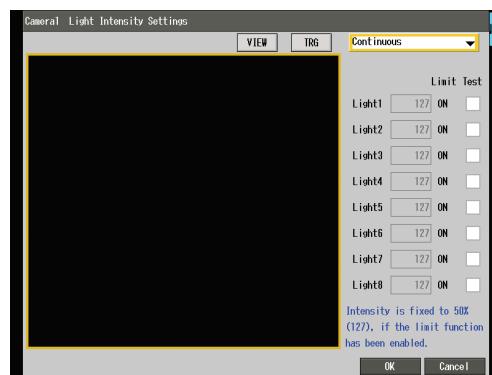
1 Select the camera connection (Camera 1 to Camera

4) connected to the controller from [Indiv. Settings] on the [Camera Settings] screen (Page 5-6).

The settings screen for the selected camera appears.

2 Select [Light Int.].

The [Light Intensity Settings] menu appears.



3 Select the update method for the image displayed on the screen.

- **Continuous** (default): The image is updated continuously.
- **Trigger:** The image is updated when a trigger input is received.

4 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-DC20E's.

Note

If the [50% Limit] is enabled for a light in the Lighting Configuration (Page 5-18), 127 will be the highest light intensity level used (regardless of the set value).

5 To test the light adjust the light intensity, check the "Test" check box next to the light.

6 When the settings are complete, click [OK].

CCD Imaging Region

Specify the area on the CCD active area to be used for capturing an image.

▶ Note

This menu cannot be used to specify the area for analog cameras. To adjust the area for an analog camera the [Resolution] setting under [Camera Specifications] needs to be used. The allowable range varies for each model. If the [Resolution] is modified, the controller must be restarted for changed to take effect.

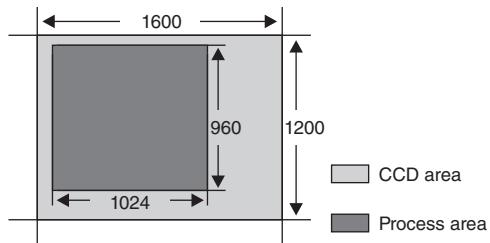
Reference

The image area can be individually set for each camera.

Differences in active and process areas

Active area (CCD) and process area

- The size (in pixels) of the CCD used for capturing images depends on which camera is connected to the controller. This area is known as the active area.
- The controller cannot use all of the active area for a single image do this can be reduced to what is known as the process area.



Example shown for XG-200C used in 1-megapixel mode

- The active and process area size depends on the camera and image capture modes being used.

Reference

The process area within the active area can be set separately for each program No.

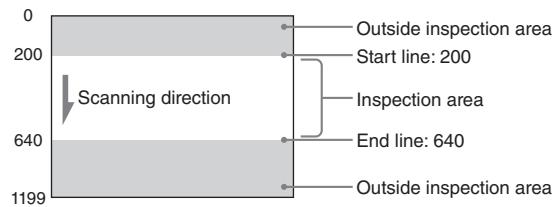
The relationship between camera resolution, active area, and process area

The relationship between the camera resolution, active, and process area are shown below.

Camera resolution	Active area (pixels)	Process area (pixels)
5 megapixels	2432 x 2050	2432 x 2050
2 megapixels	1600 x 1200	1600 x 1200 or 1024 x 960
1 megapixel	1000 x 1000	1000 x 1000
320,000 pixels	656 x 492	640 x 480 or
310,000 pixels	640 x 480	512 x 480

An image area can be defined within the process area

The process area can be narrowed in the vertical direction to create an image area. By eliminating unnecessary parts of the image, the process area transfer rate can be greatly increased.



CCD imaging region set to 200 to 640.

▶ Note

- Tools will not be processed if they do not lie between the start and end lines, even if they are in the process area.
- A minimum of 100 lines must be set when using the XG-H200C/H200M.

Specifying the process and image area

Specify the area of the CCD to make up the process and image area.

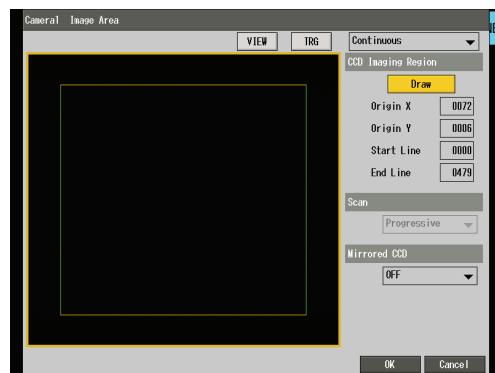
- 1 **Select the camera connection (Camera 1 to Camera 4) connected to the controller from [Indiv. Settings] on the [Camera Settings] screen (Page 5-6).**

The settings screen for the selected camera appears.

- 2 **Select [Image Area].**

The [(Selected camera) Image area] menu appears.

- 3 **Select [CCD Imaging Region].**



- 4 **Select [Draw] and move the 8-way key up, down, left or right to specify the process area, then press the No. 0 (ENTER) button (only when using 1-megapixel mode or with 320,000-pixel and 310,000-pixel high speed cameras).**

While specifying the process area, the coordinates of the top left corner of the area displayed appear in the [Origin X] and [Origin Y] fields on the right side of the screen.

Reference

- The origin coordinates displayed represent the top left corner of the process area.
- By default, the process area is set to the center of the active area. The default (X,Y) coordinates are (288,120) (in 1 megapixel mode), (72,6) (when using a 320,000 pixel camera), and (64,0) (when using a 310,000 pixel camera).

▶ Note

The area around the captured image might darken if the process area is positioned at the edge of the CCD when using a lens with a small projection image size.

5 Move up and down to specify the start line, and then press the No. 0 (ENTER) button.

While specifying the start line, the Y coordinate of the start line is shown in the [Start Line] field.

6 Move up and down to specify the end line, and then press the No. 0 (ENTER) button.

While specifying the end line, the Y coordinate of the end line is shown in the [End Line] field.

7 When the drawing is complete press the No. 2 (ESCAPE) button.

8 When the settings are complete, click [OK].

Scan

The CCD scanning method used by the camera can be specified.

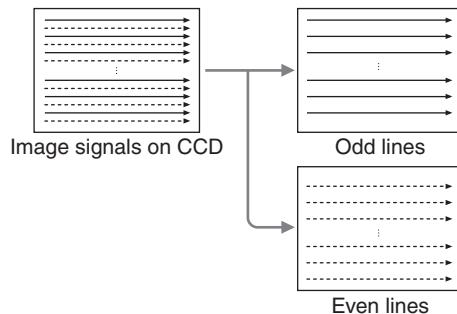
► Note

Scan settings can only be changed for monochrome cameras.

- **Interlace mode:** Transfers images from the CCD of the camera by processing odd then even lines alternatively. This does not offer optimum picture quality per image, but it shortens transfer times and is suitable for fast-moving lines.

The transfer times are shown in the table below. The numbers in parentheses are the transfer times for conventional cameras.

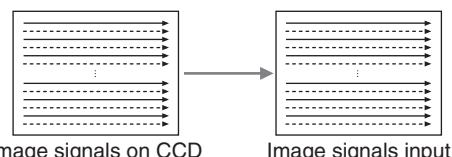
Camera type	Transfer time
High-speed 5-megapixel camera	40.3 ms
High-speed 2-megapixel camera	16.1 ms (32.7 ms)
High-speed 1-megapixel camera	13.9 ms
High-speed 310,000-pixel camera	2.5 ms (8.8 ms)



- **Progressive mode:** Transfers images from the CCD of the camera in full starting from the top line. This provides better picture quality but transfer times are longer when compared with interlace scanning.

The transfer times are shown in the table below. The numbers in parentheses are the transfer times for conventional cameras.

Camera type	Transfer time
High-speed 5-megapixel camera	61.2 ms
High-speed 2-megapixel camera	29.2 ms (58.5 ms)
High-speed 1-megapixel camera	20.5 ms
High-speed 310,000-pixel camera	4.7 ms (16.0 ms)



► Note

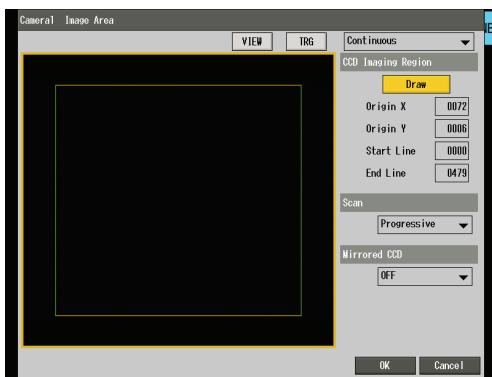
- Scan settings can only be changed for monochrome cameras.
- For analog cameras, this option is available alongside the [Resolution] field together with the CCD imaging region. The options vary for each model.

- 1 Select the camera connection (Camera 1 to Camera 4) connected to the controller from [Indiv. Settings] on the [Camera Settings] screen (Page 5-6).**

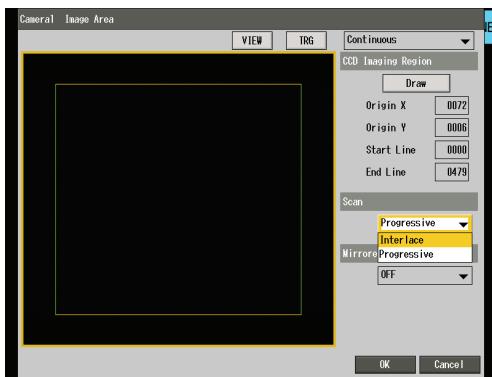
The settings screen for the selected camera appears.

- 2 Select [Draw].**

The [CCD Imaging Region] menu appears.



- 3 Select [Scan], and then select the scan mode.**

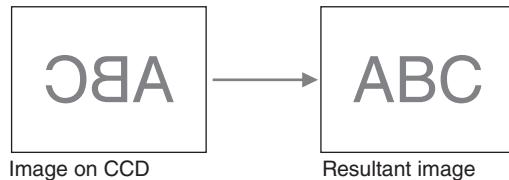


- **Progressive** (default): Captures images using progressive mode (all lines).
- **Interlace**: Captures images using interlace mode (alternate lines).

- 4 When the settings are complete, click [OK].**

Mirrored CCD

Images on the CCD can be inverted horizontally before they are captured. This is useful when needing to invert a backwards image due to using a side view attachment or look at a target from behind.



► Note

Once an image has been converted it cannot be reverted to its normal orientation later.

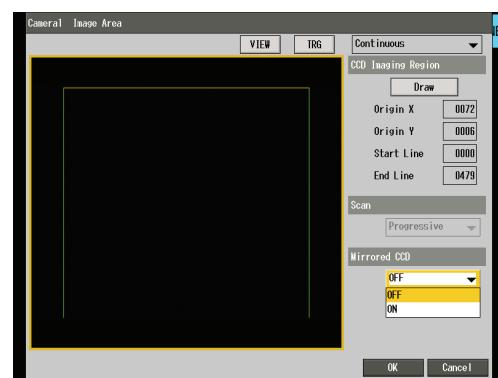
- 1 Select the camera connection (Camera 1 to Camera 4) connected to the controller from [Indiv. Settings] on the [Camera Settings] screen (Page 5-6).**

The settings screen for the selected camera appears.

- 2 Select [Draw].**

The [CCD Imaging Region] menu appears.

- 3 Select [Mirrored CCD], and then select whether to mirror the image.**



- **OFF** (default): Mirror the images.
- **ON**: Horizontally invert the image.

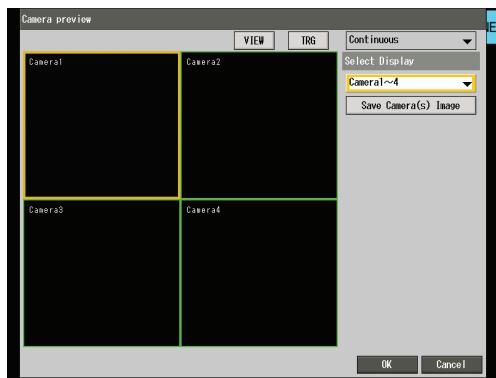
- 4 When the settings are complete, click [OK].**

Camera Preview

The camera preview allows for the checking of the images being captured by the camera based on the settings made. The current image can also be saved as a bitmap file to an SD card. This is useful for quickly checking camera settings and saving images for use in XG VisionEditor.

1 Select [Camera preview] under [Indiv. Settings] on the [Camera Settings] screen.

The images from the connected cameras appear in the [Camera preview] menu.



Reference

- The camera preview can be set to update in [Continuous] or [Trigger] mode. This setting is independent from the Screen Update setting (Page 5-20).
- Use [VIEW] to display the view toolbar (Page 3-9) for the selected camera, enabling the image to be magnified, auto fit to area and scrolled around.

2 From the [Select Display] menu the view can be changed.

- **Camera1:** Displays the image from Camera 1.
- **Camera2:** Displays the image from Camera 2.
- **Camera3:** Displays the image from Camera 3.
- **Camera4:** Displays the image from Camera 4.
- **Camera1-4:** Displays images from all the connected cameras.

3 To save the current camera image as a bitmap file on the SD card, click [Save Camera(s) Image].

Specify the SD card from [Location] on the [Save Camera(s) Image] menu and click [Execute].

The current image from all connected cameras will be saved to the specified SD card under the folder "\xg\cam_img", named "YYMMDD_MMHHSS_&Cam(Cam No.)Img.bmp".

Reference

This function saves images from all cameras, regardless of the selected preview.

4 To finish previewing, click [OK].

Reference

When [Camera preview] is closed by clicking [OK], the update mode and view toolbar settings will stay the same until power is turned off.

Trigger Settings

Use this option to set the system defaults for which trigger signals to use for capturing images.

Reference

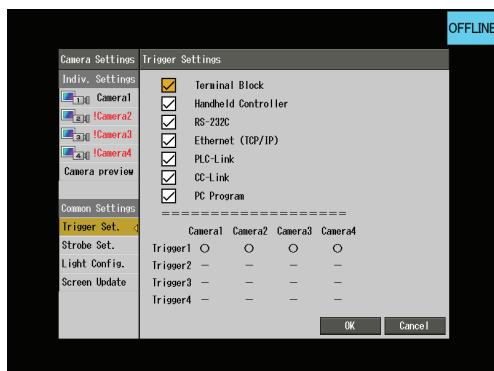
- Trigger settings are applied to all cameras.
- These settings are only reflected in the capture unit when [Trigger Wait] is set to ON and [Type] is set to External.

About the active camera display

The cameras connected to the controller and their respective trigger number are shown at the bottom part of the [Trigger Settings] screen.

Selecting External Trigger Sources

1 Select [Trigger Settings] under [Common Settings] on the [Camera Settings] screen (Page 5-6).



2 Select the trigger type to be used by checking the appropriate boxes.

- **Terminal Block:** Trigger through external I/O terminals %Trg1-%Trg4
- **Handheld Controller:** Trigger using the [TRIGGER] button on the handheld controller
- **RS-232C:** Trigger via commands through the RS-232C port
- **Ethernet (TCP/IP):** Trigger via commands through the Ethernet port
- **PLC-Link:** Trigger via commands using the PLC-Link (Ethernet or RS-232C).
- **CC-Link:** Trigger via commands using the CC-Link
- **PC Program:** Trigger through the ActiveX control

3 When the settings are complete, click [OK].

Strobe Lighting Settings

The settings for controlling lighting can be changed with the system variables %Flash1 to %Flash4 which are assigned to F_OUT0 to F_OUT3 on the controller. For I/O signal controls with external equipment, refer to "Chapter 6 I/O Interface Specifications" (Page 6-1).

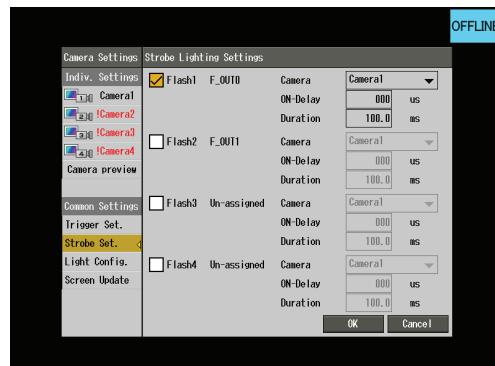
1 Select [Strobe Lighting Settings] under [Common Settings] on the [Camera Settings] screen (Page 5-6).

The [Strobe Lighting Settings] menu appears.

2 Place a check next to the FLASH terminal for use and change the settings.

Reference

A check will be shown next to the FLASH terminal if it has been assigned to an output terminal on the controller and is ready to be used.



Camera

Select the camera that will control the strobe signal from Camera1 to Camera4.

ON-Delay

Specify the starting point for the flash signal output within the range -500 to 500 (μs), where 0 is the start of image capturing (Default: 0 μs, the time of trigger input). If a negative value is specified, output starts before the CCD opens. If a positive value is specified, output starts after the CCD opens.

► Note

To use several FLASH signals for a single camera, specify values so that the delay in the output starting points is 500 μs or less.

Duration

Set the FLASH signal duration within the range 0.1 to 999.9 (ms). (Default: 100.0 ms)

Reference

The signal type for the FLASH signal output, [Normally open] or [Normally closed], is set in the output assignments. Refer to "Terminal Output Settings (Parallel Port)" (Page 5-22) for more details.

3 When the settings are complete, click [OK].**Lighting Configuration**

If a lighting controller CA-DC20E is connected to the controller the light configuration can be set.

Assigning FLASH Terminal Outputs to Lights

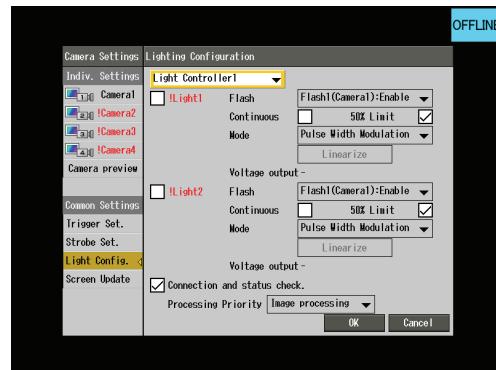
Change settings and assignments of FLASH terminals for controlling the lights connected to the lighting controllers. The FLASH system variables enable the control of lighting without the need for external wiring.

Reference

Refer to "Strobe Lighting Settings" (Page 5-17) for more details on FLASH terminal settings and connections.

1 Select [Lighting Configuration] under [Common Settings] on the [Camera Settings] screen (Page 5-6).

The [Lighting Configuration] menu appears.

**2 Select the light 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 module closest to the controller.

3 Check the box next to the light number to be configured, then adjust the settings.**Flash**

Select the FLASH signal to use from Flash1 through 4. The light will illuminate according to the output status of the assigned FLASH signal.

▶ Note

The light will not illuminate even after setting if the selected FLASH signal is not assigned to a terminal or the terminal is not checked in [Strobe Lighting Settings] (Page 5-17).

Continuous

Check continuous to keep the light illuminated regardless of the FLASH terminal output.

▶ Note

Flash assignments cannot be changed when continuous operation is selected.

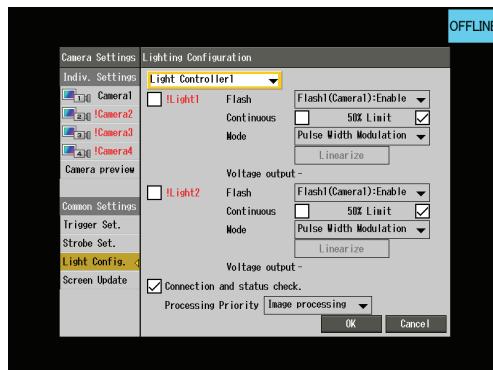
- 4 Repeat steps 2 and 3 to configure the settings for each light.
- 5 When the settings are complete, click [OK].

Light controller settings

Settings for the lighter controller module (CA-DC20E) (option) connected to the controller can be changed.

- 1 Select [Light Config.] under [Common Settings] on the [Camera Settings] screen (Page 5-6).

The [Light Config.] menu appears.



- 2 Select the light controller to change the settings for.

Reference

When multiple lighting controllers are connected, they will be numbered 1 through 4, with 1 being the unit closest to the controller.

- 3 Change the settings as required.

Settings can be changed for each light connected to the controller.

Reference

- The [Connection and status check] option applies to all lighting controller modules.
- The [Voltage output] is changed by setting the DIP switches on the lighting controller module. For more details, refer to "Using the Illumination Expansion Unit" (Page 2-27).

Mode

Select the lighting mode.

- **Pulse Width Modulation** (default): Controls and illuminates the light using PWM.
- **D.C.**: Illuminates and controls the light using DC.

Linearize

If the [Mode] is set to [D.C.], the output can be automatically set to the characteristics of the currently connected light source so that the intensity value specified is linear to the light intensity.

50% Limit

Use this option to limit the light output to 50% to prevent degradation of the LED light through overheating (default: ON).

► Note

If this is set to "ON", the light intensity will be fixed at 127 even if the light intensity setting (Page 5-11) is set to 128 or higher.

Connection and status check

Use this option for checking if there are any errors with the lighting controller before capturing an image (Default: ON). Disabling the [Connection and status check.] option results in a quicker processing time, but disables error checking when capturing images.

Processing Priority

Use this option to specify the processing priority when changing light intensity. Change this to [Lighting] to ensure that intensity adjustments are reflected at specific image capture points.

- **Image processing** (default): Adjusts the intensity at a time that does not affect the program cycle.
- **Lighting**: Temporarily stops accepting trigger inputs in the capture unit and adjusts the intensity immediately. If the capture unit is in trigger wait status, %Trg*Ready will turn OFF for approx 1 to 10 ms while the intensity is adjusted.

4 When the settings are complete, click [OK].

Screen Update

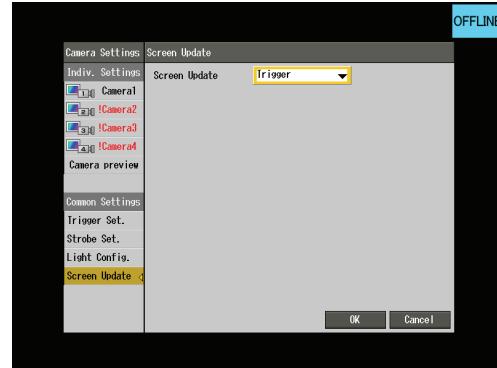
This controls when the display screen is updated while displaying images.

► Reference

This setting does not apply to Camera Settings and White Balance adjustment (Page 5-21).

1 Select [Screen Update] under [Common Settings] on the [Camera Settings] screen.

The [Screen Update] menu appears.



2 Change the settings as required.

- **Trigger** (default): Updates the screen based on a trigger input.
- **Continuous**: Displays a live image.

3 When the settings are complete, click [OK].

► Note

When [Continuous] is selected these limitations apply:

- Although the screen is always updated, an inspection will not be performed unless a trigger input is received.
- There will be a time lag equivalent to or less than the "Shutter speed + Image capture time" between the trigger input and the actual image capture.

Adjusting the White Balance

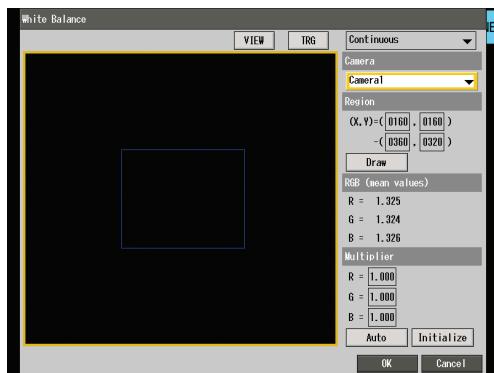
If a color camera is connected, the RGB levels (white balance) can be adjusted to match the lighting environment of the target area. Perform such adjustment when installing a new system or when changing cameras or lighting.

▶ Note

- 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.
- Any unsaved settings, results and archive data will be cleared (Page 3-24) when changing the white balance.
- In Run mode, this setting only affects capture units that have the use system settings option enabled. Refer to "Capture" (Page 4-16) for more details about referencing global settings.

1 From the System Configuration, select [Cameras] - [White Balance].

The [White Balance] menu appears.



Reference

Camera images can be updated in [Continuous] or [Trigger] modes.

2 Select the camera to be adjusted.

▶ Note

A monochrome camera cannot be selected.

Reference

Individual camera settings (such as shutter speed), for making adjustments can be set in the [Camera Settings] in the System Configuration menu.

3 Specify the reference area for adjusting the white balance.

Enter a numerical value or select [Draw] to specify the area.

4 Place a white piece of paper (or other white target) in the area specified in step 3, and then press the No. 3 (TRIGGER) button on the handheld controller, or click [TRG] on the screen.

The average color values (R, G, B values) are displayed in the [RGB (mean values)] field.

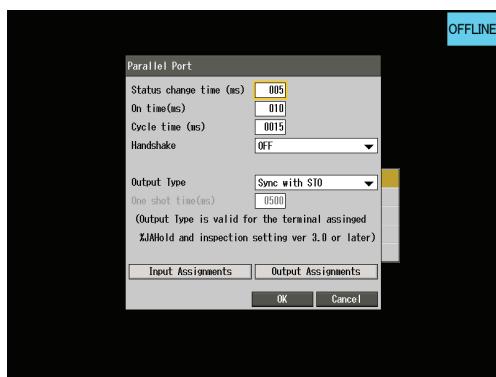
Terminal Output Settings (Parallel Port)

Settings for controlling the input and output of data through the controllers terminals (parallel and terminal block) can be changed. For more details on interfacing signals with external devices, "Terminal Output Settings (Parallel Port)" (Page 5-22), "Parallel I/O Interface" (Page 6-19) refer to "Controller Global Settings" in the XG VisionEditor Reference Manual.

1 From the System Configuration menu, select [Communications & I/O] - [Parallel Port].

The [Parallel Port] menu appears.

2 Change the settings as required.



Status change time (ms)

Set the length of time from when the data is ready for output to the leading edge of %Sto within the range 1 to 999 (ms). (Default: 5 ms)

On time (ms)

Set the time from the leading edge of %Sto to the trailing edge of %Sto within the range 1 to 999 (ms). (Default: 10 ms)

Cycle time (ms)

Set the time between two consecutive leading edges of %Sto within the range 2 to 1000 (ms). (Default: 15 ms)

Handshake

Select [OFF] (default) or [ON] to perform handshaking for parallel terminal input and output.

Output Type

Select the method used to control the behavior of the output %JAHold.

- **Latching**: latches the output when a NG result occurs. (To unlatch, either reset, change the program, or turn the outputs off.)
- **Sync with STO** (default): turns ON and OFF the output in synchronization with the %Sto output (Page 4-291).
- **One shot**: turns the output on for the time specified in [One shot time (ms)] and then turn off immediately after.

► Note

- If the program was created in version 2.1 or earlier, the output will be fixed in [Latching] state regardless of the [Output Type] setting.
- If [Sync with STO] is selected %Sto will not be output unless at least one parallel terminal output unit is processed in the flowchart.
- A parallel terminal output unit must be processed to synchronize the output of %JAHold with %Sto. The parallel terminal output unit does not have to contain output data if there is no data to output via the parallel port.

One shot time (ms)

Set the one shot duration within the range 1 to 9999 (ms). (Default: 500 ms.) This is only valid if the [Output Type] is set to [One shot].

Input Assignments

Review/edit input assignments.

Output Assignments

Review/edit output assignments.

3 When the settings are complete, click [OK].

Reference

- The strobe output settings can be changed in the [Camera Settings] on the System Configuration menu, or by using the [Strobe Lighting Settings] menu (Page 4-24) in the capture unit.
- For more details on system variables that can be assigned, refer to the XG VisionEditor Reference Manual (Control/Data Edition).
- Assignment of the same bit on the same system variable to multiple input terminals on the parallel port or RY addresses using CC-Link is not allowed.

► Note

The controller must be restarted if changes are made to the input assignments or output assignments.

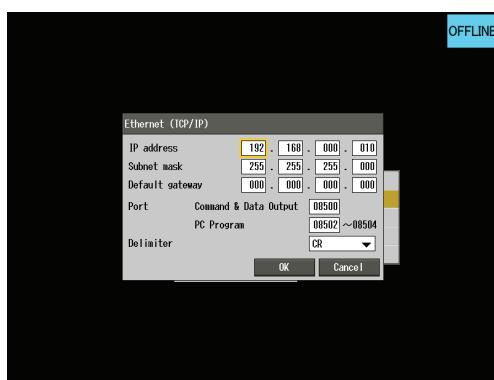
Ethernet (TCP/IP) Network Settings

Settings for controlling the input and output of data through the Ethernet port can be changed. For details on interfacing signals with external devices, refer to "Chapter 6 I/O Interface Specifications" (Page 6-1).

1 From the System Configuration menu, select [Communications & I/O] - [Ethernet (TCP/IP)].

The [Ethernet (TCP/IP)] menu appears.

2 Change the settings as required.



► Note

If any incorrect settings are made, not only the controller but also other equipment on the network may not work properly. Consult your system or network administrator for information on setting values.

IP address

Enter the IP address for the controller. (Default value: 192.168.0.10)

Subnet mask

Enter a subnet mask. (Default value: 255.255.255.0)

Default gateway

Enter a default gateway IP address (Default value: 0.0.0.0).

► Note

- The IP address specified as the destination for archive data using FTP (Page 4-317) must be unique.
- If the PLC-Link (Ethernet) is enabled, the IP address must not be the same as the IP address on the other end of the PLC link.
- If PLC-Link (Ethernet) is enabled and the settings are changed, the controller must be restarted for changes to take effect.

Port

Enter the port number used for data I/O on the controller.

- Command & Data Output:** Enter the port number used for non-protocol specific commands and data output. (Default: 8500)
- PC Program:** Enter the port used to communicate with PC programs (XG VisionEditor, XG VisionTerminal, and ActiveX controls). (Default: 8502). Note, PC programs use three consecutive ports from the specified number. For example, if you enter 8710, the programs will use ports 8710 to 8712, or for 10108, ports 10108 to 10110.

► Note

- The same port number cannot be used for both [Command & Data Output] and [PC Program].
- The port number for outputting archive data by FTP (Page 4-317) is 65535. If this number is used for either [Command & Data Output] or [PC Program], the FTP output feature cannot be used.

Delimiter

Select [CR] (default) or [CR + LF] as the delimiter for Ethernet communication.

3 When the settings are complete, click [OK].

RS-232 Network Settings

Settings for controlling the input and output of data through the RS-232 port can be changed. For details on interfacing signals with external devices, refer to "Chapter 6 I/O Interface Specifications" (Page 6-1) and "Controller Global Settings" in the XG VisionEditor Manual.

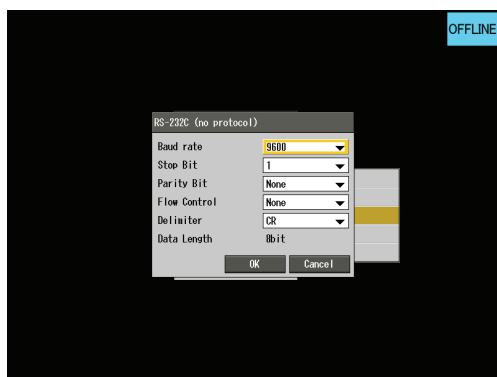
1 From the System Configuration menu, select [Communications & I/O] - [RS-232C (no protocol)].

The [RS-232C (no protocol)] menu appears.

► Note

This item cannot be selected if PLC-Link (RS-232C) is enabled.

2 Change the settings as required.



Baud rate

Select 9600 (default), 19200, 38400, 57600, or 115200 (bps) for the baud rate.

Stop Bit

Select [1] (default) or [2] for the stop bit.

Parity Bit

Select [None] (default), [Odd], or [Even] for the parity bit.

Flow Control

Select [None] (default) or [CTS/RTS] for the flow control.

Delimiter

Select [CR] (default) or [CR + LF] for the delimiter of RS-232C communication.

3 When the settings are complete, click [OK].

Reference

The data length is fixed at 8 bits.

PLC-Link Settings (PLC-Link)

Settings for controlling the input and output of data through PLC Link can be changed.

Reference

Refer to Types of "Compatible PLC Link Connections" (Page 6-14) for more details on using the PLC link function.

▶ Note

- If the communication mode and PLC-Link mode settings are changed, the controller must be restarted for changes to take effect.
- If the communication mode is changed to [PLC-Link], a message "Initializing PLC-Link *th time" appears in the lower right of the screen and disappears after the connection is established.
- If you change to run mode after establishing the [PLC-Link] communication mode, the controller will repeat the initialization process until a connection to the PLC is established. If there is no response from the connected PLC, the warning "PLC communication has failed" is displayed each time initialization is performed. If the warning continues to appear, check to see the PLC is connected correctly.

Using the PLC Link via RS-232C

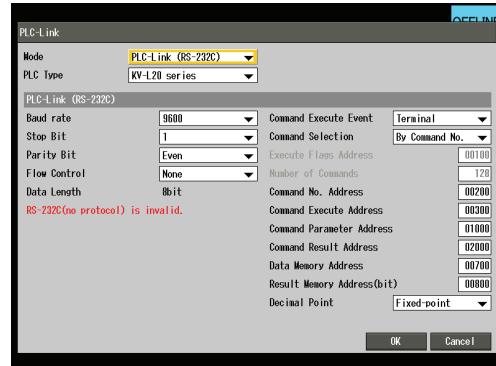
Use the following procedures when using the PLC-Link via RS-232C between the controller and PLC connected with a RS-232C link unit. For more information about data addressing, refer to the XG VisionEditor Reference Manual (Programming Edition).

1 From the System Configuration menu, select [Communications & I/O] - [PLC-Link].

The [PLC-Link] menu appears.



2 Select [PLC-link (RS-232C)] in [Mode].



3 Select the Series name to be connected in [PLC Type].

The settings for the selected PLC type appear.

4 Change the settings as required.

The settings on the left side of the menu relate to the PLC link via RS-232 settings. Refer to "PLC-Link Common Settings" (Page 5-27) for details on the settings on the right.

Baud rate

Select 9600 (default), 19200, 38400, 57600, or 115200 (bps) for the baud rate.

► Note

If [SYSMAC C Series] is selected, only "19200" or "9600" can be selected.

Stop Bit

Select [1] (default) or [2] for the stop bit.

► Note

If [KV-L20 Series] is selected, the stop bit is fixed to [1].

Parity Bit

Select [None] (default), [Odd], or [Even] for the parity bit.

► Note

If [KV-L20 Series] is selected, the parity bit is fixed to [Even].

Flow Control

Select [None] (default) or [CTS/RTS] for the flow control.

► Note

If [MELSEC AnN series] or [MELSEC Q/L series] is selected, the flow control is fixed to [CTS/RTS]. If [KV-L20 Series], [SYSMAC C Series], or [SYSMAC CJ/CS1 Series] is selected, the flow control is fixed to [None].

Data Length

Fixed at 8 bits.

5 When the settings are complete, click [OK].

Using the PLC Link via Ethernet

Use the following procedures when using the PLC link via Ethernet between the controller and the PLC connected with a Ethernet link unit. For more information about data addressing, refer to the XG VisionEditor Reference Manual (Programming Edition).

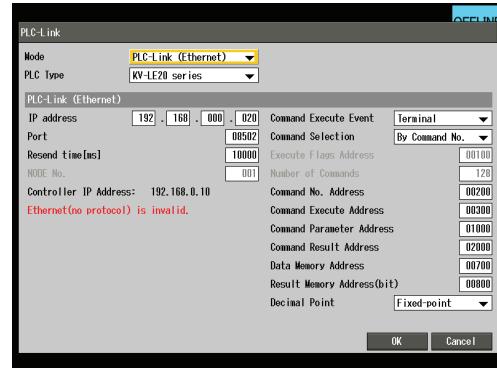
1 From the System Configuration menu, select

[Communications & I/O] - [PLC-Link].

The [PLC-Link] menu appears.



2 Select [PLC-Link (Ethernet)] in [Mode].



3 Select the Series name to be connected in [PLC Type].

The settings for the selected PLC type appear.

4 Change the settings as required.

The settings on the left side of the menu relate to the PLC link via RS-232 settings. Refer to "PLC-Link Common Settings" (Page 5-27) for details on settings on the settings on the right.

IP address

Enter the IP address for the unit that the controller is communicating to (default:192.168.0.20).

► Note

The IP address must be different from the controller's IP address.

Port

Enter the port number of the PLC link unit (default: 8502 (KV-LE20 Series), 5000 (MELSEC Q/L Series), 9600 (SYSMAC CJ/CS1 Series)).

► Note

Changing the [PLC Type] returns the values to their default settings.

Resend time [ms]

Enter the resend time (ms) if communication error occurs (default 10000 ms).

NODE No.

Specify the node number (available only when [SYSMAC CJ/CS1 Series] is selected).

Controller IP Address

Shows the IP address of the controller.

5 When the settings are complete, click [OK].

► Note

If you specify [65535] for the [Port], the FTP feature cannot be used for outputting archive data (Page 4-317).

PLC-Link Common Settings

Common settings for the PLC-link

PLC link settings regardless of communication type.

Command Execute Event

Choose the method used for executing commands sent via PLC Link.

- **Terminal** (default): Execute commands on the leading edge of the terminal assigned as the PLC terminal.
- **Poling**: Execute commands when the value in a data memory designated as the control address changes from 0 to 1.

► Note

- Only custom commands can be executed using the PLC-Link.
- Depending on the communication quality, polling may result in slower command execution when compared to using terminal.

Reference

- For details on custom commands that can be used via PLC-Link, refer to the XG VisionEditor Reference Manual (Control/Data Edition).
- For details on default custom commands refer to "List of Custom Commands" (Page 8-89).

Command Selection

Select the method used to specify commands sent via PLC Link.

- **By Command No.** (default): Commands are specified by using the custom command number in the data memory designated as the [Command No. Address].
- **By Execute Flags**: Commands are specified by using "1"s in data memory words that correspond to the custom command to be executed. This data memory begins at the [Execute Flags Address].

Specifying commands (By Command No.)

Command No. Address

Specify the address (default: 00200) of the data memory used for custom command numbers.

- Use 1 word addresses.
- A command will be executed by entering the number of the custom command (0 to 127).

Command Execute Address

Specify the address (default: 00300) of the data memory word used for executing commands that are entered by their command number. This address is used to verify command results (0: Success, Error Code: Fail), and for executing commands when using the polling method (1: execute).

Uses 1 word addresses.

Specifying commands (By Execute Flags)

Execute Flags Address

Specify the starting address (default: 00100) of the data memory used for specifying commands individually.

- This function uses the number of data memory addresses specified in the [Number of Commands] field (1 word per command, max 128 words).
- In addition to specifying individual commands to execute and verifying command results, this address is also used to execute commands by polling.

▶ Note

- Custom commands are always specified from a 0-based address. Non 0-based addresses cannot be used.
- If a "1" is entered in two or more data memory words at the same time, only the command from the smaller address will be executed.

Number of Commands

Specify the number of data memory words (commands) used when executing commands by flags. (0 to 128, default: 128.)

Reference

Response times for executing commands using the polling method can be improved by specifying the smallest number of flags required.

Common settings for commands

Command Parameter Address

Specify the starting address (default: 01000) of the data memory used for command parameters (*01 to *16).

- This function uses 2 words of addresses for each parameter from the starting data address (max 32 words for 16 parameters).
- Enter values for the parameters defined in the commands and specify any parameters required for execution.

Reference

For commands that use text string parameters, the parser will read 2 words per character from the designated parameter data address (terminate strings with a "0" or "NULL").

Command Result Address

Specify the starting address (default: 02000) of the data memory used for storing data from commands that return results.

- This function uses 2 words per data item (or 2 words per character if the command returns text strings).
- The range of data memories required for storing data depends on the command definition.

Specifying result data output

Data Memory Address

Specify the starting address (default: 00700) of the data memory used for storing data from data output units.

- This function uses 2 words per data item (or 2 words per character if the command returns text strings).
- The range of data memories required for storing data depends on the settings in the [Item] tab of the data output unit (Page 4-294).

Result Memory Address (bit)

Specify the address (default: 00800) of the data memory used for confirming the data has been output.

- This function uses 1 word addresses.
- A "1" will be written if the result output for one data output unit completes normally.
- The location in the data memory where the result output completion status is written depends on the settings in the [Item] tab of the data output unit (Page 4-294).

Decimal Point

Choose the method for handling numbers from output units, parameters used with MW/MR/MS/MWX/MRX/MXS commands, and for command data and results.

- **Fixed-point** (default): Process the number by multiplying it by 1000 and storing it as 32 bits of signed integer data in the data memory (address m: lower 16 bits, address m+1: upper 16 bits).
- **Floating-point**: Processes the number as single-precision floating point data (32 bits) in the data memory.

CC-Link Settings (CC-Link)

Use the following procedures to setup and communicate with the CC-Link module CA-NCL10E. For more information about synchronizing CC-Link variables, refer to the XG VisionEditor Reference Manual (Control/Data Edition).

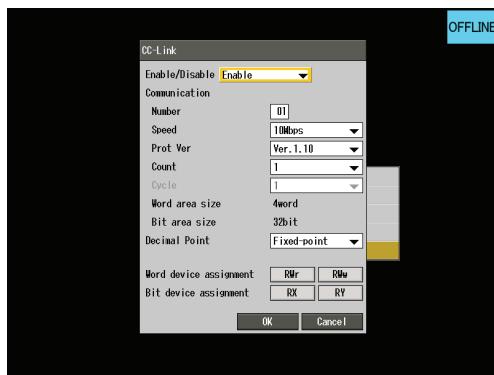
► Note

- If any settings other than the [Decimal Point] settings are changed, the controller must be restarted for changes to take effect.
- After restarting with the CC-Link set to [Enable], the controller will repeat the initialization process until a connection to the CC-Link unit is established. If there is no response from the connected CC-Link unit, the confirmation menu "CC-Link communication has failed" is displayed each time initialization fails.

1 From the System Configuration menu, select [Communications & I/O] - [CC-Link].

The [CC-Link] menu appears.

2 Specify [Enable] in the [Enable/Disable] field.



► Note

If the input terminal assignment and coinciding system variable/bit is set to RY, the [OK] button will remain disabled, preventing changes to be confirmed, even when choosing [Enable] selecting [Enable]. Change the input assignment or coinciding RY setting, then choose [Enable].

3 Change the settings as required.

Number

Select the station number (1 to 64) of the CC-Link on the controller (Default: 1). With CC-Link, up to 64 stations can be connected to one master station (fixed as number 0). The controller reserves the number of stations set in [Count] starting from the number set in [Number]. For example, if [Number] is set to 10 and [Count] is set to 4 stations, the controller will have exclusive use of station numbers 10, 11, 12, and 13.

Reference

Set the station number so that the same number is not used on multiple devices.

Speed

Select 156 Kbps, 625 Kbps, 2.5 Mbps, 5 Mbps, or 10 Mbps (default) for the communication speed.

Reference

- The transfer speed should be set to the same setting as the master station.
- The maximum transmission distance changes depending on the selected speed. Refer to the XG VisionEditor Reference Manual (Control/Data Edition) for more details.

Prot Ver

Select the CC-Link protocol version.

- **Ver. 1.10** (default): Communicates using version 1.10.
- **Ver. 2.00**: Communicates using version 2.00. This should only be set if the master station is compatible. Using version 2.00 means the cyclic settings can be configured.

Reference

Lowering the protocol version from Ver. 2.00 to Ver. 1.10 will disable any previously set word device assignments.

Count

Set the number of stations (1 to 4) reserved by the controller (default: 1). Increasing the number of stations increases the amount of data that can be transferred.

Cycle

If [Ver. 2.00] is selected for [Prot Ver], set the number of cycles (1 to 8) in the cycle settings (default: 1). Increasing the number of cycles increases the amount of data that can be sent or received with the same number of stations.

▶ Note

- Increasing the number of cycles slows down the response time.
- Reducing the number of stations may disable previously configured words, bit assignment settings and prevent outputs. After changing the number of stations and cycles, check the assignment status display to see if the necessary inputs and outputs are enabled.
- The number of data points allocated by setting the number of stations and cycles includes the data used by the system. The number of data points available for user configuration are below:

Cycle: 1x

Data type	Word device		Bit device	
	RWr	RWw	RX	RY
1 station	4	4	11	12
2 stations	8	8	43	44
3 stations	12	12	75	76
4 stations	16	16	107	108

Cycle: 2x

Data type	Word device		Bit device	
	RWr	RWw	RX	RY
1 station	8	8	11	12
2 stations	16	16	75	76
3 stations	24	24	139	140
4 stations	32	32	203	204

Cycle: 4x

Data type	Word device		Bit device	
	RWr	RWw	RX	RY
1 station	16	16	43	44
2 stations	32	32	171	172
3 stations	48	48	299	300
4 stations	64	64	427	428

Cycle: 8x

Data type	Word device		Bit device	
	RWr	RWw	RX	RY
1 station	32	32	107	108
2 stations	64	64	363	364
3 stations	96	96	619	620
4 stations	128	128	875	876

Reference

The word device uses two words for each item, excluding the Command Result and Command Number items.

4 Change the [Decimal Point] settings as required.

Choose the appropriate data expression method for each command parameter MW/MR/MS/MWX/MRX/MSX, commands data output, and result data output for the word device input and output.

- Fixed-point** (default): Process the number by multiplying it by 1000 and storing it as 32 bits of signed integer data in the word device.
- Floating-point**: Processes the number as single-precision floating point data (32 bits) in the word device output (RWrX: lower 16 bits, RWrX+1: upper 16 bits).

Reference

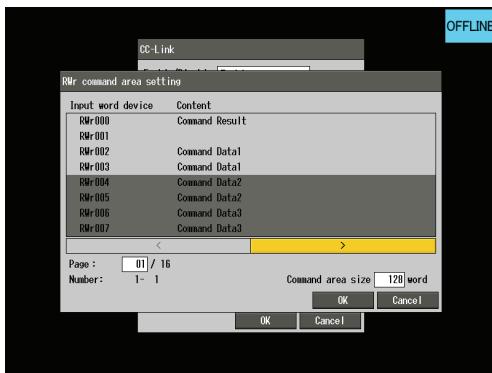
If a command uses an integer, the controller will read the command parameter as an integer by rounding off the tenth digit regardless of the setting, and write the command data output as an integer.

5 Confirm the word device assignment as necessary.

This function shows the word device output and input and is useful for finding unused ranges.

RWr

A list of word outputs appear in the [RWr command area setting] menu.



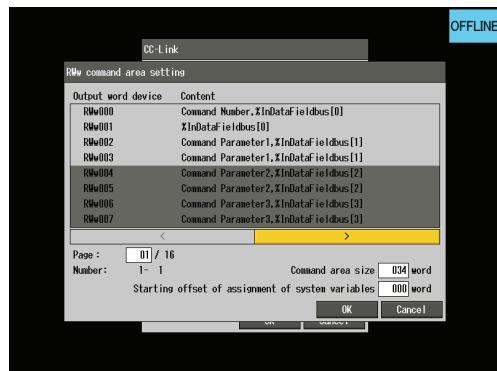
- Data output units (Page 4-294) used in the flowchart that specify CC-Link as the destination are listed by their unit ID in the write data range.
- The items used by commands are written to the continuous 128 words block (by default). The command result is written to RWr000 and command data1 to 63 is written to RWr002 to RWr127.
- Reducing the command area size reduces the command area 2 words at a time from RWr127.
- Any device ranges that cannot be used with the current settings are grayed out.
- The result data Command Data1 to 63 is registered using the method chosen in [Decimal Point].

Reference

If data outputs and commands are used at the same time, their data ranges may overlap. Avoid this by reducing the command area size to the least amount of words required, and by changing the starting address for outputting results in the [Offset of RWr] setting for the data output unit. Refer to "Data Output" (Page 4-294) and "Control/Data Output via CC-Link" in the XG VisionEditor Reference Manual (Control/Data Edition) for more details.

RWw

A list of word inputs appear in the [RWw command area setting] menu.



- By default, the system variables for variable synchronizing starting at %InDataFieldbus [0] are assigned to RWw000, 2 words for each item.
- The items used by commands are written to the continuous 34 words block (by default). The command number is written to RWw000 and command parameter1 to 16 is written to RWw002 to RWw034.
- Reducing the command area size reduces the command area 2 words at a time from RWw033.
- Any device ranges that cannot be used with the current settings are grayed out.
- Data that includes decimal points and is used in Command Parameter1 to 16 is registered using the method chosen in [Decimal Point].

Note

Only custom commands can be executed using the CC-Link.

Reference

- If commands and variables are used at the same time, their data ranges may overlap. Avoid this by reducing the command area size to the least amount of words required, and by changing the starting address for synchronizing variables in the [Starting offset of assignment of system variables] setting on the variable delay unit. Refer to "Controlling and Outputting Data with CC-Link" in the XG VisionEditor Reference Manual (Control/Data Edition) for more details.
- For details on custom commands that can be used via CC-Link refer to the XG VisionEditor Reference Manual (Control/Data Edition).
- For details on default custom commands refer to "List of Custom Commands" (Page 8-89).

6 Change the bit assignments as required.

Any user-specified system variable related to I/O parallel terminal control can be assigned to bit outputs. Only available addresses based on the current settings are displayed.

▶ Note

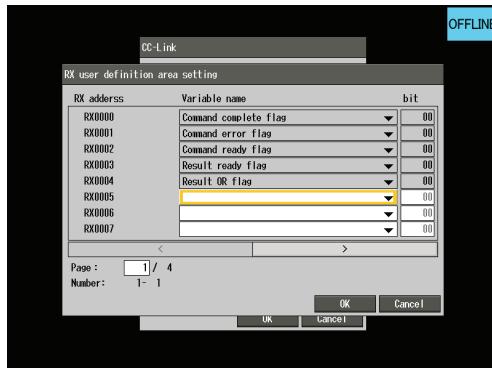
As CC-Link performs communication by scanning the links, high speed switching may not be picked up. The scan cycle changes depending on the number of stations, cycles, and settings of other devices on the network. Be sure to check the signal reliability of signals when using CC-Link.

Reference

The bits required for commands and data outputs are assigned to a reserved area and cannot be changed. For more information about device assignments, refer to the XG VisionEditor Reference Manual (Control/Data Edition).

RX

The [RX user definition area setting] menu appears. Use this menu to assign system variable outputs and their bits to the devices address.



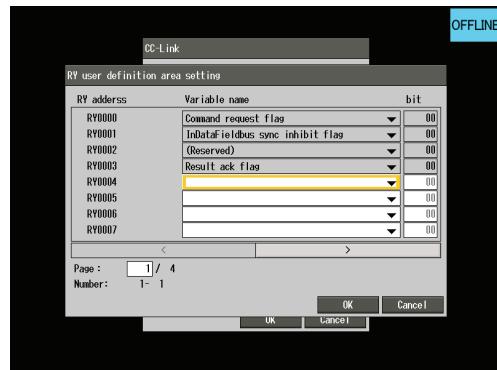
- Use the columns under [Variable name] and [bit] to assign the desired system variable output and its associated bits to an RX address. Only system variables related to parallel port control can be assigned.
- Any ranges that cannot be used based on the current settings are not displayed.

Reference

For more details on the system variables that can be assigned, refer to the XG VisionEditor Reference Manual (Control/Data Edition).

RY

The [RY user definition area setting] menu appears. Use this menu to assign system variable inputs and their bits to the devices address.



- Use the columns under [Variable name] and [bit] to assign the desired system variable input and its associated bits to an RY address. Only system variables related to parallel port control can be assigned.
- Any ranges that cannot be used based on the current settings are not displayed.

Reference

- For more details on the system variables that can be assigned, refer to the XG VisionEditor Reference Manual (Control/Data Edition).
- It is not possible to assign the same bit of the same system variable to multiple RY addresses and input terminals on the parallel port.

7 Click [OK].

Saving and Loading Global Settings

The current global settings can be saved to an SD card, or loaded from an SD card.

▶ Note

Turning off the controller while you are saving the settings may cause errors in the internal data.

Reference

With the menu displayed from clicking [Program] - [New/Edit/Del Programs] on the function menu in Run mode, or by clicking [Program] - [Save/Load Inspection Program] on the System Configuration menu, all the program files and global settings can be saved in a single operation. These functions are useful for making backups of all settings on the controller (Page 4-324).

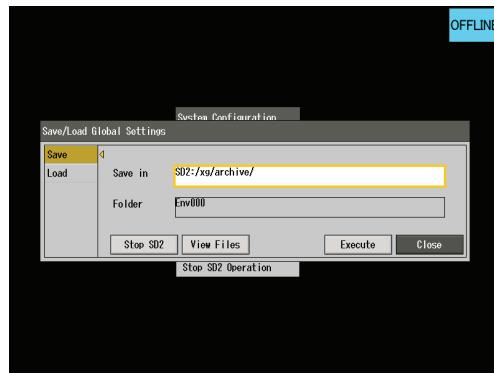
Saving the Global Settings

Global settings can be saved to an SD card.

1 Select [Program] from the System Configuration menu and select [Save/Load Global Settings].

The [Save /Load Global Settings] menu appears.

2 Click [Save].



3 Select [Save in] and specify where to save the global settings.

Specify a folder, (if necessary), where the controller manages all program files.

4 Select [Folder] and specify where to save the global settings.

5 Click [Execute].

The global settings will be saved.

6 When the settings have been saved, a confirmation screen appears.

Reference

Use [View Files] to bring up the [View Files] menu (Page 3-31) and confirm the global settings file env.dat is saved in the specified folder.

Loading the Global Settings

Global settings can be loaded onto the controller from the SD card.

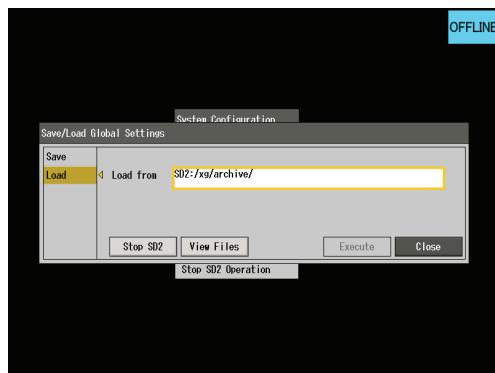
▶ Note

If the global data is loaded from the SD card, all the existing global data will be overwritten. Save the current global data in the SD card as required, and then perform the following operations.

1 Select [Program] from the System Configuration menu and select [Save/Load Global Settings].

The [Save/Load Global Settings] menu appears.

2 Select [Load].



3 Select [Load from] and specify the location of the global data.

Specify a folder, (if necessary), where the controller manages all program files.

4 Click [Execute].

The global settings will be loaded.

When loading operation is completed, a confirmation screen appears.

Reference

The loaded global settings will not take effect until the controller is restarted. The controller can be restarted by clicking [Restart now] on the confirmation screen.

5 Restart the controller.

▶ Note

The new global settings will not take effect until the controller is restarted.

System Information

Use this option to display information about the controller, including the controller name, controller hardware version, program file version, and available space.

1 Select [System Information] from the System Configuration menu.

The [System Information] menu appears.



2 Review the information.

- **Model (version):** Shows the controller model and firmware version.
- **Serial No.:** Shows the serial number of the controller.
- **Controller ID:** Shows the unique ID of the controller.
- **Controller Name:** Shows the name assigned to the controller.
- **Hardware Version:** Shows the hardware version of the controller.
- **Version Information:** Shows the versions of the program files currently on the controller.
- **Free area:** Shows the available memory on each SD card displayed in the form "available memory / total capacity".

Reference

- The [Controller Name] field will be empty if a name has not been set for the controller (Page 5-3).
- If an SD card is not inserted, the "Free area" field will display "0 KB/ 0 KB".

3 Click [Close].

Chapter 6

I/O Interface Specifications

Overview of the I/O Interface

The controller has four communication ports and two discrete I/O terminal blocks.

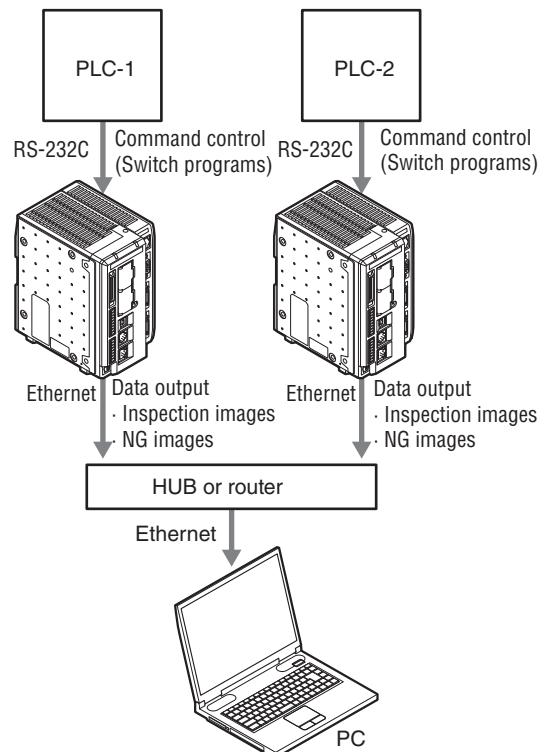
- RS-232C Interface (Page 6-2)
- Ethernet Interface (Page 6-4)
- USB Interface (Page 6-8)
- CC-Link Interface (Page 6-17)
- Parallel I/O Interface (Page 6-19)
- Terminal Block Interface (Page 6-21)

Commands can be sent and data output via the RS-232C and Ethernet communication ports in standard and PLC-Link modes. Multiple communication ports can be used at the same time.

In addition to standard communication, data output and control can also be done using PLC link communication via the RS-232 and Ethernet interfaces. Refer to "PLC Link Communication Mode" (Page 6-10) for details on the PLC link.

Example of multi port usage

Data such as measurement results and NG images are output to the PC via Ethernet while the inspection settings are controlled from the PLC via RS-232C.



▶ Note

Communication software is required to correctly display data on the computer.

RS-232C Interface

The RS-232C port on the system can be used to communicate with external equipment. The system can communicate with external equipment using two communication modes: no protocol mode or the PLC link mode.

The transmitted data will differ depending on the communication mode. Switch modes depending on the environment. Refer to "List of Communication Commands" in the XG VisionEditor Reference Manual for more details on the no protocol mode and switching the communication mode.

▶ Note

The signal GND and power GND are common to both communication modes. Take care to avoid voltage differences when connecting external devices to the controller.

RS-232C Port Specifications

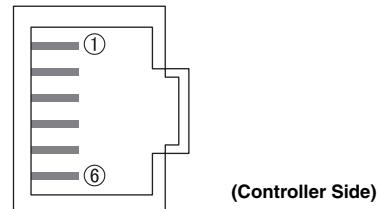
Standard specifications

- Connector: RJ-11
- Standards: The connected device must comply with EIA (Electronic Industries Association) RS-232C standards.

Item	Compatibility
Communication System	Full-duplex
Synchronous system	Asynchronous
Transmission Code	ASCII (Part binary code)
Data-bit Length	8-bit
Stop-bit Length	1-bit/2-bit
Parity Check	None/odd/even
Communication Speed	9'600 / 19'200 / 38'400 / 57'600 / 115'200 bps
Data Delimiter	CR/CR + LF/LF
Flow Control	None, CTS/RTS
Maximum Cable Length	15 m

XG controller port specifications

Specifications for the RS-232C port are as follows:



No.	Signal	Signal Description	Signal Direction
1	CS (CTS)	Data Transmission Permission	Output
2	Not used	-	-
3	SD (TXD)	Data Transmission	Input
4	SG (GND)	GND	-
5	RD (RXD)	Data Reception	Output
6	RS (RTS)	Data Transmission Request	Input

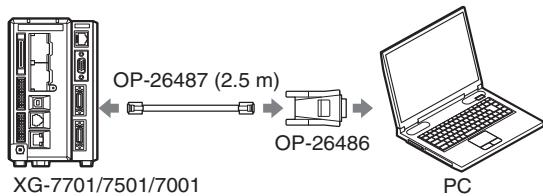
Reference

Since the controller uses the RS-232C modem definition, SD is assigned to input and RD is assigned to output.

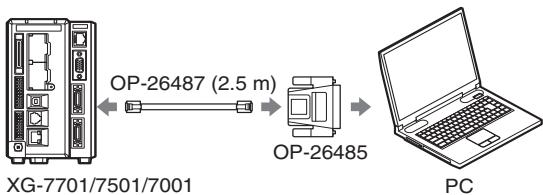
Connecting to a PLC / PC

The controller can be connected to your computer using a dedicated serial cable (optional).

When the PLC / PC has a D-sub 9-pin connector



When the PLC / PC has a D-sub 25-pin connector



▶ Note

- In the connection examples above, flow control is not possible. If flow control is necessary, connect using the page 6-10 method.
- The controller uses the communication settings selected in the communication mode specified in the System Settings in XG VisionEditor. For more details, refer to “Controller Global Settings” in the XG VisionEditor Reference Manual. The baud rate for no protocol mode and parity bit settings can be viewed and changed using [RS-232C (no protocol)] (Page 5-24) on the System Configuration menu.

Ethernet Interface

The Ethernet port on the controller can be used to communicate with external equipment in addition to connecting to Keyence software XG VisionEditor, XG VisionTerminal, and the ActiveX control. The controller can communicate with external equipment using two communication modes: no protocol mode (Page 6-5) based on the RS-232C command set, or the PLC link mode (Page 6-10). The system also acts as an FTP client (Page 4-317) and an external FTP server can be specified as the output destination for sending stored images and history data.

Settings such as the IP Address, subnet mask, default gateway, and port number need to be specified under [Ethernet] in the System Settings menu. For details about the Ethernet settings on the controller, see "Ethernet (TCP/IP) Network Settings" (Page 5-23). For details about the settings in XG VisionEditor, see "Controller Global Settings" in the XG VisionEditor Reference Manual.

Reference

For communication using the PLC link mode, see "Controller Global Settings" in the XG VisionEditor Reference Manual.

Ethernet Port Specifications

Standard specifications

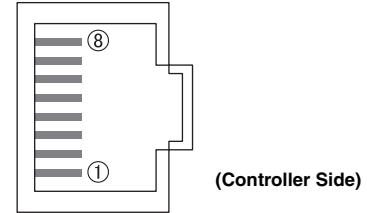
- Connector: RJ-45
- Medium: 10 BASE-T/100 BASE-TX/1000 BASE-T
- Communication protocol: TCP/IP (except PLC link), UDP (PLC link), FTP (FTP client function (only during history data output))

Reference

Keyence software uses both TCP/IP and UDP.

XG controller port specifications

The specifications of the Ethernet port are as follows:



10 BASE-T/ 100 BASE-T		1000 BASE-T		
No.	Signal	Signal Direction	Signal Direction	
1	TX +	Output	TRX+	Input/Output
2	TX -	Output	TRX-	Input/Output
3	RX +	Input	TRX+	Input/Output
4	Not used	-	TRX-	Input/Output
5	Not used	-	TRX-	Input/Output
6	RX -	Input	TRX-	Input/Output
7	Not used	-	TRX+	Input/Output
8	Not used	-	TRX-	Input/Output

Note

Use category 5e LAN cable or above when connecting via 1000 Base-T.

Preparation for Transmission via Ethernet

The controller can be controlled via Ethernet by connecting to a PLC / PC using an Ethernet cable. The controller can transmit various data types including settings, images, measurement values and inspection results.

▶ Note

- Consult your system or network administrator when connecting to an existing LAN. If any incorrect settings are made, not only the controller but also other equipment on the network may not work properly.
- The controller may truncate parts of the output data, depending on the network conditions. (The controller does not resend data with packet loss)
- Some delays may occur with data transmission between the network and the controller, depending on the network conditions. If a response is required, such as a trigger input, communicating via the I/O interface is recommended.
- The firewall function on the connected PC must be disabled, as it may cause a problem with the communication.
- Use equipment that is intended for use in a factory environment (such as hubs and LAN cables) for the network. Using commercial equipment meant for office applications may cause unstable operations.

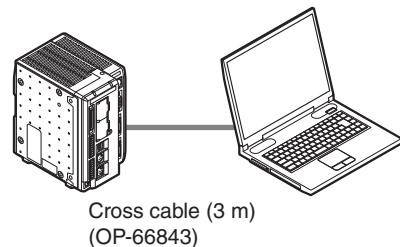
Communication specifications

The Ethernet communication specifications are as follows:

- Communication protocol: TCP/IP (except PLC link), UDP (PLC link), FTP (FTP client function (only during history data output))
- Topology: Peer to Peer

One-to-one connection with a PC

This section describes how to prepare and communicate when the controller is controlled in a one-to-one connection with a PC, and not via the LAN. To connect to your PC, a cross cable (3 m) OP-66843 should be used.



Connecting the controller to a PC

1 Change the TCP-IP settings on the system.

The system uses the TCP/IP settings specified in the System Settings in XG VisionEditor. For more details, see “Controller Global Settings” in the XG VisionEditor Reference Manual.

The IP address, subnet mask, and default gateway settings can be viewed and changed using [Ethernet] (Page 5-23) on the System Configuration menu.

2 Change the TCP-IP settings on a PC.

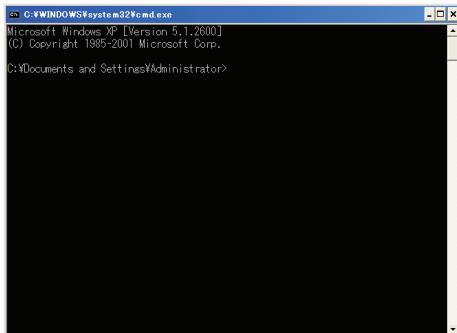
When the controller is directly connected to a PC with a cross cable, set the IP address between 192.168.0.1 and 192.168.0.255 excluding 192.168.0.10 (when the subnet mask of the controller and PC are 255.255.255.0).

See the instruction manual for your computer or LAN settings for more information.

3 Turn off the controller and the PC and connect the Ethernet connector on the PC to the Ethernet port using a cross cable.

4 Turn on the controller and the PC.

5 Start [Command Prompt] on the PC.



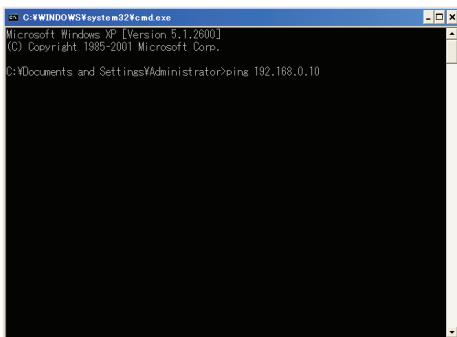
Reference

To start the command prompt (Windows XP), click the [Start] menu then click [All Programs] - [Accessories] - [Command Prompt].

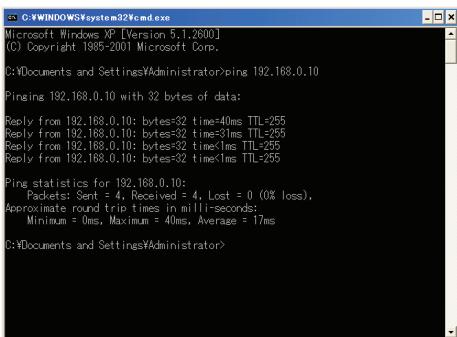
6 Enter [ping] followed by the IP address of the controller in alphanumeric characters and press the Enter key.

When the IP address of the controller is [192.168.0.10]

Enter [ping 192.168.0.10].

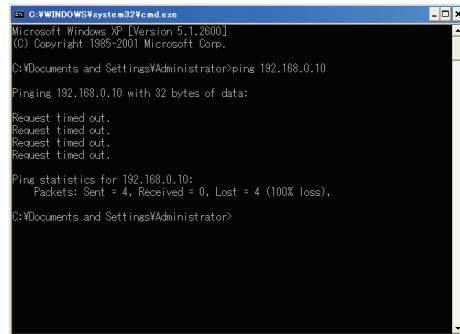


If the controller and the PC are properly configured, a message [Reply from (the IP address of the controller) ~] will appear.



When [Request timed out] appears

If a message [Request timed out] appears and the correct IP address of the controller has been specified in the ping command, the setting and configuration of the controller and the PC is incorrect.



Check that the steps from 1 to 4 described on the previous page have been properly performed.

An example of communicating with the controller using Telnet software and no protocol mode

You can use Telnet software to communicate with the controller. In this example, the operation process using Tera Term (free software) is described.

Reference

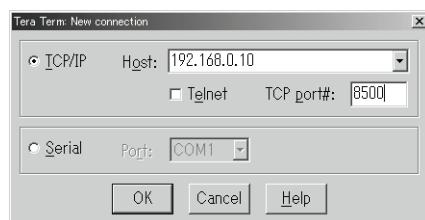
See the following URL for details on Tera Term (as of January 2010).
<http://www.vector.co.jp/soft/win95/net/se067018.html>

1 Prepare Telnet software.

Install Telnet software such as Tera Term (freeware).

2 Start Telnet software on your PC and configure settings for the host.

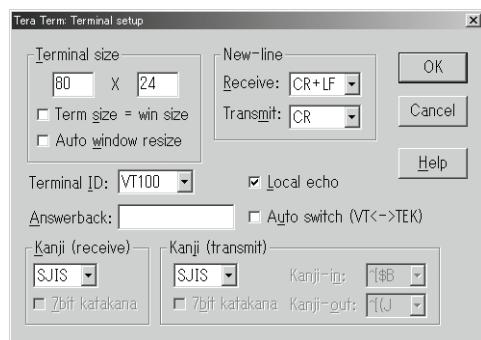
- Host: Enter the IP address of the controller. (Default value: 192.168.0.10).
- TCP port#: Enter the communication port specified for the controller. (Default value: 8500).



3 Connect the host.

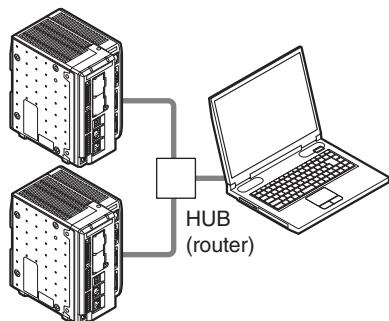
If Tera Term is used, click [OK] after configuring the host computer connections.

The command system used in communication is the same as that of the no protocol mode in RS-232C. For more details, refer to "Standard Instruction" in the XG VisionEditor Reference Manual.



One-to-n connection with a PLC / PC

This section describes how to prepare and communicate when more than one controller is controlled by one PC via a LAN.



Differences between one-to-one connections and one-to-n connections

Preparation and control methods for one-to-n connection are basically the same as those for one-to-one connection. However, the following points differ.

- To connect multiple controllers, a hub or router that supports 1000BASE-T, 100BASE-TX or 10BASE-T is required.
- To connect a controller to a hub (or router), use a commercial straight cable. Keyence recommends using a shielded twisted pair (STP) straight cable, category 5e or greater.
- The IP addresses of the controllers on the network and that of the PC must be different to prevent communication breakdown.

An example of using two controllers (In this example the subnet mask of the controller and PC is 255.255.255.0)

- IP address of the first controller: 192.168.0.10 (default)
- IP address of the second controller: 192.168.0.11 (changed because the default value would be the same as first controller)
- The IP address of the PC: 192.168.0.12 (changed to not interfere with the other addresses but using the same first three ABC classes)
- If a router is used, the Ethernet settings of the controllers must be changed according to the settings of the router. For more details, see the instruction manual of the router or consult your system or network administrator.

Notes on one-to-n connections

- Multiple controllers cannot exchange data with each other or control each other.
- The maximum number of computers that can be connected at once depends on the software and hardware of the devices connected. For more details, contact the manufacturer of the software or hardware of the devices connected.
- Consult your controller or network administrator when connecting to an existing LAN. If any incorrect settings are made, not only the controller but also other equipment on the network may not work properly.
- The baud rate and or connection stability may vary depending on the combination of connected devices and the network status. Make sure to check the operational functionality of the network before starting actual operation.

USB Interface

The USB port on the controller is used exclusively for connecting to Keyence software XG VisionEditor, XG VisionTerminal. The USB port cannot be used with any other software.

▶ Note

The connector shield, signal GND, and power GND are common. Take care to avoid voltage differences when connecting external devices to the controller.

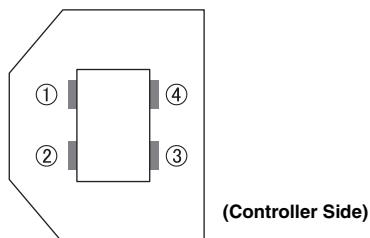
USB Port Specifications

Standard specifications

- Connector: Female B connector
- Standard: USB Version 2.0.

XG controller port specifications

Specifications of the USB port on the controller are as follows:



No.	Signal	Signal Description	Signal Direction
1	VBUS	VBUS	-
2	D-	Differential signal -	Input/Output
3	D+	Differential signal+	Input/Output
4	GND	GND	-

Connecting to a PC

You can connect the controller to the PC via the USB port. To connect the controller to the PC, use a USB cable (2 m) OP-66844.

▶ Note

- Only a single PC can be connected to one controller.
- If a cable other than OP-66844 or an extension cable is used, the controller may not operate correctly.
- Conventional USB devices such as a USB mouse, card reader or thumb drive cannot be connected to this port.
- Communication may be interrupted due to high voltage or electrical noise near the system. If communication is interrupted, disconnect and re-connect the USB cable, and restart the software.
- If communication interruption occurs frequently, check the surrounding area for noise sources (inverter, solenoid valve, etc.).

System requirements

To connect the controller to a PC via the USB port, a PC with the following requirements is needed.

- Operating system: Microsoft Windows 7 Home Premium/Professional/Enterprise/Ultimate Edition, Microsoft Windows Vista Home Basic/Premium/Business/Ultimate/Enterprise Edition, Microsoft Windows XP Home/Professional Edition SP2 or later, or Windows 2000 Professional SP4 or later (Other Windows operating systems are not supported).
- USB 2.0 compatible connector
- CD-ROM / DVD drive

▶ Note

Only the 32-bit version of the operating systems are supported.

Installing the driver

You must install the USB driver before connecting the controller to a PC. After the driver is installed, the controller can communicate correctly with a PC running the Keyence software XG VisionEditor, XG VisionTerminal.

▶ Note

USB driver installation must be performed by a user with Administrators privileges.

This section describes how to install the driver, using Windows XP as an example.

▶ Note

The installation wizard does not automatically appear on Windows 7. To install on Windows 7, connect the controller and the PC, then use Device Manager to manually install the USB driver.

In Device Manager, click [Update driver] under [Other devices] bring up the property page for the [XG-7000/7500], and specify the folder that contains the USB driver.

1 Turn on the controller and the PC.

2 When the PC starts, insert the XG-H7NE CD-ROM in the CD-ROM drive.

3 Connect the USB port of the controller and that of the PC using the OP-66844 cable (optional).

[Found New Hardware Wizard] will appear on the PC screen.



4 Select [No, not this time], and click [Next].

5 Select [Install from the list or specified location] and specify the folder that contains the USB driver.

Installation of the USB driver starts.

Reference

- The USB driver is stored in the \driver\USB folder on the XG-H7NE CD-ROM. These drivers are also installed in the c:\drivers\V-Works for XG folder when installing XG VisionEditor and XG VisionTerminal.
- When installing drivers in Windows XP, a warning message may appear confirming the installation. When such a warning message appears, click [Continue] to continue installation.

6 When installation of the USB driver is completed, click [Finish].



The controller is now ready to communicate with PC via the USB port.

PLC Link Communication Mode

PLC link communication mode is an intelligent dedicated link between controller and the PLC that allows direct input/output access to data memories in a PLC (programmable controller) via the RS-232C or Ethernet interface.

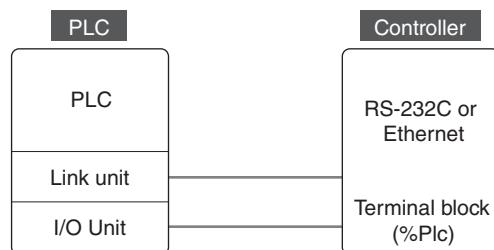
The controller can execute commands in addition to the data output of measurement results. Command execution can be configured to use polling or the systems PLC terminal control input.

► Note

- PLC link communication mode cannot be used on the RS-232C and Ethernet interfaces simultaneously.
- The RS-232C interface cannot be used in its basic (no protocol mode) when it is used for PLC link communication mode.
- CC-Link cannot be used simultaneously with the PLC link.

1. Wiring Overview

The PLC is wired to the controller in the following way.



Reference

- When the controller is not receiving commands from the PLC or when it is polling, the PLC does not need to be connected to the input terminal %Plc.
- Since the controller complies with the modem definition, when connecting the controller to a device that complies with the terminal definition via RS-232C, connect the SD signal of the controller to the SD signal of the device and the RD signal of the controller to the RD signal of the device.

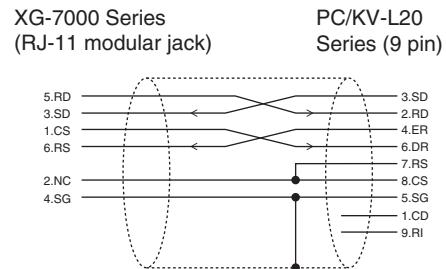
2. PLC Link Communication Mode Settings

The controller uses the communication mode selection and PLC link communication settings specified in the System Settings in XG VisionEditor. Refer to "PLC-Link Settings (PLC-Link)" (Page 5-25) for more details.

3. Wiring for the PLC Link and Setting the Link Unit (RS-232C)

Wiring to a Keyence KV-L20 Series PLC

- Use OP-26486 (D-sub 9-pin female connector) and OP-26487 (2.5 m straight cable).
- Set the link unit operation mode to [KV-Builder mode] (for the KV-700) or [KV-STUDIO mode] (for the KV-1000/3000/5000).



⚠ Warning

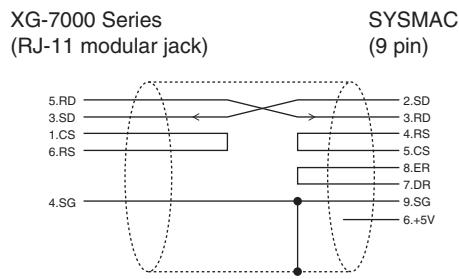
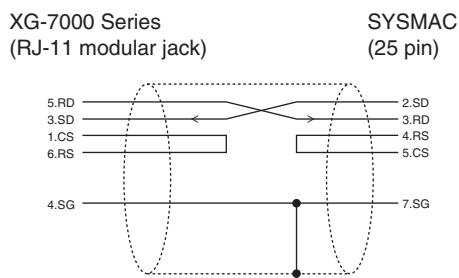
The controllers signal GND, and power GND are common. Take care to avoid voltage discrepancies when connecting external devices to the controller.

When connecting to an Omron SYSMAC CJ1/CS1 PLC

Reference

When connecting to a SYSMAC C, adapt the wiring described here to the pins on the actual connectors used for the connection.

- Use OP-84384 (D-sub 9 pin male connector for the SYSMAC) and OP-26487 (2.5 m straight cable).
- Set the link unit operation mode to "Upper link (SYSWAY)".
- Set the 1:1 or 1:N process to "1:N process".
- Set the unit number to "No. 0".
- Set the CS control to "None".
- When enabling settings using CX-Programmer 6.0 or later, make sure to set the [Optional settings on/off] item to [On]. When set to [Off], changes to other settings will not be active.

For 9-pin**For 25-pin****⚠ Warning**

- If OP-26486 is used to connect to a SYSMAC (9 pin), it may cause damage to the controller or the connected device. Do not use this connector.
- The controllers signal GND, and power GND are common. Take care to avoid voltage discrepancies when connecting external devices to the controller.

When connecting to a Mitsubishi MELSEC Series PLC

- Use OP-86930 (D-sub 9 pin male connector) and OP-26487 (2.5 m straight cable).
- Set the operation mode for the link unit to [MC protocol format 5] (for Q and L Series) or "exclusive protocol format 1" (for A Series). Set the checksum setting to [On].

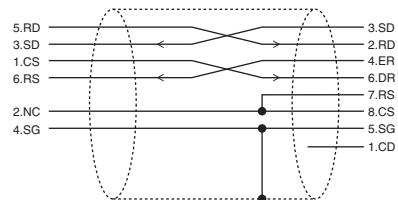
▶ Note

When connected to the A Series, "RS-232C CD terminal unchecked" must be defined in the ladder. See the manual for the Mitsubishi Electric computing link unit for more details.

Reference

- It is necessary to convert to a D-sub 9 pin male connector when using the OP-26486 (D-sub 9 pin female connector). Use a commercially available gender changer (D-sub 9 pin female to D-sub 9 pin male, straight connection).
- To use the Q Series link unit QJ71C24 (N) -R2 set "Baud rate 115200 bit/s, data length 8 bits, stop bit 1, even parity", and the switch setting in the PC parameters to "OBEE (hexadecimal)".

XG-7000 Series
(RJ-11 modular jack) MELSEC
(9 pin)

**⚠ Warning**

The controllers signal GND, and power GND are common. Take care to avoid voltage discrepancies when connecting external devices to the controller.

3. Wiring for the PLC Link and Setting the Link Unit (Ethernet)

- Make sure that the specified IP address is unique and different than the IP addresses for other devices.
- For all devices on a connected network use the same subnet mask. For additional networks use a unique different subnet mask.
- Use a category 5e or greater shielded twisted pair (STP) cable for connection. When connecting the equipment directly (1 to 1), use a cross cable. When connecting through a hub, use a straight cable.

Wiring to a Keyence KV Series PLC

Conduct settings using KV BUILDER Ver. 3.52 or later.

- **IP address:** In the PLC link settings on the controller, set the specified IP address in [IP Address].
- **Port number (VT):** In the PLC link settings on the controller, set the specified port number in [Port].

When connecting to an Omron SYSMAC PLC

Conduct the settings using CX-Programmer.

- **Node No.:** Set this to a value that is different to the node number used for other equipment on the network. This includes the node number specified in the PLC link setting on the controller. (The default system node number is 001.)
- **IP address:** In the PLC link settings on the controller, set the specified IP address in [IP Address].
- **FINS UDP port:** Select [Define user], and in the PLC link settings on the controller, set the specified port number in [Port].
- **IP address table:** Set the IP address and node address specified in the [Ethernet] menu (Page 5-23) on the controller. The node address is normally [1].
- **IP router table:** Only set this item when using a router. In router address, set the IP address for the router. In IP address, set the IP address specified in the [Ethernet] menu (Page 5-23) on the controller.

Reference

Use the IP Setting switch on the back of the PLC for the IP address on the CS1W-ETN11 PLC.

When connecting to a Mitsubishi MELSEC link unit

Change settings using the network parameters in GX-Developer or GX-Works2.

[MELSECNET/Ethernet]

- **Network type:** Select [Ethernet].
- **Mode:** Select [Online].

[Operation settings]

- **Communication data code setting:** Select [Binary code communication].
- **Initial timing setting:** Select [Always OPEN].
- **IP address setting:** In the PLC link settings on the controller, set the specified IP address in [IP Address].
- **Send frame setting:** Select [Ethernet (V2.0)].
- **Authorize writing during RUN:** Select [Authorize].

► Note

- In normal operations, do not change the communication port number of the MELSEC side from 5000 (default).
- To check the setting of the communication port number of the MELSEC side, select [Ethernet diagnosis] in the [Diagnosis] menu of the GX-Developer or GX-Works2, then check the [Auto Open UDP Port] in the displayed window. If the communication port number is set to 5000, it is displayed as "1388" in hexadecimal.

When connecting to a Mitsubishi MELSEC PLC with built-in Ethernet port

Change settings via a PC in GX-Developer or GX-Works2.

▶ Note

Due to limitations with the built-in Ethernet port, a communication error may occur when the MELSEC receives incomplete IP packets.

- When using PLC link communication via a hub, do not connect to a network (company LANs, etc.) where incomplete data may occur with packets being sent and received.
- Connect via a dedicated link unit when using the PLC link over normal networks.

[Ethernet Port Settings]

- **IP address:** In the PLC link settings on the controller, set the specified IP address in [IP Address].
- **Communication data code setting:** Select [Binary code communication].
- **Authorize writing during RUN:** Check [Authorize].

[Open Settings]

Add these settings.

- **Protocol:** Select [UDP].
- **Open method:** Select [MC protocol].
- **Local node port number:** Specify a hexadecimal value within the range 0401 to 1387, and 1392 to FFFE.

Numbers from 1388 to 1391 (5000 to 5009 in decimal) are reserved.

Specify the [Port] setting in the controller with the decimal notation of the hexadecimal value specified here. (Example, if the local node port number is 1387, specify 4999 in the controller).

▶ Note

- The built-in Ethernet port does not support Auto open UDP port (port number default: 5000) like the QJ71E71-100. Specify the communications port on the controller to a value from 1025 to 4999, and 5010 to 65535.
- When connected to a hub do not set more than one controller to the same port number. Set each controller with a different communication port number, and register local port numbers to the specific controller.

Compatible PLC Link Connections

The following PLCs are compatible with the PLC link connection.

▶ Note

- Except for the built-in Ethernet port on certain PLCs, only connections via a link unit are supported.
- The range of data memories differ depending on the system. For more details, refer to the manual for each PLC.

RS-232C Interface

Keyence Corporation

Series name	PLC Controller	Link unit	PLC operation mode	PLC type
KV	KV-700	KV-L20	KV BUILDER mode	KV-L20 Series
	KV-1000	KV-L20R	KV STUDIO mode	KV-L20 Series
	KV-3000, KV-5000	KV-L20V	KV STUDIO mode	KV-L20 Series

Mitsubishi Electric Corporation

Series name	PLC Controller	Link unit	PLC operation mode	PLC type
MELSEC-AnS	A1S, A1SH, A1SJ, A1SJH1, A2S, A2SH, A171S, A171SH	A1SJ71 (U) C24-R2, A1SJ71 (U) C24-PRF	Exclusive protocol format 1	MELSEC AnN Series
	A1CPUC24-R2	Calculator link port	Exclusive protocol format 1	MELSEC AnN Series
	A2US, A2USH	A1SJ71 (U) C24-R2, A1SJ71 (U) C24-PRF	Exclusive protocol format 1	MELSEC AnN Series
	A0J2, A0J2H	A0J2-C214-S1	Exclusive protocol format 1	MELSEC AnN Series
MELSEC-AnN	A1N, A2N, A3N	AJ71C24, AJ71C24-S3, AJ71C24-S6, AJ71C24-S8, AJ71UC24	Exclusive protocol format 1	MELSEC AnN Series
MELSEC-AnA	A2A, A3A	AJ71C24-S6, AJ71C24-S8, AJ71UC24	Exclusive protocol format 1	MELSEC AnN Series
MELSEC-AnU	A2U, A3U, A4U	AJ71C24-S6, AJ71C24-S8, AJ71UC24	Exclusive protocol format 1	MELSEC AnN Series
MELSEC-QnA	Q2A, Q2A-S1, Q3A, Q4A	AJ71QC24 (N) AJ71QC24 (N) R2 AJ71QC24 (N) R4	Exclusive protocol format 1	MELSEC AnN Series
	Q2AS, Q2AS-S1, Q2ASH, Q2ASH-S1	A1SJ71QC24 A1SJ71QC24-R2	Exclusive protocol format 1	MELSEC AnN Series
	Q00CPU, Q01CPU	QJ71C24, QJ71C24 (N)-R2	MC protocol format 5	MELSEC Q/L Series
MELSEC-Q	Q02CPU, Q02HCPU, Q02UCPU, Q03UDECPU, Q04UDEHCPU, Q06UDEHCPU, Q10UDEHCPU, Q13UDEHCPU, Q20UDEHCPU, Q26UDEHCPU, Q06HCPU, Q12HCPU, Q25HCPU, Q02UCPU	QJ71C24, QJ71C24 (N)-R2	MC protocol format 5	MELSEC Q/L Series
	Q02CPU-A, Q02HCPU-A, Q06HCPU-A	A1SJ71 (U) C24-R2 A1SJ71 (U) C24-PRF	Exclusive protocol format 1	MELSEC AnN Series
	L02CPU, L26CPU-BT	LJ71C24, LJ71C24-R2	MC protocol format 5	MELSEC Q/L Series

Omron Corporation

Series name	PLC Controller	Link unit	PLC operation mode	PLC type
SYSMAC SPM1	SRM1-C01, SRM1-C02	CPM1-C1F01	Upper link (SYSWAY)	SYSMAC-C Series
SYSMAC CPM1	CPM1, CPM1A	CPM1-C1F01	Upper link (SYSWAY)	SYSMAC-C Series
SYSMAC CPM1A				
SYSMAC CPM2A	CPM2A-30CD** CPM2A-40CD** CPM2A-60CD**	CPM1-C1F01	Upper link (SYSWAY)	SYSMAC-C Series
SYSMAC CPM2C	CPM2C-10CD** CPM2C-20CD**	CPM1-C1F01 CPM2C-C1F01	Upper link (SYSWAY)	SYSMAC-C Series
SYSMAC CQM1H	CQM1H-CPU11*, CQM1H-CPU21*, CQM1H-CPU51/61	CPM1-C1F01 CQM1H-SCB41	Upper link (SYSWAY)	SYSMAC-C Series
SYSMAC C	C120, C120F C200H C200HS-CPU01, C200HS-CPU03, C200HS-CPU21/23 C200HS-CPU31/33 C500, C500F, C1000H, C1000HF, C2000, C2000H	C120-LK201-V1 C200H-LK201(-V1) C200H-LK201(-V1) C500-LK201-V1 C500-LK203	Upper link (SYSWAY)	SYSMAC-C Series
SYSMAC α	C200HE-CPU11 C200HE-CPU32 C200HE-CPU42 C200HG-CPU33 C200HG-CPU43 C200HG-CPU53 C200HG-CPU63 C200HX-CPU34, C200HX-CPU44, C200HX-CPU54, C200HX-CPU64, C200HX-CPU65-Z, C200HX-CPU85-Z	C200H-LK201(-V1) C200H-LK201(-V1)	Upper link (SYSWAY)	SYSMAC-C Series
SYSMAC CJ	CJ1M-CPU11-ETN, CJ1M-CPU12, CJ1M-CPU12-ETN, CJ1M-CPU13, CJ1M-CPU13-ETN, CJ1M-CPU22, CJ1M-CPU23, CJ1G-CPU44, CJ1G-CPU45, CJ1G-CPU42H, CJ1G-CPU43H, CJ1G-CPU44H, CJ1G-CPU45H, CJ1H-CPU64H-R, CJ1H-CPU65H, CJ1H-CPU65H-R, CJ1H-CPU66H, CJ1H-CPU66H-R, CJ1H-CPU67H, CJ1H-CPU67H-R, CJ2H-CPU64-EIP, CJ2H-CPU65-EIP, CJ2H-CPU66-EIP, CJ2H-CPU67-EIP, CJ2H-CPU68-EIP	CJ1W-SCU21(-V1), CJ1W-SCU41	Upper link (SYSWAY)	SYSMAC-CJ/CS1 Series
SYSMAC CS1	CS1G-CPU42 (H), CS1G-CPU43 (H), CS1G-CPU44 (H), CS1G-CPU45 (H), CS1H-CPU63 (H), CS1H-CPU64 (H), CS1H-CPU65 (H), CS1H-CPU66 (H), CS1H-CPU67 (H)	CS1W-SCU21 (-V1)	Upper link (SYSWAY)	SYSMAC-CJ/CS1 Series

* The CQM1H-SCB41 link unit cannot be used.

Ethernet interface

Keyence Corporation

Series name	PLC Controller	Link unit	PLC type
KV	KV-700	KV-LE20	KV-LE20 Series
	KV-1000	KV-LE20A	
	KV-3000	KV-LE20V	KV-LE20 Series
	KV-5000*		

*Also compatible with the built-in Ethernet interface on the system.

Mitsubishi Electric Corporation

Series name	PLC Controller	Link unit	PLC type
MELSEC-Q	Q00CPU, Q01CPU	QJ71E71	MELSEC Q/L Series
	Q02CPU, Q02HCPU, Q02UCPU,	QJ71E71-100	
	Q03UDECPU*, Q04UDEHCPU*,		
	Q06UDEHCPU*, Q10UDEHCPU*,		
	Q13UDEHCPU*, Q20UDEHCPU*,		
	Q26UDEHCPU*, Q06HCPU, Q12HCPU,		
MELSEC-L	Q25HCPU L02CPU*, L26CPU-BT*	None	MELSEC Q/L Series

*Also compatible with the built-in Ethernet interface on the system.

Omron Corporation

Series name	PLC Controller	Link unit	PLC type
SYSMAC CJ	CJ1M-CPU11-ETN*,	CJ1W-ETN11,	SYSMAC-CJ/CS1 Series
	CJ1M-CPU12, CJ1M-CPU12-ETN*,	CJ1W-ETN21	
	CJ1M-CPU13, CJ1M-CPU13-ETN*,		
	CJ1M-CPU22, CJ1M-CPU23,		
	CJ1G-CPU44, CJ1G-CPU45,		
	CJ1G-CPU42H, CJ1G-CPU43H,		
	CJ1G-CPU44H, CJ1G-CPU45H,		
	CJ1H-CPU64H-R, CJ1H-CPU65H,		
	CJ1H-CPU65H-R, CJ1H-CPU66H,		
	CJ1H-CPU66H-R, CJ1H-CPU67H,		
SYSMAC CS1	CJ1H-CPU67H-R, CJ2H-CPU64-EIP*,		
	CJ2H-CPU65-EIP*, CJ2H-CPU66-EIP*,		
	CJ2H-CPU67-EIP*, CJ2H-CPU68-EIP*		
	CS1G-CPU42 (H), CS1G-CPU43 (H)	CS1W-ETN11,	SYSMAC-CJ/CS1 Series
	CS1G-CPU44 (H), CS1G-CPU45 (H)	CJ1W-ETN21	
	CS1H-CPU63 (H), CS1H-CPU64 (H)		
	CS1H-CPU65 (H), CS1H-CPU66 (H)		
	CS1H-CPU67 (H)		

*Also compatible with the built-in Ethernet interface on the system.

CC-Link Interface

The controller can be used as a remote device station on a network connection with a CC-Link master station by connecting the optional CA-NCL10E unit. The CC-Link interface supports command execution, input / output control and measurement result data.

The settings in the System Settings are used to set the station type, communication speed, and number of exclusive stations on the CC-Link. Refer to "CC-Link Settings (CC-Link)" (Page 5-30) for more details.

Reference

See "Installing the Communication Expansion Unit" (Page 2-5) for more details on connecting the CA-NCL10E unit.

Note

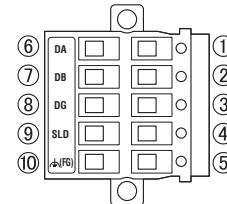
- The controller must be turned off before connecting or removing the CA-NCL10E unit.
- Restart the controller and master station after changing the CC-Link settings.

CA-NCL10E CC-Link Specifications

Standard specifications

Item	Standard specifications		
CC-Link station type	Ver. 1.10	remote device station	
	Ver. 2.00	remote device station	
Communication Speed	156 kbps, 625 kbps, 2.5 Mbps, 5 Mbps, 10 Mbps		
	Ver. 1.10 compatible CC-Link cable		
Connection cable	FANC-110SBH, FA-CBL200PSBH, CS110 OP-79426, OP-79427		
	156 kbps	1,200 m	
	625 kbps	900 m	
Max. total cable length	2.5 Mbps	400 m	
	5 Mbps	160 m	
	10 Mbps	100 m	
Exclusive stations	Selectable from 1 station, 2 stations, 3 stations, or 4 stations		
Extended cyclic settings (Ver. 2.00 only)	Selectable from 1x, 2x, 4x, and 8x		

Connector Specifications



No.	Wire color	Signal name	Function
1, 6	Blue	DA	Communication wire "DA" for CC-Link. Connects to the master station or other slave stations (1 and 6 are shorted).
2, 7	White	DB	Communication wire "DB" for CC-Link. Connects to the master station or other slave stations (2 and 7 are shorted).
3, 8	Yellow	DG	Communication wire "DG" for CC-Link. Connects to the master station or other slave stations (3 and 8 are shorted).
4, 9	Bare wire	SLD	Shield. Connect the shielded wire from the CC-Link Ver. 1.10 compatible cable (OP-79426, OP-79427, etc.) (4 and 9 are shorted).
5, 10	-	FG	Frame ground "FG" for CC-Link. Ground per Class D earth* (100 Ω or less) (5 and 10 are shorted).

* Use a cable with a cross-section area of at least 2 mm² as the grounding cable.

Connecting to the CC-Link

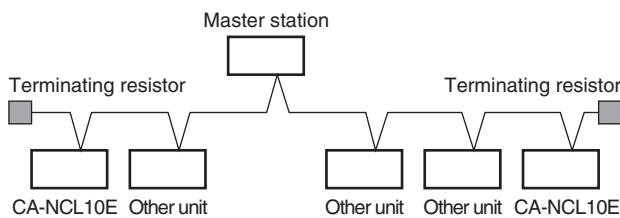
Precautions when wiring

Take note of the following when wiring the CA-NCL10E unit.

- When connecting the CA-NCL10E to a CC-Link network / device, always use a CC-Link Ver. 1.10 compatible cable or a cable recognized by the CC-Link association. Correct operation cannot be assured when using another type of cable.
- When a CC-Link cable is used near a high voltage / current source or cable, electrical noise may cause operational errors. When using both a CC-Link cable and high voltage / current devices maintain at least 100 mm of separation between them.

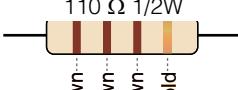
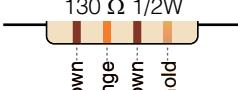
Terminating resistor

When connecting a CA-NCL10E unit to both ends of the CC Link network, install a terminating resistor between terminals DA and DB. Make sure to install the terminating resistors, as they reduce signal noise and stabilize communications.

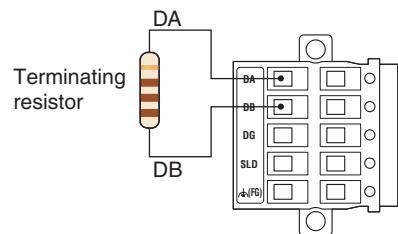


The terminating resistor will differ depending on the cable type

There are two different terminating resistors ($110\ \Omega$, $130\ \Omega$) that ship with the CA-NCL10E. Two of each are shipped, one for terminating each end of the network with CA-NCL10E. Use the correct terminating resistor for the type of CC-Link cable being used.

Cable type	Terminating resistor
Ver. 1.10 compatible CC-Link cable FANUC-SBH, FA-CBL200PSBH, CS110 OP-79426, OP-79427	$110\ \Omega$ 1/2W 
CC-Link cable	$130\ \Omega$ 1/2W 
CC-Link high-performance cable	

CA-NCL10E terminating resistor installation



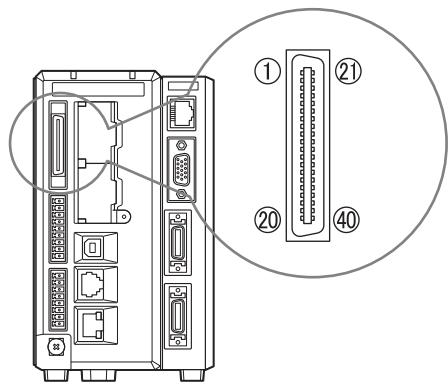
Reference

Terminals 1 and 6, and 2 and 7 are shorted, so the terminating resistor may be installed on either 1 and 2 or 6 and 7.

Parallel I/O Interface

Connector Specifications

The following values show the parallel I/O connector specifications for the controller.



Connector

FX2B-40SA-1.27R (Hirose Electric)

Color ribbon cable

UL20028-FRX-CF-40 (Fujikura, equivalent wire gauge AWG28)

Reference

In normal situations, use the specialized parallel connection cable (3 m) OP-51657 (sold separately).

Default Pin Assignment: When using cable color OP-51657 (sold separately)

No.	Name	Description	Input / Output	Assigned default state ^{*1}			Circuit diagram (Page 6-23)	Cable color
				Assigned variable	Function ^{*2}	Bit		
1	COMIN2	Connector Common for inputs	-	-	-	-	-	Brown
2	IN0	General purpose input 0	Input	%CmdParam		0	-	B Red
3	IN1	General purpose input 1	Input	%CmdParam		1	-	B Orange
4	IN2	General purpose input 2	Input	%CmdParam		2	-	B Yellow
5	IN3	General purpose input 3	Input	%CmdParam	Parameter inputs for custom commands	3	-	B Green
6	IN4	General purpose input 4	Input	%CmdParam		4	-	B Blue
7	IN5	General purpose input 5	Input	%CmdParam		5	-	B Purple
8	IN6	General purpose input 6	Input	%CmdParam		6	-	B Gray
9	IN7	General purpose input 7	Input	%CmdParam		7	-	B White
10	IN8	General purpose input 8	Input	%CmdCode		0	-	B Black
11	IN9	General purpose input 9	Input	%CmdCode	Number input for custom commands	1	-	B Brown
12	IN10	General purpose input 10	Input	%CmdCode		2	-	B Red
13	IN11	General purpose input 11	Input	%CmdCode		3	-	B Orange
14	IN12	General purpose input 12	Input	%CmdStrobe	Custom command Assignment input (pin)	0	-	B Yellow
15	IN13	General purpose input 13	Input	%Reset	Reset input	0	-	B Green
16	IN14	General purpose input 14	Input	%Pst	Cycle output data input	0	-	B Blue
17	COMOUT2	Connector Common for outputs	-	-	-	-	-	Purple
18	OUT0	General purpose output 0	Output	%Ack	Command acknowledgement output	0	N.O.	D Gray

No.	Name	Description	Input / Output	Assigned variable	Assigned default state ^{*1}			Circuit diagram (Page 6-23)	Cable color
					Function ^{*2}	Bit	N.O./N.C		
19	OUT1	General purpose output 1	Output	%Nack	Command failure output	0	N.O.	D	White
20	OUT2	General purpose output 2	Output	%Busy	Busy output	0	N.O.	D	Black
21	OUT3	General purpose output 3	Output	%CmdReady	Command ready output	0	N.O.	D	Brown
22	OUT4	General purpose output 4	Output	%Trg1Ready	Trigger 1 ready output	0	N.O.	D	Red
23	OUT5	General purpose output 5	Output	%Trg2Ready	Trigger 2 ready output	0	N.O.	D	Orange
24	OUT6	General purpose output 6	Output	%OutDataA		0	N.O.	D	Yellow
25	OUT7	General purpose output 7	Output	%OutDataA		1	N.O.	D	Green
26	OUT8	General purpose output 8	Output	%OutDataA		2	N.O.	D	Blue
27	OUT9	General purpose output 9	Output	%OutDataA		3	N.O.	D	Purple
28	OUT10	General purpose output 10	Output	%OutDataA		4	N.O.	D	Gray
29	OUT11	General purpose output 11	Output	%OutDataA		5	N.O.	D	White
30	OUT12	General purpose output 12	Output	%OutDataA		6	N.O.	D	Black
31	OUT13	General purpose output 13	Output	%OutDataA	System variable %OutDataA Data output	7	N.O.	D	Brown
32	OUT14	General purpose output 14	Output	%OutDataA		8	N.O.	D	Red
33	OUT15	General purpose output 15	Output	%OutDataA		9	N.O.	D	Orange
34	OUT16	General purpose output 16	Output	%OutDataA		10	N.O.	D	Yellow
35	OUT17	General purpose output 17	Output	%OutDataA		11	N.O.	D	Green
36	OUT18	General purpose output 18	Output	%OutDataA		12	N.O.	D	Blue
37	OUT19	General purpose output 19	Output	%OutDataA		13	N.O.	D	Purple
38	OUT20	General purpose output 20	Output	%OutDataA		14	N.O.	D	Gray
39	OUT21	General purpose output 21	Output	%OutDataA		15	N.O.	D	White
40	COMOUT2	Connector Common for outputs	-	-		-	-	-	Black

*1 The assigned default state refers to the default system variables assigned to each pin in the System Settings menu. These assignments may vary if the System Settings have been changed.

*2 For more details, see "List of System Variables" in the XG VisionEditor Reference Manual.

▶ Note

- COMOUT2 for Pin 17 and Pin 40 are common.
- Power source 0V, COMIN1, COMIN2, COMOUT1, COMOUT2, COMOUT_F+, and COMOUT_F- are all isolated.
- COMIN2 is a common terminal exclusively used for input pins 2 to 16 on the parallel I/O connector.
- COMOUT2 is a common terminal exclusively used for output pins 18 to 39 on the parallel I/O connector.

Terminal Block Interface

Terminal Specifications

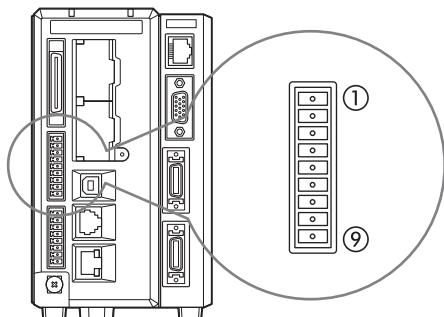
Terminal block specifications for the controller are as follows.

▶ Note

Tightening above the standard torque may cause damage to the terminal block.

OUTPUT connector

Socket block



MC1.5/9-ST-3.5BK (Phoenix Contact)

Suitable wiring

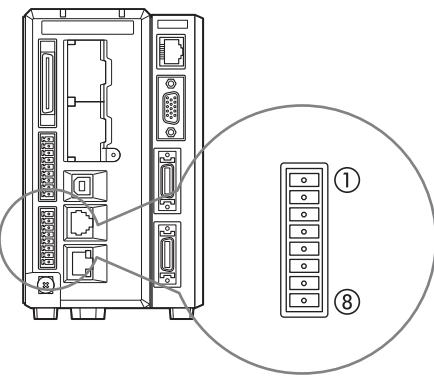
AWG16 to 28

Terminal block screw torque

Less than 0.25 Nm

INPUT connector

Socket block



MC1.5/8-ST-3.5BK (Phoenix Contact)

Suitable wiring

AWG16 to 28

Terminal block screw torque

Less than 0.25 Nm

Terminal Layout

OUTPUT connector

No.	Name	Description	Input / Output	Assigned default state ^{*1}			Bit	N.O/N.C	Circuit diagram (Page 6-24)
				Assigned variable	Function ^{*2}				
1	OUT22 (STO)	General purpose output 22	Output	%Sto	Data cycle output		0	N.O.	D
2	OUT23 (OR)	General purpose output 23	Output	%JAHold	Total status output		0	N.O.	D
3	F_OUT2 (ERR)	High-speed general purpose output 2	Output	%Error0	Error 0 output		0	N.O.	C
4	F_OUT3 (RUN)	High-speed general purpose output 3	Output	%Run	Run mode output		0	N.O.	C
5	COMOUT1 (COMOUT)	Common for terminal block outputs	-	-	-		-	-	-
6	F_OUT0 (FLS1)	High-speed general purpose output 0	Output	%Flash1	External lighting strobe output 1		0	N.C.	C

No.	Name Values in parentheses denote printed labels on the connector at the time of shipment	Description	Input / Output	Assigned default state ^{*1}			Bit	N.O/N.C	Circuit diagram (Page 6-24)
				Assigned variable	Function ^{*2}				
7	F_OUT1 (FLS2)	High-speed general purpose output 1	Output	%Flash2	External lighting strobe output 2		0	N.C.	C
8	COMOUT_F+ (COMF+)	(+) common for high-speed terminal block outputs	-	-	-		-	-	-
9	COMOUT_F- (COMF-)	(-) common for high-speed terminal block outputs	-	-	-		-	-	-

► Note

- Power source 0V, COMOUT1, COMOUT_F+, and COMOUT_F- are all isolated.
- COMOUT1 is a common terminal exclusively used for terminal outputs 1 and 2.
- COMOUT_F+ and COMOUT_F- are the common terminals exclusively used for terminal outputs 3 to 4 and 6 to 7.

INPUT connector

No.	Name Values in parentheses denote printed labels on the connector at the time of shipment	Description	Input / Output	Assigned default state ^{*1}			Bit	N.O/N.C	Circuit diagram (Page 6-23)
				Assigned variable	Function ^{*2}				
1	COMIN1 (COMIN)	Common for terminal block inputs	-	-	-	-	-	-	-
2	IN15 (PLC)	General purpose input 15	Input	%Plc	Custom command execution input (PLC)	0	-	-	B
3	F_IN0 (TRG1)	High-speed general purpose input 0	Input	%Trg1	Trigger 1 input	0	-	-	A
4	F_IN1 (TRG2)	High-speed general purpose input 1	Input	%Trg2	Trigger 2 input	0	-	-	A
5	F_IN2 (TEST)	High-speed general purpose input 2	Input	%Test	Trial run input	0	-	-	A
6	F_IN3 (EXT)	High-speed general purpose input 3	Input	%Ext	Disable trigger input	0	-	-	A
7	24VDC	+ power supply (24 V DC) input	-	-	-	-	-	-	-
8	0V	- power supply (0 V) input	-	-	-	-	-	-	-

*1 The assigned default state refers to the default system variables assigned to each pin in the System Settings menu. These assignments may vary if the System Settings have been changed.

*2 For more details, see "List of System Variables" in the XG VisionEditor Reference Manual.

► Note

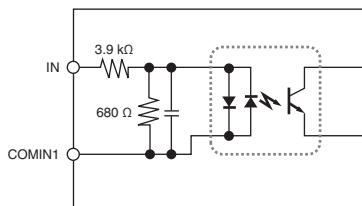
- Power source 0V and COMIN1 are isolated.
- COMOUT1 is a common terminal exclusively used for terminal inputs 2 to 6.

Input/Output Circuit

Input Connections

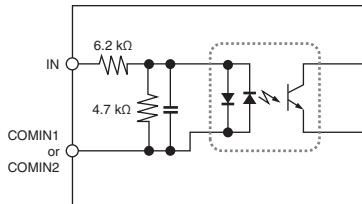
Input circuit diagram

Circuit A (F_IN0 to 3 only, EV compatible)



- Max. imposed voltage: 26.4 V
- ON voltage: 10.8 V or greater
- ON current: 3 mA or greater
- OFF voltage: 5 V or less
- OFF current: 1 mA or less

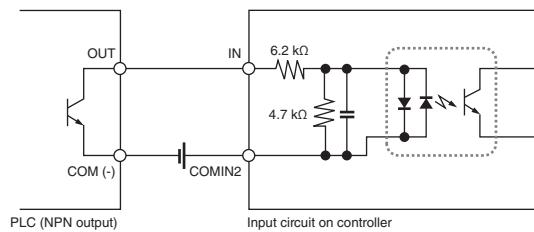
Circuit B (other inputs)



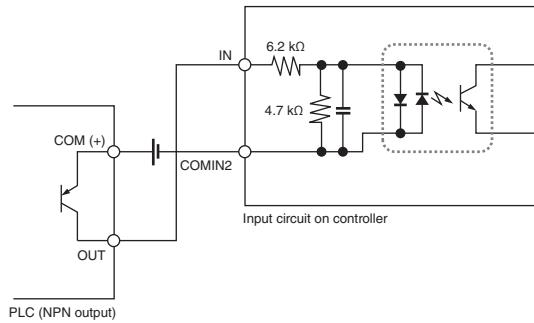
- Max. imposed voltage: 26.4 V
- ON voltage: 10.8 V or greater
- ON current: 2 mA or greater
- OFF voltage: 3 V or less
- OFF current: 0.3 mA or less

Example of connections

When connecting a NPN PLC output to the system input



When connecting a PNP output to the controller input



Reference

See "Terminal Layout" (Page 6-21) for common connections.

Output Connections

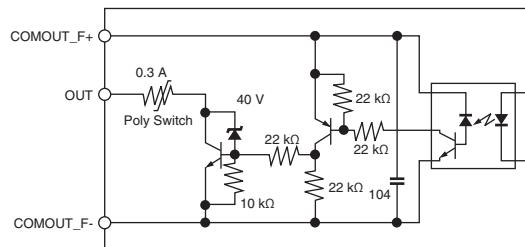
► Note

The overcurrent protective Poly Switch is set to trip at 1 A. Use a power supply with an output rated 1 A or more.

NPN output circuit diagram

Controllers with no P at the end of the part number eg. XG-7702

Circuit C (F_OUT0 to 3)

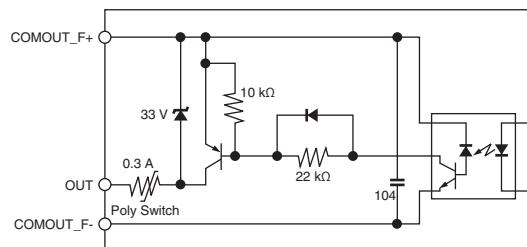


- Max. imposed voltage: 30 V
- Max. sink current: 50 mA
- Leakage current: 0.1 mA or less
- Residual voltage:
 - 1.4 V or less (50 mA)
 - 1.0 V or less (20 mA)

PNP output circuit diagram

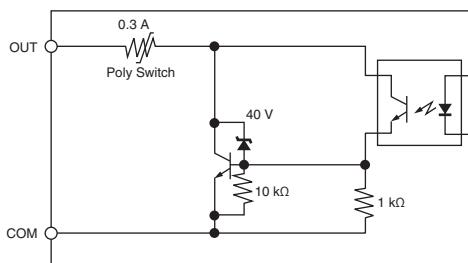
Controllers with a "P" at the end of the part number eg. XG-7702P

Circuit C (F_OUT0 to 3)



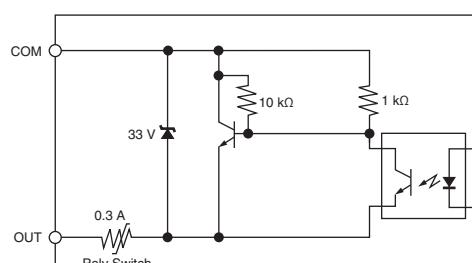
- Max. imposed voltage: 30 V
- Max. sink current: 50 mA
- Leakage current: 0.1 mA or less
- Residual voltage:
 - 1.4 V or less (50 mA)
 - 1.0 V or less (20 mA)

Circuit D (Other outputs)



- Max. imposed voltage: 30 V
- Max. sink current: 50 mA
- Leakage current: 0.1 mA or less
- Residual voltage:
 - 1.4 V or less (50 mA)
 - 1.0 V or less (20 mA)

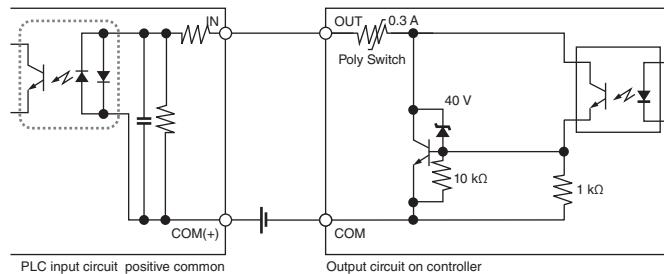
Circuit D (Other outputs)



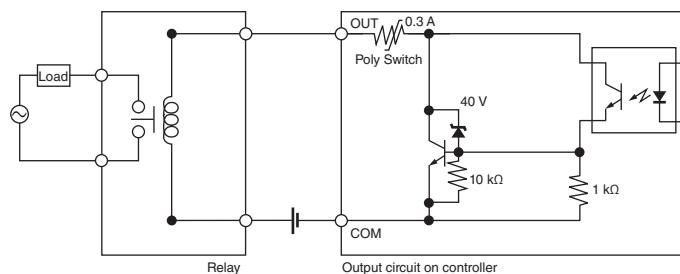
- Max. imposed voltage: 30 V
- Max. sink current: 50 mA
- Leakage current: 0.1 mA or less
- Residual voltage:
 - 1.4 V or less (50 mA)
 - 1.0 V or less (20 mA)

Example of connections (system with NPN outputs)

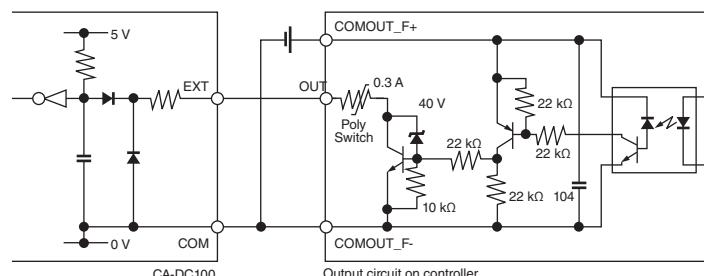
When connecting a NPN output from the controller to a PLC with a positive common



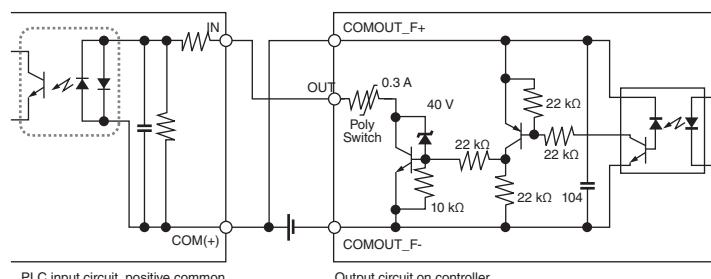
When connecting a NPN output from the controller to a relay



When connecting the F_OUT output (NPN) from the controller to the no-voltage input terminal for the CA-DC100 LED light controller



When connecting the F_OUT output (NPN) from the controller to a PLC with a positive common

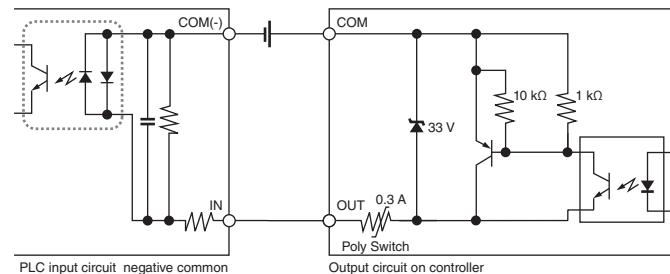


▶ Note

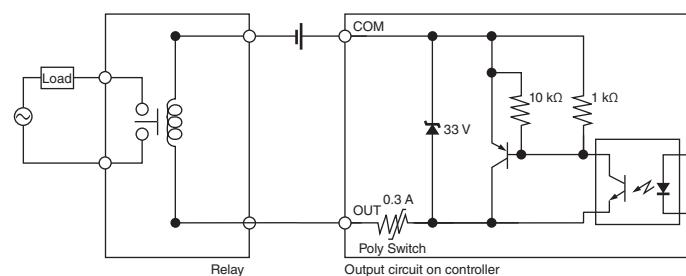
- The GND output terminal for the terminal block is the COMOUT1 terminal.
- The GND output terminal for the parallel I/O is the COMOUT2 terminal.

Example of connections (systems with PNP output)

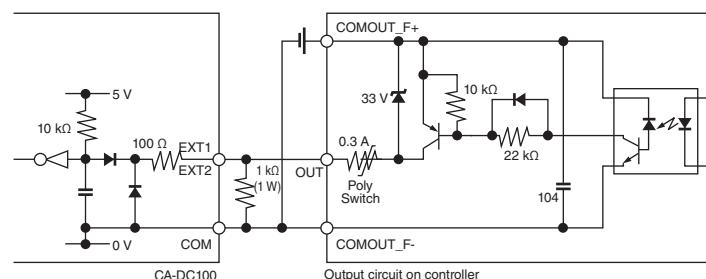
When connecting a PNP output from the controller to a PLC with a negative common



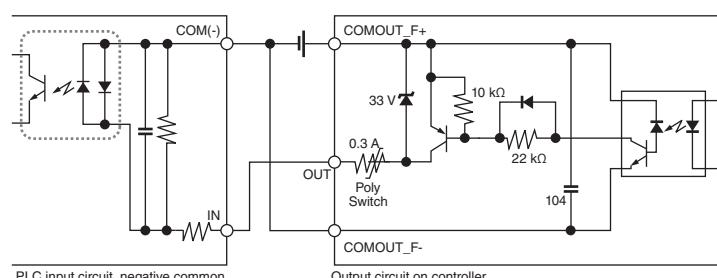
When connecting a PNP output from the controller to a relay



When transmitting a F_OUT output (PNP) from the controller to the no-voltage input terminal for the CA-DC100 LED light controller



When transmitting a F_OUT output (PNP) from the controller to a PLC with a negative common



► Note

- The GND output terminal for the terminal block is the COMOUT1 terminal.
- The GND output terminal for the parallel I/O is the COMOUT2 terminal.

Chapter 7

Specifications

Main Specifications

► Note

The number of settings available for all items listed depends on the total amount of available memory in the system.

Controller Unit (XG-7701(P)/7501(P)/7001(P)/7001A)

	XG-7701(P)	XG-7501(P)	XG-7001(P)	XG-7001A
Resolution	<p>When XH-H500C/H500M is connected</p> <ul style="list-style-type: none"> • 5 megapixel mode: 2432 (H) x 2050 (V), approx. 4,990,000 pixels <p>When XG-200C/S200C/H200C/200M/S200M/H200M is connected</p> <ul style="list-style-type: none"> • 2 megapixel mode: 1600 (H) x 1200 (V), 1,920,000 pixels • 1 megapixel mode: 1024 (H) x 960 (V), approx. 980,000 pixels <p>When XG-H100C/H100M is connected</p> <ul style="list-style-type: none"> • 1 megapixel mode: 1000 (H) x 1000 (V), 1,000,000 pixels <p>When XG-035C/S035C/035M/S035M/H035C/H035M is connected</p> <ul style="list-style-type: none"> • 310,000 pixel mode: 640 (H) x 480 (V), approx. 310,000 pixels • 240,000 pixel mode: 512 (H) x 480 (V), approx. 240,000 pixels 	<p>When XG-200C/S200C/H200C/200M/S200M/H200M is connected</p> <ul style="list-style-type: none"> • 2 megapixel mode: 1600 (H) x 1200 (V), 1,920,000 pixels • 1 megapixel mode: 1024 (H) x 960 (V), approx. 980,000 pixels <p>When XG-H100C/H100M is connected</p> <ul style="list-style-type: none"> • 1 megapixel mode: 1000 (H) x 1000 (V), 1,000,000 pixels <p>When XG-035C/S035C/035M/S035M/H035C/H035M is connected</p> <ul style="list-style-type: none"> • 310,000 pixel mode: 640 (H) x 480 (V), approx. 310,000 pixels • 240,000 pixel mode: 512 (H) x 480 (V), approx. 240,000 pixels 	<p>When XG-200C/S200C/H200C/200M/S200M/H200M is connected</p> <ul style="list-style-type: none"> • 2 megapixel mode: 1600 (H) x 1200 (V), 1,920,000 pixels • 1 megapixel mode: 1024 (H) x 960 (V), approx. 980,000 pixels <p>When XG-H100C/H100M is connected</p> <ul style="list-style-type: none"> • 1 megapixel mode: 1000 (H) x 1000 (V), 1,000,000 pixels <p>When XG-035C/S035C/035M/S035M/H035C/H035M is connected</p> <ul style="list-style-type: none"> • 310,000 pixel mode: 640 (H) x 480 (V), approx. 310,000 pixels • 240,000 pixel mode: 512 (H) x 480 (V), approx. 240,000 pixels 	<ul style="list-style-type: none"> • 310,000 pixel mode: 640 (H) x 480 (V), approx. 310,000 pixels • 240,000 pixel mode: 512 (H) x 480 (V), approx. 240,000 pixels
Camera Inputs	<p>Two digital color/monochrome cameras (Compatible with XG-H500C/200C/S200C/H200C/H100C/035C/S035C/H035C/H500M/200M/S200M/H200M/H100M/035M/S035M/H035M, mixed connection possible)</p>	<p>Two digital color/monochrome cameras (Compatible with XG-200C/S200C/H200C/H100C/035C/S035C/H035C/H035M/S035M/H200M/H100M/035M/S035M/H035M, mixed connection possible)</p>	<p>Two digital color/monochrome cameras (Compatible with XG-035C/S035C/H035C/H035M/S035M/H035M, mixed connection possible.)</p>	<p>Two analog cameras Keyence Corporation cameras (monochrome CA-CM20). The following cameras have been tested for compatibility, but mixed connection is not supported: Sony (XC-HR50/XC-HR57/XC-56/XC-ST50/XC-EI50/XC-EI30/XC-EU50) Toshiba Teli (CS8550Di/CS8570D/CS8560D)</p> <ul style="list-style-type: none"> • Two extra cameras can be connected by using the expansion unit XG-E700, for up to four cameras in total. • Two extra cameras can be connected by using the expansion unit XG-E700A, for up to four cameras in total.
Trigger input	<p>4-camera simultaneous/individual capture. (Simultaneous capture support limited to 2 cameras if XG-E700 is not connected.)</p>	<p>4-camera simultaneous capture/individual capture can be selected. (Simultaneous capture support limited to 2 cameras if XG-E700A is not connected.)</p>		
Main image processor	DSP (High-speed)	DSP	DSP	DSP (High-speed)
Program capacity	SD Cards 1 and 2 can each hold 1,000 programs (depending on the size of the SD card and the size of the programs), external switching possible,			
Number of registered screens	Maximum 1,000 screens per single program (depending on SD card size). Image registration supports JPEG compression saving and position adjustment. External switching possible through referencing variables.			

		XG-7701(P)	XG-7501(P)	XG-7001(P)	XG-7001A
SD card		SD card slot x 2 (SDHC compatible) Compatible with OP-87133 (512 MB), CA-SD1G, and CA-SD4G (4 GB: SDHC).		SD card slot x 2 (SDHC compatible) Compatible with OP-87133, CA-SD1G (1 GB), CA-SD4G (4 GB: SDHC).	
Number of units		1,000 units maximum per inspection program (depending on system memory capacity)			
Image Acquisition Unit	Capture		<ul style="list-style-type: none"> Supports simultaneous capture for up to four cameras Supports buffered image processing using image buffer memory Supports multiple placement and loop execution Supports variable referencing across a range of setting parameters Supports trigger delay for each camera Supports CA-DC20E illumination configuration and intensity 		
Processing	Inspection region (Regions supported depends on unit)		<ul style="list-style-type: none"> Supported region shapes: rectangle, rotated rectangle, circle, oval, ring, arc, polygon (up to 12 sides), and composite (up to 32 individual regions including masks). Image region (inspection region generated from a binary image) Supported mask regions: 4 per single unit (excluding composite regions). Supports variable referencing for both inspection and mask regions. Support of multiple areas as mask regions (ShapeTrax2 only) 		
Vision Tools	Filters (filters supported depends on the unit)		<ul style="list-style-type: none"> Available filters: Expand, shrink, average, median, edge sharpening, edge extract X, edge extract Y, Sobel, Prewitt, Roberts, Laplacian, binary, subtract, Preserve Intensity, contrast conversion, image extraction, shading correction, blur, custom, custom (advance), blob. Iterations: The same enhancement can be repeated individually up to 9 times. (except: binarization, subtract, preserve intensity, contrast conversion, shading correction, blur, blob 1 iteration). Stacking: 13 steps, any combination (binarization, subtract, blob: can only be applied once in stack). Supports variable referencing across a range of setting parameters 		
	Color extraction (only available when a color camera is connected)		<ul style="list-style-type: none"> Color to binary, color to gray, fine color, gray, RGB gray (Color can be specified in HSB terms fine color can only be selected for stain mode) Supports variable referencing across a range of setting parameters 		
	Calibration function		<ul style="list-style-type: none"> Individual calibration can be applied to units X, Y and length data (variable referencing allowed). Calibration can be turned ON/OFF for each inspection unit. 		
	Unit execution		<ul style="list-style-type: none"> Unit execution can be configured in the system settings to apply only to XG VisionEditor or to the controller. Unit results, variable referencing allowed. 		
Presence/Absence	Area	Counts the number of white or black pixels.			
Position detection	Pattern search		<ul style="list-style-type: none"> Supports multiple pattern searches for up to 99 patterns oriented throughout 360 degrees. Supports variable referencing for search, pattern and 4 mask regions. Supports variable referencing for detection point offsets. Supports referencing of registered images using image variables for processing. 		
	ShapeTrax2		<ul style="list-style-type: none"> Edge-based search tool for detection of up to 2,000 patterns Works with patterns oriented throughout 360 degrees over a scale ratio of 50% to 200%. Supports variable referencing for search, pattern, 4 mask regions and multiple mask areas. Supports variable referencing for detection point offsets. Supports referencing of registered images using image variables for processing. 		
	Edge position		<ul style="list-style-type: none"> Measures up to 3,600 positions simultaneously. Supports angle measurement using ring and arc inspection regions. 		
	Trend edge position		<ul style="list-style-type: none"> Measures the average, maximum, and minimum edge positions in a single inspection region divided into up to 5,000 segments. Supports angle measurement using ring and arc inspection regions. Detects straight lines and circles from a group of detection points using the least-squares method (with correction). 		
	Blob	Measures the center of gravity and main axis angle (180/360 degrees selectable) for up to 9,999 blobs.			

		XG-7701(P)	XG-7501(P)	XG-7001(P)	XG-7001A
Vision Tools (continued)	Edge Width	Measures the distance between two edges (outer gap, inner gap, specified edges for up to 1800 detected edges).			
	Edge Pitch	Measures the gap pitch and center pitch for up to 1,800 detected edges.			
	Edge Angle	Measures the angle between two detected edges.			
	Edge Pairs	Measures the gap pitch and center pitch for up to 3,600 detected edges formed into pairs from two scans.			
	Trend Edge Width	Measures the average, maximum, and minimum edge widths between two edges (outer gap, inner gap) in a single inspection region that has been divided into up to 5,000 segments.			
	Blob	Labels and counts up to 9,999 blobs measuring the center of gravity, main axis angle (180/360 degrees selectable), area, Feret diameter, perimeter, roundness, width, aspect ratio, major axis, box height and axes ratio.			
	Stain	<ul style="list-style-type: none"> • Detects flaws and stains inside a region by comparing the average intensity of segments. • Supports image subtracted stain detection by using a subtraction filter from a registered image. • Supports multiple detection of up to 99 groups using the stain grouping function, detected position, and filtering based on feature characteristics. • Supports direct measurement of the color image using fine color. • Supports image contrast display. 			
	Trend Edge Stain	<ul style="list-style-type: none"> • Detects a defect (protrusion or indentation) that deviates in shape with respect to a model line based on detected edge points of a target profile. • Supports flaw detection using straight lines, circles, ovals, and free-form curves as model lines. 			
	Intensity Inspection	<ul style="list-style-type: none"> • Measures the pixel intensity value. • Required as the reference unit for the preserve intensity filter. 			
	Color (only when a color camera is connected)	RGB and HSB measurement supported.			
Control Units	OCR	<ul style="list-style-type: none"> • Supports character recognition of alphanumeric characters and user specified symbols for up to 2 lines of 20 characters (40 total) identified automatically or from a fixed region. • Supports a user-definable library of up to 200 characters, including 20 custom characters. Supports a calendar tolerance function (with zero suppression and offset function). • Supports encrypted date and time and shift codes. 			
	Position adjustment Unit	<ul style="list-style-type: none"> • Provides 1- or 2-point position correction for X, Y, and θ (± 180 degree) orientation of inspection, image operation and on-screen graphics units. • Supports referencing by all or individual measurement units. • Supports batch reference registration using a registered image. 			
	Branch Join	Supports up to 64 flow branches per unit based on a reference (unit results, variable reference).			
	Loop Function	Supports multiple unit execution control based on the number of loops (fixed or variable reference) specified.			
	Exit Loop	Forced exit from loops.			
	End	Ends the flow processing.			

		XG-7701(P)	XG-7501(P)	XG-7001(P)	XG-7001A
Calculation		<ul style="list-style-type: none"> Allows multiple calculation processing separated by line feeds. Up to 5,000 characters including comments. Supports timeout-based and answer-based (ANS) unit judgment. Arithmetic operators: Add, subtract, multiply, divide, remainder, power. Logic operators: NOT, AND, OR, XOR. Comparison operators: equal, not equal, greater than, less than, more than inclusive, less than inclusive. Arithmetical functions: Abs, AsCircle, AsLine, AsPoint, Atoi, Ave, Ave2 (array), AveR (range), AveR2 (array, range), Ceil (round up), Deg (radian to degree), Exp, Floor, Int (round off), Ln, Log, Max, Min2 (array), MaxN (index), MaxN2 (index, array), Min, Min2 (array), MinN (index), MinN2 (index, array), Pi, Rad, Round (round up), Sort, Sqr, Sqrt, Sum (array) Trigonometric functions: Sin, Cos, Tan, Asin, Acos, Atan, Atan2(P1/P2) Geometric functions: AngC, Angle, AngW, Circle3 (3 points), CircleLs (array), CircleTangent, ConvCrd, ConvCrd2, Dist, ISect, I2Circle, ILineCircle, Line (2 points), LineLs (array), LLAngle, LnAngle, LnDist, LnDistP (sign), LnDistXY, VMidLine, MidXY, Rotate, RotCenter, MidLine, ConvPixToWld, ConvWldToPix, MultiPtCalib, AddVector, SubVector, OuterProd, InnerProd Calender functions: ShiftDay, ShiftMonth, ShiftYear Bit functions: B_And, B_Not, B_Or, B_Xor, Bind Statements: FOR, STEP, NEXT, EXIT FOR, IF, ELSE IF, END IF, DO WHILE (undefined loop), EXIT DO (undefined loop), comments, continue to next line Others: Calculation results Displays and highlights calculation errors. 			
Operation Units		<ul style="list-style-type: none"> Creates images based off of a feature extracted from one or multiple images, or an image with enhanced intensity differences. Operation: Processing across multiple images. Supports a combination of 1:1, n:1, n:n (max n is 32) images 			
Image operation		<ul style="list-style-type: none"> Conversion: Operation performed on one image. Operation types: Add, Subtract, AbsoluteDifference, Average, Multiply (with normalization), Multiply (without normalization), Max, Min, AND, OR, XOR, NAND, NOR, XNOR Conversion types: Add, Subtract, AbsoluteDifference, Multiply, Rotation, Translation, Z, Trapezoid Correct, Pixel Val. Conv., Blob, NOT, AND, OR, XOR, NAND, NOR, XNOR, Right Bit Shift, Left Bit Shift 			
C Plug In		<ul style="list-style-type: none"> C language source files can be compiled for both controller and PC simulation environments. (Supported compilers: For the controller: Texas Instruments C6000 Code Generation Tools 6.0.* or 6.1.* (6.0.11 recommended), For the PC: Microsoft Visual Studio 2005/2008, Visual C++ 2008 Express Edition.) Supports access to pixel values from the specified image variable. Local variables, global variables, and system variables values can be passed for referencing and rewriting (rewriting not supported for system variables). Visual Studio debugging. 			
Calibration		<ul style="list-style-type: none"> Lens and trapezoidal distortion can be corrected by teaching a calibration pattern. Supports two forms of correction, based off of the image itself, and by calculating the coordinates. Multiple calibration patterns can be used during teaching. User defined calibration patterns available for printing. 			
Timing Units	Pause	Pause flow for specified time (0 ms to 1 hour: fixed or variable reference)			
	Timer	Start user timer (0 to 7)			
	Wait timer	Pause flow for time based on user timer (0 to 7)			
	Wait on terminal condition	<ul style="list-style-type: none"> Pause flow based on AND/OR evaluation of up to 20 terminals for state changes (edge/level, ON/OFF, rising/trailing edge). Supports CC-Link bit devices 			
	Wait on variable conditions	Pause flow based on AND/OR evaluation from comparing results of variables (max 8) and reference values (max 2).			
	Wait on dialog conditions	Pause flow from the time a dialog is open to the time it is closed.			
Display Unit	On-screen graphics	Displays graphic objects and characters linked to variables and step results. Graphic objects: rectangle, rotated rectangle, circle, oval, ring, arc, point (rotating crosshair), line, characters: text, values, active text, OCR.			

		XG-7701(P)	XG-7501(P)	XG-7001(P)	XG-7001A
Terminal output		<ul style="list-style-type: none"> Outputs user-defined inspection results to the I/O terminals. Supports time-delayed separated outputs of up to 28 points up to 8 times. Skips data output for unexecuted units. Output priority can be set for processing images or outputs. 			
Output Units	Data output	<ul style="list-style-type: none"> User-defined inspection results (256 maximum) can be output to either the SD card, RS-232C, Ethernet, CC-Link, PLC-Link, or PC Program (ActiveX). Supports use of up to 16 custom-formatted output strings. Skips data output for unexecuted units. User defined output folder and file naming rules (when outputting to the SD card or PC Program (ActiveX)) Output priority can be set for processing images or outputs. 			
	Image output	<ul style="list-style-type: none"> Outputs image data for an image variable to either the SD card or PC Program (ActiveX). (BMP / JPG selectable file format) User defined output folder, folder spanning (by no. of images or date), and file naming rules. Output priority can be set for processing images or outputs. 			
Execute Command Units	Command	Any command can be issued to the controller during Run mode from the image processing flow.			
Common Outputs	Unit Total status	Outputs the logical OR of the results of selected units as the total status.			
	Unit Total error	Outputs the logical OR of unit errors of selected units as the total error.			
Image capture range	Processing area setting	<ul style="list-style-type: none"> The applicable 980,000 pixels (1024 (H) x 960 (V)) can be captured from 1,920,000 pixels (1 megapixel mode). The applicable 240,000 pixels (512 (H) x 480 (V)) can be captured from 320,000 pixels (standard mode). 	The applicable 240,000 pixels (512 (H) x 480 (V)) can be captured from 320,000 pixels (standard mode).		
	Scanning method selection (monochrome camera only)	* 310,000 pixels when the XG-H035C/H035M is connected.			
Correction function	Capture Start/End Line Setting	<p>Capture start/end lines can be set anywhere within the image capture range. (XG-H200C, H200M cannot capture fewer than 100 lines.)</p> <p>Capture start line be changed for each capture unit by referencing variables.</p>			
	Camera gain adjustment	Sensitivity offset and span adjustment (RGB batch/individual and span can be set for each of 16 brightness levels. RGB individual settings can be supported when a color camera is connected.)			
Display Screens	White Balance adjustment (color camera only)	Manual adjustment using white target			
	Image inversion function	Mirrored image generation			
Screen parts	Scaling function	Supports calibration and scaling for X, Y, and length for each camera. Scaling also supported based on measurement and calculation values.			
	Number of screen configurations	Supports 100 screens per program with external switching possible.			
	Number of frames	Display control according to user group.			
	Number of displays	<ul style="list-style-type: none"> 5 individually customizable (layout and size) displays per screen. Display the current image from a user-specified camera, a registered image, as well as any user-specified archived image stored in the system's image memory. Zoom capability linked to inspection regions of user-specified vision tools or primary targets. Selection with external control. 			
	Screen parts	<ul style="list-style-type: none"> Display base frame, page frame Basic parts: values, text, active text, horizontal line, vertical line, point, rectangle, circle, polygon. Standard parts: program name, date, time, display camera & image information, display area & magnification, Total Status Pass / Fail, Logo Image (BMP), Unit Details (Vision Tools), Unit Details (Non-Vision Tools), Variable List, Unit Pass / Fail Graphic, Unit Result Summary List. 			

		XG-7701(P)	XG-7501(P)	XG-7001(P)	XG-7001A
Number of dialogs		<ul style="list-style-type: none"> • Maximum of 900 per program with, external switching possible. • Supports dialog based menus that can be used to change or set various parameters while the controller is in Run mode. (Dialog transparency can be changed to 100%, 90%, 75%, 50%, or 25%) • Screens can be linked to dialogs being used. Dialogs can be displayed or hidden based on the user group logged in. 			
Elements		Text, numerical input, drop down menus, option button, confirmation button.			
Dialog menus	Standard dialogs	<p>Dialogs support: Region Setting, Image Registration, Color Extract, Statistics, Image Archive, Library, Unit Properties, View Toolbar, Function Menu, Change Program, View Files, I/O Diagnostic, RS-232C Diagnostic, Change User, Setup Date / Time, Save Program, Rename Program, Copy/Delete Settings, Save / Load Settings, Stop SD2 Operation, Resources, New / Edit / Delete Programs, Variables, Setup Total Status, Setup Total Error, Setup Scale Factor, Image Capture Buffer Settings, Setup Statistics, Setup Image Archive, Camera Selection, FTP Settings.</p> <ul style="list-style-type: none"> • Inspection Region, Color, library dialogs support changes based on login permissions. • Image Registration dialog can reference the amount of correction provided by the reference unit. • Unit properties dialog can be used for all units except the C Plugin unit dialogs. • Holding default variable values can be enabled for Variables and New / Edit / Delete Programs dialogs. 			
	Edit Unit dialog	<ul style="list-style-type: none"> • Supports changes to settings of pre-configured units (Image Acquisition, Vision Tools, Position Adjustment, Operations, Functions, Timing, Display, Output, Execute Command). • Supports the choice of image to be displayed (current or registered image) and controller operation (trigger input, and outputs) when dialog opened. • Supports the updating of registration reference values from registered images. 			

		XG-7701(P)	XG-7501(P)	XG-7001(P)	XG-7001A	
Statistics	Data points	Maximum of 100,000 data points per item (can be saved onto an SD card in a single operation).				
	Data	Maximum, minimum, average, deviation (3σ), OK / NG count, execution count				
Support functions	<ul style="list-style-type: none"> The number of images that can be archived in the controller's image memory is as follows: <ul style="list-style-type: none"> Maximum 1,013 images (monochrome camera in 240,000 pixel mode) Maximum 501 images (monochrome camera in 310,000 pixel mode) Maximum 245 images (monochrome camera in 1 megapixel mode) Maximum 117 images (monochrome camera in 2 megapixel mode) Maximum 40 images (monochrome camera in 5 megapixel mode) Maximum 1,008 images (color camera in 240,000 pixel mode) Maximum 498 images (color camera in 310,000 pixel mode) Maximum 240 images (color camera in 1 megapixel mode) Maximum 112 images (color camera in 2 megapixel mode) Maximum 35 images (color camera in 5 megapixel mode) Simultaneously processing of up to 8 archives with different content. Archive images as single or multiple images. Choice of buffer control either by overwriting the buffer each time or by processing until the buffer is full. Supports storage of result data to allow reproduction of measurement conditions at the time the image was recorded. Supports archived data output to SD card, PC Program (ActiveX), or FTP server for each archive. 					
	Image Archive					
	Image Zoom In/Out	Capable of zooming during operation from 4% to 2500%. Supports display scrolling by handheld controller or linked to the measurement position. (Zoom ratio can be set individually when showing multiple displays).				
	Setting Assist Function	Edge differential Waveform display	Graphically displays edge waveform and measurement values during operation.			
		Profile display	Graphically displays trend edge position and width of all detected edges during operation.			
		Contrast display	Graphically displays stain detection (stain level) during operation.			
		Waveform display	Graphically displays OCR character extraction during operation			
		Stain graph display	Displays a stain graph of trend edge stains during operation.			
		Features display	Features can be registered and displayed for ShapeTrax2 during operation.			
		SD card save function	<ul style="list-style-type: none"> The following data can be saved (apart from program data) directly while running inspections: Measurement value, judgment result, NG count, processed image BMP/JPG, archived image (BMP/JPG), raw image, statistical analysis data, RS-232C communication log, program data, operation log. User-specified camera images can be saved in offline mode. 			
Others	Screen capture change logged in user, file management, I/O monitoring, RS-232C monitoring (with logging capability)					

	XG-7701(P)	XG-7501(P)	XG-7001(P)	XG-7001A
Control inputs (user-assignable)	20 inputs (including 4 high-speed inputs assignable as trigger inputs). Input rating 26.4 V or less, 2 mA or more (high-speed inputs 3 mA or more).			
Control outputs (user-assignable)	28 outputs (including 4 high-speed outputs usable as FLASH outputs synchronized with the trigger inputs). NPN open collector, maximum 50 mA (30 V or less) ^{*1}			
Monitor output	Analog RGB output SVGA 800 x 600 (24-bit color 60 Hz)			
Operation indicators	Power, Error LED display			
RS-232C	Numerical value and control input/output, max baud rate 115200 bps.			
PLC link	<ul style="list-style-type: none"> Numerical value and control input/output using the RS-232C port or Ethernet port enabled (cannot be used with CC-Link). The following PLCs are supported through PLC link:^{*2} <ul style="list-style-type: none"> Keyence Corporation.: KV-700 Series, KV-1000 Series, KV-3000 Series, KV-5000 Series Mitsubishi Electric: A Series (RS-232C only), Q Series, L Series OMRON: SYSMAC C Series (RS-232C only), CS1/CJ1/CJ2 Series 			
Ethernet	<ul style="list-style-type: none"> Numerical value, and control input/output. PC connectivity for Keyence V-Works software to connect to the system for the upload/download of programs and data including images, and to perform various simulations. FTP client support (only during archived data output). 1000BASE-T/100BASE-TX/10BASE-T 			
USB	<ul style="list-style-type: none"> PC connectivity for Keyence V-Works software to connect to the system for the upload/download of numerical value output, programs, data including images, and to perform various simulations. USB 2.0 only 			
CC-Link	<ul style="list-style-type: none"> The CC-Link unit CA-NCL10E can be connected for numerical value and control input/output (cannot be used with PLC link). Compatible with Ver.1.10 and Ver. 2.00 remote device stations 			
Handheld controller	<ul style="list-style-type: none"> OP-84231 or OP-84236 (blank) providing menu access and navigation. Programmable function buttons. Button functionality enabled / disabled based by user groups. 			
Display language	Japanese / English selectable			
Illumination control	Illumination expansion unit CA-DC20E for LED lighting (12 V, 24 V) and intensity control 2 channels per unit, maximum of 4 units (8 channels total).			
Power supply voltage	24 V DC ±10%			
Rating				
Current consumption	<ul style="list-style-type: none"> 2.4 A maximum load (2 cameras) 3.2 A maximum load (4 cameras) 	<ul style="list-style-type: none"> 2.2 A (2 cameras at maximum load) 2.8 A (4 cameras at maximum load) 	<ul style="list-style-type: none"> 2.2 A (2 cameras at maximum load) 2.6 A (4 cameras at maximum load) 	<ul style="list-style-type: none"> With 2 cameras connected: 0 to +50°C (single megapixel camera: 0 to +45°C) With 4 cameras connected: 0 to +45°C
Ambient temperature		0 to +50°C		
Environmental resistance				
Relative humidity	35 to 85% RH (no condensation)			
Weight	Approx. 1,250 g			Approx. 1,300 g

*1 Inquire to Keyence when your application requires the PNP-type interface (except for XG-7001A).

*2 Models equipped with an Ethernet port on the CPU unit support direct connection to the Ethernet port.

Cameras (XG-H500C/H500M)

	XG-H500C	XG-H500M
CCD	2/3-inch color CCD, square pixels 11x-speed reading (2 outputs), 5,050,000 pixels	2/3-inch monochrome CCD, square element all pixels 11x-speed reading (2 outputs), 5,050,000 pixels
CCD pixel size	3.45 µm x 3.45 µm	
Effective pixels	4,990,000 pixels, 2432 (H) x 2050 (V)	
Scanning method	Progressive (61.2 ms)	Progressive (61.2 ms), interlace (40.3 ms)
Image transfer frequency	130 MHz (65 MHz x 2 ch)	
Transfer system	Digital serial transfer	
Electronic shutter	1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000 0.05 ms to 9000 ms can be set through manual input	
Lens mount	C-mount	
Environmental resistance	Ambient temperature 0 to +40°C Relative humidity 35 to 85% RH (no condensation)	
Weight	Approx. 130 g (lens not included)	

Cameras (XG-H200C/H200M)

	XG-H200C	XG-H200M
CCD	1/1.8-inch color CCD, square pixels 7x-speed reading 2,010,000 pixels	1/1.8-inch monochrome CCD, square element all pixels 7x-speed reading 2,010,000 pixels
CCD pixel size	4.4 µm x 4.4 µm	
Effective pixels	1,920,000 pixels, 1600 (H) x 1200 (V) (In the 1 megapixel mode, 980,000 pixels (1024 x 960) of the 1,920,000 pixels are in the processing range.)	
Scanning method	Progressive (29.2 ms: 2 megapixel mode, 24.2 ms: 1 megapixel mode)	Progressive (29.2 ms: 2 megapixel mode, 24.2 ms: 1 megapixel mode), interlace (16.1 ms: 2 megapixel mode, 13.6 ms: 1 megapixel mode)
Image transfer frequency	82 MHz (41 MHz x 2 ch)	
Transfer system	Digital serial transfer	
Electronic shutter	1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000 0.05 ms to 9000 ms can be set through manual input	
Lens mount	C-mount	
Environmental resistance	Ambient temperature 0 to +40°C Relative humidity 35 to 85% RH (no condensation)	
Weight	Approx. 130 g (lens not included)	

Cameras (XG-200C/S200C)

	XG-200C	XG-S200C
CCD	1/1.8 type color CCD, square pixels reading, 2x-speed reading 2,010,000 pixels	
CCD pixel size	4.4 μ m x 4.4 μ m	
Effective pixels	Color 1,920,000 pixels, 1600 (H) x 1200 (V) (In the 1 megapixel mode, 980,000 pixels (1024 x 960) of the 1,920,000 pixels are in the processing range.)	
Scanning method	Progressive (58.5 ms: 2 megapixel mode, 47.6 ms: 1 megapixel mode)	
Image transfer frequency	40 MHz	
Transfer system	Digital serial transfer	
Electronic shutter	1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000 0.05 ms to 9000 ms can be set through manual input	
Lens mount	C-mount	Special mount (M15.5 P0.5 male)
Environmental resistance	Ambient temperature	0 to +40°C
	Relative humidity	35 to 85% RH (no condensation)
Weight	Approx. 110 g (lens not included)	<ul style="list-style-type: none"> Head: approx. 210 g (cable included, lens not included) Control unit: approx. 70 g

Cameras (XG-200M/S200M)

	XG-200M	XG-S200M
CCD	1/1.8 type monochrome CCD, square pixels reading, 2x-speed reading 2,010,000 pixels	
CCD pixel size	4.4 μ m x 4.4 μ m	
Effective pixels	1,920,000 pixels, 1600 (H) x 1200 (V) (In the 1 megapixel mode, 980,000 pixels (1024 x 960) of the 1,920,000 pixels are in the processing range.)	
Scanning method	Progressive (58.5 ms: 2 megapixel mode, 47.6 ms: 1 megapixel mode) Interlace (32.7 ms: 2 megapixel mode, 27.0 ms: 1 megapixel mode)	
Image transfer frequency	40 MHz	
Transfer system	Digital serial transfer	
Electronic shutter	1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000 0.05 ms to 9000 ms can be set through manual input	
Lens mount	C-mount	Special mount (M15.5 P0.5 male)
Environmental resistance	Ambient temperature	0 to +40°C
	Relative humidity	35 to 85% RH (no condensation)
Weight	Approx. 110 g (lens not included)	<ul style="list-style-type: none"> Head: approx. 210 g (cable included, lens not included) Control unit: approx. 70 g

Cameras (XG-H100C/H100M)

	XG-H100C	XG-H100M
CCD	2/3-inch color CCD, square pixels 7x-speed reading (2 outputs) 1,040,000 pixels	2/3-inch monochrome CCD, square element all pixels 7x-speed reading (2 outputs) 1,040,000 pixels
CCD pixel size	7.4 μ m x 7.4 μ m	
Effective pixels	1 megapixel 1000 (H) x 1000 (V)	
Scanning method	Progressive (20.5 ms)	Progressive (20.5 ms), interlace (13.9 ms)
Image transfer frequency	80 MHz (40 MHz x 2 ch)	
Transfer system	Digital serial transfer	
Electronic shutter	1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000 0.05 ms to 9000 ms can be set through manual input	
Lens mount	C-mount	
Environmental resistance	Ambient temperature 0 to +40°C Relative humidity 35 to 85% RH (no condensation)	
Weight	Approx. 120 g (lens not included)	

Cameras (XG-H035C/H035M)

	XG-H035C	XG-H035M
CCD	1/3-inch color CCD, square pixels 7x-speed reading (2 outputs) 340,000 pixels	1/3-inch monochrome CCD, square element all pixels 7x-speed reading (2 outputs) 340,000 pixels
CCD pixel size	7.4 μ m x 7.4 μ m	
Effective pixels	310,000 pixels, 640 (H) x 480 (V) (In standard mode, 240,000 pixels (512 x 480) of the 310,000 pixels or 310,000 pixels (640 x 480) are used in the process area.)	
Scanning method	Progressive (4.7 ms)	Progressive (4.7 ms), interlace (2.5 ms)
Image transfer frequency	80 MHz (40 MHz x 2 ch)	
Transfer system	Digital serial transfer	
Electronic shutter	1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000 0.05 ms to 9000 ms can be set through manual input	
Lens mount	C-mount	
Environmental resistance	Ambient temperature 0 to +40°C Relative humidity 35 to 85% RH (no condensation)	
Weight	Approx. 120 g (lens not included)	

Cameras (XG-035C/S035C)

	XG-035C	XG-S035C
CCD	1/3 type color CCD, square pixels 2x-speed reading 350,000 pixels	
CCD pixel size	4.4 μ m x 4.4 μ m	
Effective pixels	Color 320,000 pixels, 656(H) x 492(V) (In standard mode, 240,000 pixels (512 x 480) of the 320,000 pixels or 310,000 pixels (640 x 480) are used in the process area.)	
Scanning method	Progressive (16.0 ms)	
Image transfer frequency	24.5 MHz	
Transfer system	Digital serial transfer	
Electronic shutter	1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000 0.05 ms to 9000 ms can be set through manual input	
Lens mount	C-mount	Special mount (M10.5 P0.5 male)
Environmental resistance	Ambient temperature	0 to +50°C • Head: 0 to +50°C • Amplifier: 0 to +40°C
	Relative humidity	35 to 85% RH (no condensation)
Weight	Approx. 100 g (lens not included)	• Head: approx. 160 g (cable included, lens not included) • Control unit: approx. 70 g

Cameras (XG-035M/S035M)

	XG-035M	XG-S035M
CCD	1/3 type monochrome CCD, square pixel double-speed reading, 350,000 pixels	
CCD pixel size	7.4 μ m x 7.4 μ m	
Effective pixels	Color 320,000 pixels, 656(H) x 492 (V) (In standard mode, 240,000 pixels (512 x 480) of the 320,000 pixels are in the processing range.)	
Scanning method	Progressive (16.0 ms), interlace (8.8 ms)	
Image transfer frequency	24.5 MHz	
Transfer system	Digital serial transfer	
Electronic shutter	1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000 0.05 ms to 9000 ms can be set through manual input	
Lens mount	C-mount	Special mount (M10.5 P0.5 male)
Environmental resistance	Ambient temperature	0 to +50°C • Head: 0 to +50°C • Amplifier: 0 to +40°C
	Relative humidity	35 to 85% RH (no condensation)
Weight	Approx. 100 g (lens not included)	• Head: approx. 160 g (cable included, lens not included) • Control unit: approx. 70 g

Cameras (CA-CM20: for XG-7001A)

CA-CM20	
CCD	1/3 type monochrome CCD, square pixels double-speed reading, 350,000 pixels
CCD pixel size	7.4 μ m x 7.4 μ m
Effective pixels	320,000 pixels, 648 (H) x 492 (V) (310,000 pixels (640 x 480) is the processing range)
Scanning method	Progressive (16.9 ms), interlace (8.5 ms)
Image transfer frequency	24.5 MHz
Transfer system	Analog transmission
Electronic shutter	1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000 0.05 ms to 125 ms can be set through manual input
Lens mount	C-mount
Environmental resistance	Ambient temperature: 0 to +40°C Relative humidity: 35 to 90% RH (no condensation)
Weight	Approx. 50 g (lens not included)

Illumination Expansion Unit (CA-DC20E)

CA-DC20E		
Output	Illumination control	(1) Rated voltage (DC) (2) Pulse width modulation (100 KHz) (Controller selectable)
	Intensity level	255 digital levels (controller selectable)
	Lighting connections	2 channels (LED connector or terminal block connection)
	Voltage	12 V DC / 24 V DC (DIP switch selectable)
	Capacity	Max. 40 W (30 W single channel)
	Synchronous	FLASH output synchronization/continuous illumination (controller selectable)
	Response speed	(1) Rated voltage control: Within 10 ms (with 12 V output), within 20 ms (with 24 V output) (2) Pulse width modulation control: Within 1 ms (with 12/24 V output)
Inputs	Force illumination OFF	Rated input max. 26.4 V, min. 2 mA
Display	LED display	Illumination level display: Green/Orange (Min. 128) Error display: Red (All lit)
Rating	Power supply voltage	24 V DC \pm 10%
	Current consumption	3.0 A (12 V output at maximum load) 6.5 A (24 V output at maximum load)
Environmental resistance ^{*1}	Ambient temperature	0 to +50°C ^{*2}
	Relative humidity	35 to 85% RH (no condensation)
Weight		Approx. 590 g

*1 The environmental resistance of just the LED lights is ambient temperature 0 to 40°C and relative humidity 35 to 65% (no condensation).

*2 This is limited by the ambient temperature of the connected controller.

Using the Camera Cable Extension Amplifier (CA-CNX10U/CHX10U)

▶ Note

The camera cable extension amplifier can only be used with controllers and camera expansion manufactured after September 2009.

Product name	Camera cable extension amplifier (standard camera use)	Camera cable extension amplifier (high speed cameras)
Model name	CA-CNX10U	CA-CHX10U
Support cameras	<ul style="list-style-type: none"> • XG-035C/035M • XG-S035C/S035M • XG-200C/200M • XG-S200C/S200M 	<ul style="list-style-type: none"> • XG-H035C/H035M • XG-H100C/H100M • XG-H200C/H200M • XG-H500C/H500M
Transfer system	Digital serial transfer	
Ambient Environmental resistance	<ul style="list-style-type: none"> When connected to XG-035C/035M: 0 to +50°C When connected to other cameras: 0 to +40°C 	
Relative humidity	35 to 85% RH (no condensation)	
Outside dimensions	112.6 (W) x 26 (D) x 21 (H)	
Weight	Approx. 60 g	

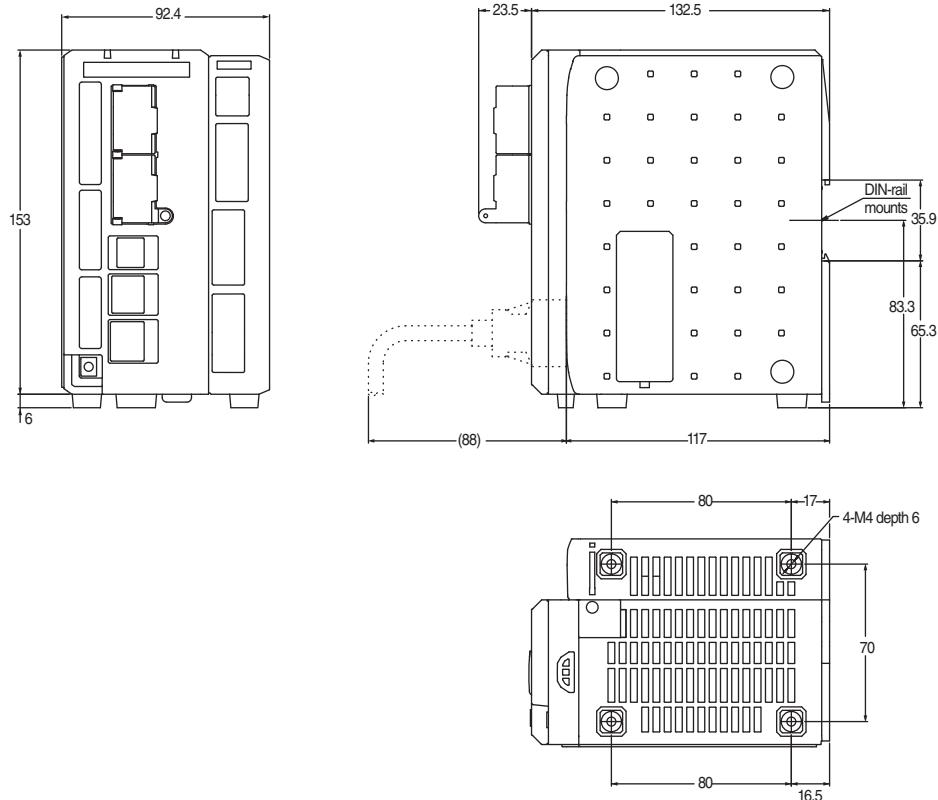
Controller power consumption ratings when using an amplifier

Connecting an amplifier increases the rated power consumption of the controller.

Controller type	Power consumption with	
	Cameras connected	amplifier (without amplifier)
XG-7001	2	2.5 A (2.2 A)
	4	3.4 A (2.8 A)
XG-7501	2	2.7 A (2.4 A)
	4	3.8 A (3.2 A)
XG-7701	2	2.7 A (2.4 A)
	4	3.8 A (3.2 A)

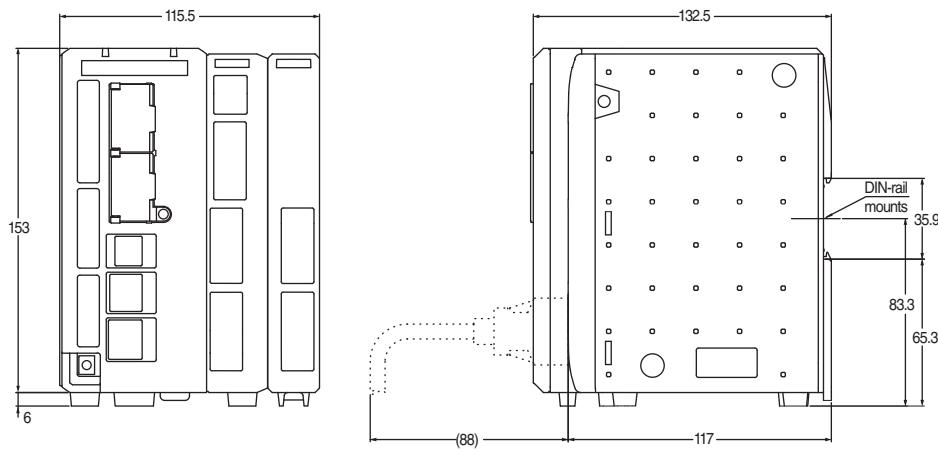
Outside Dimensions

Controller (XG-7701(P)/7501(P)/7001(P))



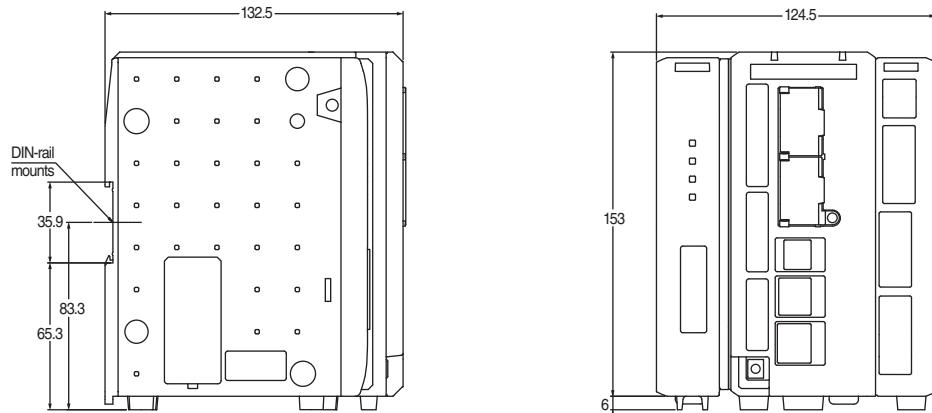
Unit: mm

With camera expansion unit XG-E700 connected



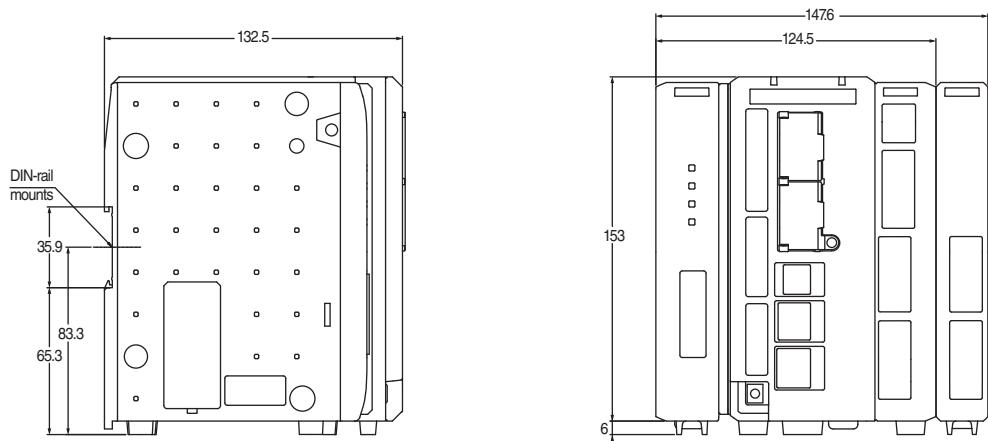
Unit: mm

(Total weight: approx. 1480 g)

With the CC-Link unit CA-NCL10E connected

Unit: mm

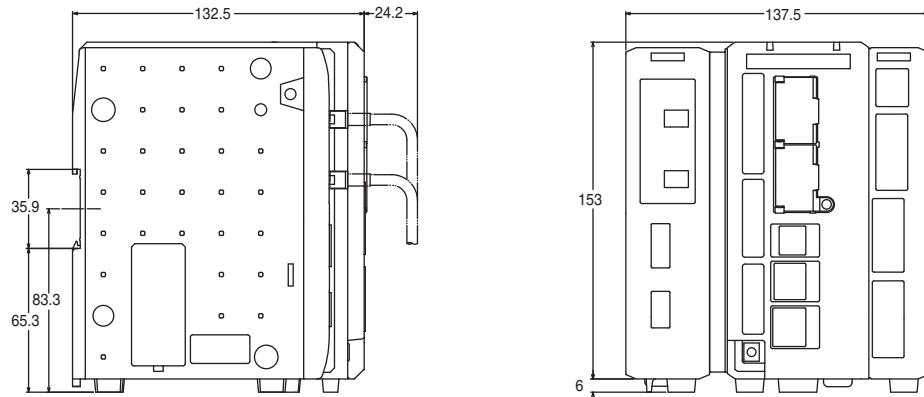
(Total weight: approx. 1,610 g)

With the camera expansion unit XG-E700 and CC-Link unit CA-NCL10E connected

Units: mm

(Total weight: approx. 1,840 g)

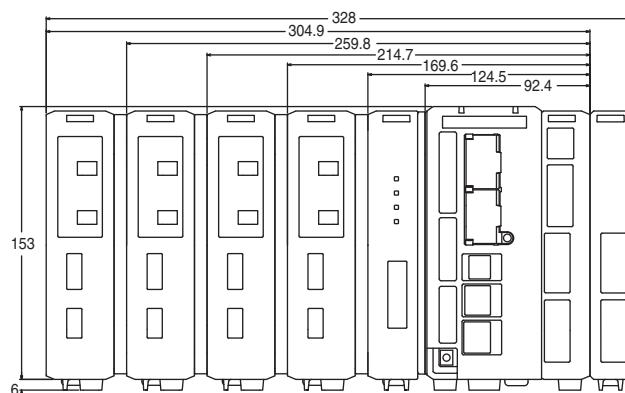
With the illumination expansion unit CA-DC20E connected



Unit: mm

(Total weight: approx. 1,840 g)

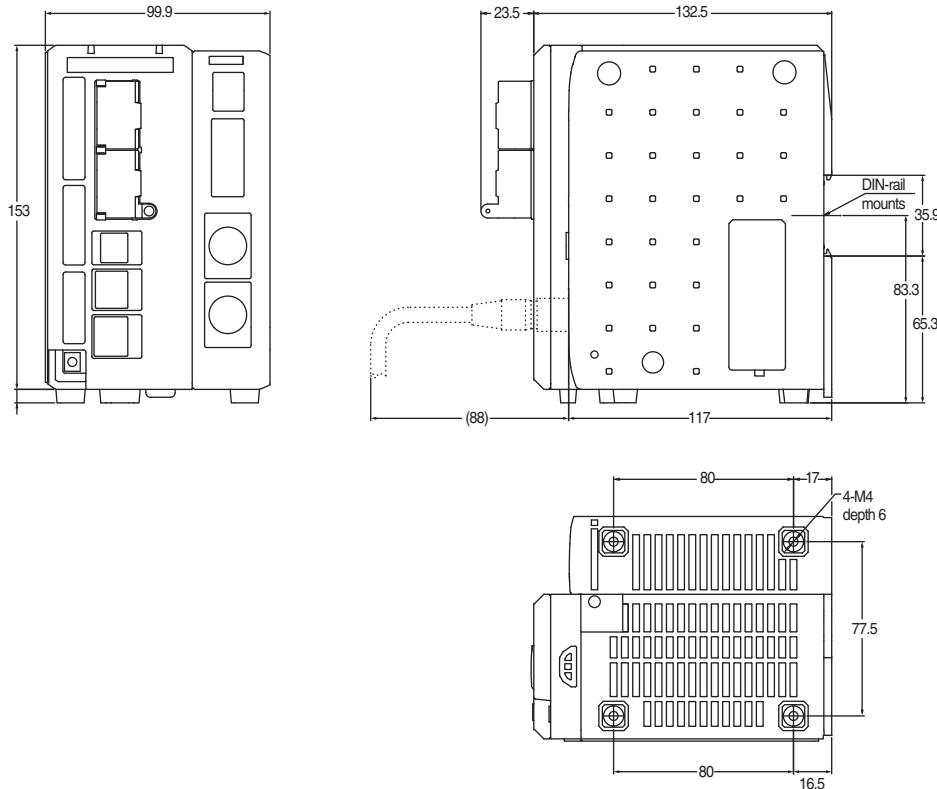
With the camera expansion unit XG-E700, CC-Link unit CA-NCL10E, and illumination expansion unit CA-DC20E connected



Unit: mm

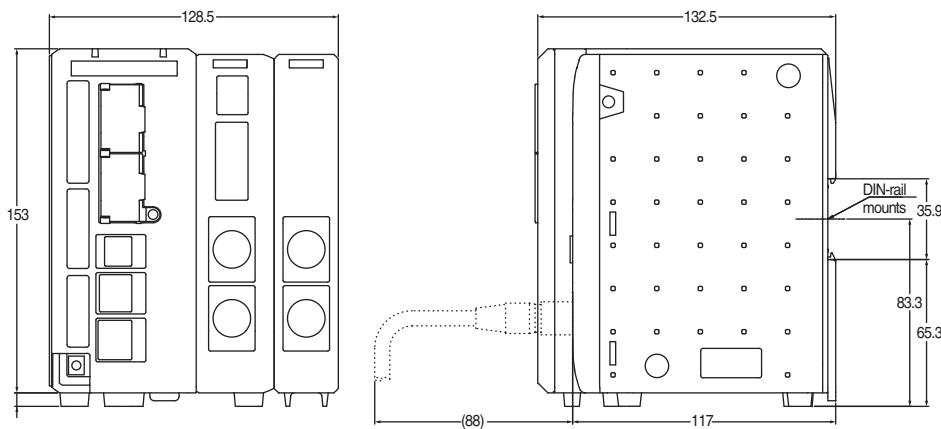
(Total weight: approx. 4,200 g)

Controller (XG-7001A)



Unit: mm

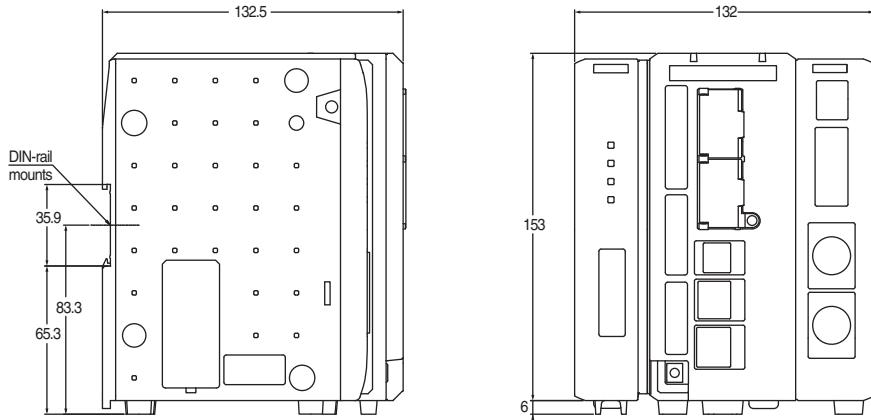
With camera expansion unit XG-E700A connected



Unit: mm

(Total weight: approx. 1,580 g)

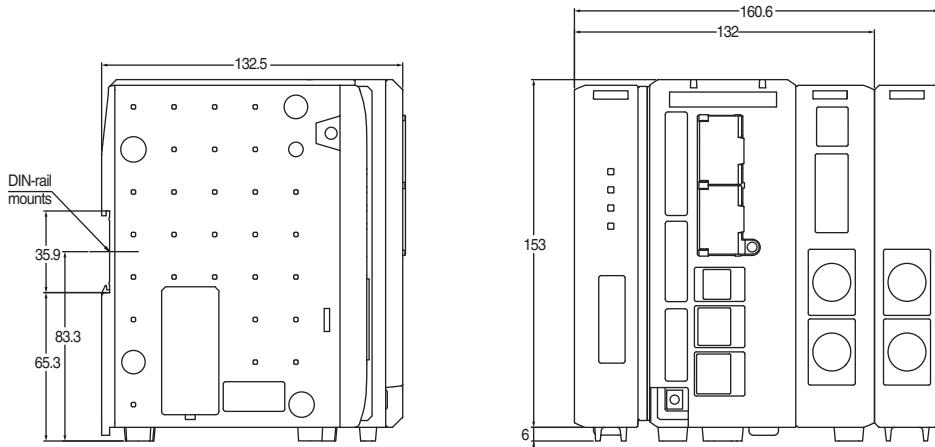
With the CC-Link unit CA-NCL10E connected



Units: mm

(Total weight: approx. 1,660 g)

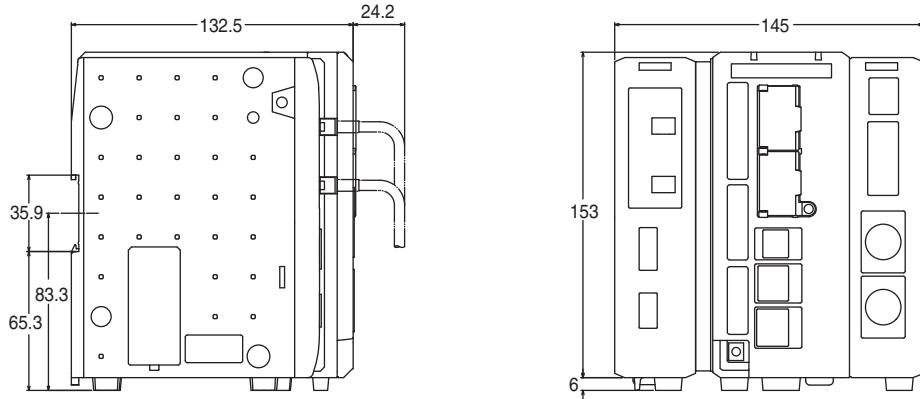
With the camera expansion unit XG-E700A and CC-Link unit CA-NCL10E connected



Unit: mm

(Total weight: approx. 1,940 g)

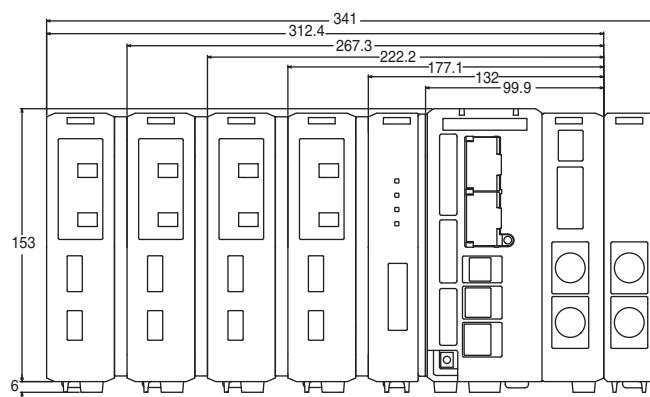
With the illumination expansion unit CA-DC20E connected



Unit: mm

(Total weight: approx. 1,890 g)

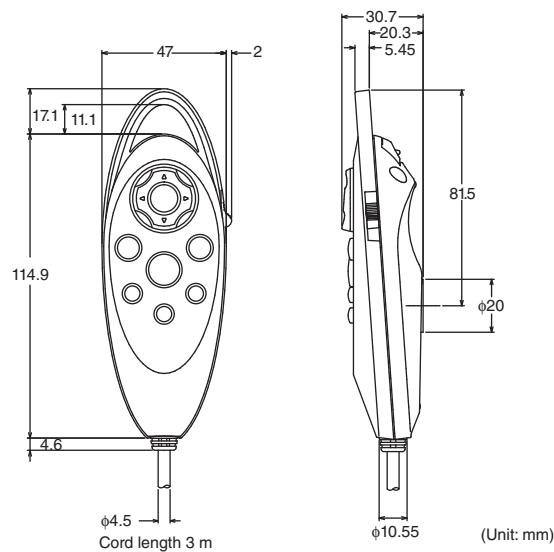
With the camera expansion unit XG-E700A, CC-Link unit CA-NCL10E, and illumination expansion unit CA-DC20E connected



Unit: mm

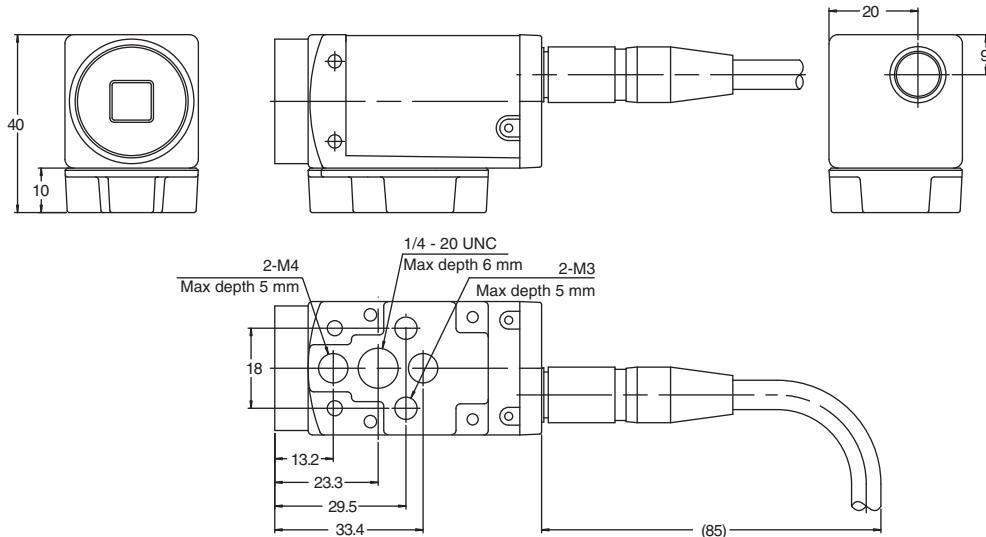
(Total weight: approx. 4,300 g)

Handheld Controller (OP-84231: with printing, OP-84236: blank)

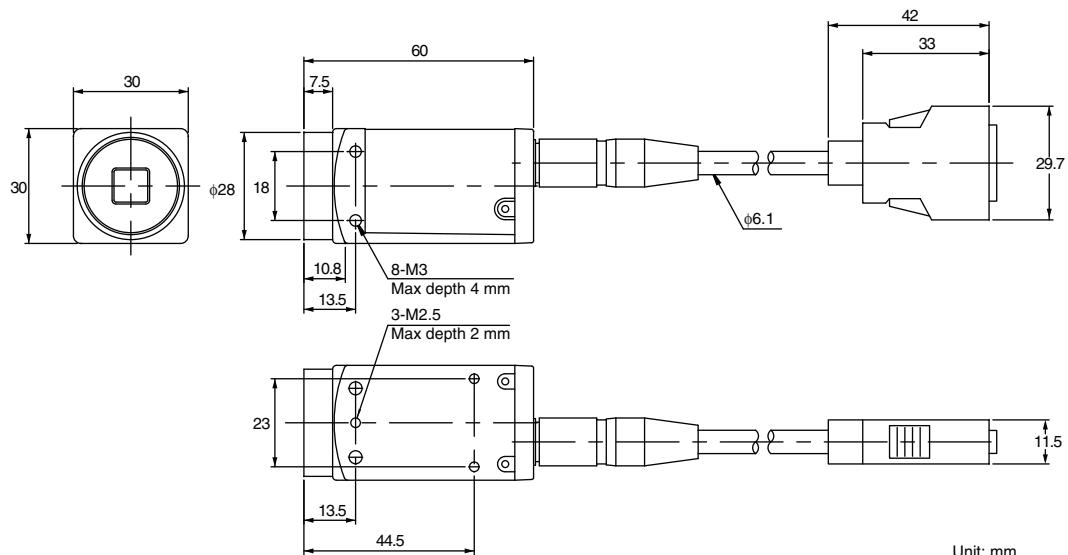


Digital Cameras (XG-200C/200M)

With plastic mount attached (factory shipped condition)



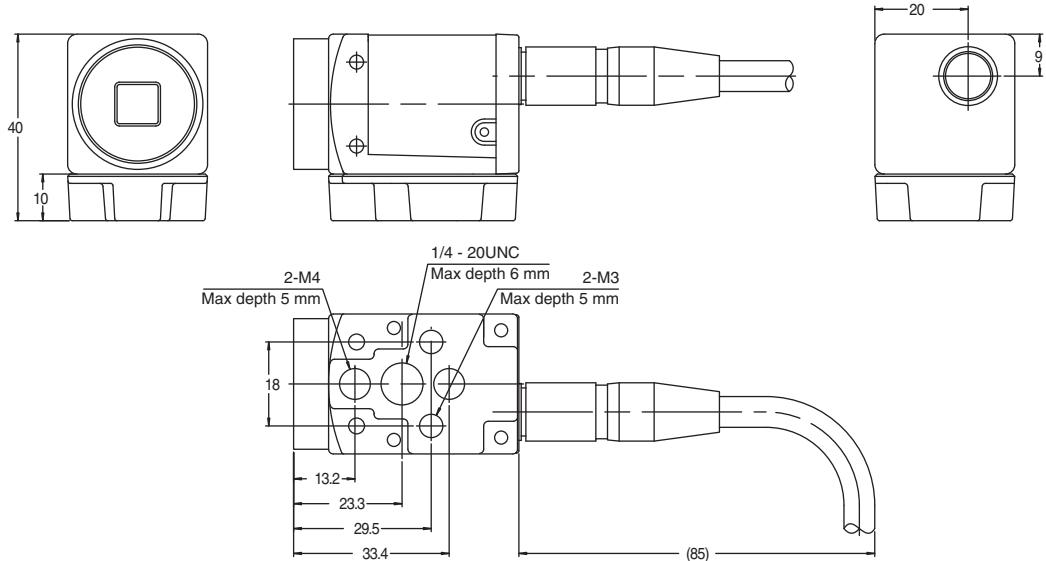
Without plastic mount



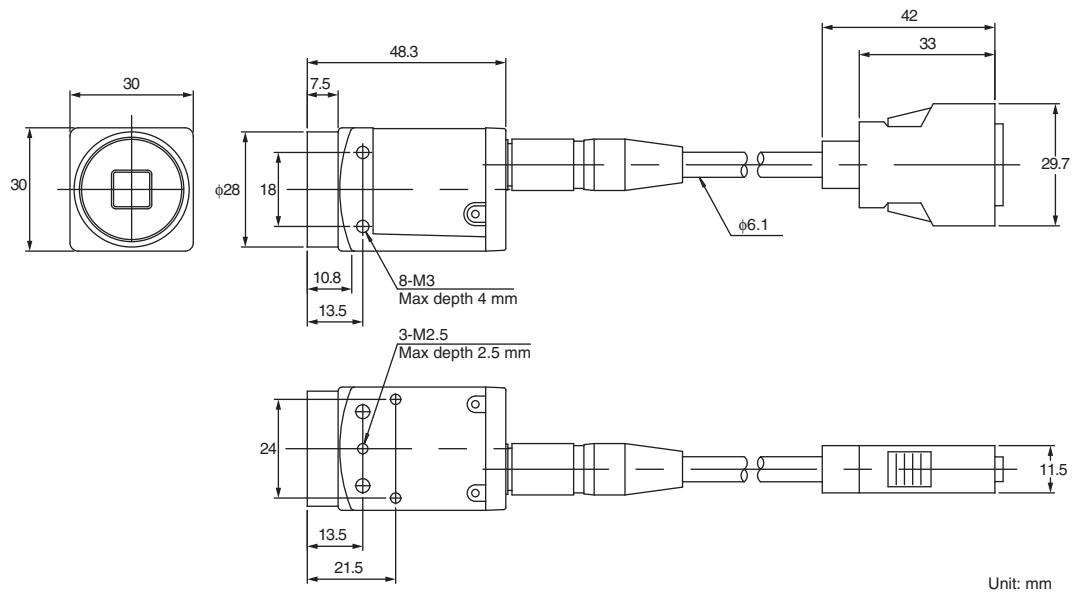
Unit: mm

Digital Cameras (XG-035C/035M)

With plastic mount attached (factory shipped condition)

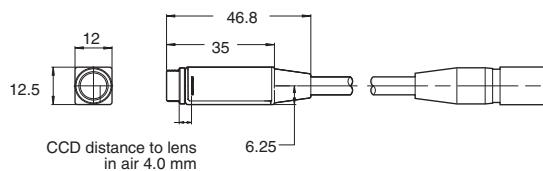


Without plastic mount

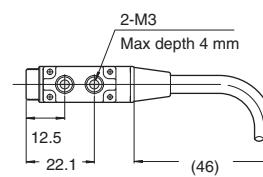
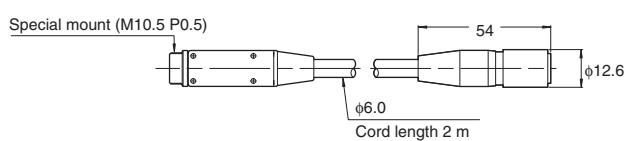
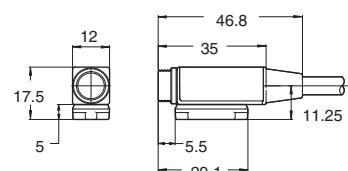


Digital Cameras (XG-S035C/S035M/S200C/S200M)

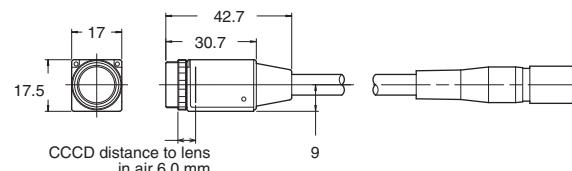
Camera XG-S035CH/XG-S035MH



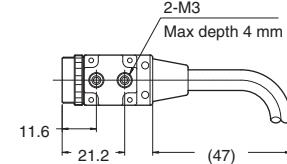
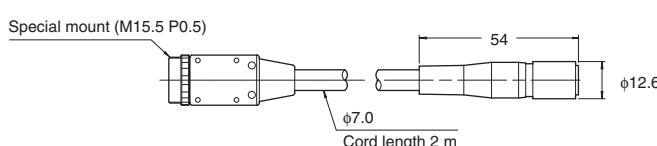
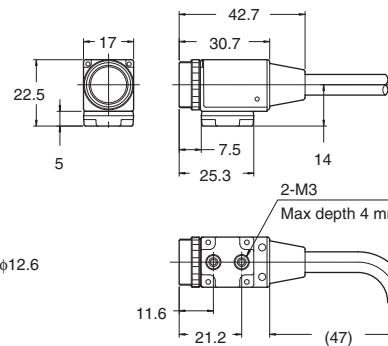
With plastic mount



Camera XG-S200CH/XG-S200MH

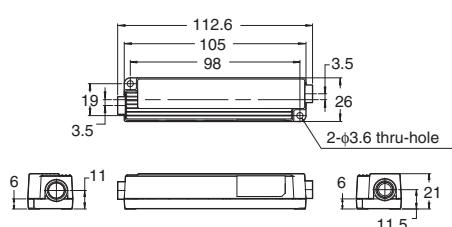


With plastic mount

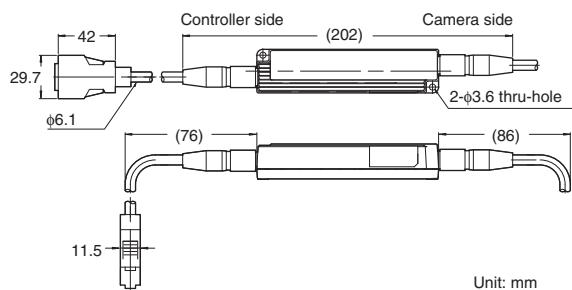


Camera control unit

XG-S200CU/S200MU/S035CU/S035MU



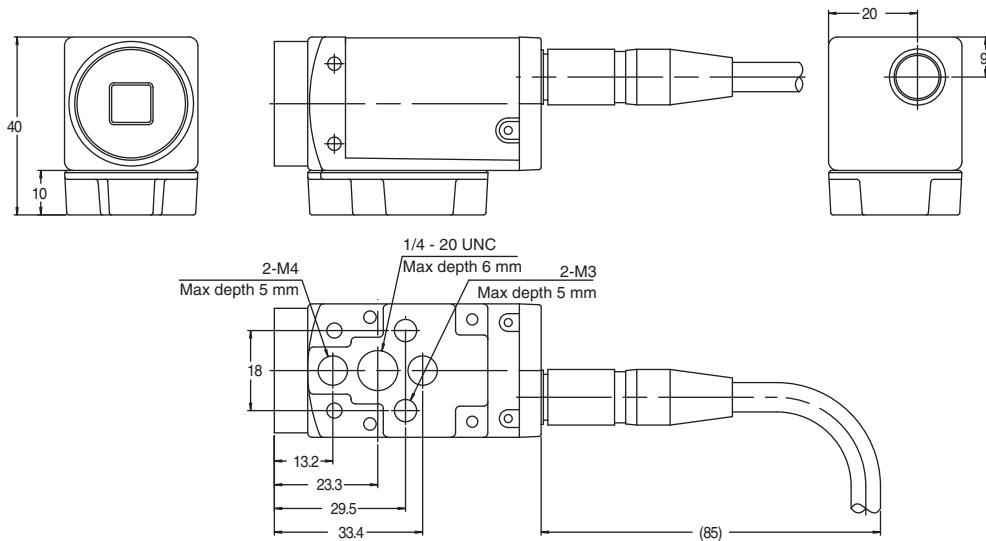
With cable connected



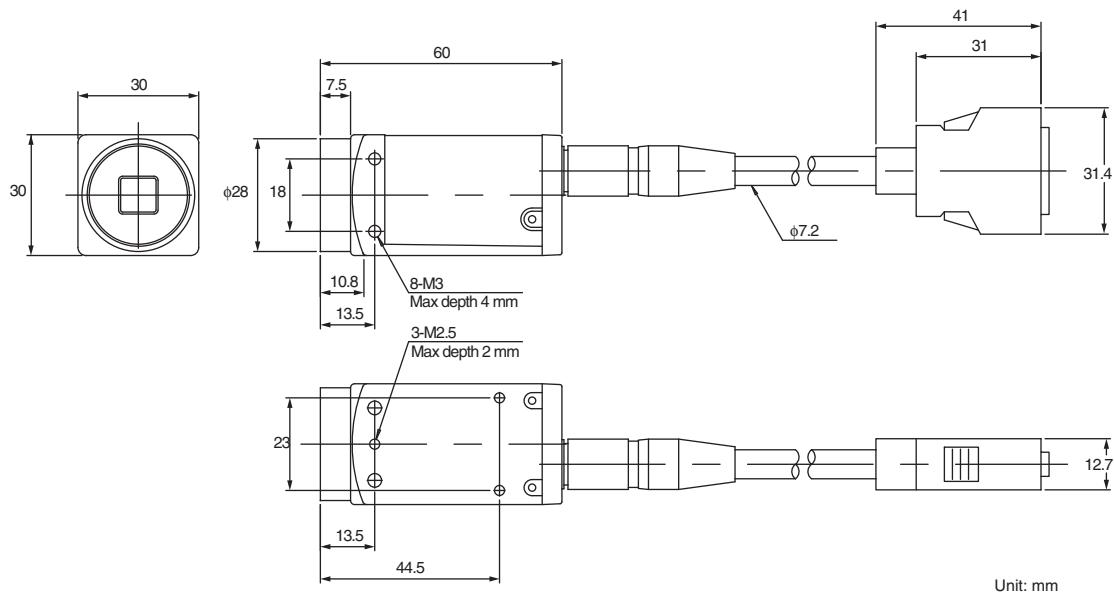
Unit: mm

Digital Cameras (XG-H500C/H500M/H200C/H200M/H100C/H100M/H035C/H035M)

With plastic mount attached (factory shipped condition)



Without plastic mount



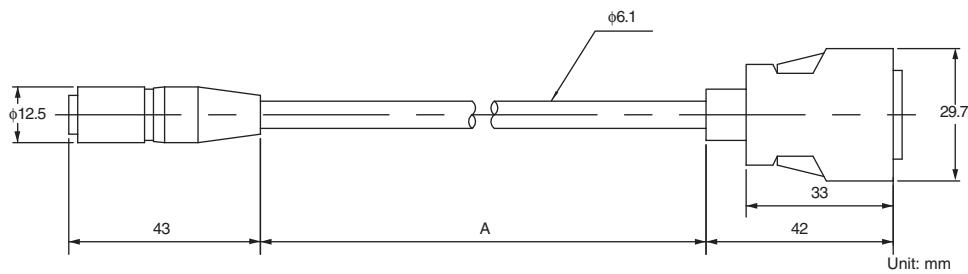
Unit: mm

Camera Cable (Digital Cameras)

▶ Note

Cannot be connected to high-speed cameras (XG-H****).

Standard cable

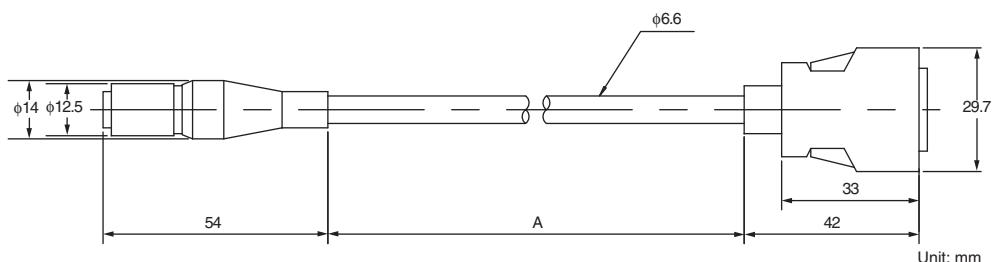


Model name	Cable length (A)	Weight	XG-035C/035M	XG-200C/200M	XG-S035C/S035M	XG-S200C/S200M
CA-CN1	1 m	100 g	○	○	○	○
CA-CN3	3 m	220 g	○	○	○	○
CA-CN5	5 m	330 g	○	○	○	○
CA-CN10	10 m	660 g	○	○	○	○
CA-CN17	17 m	1,100 g	○	x	x	x

○: Connection possible, x: Connection not possible

Standard high flex robotic cable

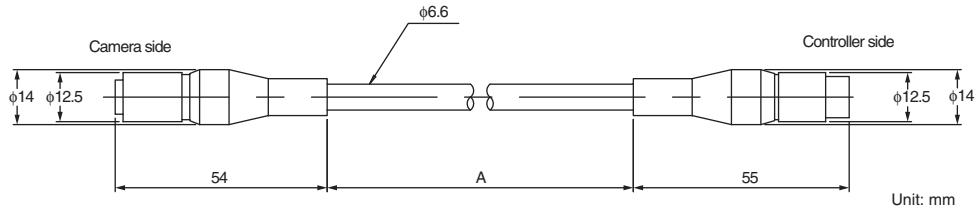
CA-CN*R



Model name	Cable length (A)	Weight	XG-035C/035M	XG-200C/200M	XG-S035C/S035M	XG-S200C/S200M
CA-CN3R	3 m	240 g	○	○	○	○
CA-CN5R	5 m	310 g	○	○	○	○
CA-CN10R	10 m	720 g	○	○	○	○
CA-CN17R	17 m	1,190 g	○	x	x	x

○: Connection possible, x: Connection not possible

CA-CN*RE



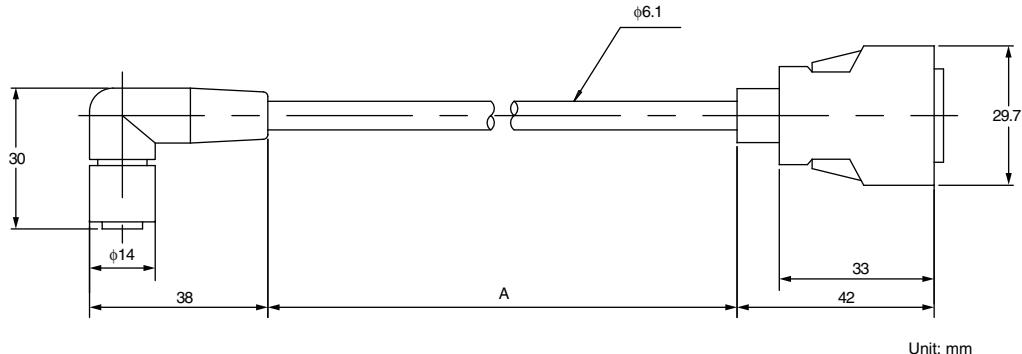
Model name	Cable length (A)	Weight	XG-035C/035M	XG-200C/200M	XG-S035C/S035M	XG-S200C/S200M
CA-CN7RE	7 m extension	500 g	○ (17 m)	○ (10 m)	○ (10 m)	○ (10 m)

Figures in () indicate maximum total length.

▶ Note

- CA-CN7RE is an extension cable and cannot be used alone.
- Connect CA-CN1/CN3/CN10/CN3R/CN10R to the controller side connector and make sure that the camera is within its maximum range.

L-shape cable



Model name	Cable length (A)	Weight	XG-035C/035M	XG-200C/200M	XG-S035C/S035M	XG-S200C/S200M
CA-CN3L	3 m	220 g	○	○	○	○
CA-CN5L	5 m	340 g	○	○	○	○
CA-CN10L	10 m	660 g	○	○	○	○
CA-CN17L	17 m	1,100 g	○	×	×	×

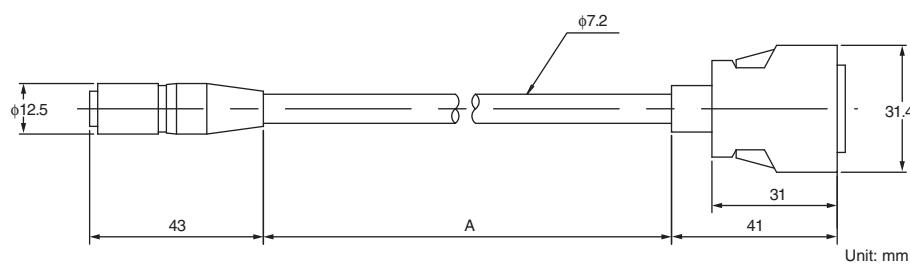
○: Connection possible, x: Connection not possible

Camera Cable (High-speed Cameras XG-H****)

▶ Note

Only use these cables with high-speed cameras (XG-H****). Failure to do so may cause damage to the connector pins.

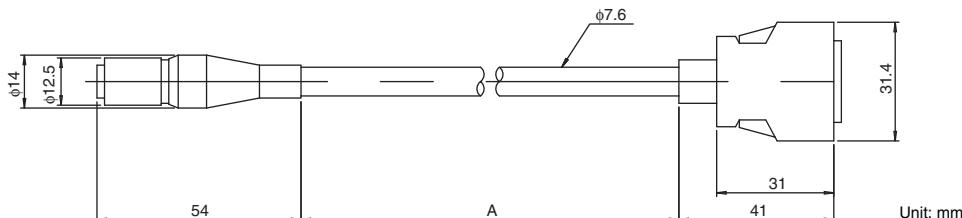
Standard cable



Model name	Cable length (A)	Weight	XG-H035C/H035M	XG-H100C/H100M
CA-CH3	3 m	290 g	○	○
CA-CH5	5 m	440 g	○	○
CA-CH10	10 m	880 g	○	○

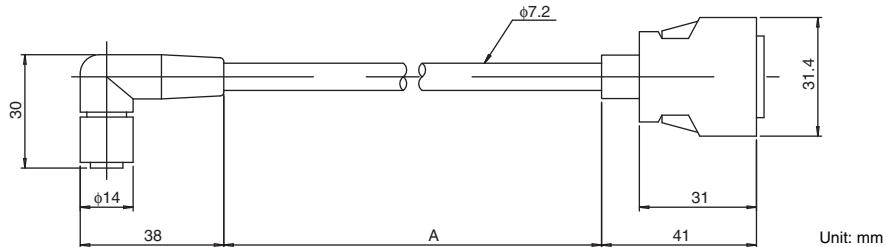
○: Connection possible, x: Connection not possible

Standard high flex robotic cable



Model name	Cable length (A)	Weight	XG-H035C/ H035M	XG-H100C/ H100M	XG-H200C/ H200M	XG-H500C/ H500M
CA-CH3R	3 m	250 g	○	○	○	○
CA-CH5R	5 m	410 g	○	○	○	○
CA-CH10R	10 m	740 g	○	○	○	○

○: Connection possible, x: Connection not possible

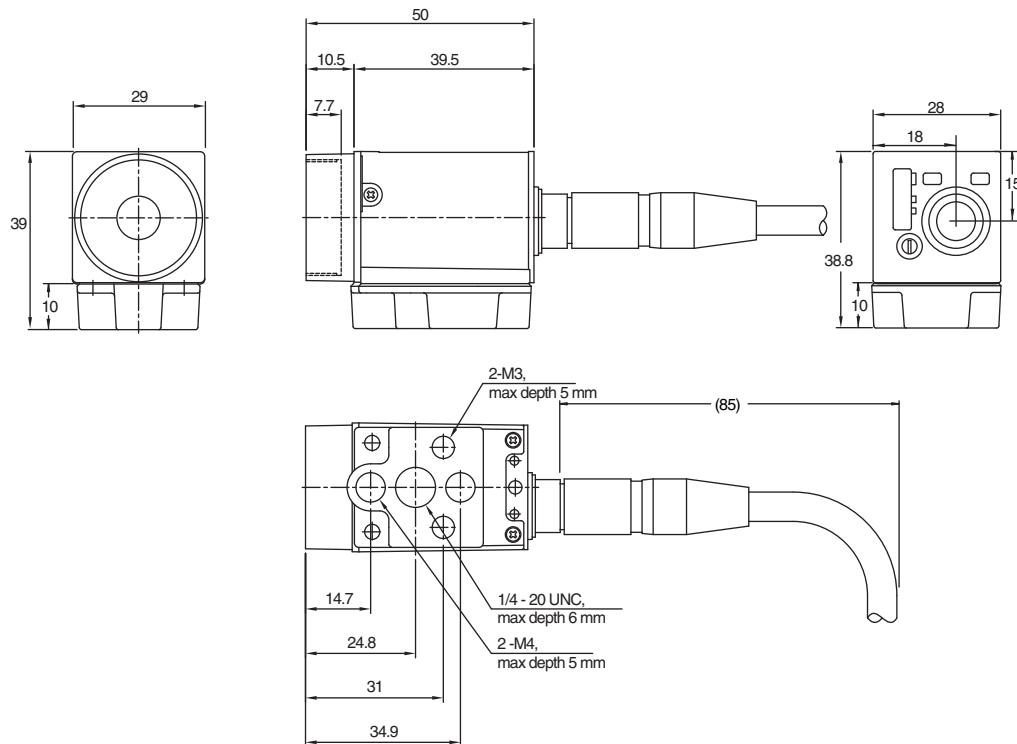
L-shape cable

Model name	Cable length (A)	Weight	XG-H035C/ H035M	XG-H100C/ H100M	XG-H200C/ H200M	XG-H500C/ H500M
CA-CH3L	3 m	270 g	○	○	○	○
CA-CH5L	5 m	450 g	○	○	○	○
CA-CH10L	10 m	810 g	○	○	○	○

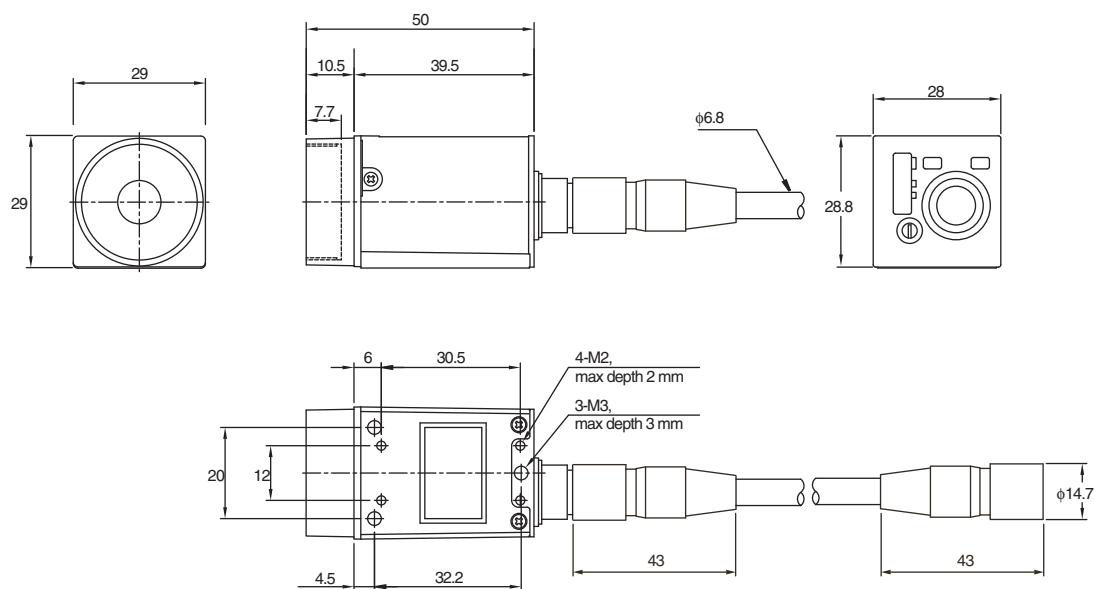
○: Connection possible, x: Connection not possible

Analog Cameras (CA-CM20: XG-7001A)

With plastic mount attached (factory shipped condition)

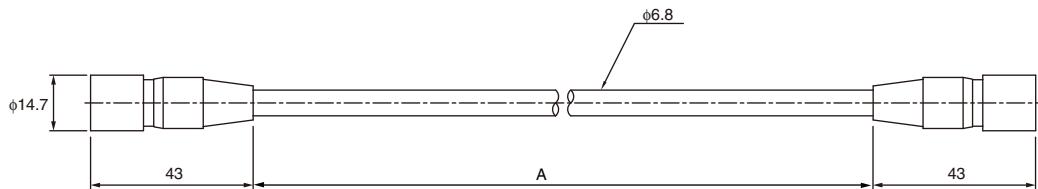


Without plastic mount



Unit : mm

Camera Cable (Analog Cameras)

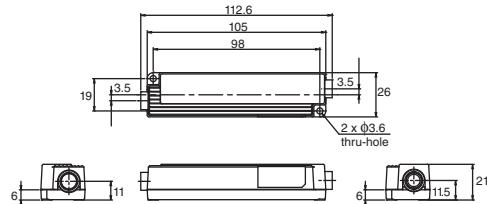


Model name	Cable length (A)	Weight	Remarks
CA-C3	3 m	260 g	
CA-C10	10 m	760 g	
OP-84389	25 m	1,530 g	Supports Keyence CA-CM20, and other specified compatible analog cameras.

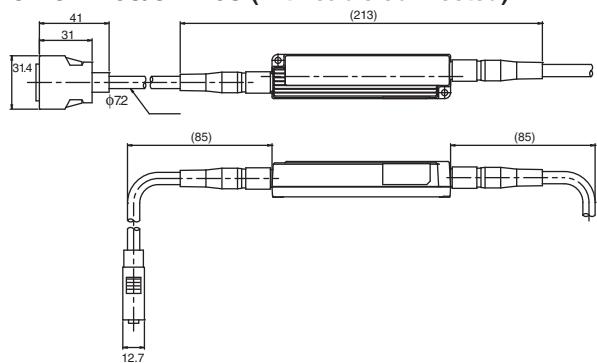
Using the Camera Cable Extension Amplifier (CA-CNX10U/CHX10U)

Outside dimensions

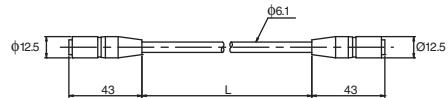
CA-CNX10U/CHX10U



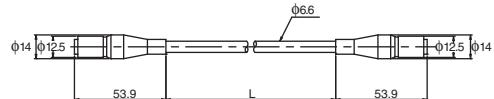
CA-CNX10U/CHX10U (with cable connected)



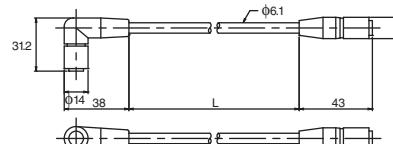
CA-CN3X/CN10X/CN17X/CH3X/CH10X



CA-CN3RX/CN10RX/CN17RX/CH10RX



CA-CN3LX/CN10LX/CN17LX



Unit: mm

Model name	Cable length (L)	Weight
CA-CN3X	3 m	200 g
CA-CN10X	10 m	600 g
CA-CN17X	17 m	990 g
CA-CH3X	3 m	270 g
CA-CH10X	10 m	820 g

Model name	Cable length (L)	Weight
CA-CN3RX	3 m	190 g
CA-CN10RX	10 m	540 g
CA-CN17RX	17 m	900 g
CA-CH10RX	10 m	740 g
CA-CN3LX	3 m	210 g
CA-CN10LX	10 m	610 g
CA-CN17LX	17 m	1,000 g

List of supported controllers and maximum cable lengths by camera

Up to 2 amplifiers can be connected in series.

- The following table shows the maximum levels of extension and maximum cable length for each camera.
- Don't exceed the maximum camera cable length and maximum number of extensions allowed.

Controller ^{*1}	Camera	Applicable amplifier	Cable length specifications	
			Maximum number of extensions	Maximum cable length
XG-7701(P)/ 7501(P)/ 7001(P)	XG-035C/035M	CA-CNX10U	2/1 ^{*2}	51 m/34 m ^{*2}
	XG-S035C/S035M		1	20 m
	XG-200C/200M		2	30 m
	XG-S200C/S200M		2/1 ^{*3}	30 m/20 m ^{*3}
	XG-H035C/H035M	CA-CHX10U	2	30 m
	XG-H100C/H100M		2	30 m
	XG-H200C/H200M		1	20 m
	XG-H500C/H500M		1	20 m

^{*1} Amplifiers can be used with controllers and camera expansion units manufactured after September, 2009.

^{*2} If the camera is used for partial capturing of less than 350 lines, the maximum number of extensions is 1, and the maximum cable length is 34 m.

^{*3} If the camera is used for partial capturing of less than 1000 lines, the maximum number of extensions is 1, and the maximum cable length is 20 m.

▶ Note

Amplifiers can only be used with KEYENCE digital cameras.

Options

List of Options

Standard camera options

Part number	Item	Reference page
CV-L3	Standard lens (focal distance 3 mm)	Page 2-19, 7-40
CV-L6	Standard lens (focal distance 6 mm)	Page 2-19, 7-40
CV-L16	Standard lens (focal distance 16 mm)	Page 2-19, 7-40
CA-LC16	Standard lens (focal distance 16 mm)	Page 2-19, 7-41
CV-L25	Standard lens (focal distance 25 mm)	Page 2-19, 7-41
CV-L35	Standard lens (focal distance 35 mm)	Page 2-19, 7-41
CV-L50	Standard lens (focal distance 50 mm)	Page 2-19, 7-42
CA-LH4	Low distortion lens (focal distance 4 mm)	Page 2-19, 7-43
CA-LH8	Low distortion lens (focal distance 8 mm)	Page 2-19, 7-43
CA-LH12	Low distortion lens (focal distance 12 mm)	Page 2-19, 7-43
CA-LH16	Low distortion lens (focal distance 16 mm)	Page 2-19, 7-43
CA-LH25	Low distortion lens (focal distance 25 mm)	Page 2-19, 7-44
CA-LH35	Low distortion lens (focal distance 35 mm)	Page 2-19, 7-44
CA-LH50	Low distortion lens (focal distance 50 mm)	Page 2-19, 7-44
CA-LH75	Low distortion lens (focal distance 75 mm)	Page 2-19, 7-44
CA-LHR5	High-resolution, low distortion lens (focal distance 5 mm)	Page 2-19, 7-46
CA-LHR8	High-resolution, low distortion lens (focal distance 8 mm)	Page 2-19, 7-46
CA-LHR12	High-resolution, low distortion lens (focal distance 12 mm)	Page 2-19, 7-46
CA-LHR16	High-resolution, low distortion lens (focal distance 16 mm)	Page 2-19, 7-47
CA-LHR25	High-resolution, low distortion lens (focal distance 25 mm)	Page 2-19, 7-47
CA-LHR35	High-resolution, low distortion lens (focal distance 35 mm)	Page 2-19, 7-47
CA-LHR50	High-resolution, low distortion lens (focal distance 50 mm)	Page 2-19, 7-48
OP-51612	Close-up spacer	Page 2-21, 7-48
CA-LM1	Macro lens with 1x optical magnification	Page 2-20, 7-49
CA-LM2	Macro lens with 2x optical magnification	
CA-LM4	Macro lens with 4x optical magnification	
CA-LM6	Macro lens with 6x optical magnification	
CA-LM8	Macro lens with 8x optical magnification	
CA-LMA1	Coaxial macro with 1x optical magnification	
CA-LMA2	Coaxial macro with 2x optical magnification	
CA-LMA4	Coaxial macro with 4x optical magnification	
CA-LM0510	Telecentric macro zoom lens 0.5x to 1.0x optical magnification	Page 2-20, 7-49
OP-66852	Plastic camera mount	Page 7-23, 7-24

High resolution ultra small camera (XG-S200C/S200M) options

Part number	Item	Reference page
CA-LHS8	High-resolution lens (focal distance 8 mm)	Page 7-51
CA-LHS16	High-resolution lens (focal distance 16 mm)	
CA-LHS25	High-resolution lens (focal distance 25 mm)	
CA-LHS50	High-resolution lens (focal distance 50 mm)	
OP-66830	Close-up spacer (5 mm)	Page 7-51
OP-66831	Close-up spacer (10 mm)	
OP-66832	Polarizing filter	
OP-66833	Side view attachment	

Ultra small camera (XG-S035C/S035M) options

Part number	Item	Reference page
CA-LS4	Standard lens (focal distance 4 mm)	Page 2-20, 7-51
CA-LS6	Standard lens (focal distance 6 mm)	
CA-LS16	Standard lens (focal distance 16 mm)	
CA-LS30	Standard lens (focal distance 30 mm)	
OP-51500	Close-up spacer (5 mm)	Page 7-51
OP-51501	Close-up spacer (10 mm)	
OP-51502	Polarizing filter	
OP-51503	Side view attachment	

Lighting

Part number	Item	Reference page
CA-DRR3	LED light (direct ring light, red)	Page 2-25, 7-52
CA-DRW3	LED light (direct ring light, white)	
CA-DRB3	LED light (direct ring light, blue)	
CA-DRR5	LED light (direct ring light, red)	
CA-DRW5	LED light (direct ring light, white)	
CA-DRB5	LED light (direct ring light, blue)	
CA-DRR7	LED light (direct ring light, red)	
CA-DRW7	LED light (direct ring light, white)	
CA-DRB7	LED light (direct ring light, blue)	
CA-DRR9	LED light (direct ring light, red)	
CA-DRW9	LED light (direct ring light, white)	
CA-DRB9	LED light (direct ring light, blue)	
CA-DRR4F	LED light (direct ring light, red)	
CA-DRW4F	LED light (direct ring light, white)	
CA-DRB4F	LED light (direct ring light, blue)	
CA-DRR10F	LED light (direct ring light, red)	
CA-DRW10F	LED light (direct ring light, white)	
CA-DRB10F	LED light (direct ring light, blue)	
CA-DLR7	LED light (low angle light, red)	Page 2-25, 7-52
CA-DLR10	LED light (low angle light, red)	
CA-DLR12	LED light (low angle light, red)	

Part number	Item	Reference page
CA-DBR5	LED light (bar light, red)	Page 2-25, 7-52
CA-DBW5	LED light (bar light, white)	
CA-DBB5	LED light (bar light, blue)	
CA-DBR8	LED light (bar light, red)	
CA-DBW8	LED light (bar light, white)	
CA-DBB8	LED light (bar light, blue)	
CA-DBR13	LED light (bar light, red)	
CA-DBW13	LED light (bar light, white)	
CA-DBB13	LED light (bar light, blue)	
CA-DDR8	LED light (dome light, red)	Page 2-26, 7-53
CA-DDW8	LED light (dome light, white)	
CA-DDB8	LED light (dome light, blue)	
CA-DDR15	LED light (dome light, red)	
CA-DDW15	LED light (dome light, white)	
CA-DDB15	LED light (dome light, blue)	
CA-DSR2	LED light (back light, red)	Page 2-25, 7-53
CA-DSW2	LED light (back light, white)	
CA-DSB2	LED light (back light, blue)	
CA-DSR3	LED light (back light, red)	
CA-DSW3	LED light (back light, white)	
CA-DSB3	LED light (back light, blue)	
CA-DSR9	LED light (back light, red)	
CA-DSW7	LED light (back light, white)	
CA-DSB7	LED light (back light, blue)	
CA-DSR15	LED light (back light, red)	
CA-DSW15	LED light (back light, white)	
CA-DSB15	LED light (back light, blue)	
CA-DXR3	LED light (coaxial light, red)	Page 2-26, 7-53
CA-DXW3	LED light (coaxial light, white)	
CA-DXB3	LED light (coaxial light, blue)	
CA-DXR5	LED light (coaxial light, red)	
CA-DXW5	LED light (coaxial light, white)	
CA-DXB5	LED light (coaxial light, blue)	
CA-DXR7	LED light (coaxial light, red)	
CA-DXW7	LED light (coaxial light, white)	
CA-DXB7	LED light (coaxial light, blue)	
CA-DQR10	LED light (square bar light, red)	Page 2-26, 7-53
CA-DQW10	LED light (square bar light, white)	
CA-DQB10	LED light (square bar light, blue)	
CA-DQR15	LED light (square bar light, red)	
CA-DQW15	LED light (square bar light, white)	
CA-DQB15	LED light (square bar light, blue)	
CA-DRR8M	LED light (round multi-angle light, red)	Page 2-25, 2-26, 7-54
CA-DRW8M	LED light (round multi-angle light, white)	
CA-DRB8M	LED light (round multi-angle light, blue)	
CA-DRR13M	LED light (round multi-angle light, red)	
CA-DRW13M	LED light (round multi-angle light, white)	
CA-DRB13M	LED light (round multi-angle light, blue)	

Part number	Item	Reference page
CA-DQR7M	LED light (square multi-angle light, red)	Page 2-25, 2-26, 7-54
CA-DQW7M	LED light (square multi-angle light, white)	
CA-DQB7M	LED light (square multi-angle light, blue)	
CA-DQR10M	LED light (square multi-angle light, red)	
CA-DQW10M	LED light (square multi-angle light, white)	
CA-DQB10M	LED light (square multi-angle light, blue)	
CA-DQW12M	LED light (square multi-angle light, red)	
CA-DQB12M	LED light (square multi-angle light, white)	
CA-DQR12M	LED light (square multi-angle light, blue)	
CA-DPR2	LED light (spot, red)	Page 2-26, 7-54
CA-DPW2	LED light (spot, white)	
CA-DPB2	LED light (spot, blue)	
CA-DPU2	Special power adapter for spot lights	
CA-DP3R	Spot light cable (3 m)	
CA-DP5R	Spot light cable (5 m)	
CA-DC20E	Illumination expansion unit	Page 7-14
CA-DC100	LED light controller	Page 7-55
CV-R11	Fluorescent ring light	Page 7-57
CA-R20	Fluorescent large-diameter ring light	

Cables

Part number	Item	Reference page
CA-CN1	Camera cable (1 m)	Page 7-27
CA-CN3	Camera cable (3 m)	
CA-CN5	Camera cable (5 m)	
CA-CN10	Camera cable (10 m)	
CA-CN17	Camera cable (17 m)	
CA-CN3R	High Flex robotic camera cable (3 m)	
CA-CN5R	High Flex robotic camera cable (5 m)	
CA-CN10R	High Flex robotic camera cable (10 m)	
CA-CN17R	High Flex robotic camera cable (17 m)	
CA-CN7RE	High Flex robotic camera extension cable (7 m)	
CA-CN3L	L-shape connector camera cable (3 m)	Page 7-28
CA-CN5L	L-shape connector camera cable (5 m)	
CA-CN10L	L-shape connector camera cable (10 m)	
CA-CN17L	L-shape connector camera cable (17 m)	
CA-CH3	High-speed camera cable (3 m)	Page 7-29
CA-CH5	High-speed camera cable (5 m)	
CA-CH10	High-speed camera cable (10 m)	
CA-CH3R	High-speed camera high flex robotic cable (3 m)	Page 7-32
CA-CH5R	High-speed camera high flex robotic cable (5 m)	
CA-CH10R	High-speed camera high flex robotic cable (10 m)	
CA-CH3L	High-speed camera L-shape connector cable (3 m)	
CA-CH5L	High-speed camera L-shape connector cable (5 m)	
CA-CH10L	High-speed camera L-shape connector cable (10 m)	

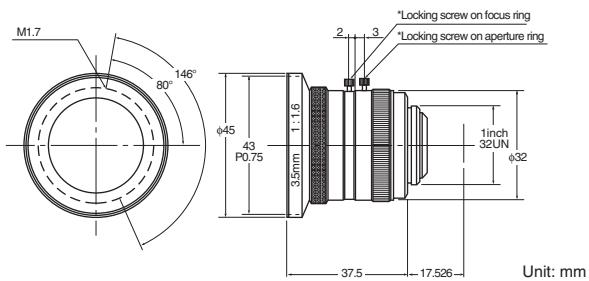
Part number	Item	Reference page
CA-C3	Analog camera cable (3 m)	Page 7-32
CA-C10	Analog camera cable (10 m)	
OP-84389	Analog camera cable (25 m)	
CA-CNX10U	Camera cable extension amplifier standard cameras	Page 2-22, 7-15, 7-32
CA-CHX10U	Camera cable extension amplifier high speed cameras	
CA-CN3X	Amplifier camera cable (3 m)	
CA-CN10X	Amplifier camera cable (10 m)	
CA-CN17X	Amplifier camera cable (17 m)	
CA-CH3X	Amplifier high speed camera cable (3 m)	
CA-CH10X	Amplifier high speed camera cable (10 m)	
CA-CN3RX	Amplifier high flex camera cable (3 m)	
CA-CN10RX	Amplifier high flex camera cable (10 m)	
CA-CN17RX	Amplifier high flex camera cable (17 m)	
CA-CH10RX	Amplifier high flex high speed camera cable (10 m)	
CA-CN3LX	Amplifier L-shape camera cable (3 m)	
CA-CN10LX	Amplifier L-shape camera cable (10 m)	
CA-CN17LX	Amplifier L-shape camera cable (17 m)	
CA-D2	LED light cable (2 m)	Page 7-56
CA-D5	LED light cable (5 m)	
CA-D3R	High flex robotic LED light cable (3 m)	
CA-D5R	High flex robotic LED light cable (5 m)	
CA-D10R	High flex robotic LED light cable (10 m)	
CA-D17R	High flex robotic LED light cable (17 m)	
CA-D1W	Y-split LED light cable (0.5 m)	
OP-84457	Bare wire LED light cable (1 m)	
OP-26487	Serial connection cable (2.5 m, straight)	Page 6-3, 6-10
OP-26486	D-sub 9-pin connector (female)	Page 6-3, 6-10
OP-26485	D-sub 25-pin connector (female)	Page 6-3
OP-84384	D-sub 9-pin connector (SYSMAC only, male)	Page 6-10
OP-86930	D-sub 9-pin connector (MELSEC only, male)	Page 6-11
OP-66843	Ethernet cable (3 m, cross cable)	Page 6-5
OP-51657	Parallel port ribbon cable (3 m)	Page 6-19
OP-66844	USB ver 2.0 cable (2 m)	Page 6-8
OP-66842	SVGA Monitor cable (3 m)	Page 2-23
OP-87055	SVGA Monitor cable (10 m)	
OP-79426	CC-Link Ver 1.10 cable (20 m)	Page 6-18
OP-79427	CC-Link Ver 1.10 cable (100 m)	Page 6-18

Other

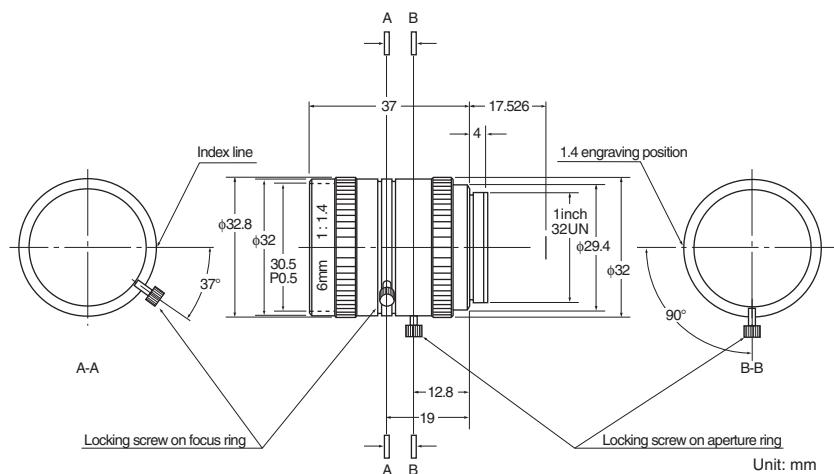
Part number	Item	Reference page
CA-U3	24 V DC power supply	Page 7-59
CA-MP81	SVGA LCD color monitor	Page 7-61
OP-87133	SD card (512 MB)	
CA-SD1G	SD card (1 GB)	Page 2-34
CA-SD4G	SD card (4 GB)	
OP-84231	Handheld controller (standard)	Page 1-8, 7-22
OP-84236	Handheld controller (blank)	Page 1-8, 7-22
OP-84364	Ferrite core for CA-NCL10E	Page 6

Standard Lenses

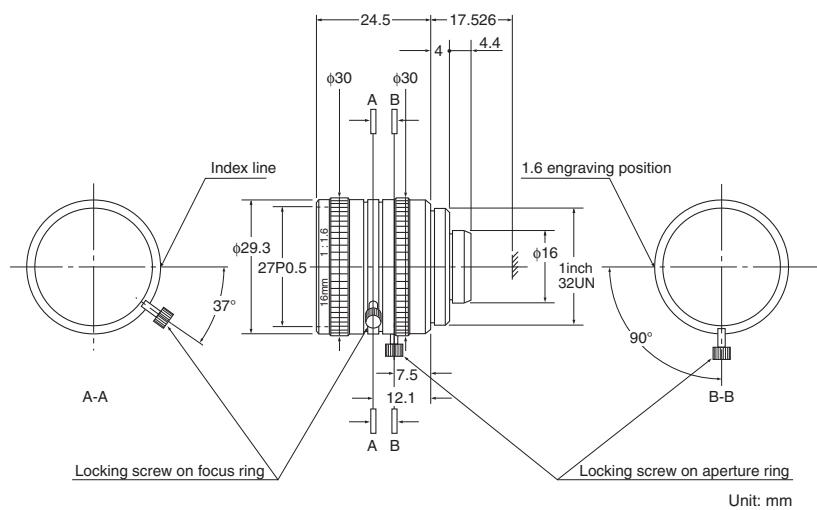
3.5-mm lens (CV-L3)

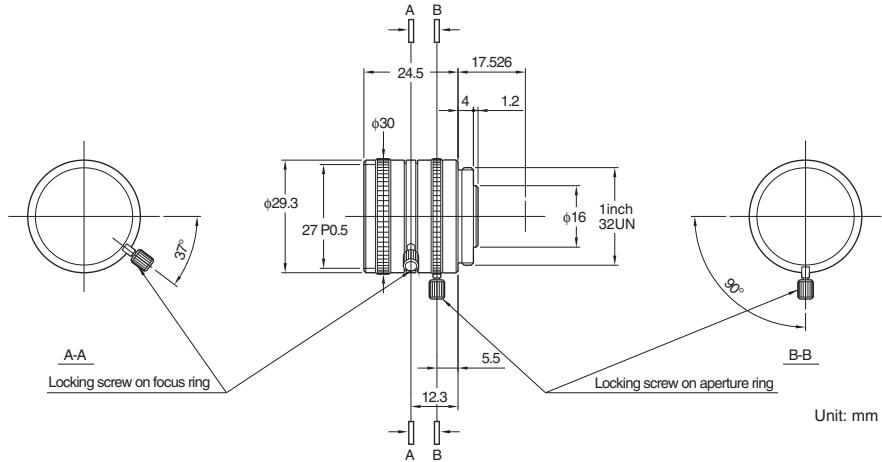
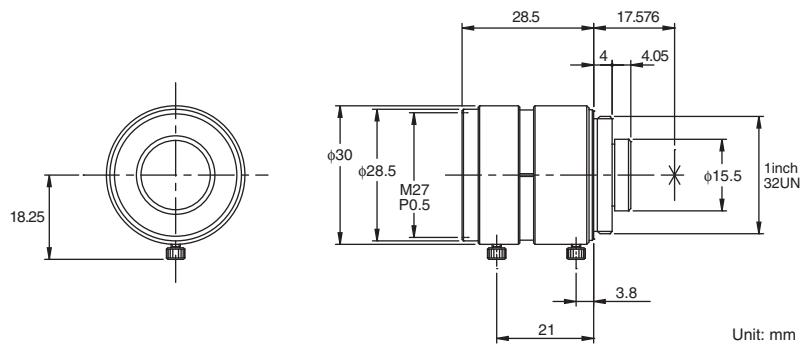
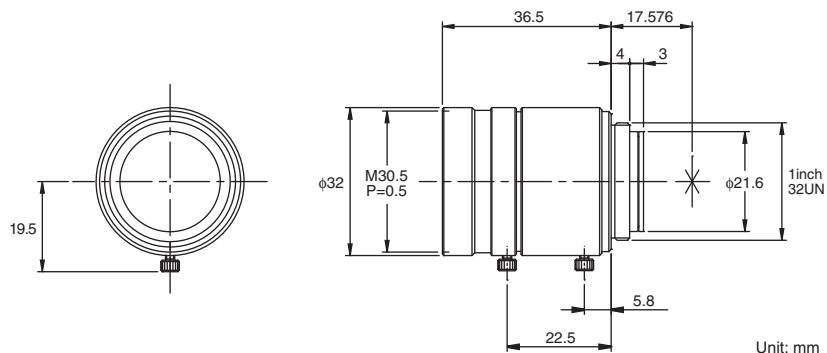


6-mm lens (CV-L6)

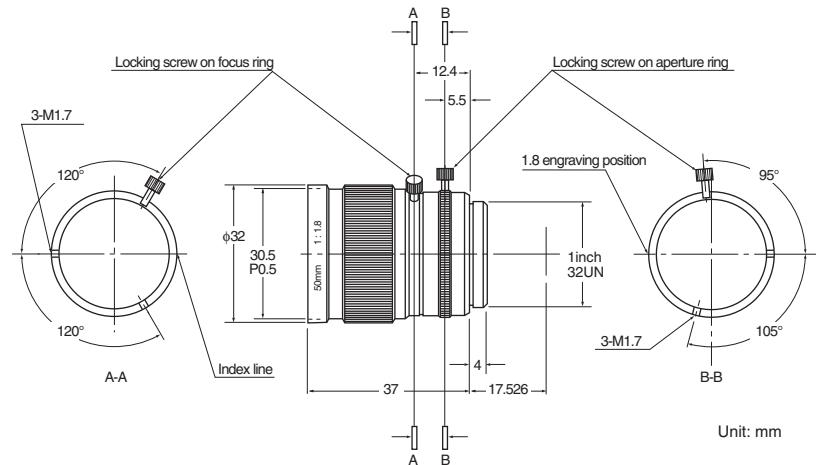


16-mm lens (CV-L16)



16-mm lens (CA-LC16)**25-mm lens (CV-L25)****35-mm lens (CV-L35)**

50-mm lens (CV-L50)



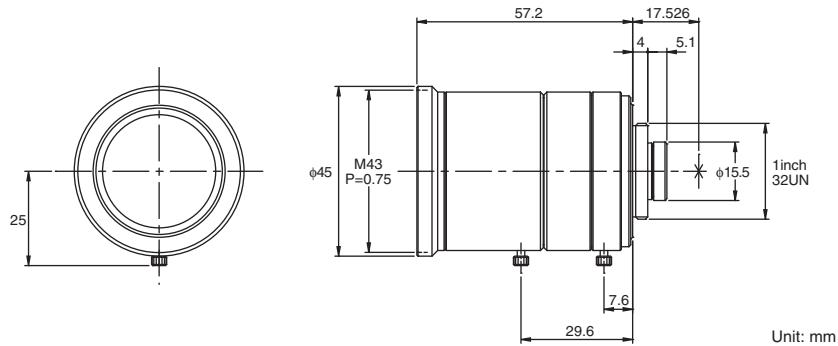
Specifications

Part number	CV-L3	CV-L6	CV-L16	CA-LC16	CV-L25	CV-L35	CV-L50
Focal Distance	3.5 mm	6 mm	16 mm	16 mm	25 mm	35 mm	50 mm
Aperture	F1.6 to CLOSE	F1.4 to CLOSE	F1.6 to CLOSE	F1.4 to CLOSE	F1.6 to F16	F1.6 to F16	F1.8 to CLOSE
Minimum working distance	0.1 m	0.2 m	0.4 m	0.4 m	0.2 m	0.3 m	1.0 m
Mount	C-mount						
Filter thread diameter	43.0 mm P0.75	300.5 mm P0.5	27.0 mm P0.5	27.0 mm P0.5	27.0 mm P0.5	30.5 mm P0.5	30.5 mm P0.5
Maximum CCD size	1/2 inch		2/3 inch				
TV distortion*	-10.0% (-5.0%)	-1.8% (-1.4%)	-0.8% (-0.2%)	-0.6% (-0.2%)	-0.6% (-0.1%)	-0.2% (-0.08%)	-0.2% (-0.1%)
Operating temperature/humidity range	0 to +50°C, 35 to 80% RH (no condensation)						
Weight	Approx. 90 g	Approx. 70 g	Approx. 44 g	Approx. 44 g	Approx. 58 g	Approx. 85 g	Approx. 50 g

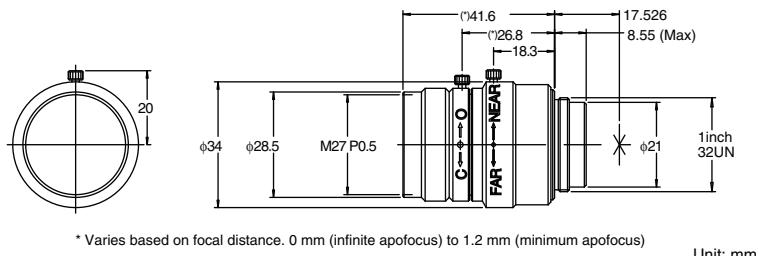
* The indicated values are for a 2/3-inch CCD. The values for 1/3 inch are indicated in parenthesis ().

Low Distortion Lenses

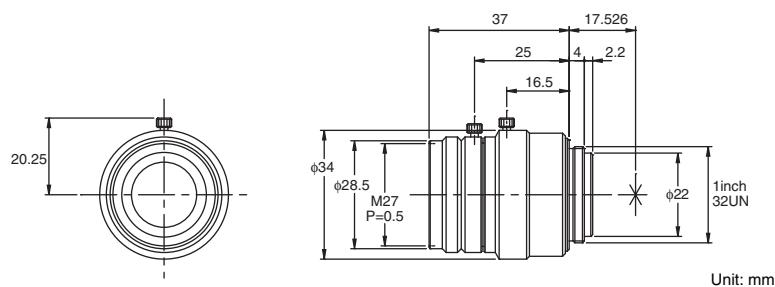
4-mm lens (CA-LH4)



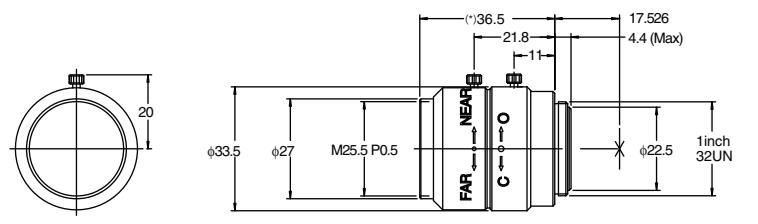
8-mm lens (CA-LH8)

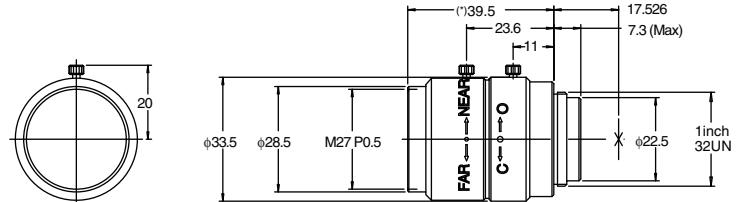


12-mm lens (CA-LH12)

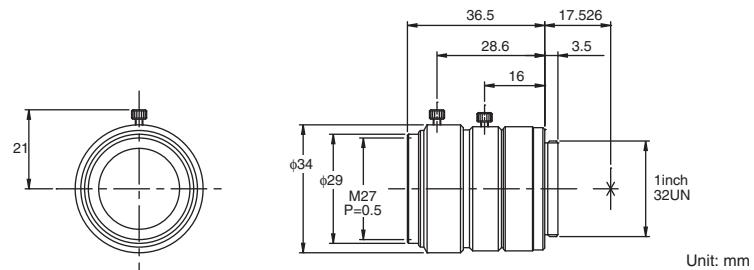


16-mm lens (CA-LH16)

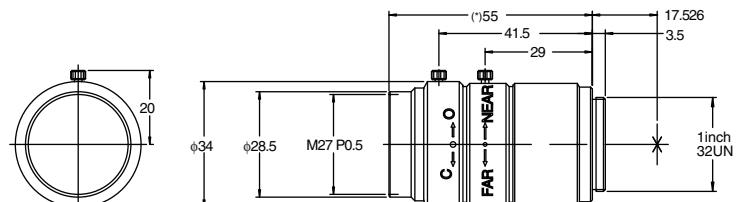


25-mm lens (CA-LH25)

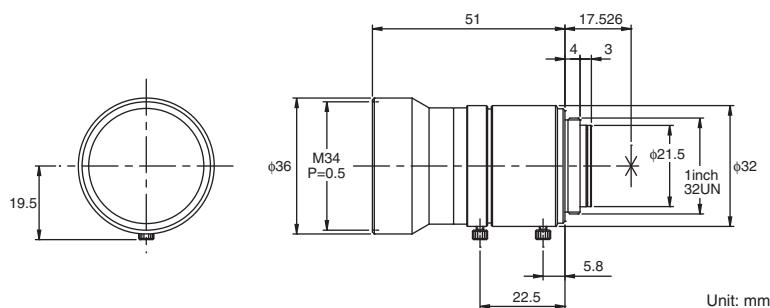
* Varies based on focal distance. 39.5 mm (infinite apofocus) to 44.0 mm (minimum apofocus) Unit: mm

35-mm lens (CA-LH35)

Unit: mm

50-mm lens (CA-LH50)

* Varies based on focal distance. 55.0 mm (infinite apofocus) to 73.5 mm (minimum apofocus) Unit: mm

75-mm lens (CA-LH75)

Unit: mm

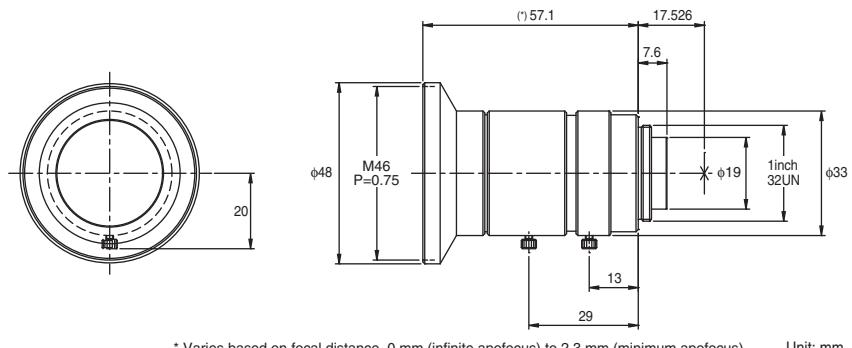
Specifications

Part number	CA-LH4	CA-LH8	CA-LH12	CA-LH16	CA-LH25	CA-LH35	CA-LH50	CA-LH75
Focal Distance	4 mm	8 mm	12 mm	16 mm	25 mm	35 mm	50 mm	75 mm
Aperture	F1.6 to F16	F1.4 to F16	F1.4 to F16	F1.4 to F16	F1.4 to F16	F2.0 to F16	F2.8 to F22	F2.5 to F22
Minimum working distance	0.1 m	0.1 m	0.15 m	0.2 m	0.2 m	0.2 m	0.2 m	1.2 m
Mount	C-mount							
Filter thread diameter	43.0 mm P0.75	27.0 mm P0.5	27.0 mm P0.5	25.5 mm P0.5	27.0 mm P0.5	27.0 mm P0.5	27.0 mm P0.5	34.0 mm P0.5
Maximum CCD size	1/1.8 inch	2/3 inch						
TV distortion*	-0.2% (-0.13%)	-0.6% (-0.28%)	-0.07% (-0.04%)	-0.05% (-0.1%)	-0.04% (-0.02%)	-0.2% (-0.05%)	-0.03% (-0.01%)	-0.1% (-0.05%)
Operating temperature/humidity range	0 to +50°C, 35 to 80% RH (no condensation)							
Weight	Approx. 150 g	Approx. 83 g	Approx. 75 g	Approx. 81g	Approx. 89g	Approx. 89 g	Approx. 92 g	Approx. 105 g

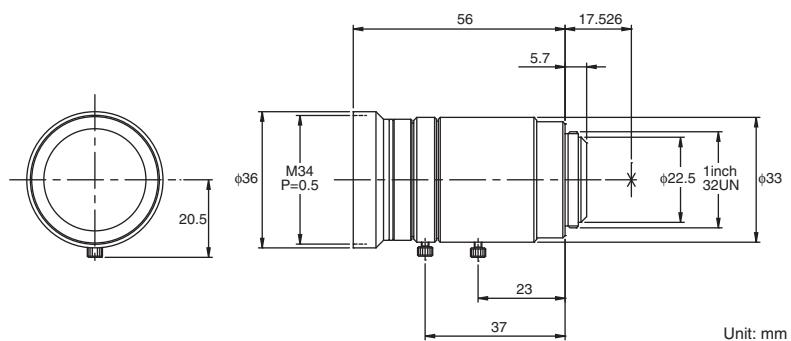
* The indicated values are for a 2/3-inch CCD. The values for 1/3 inch are indicated in parenthesis ().

High-resolution, Low Distortion Lenses

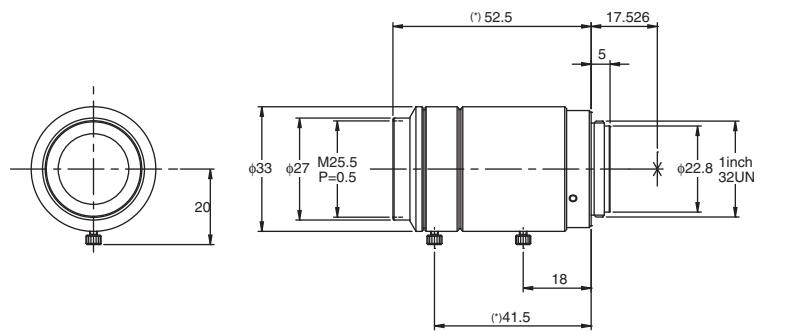
5-mm lens (CA-LHR5)

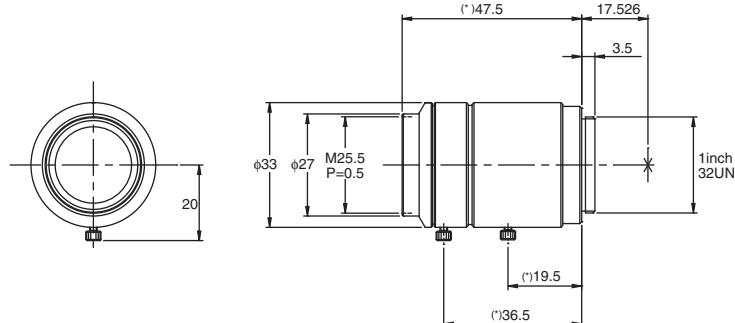


8-mm lens (CA-LHR8)



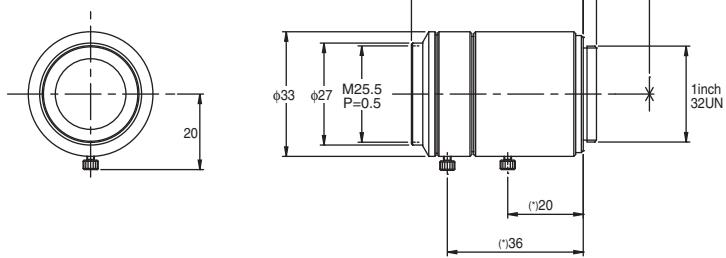
12-mm lens (CA-LHR12)



16-mm lens (CA-LHR16)

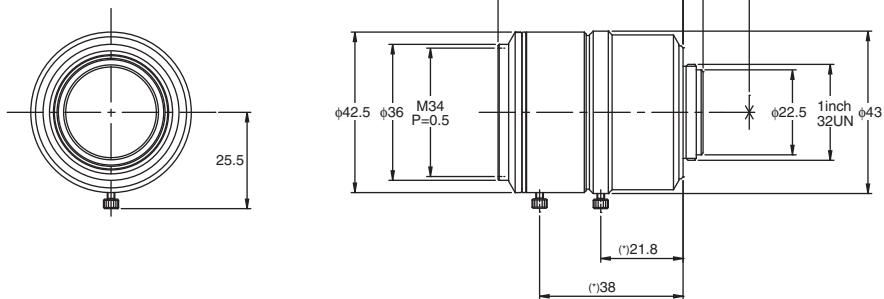
* Varies based on focal distance. 0 mm (infinite apofocus) to 2.5 mm (minimum apofocus)

Unit: mm

25-mm lens (CA-LHR25)

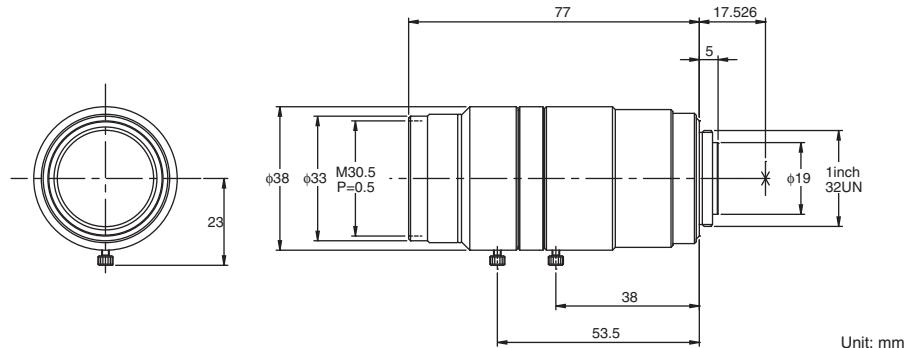
* Varies based on focal distance. 0 mm (infinite apofocus) to 5.7 mm (minimum apofocus)

Unit: mm

35-mm lens (CA-LHR35)

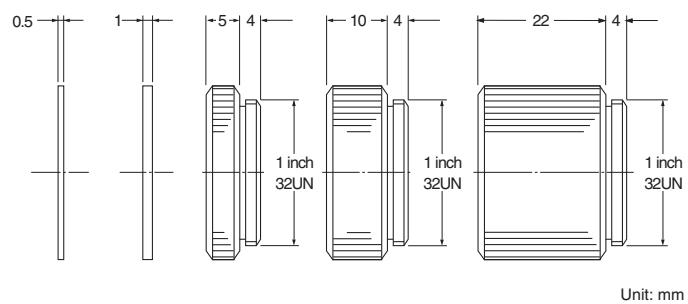
* Varies based on focal distance. 0 mm (infinite apofocus) to 19.2 mm (minimum apofocus)

Unit: mm

50-mm lens (CA-LHR50)**Specifications**

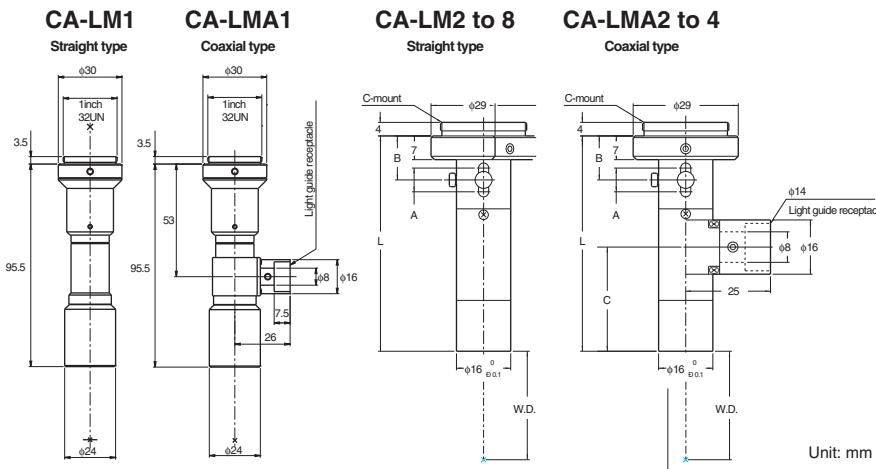
Part number	CA-LHR5	CA-LHR8	CA-LHR12	CA-LHR16	CA-LHR25	CA-LHR35	CA-LHR50
Focal Distance	5 mm	8.5 mm	12 mm	16 mm	25 mm	35 mm	50 mm
Aperture	F1.8 to CLOSE	F1.8 to F16	F1.8 to F11	F1.8 to F16	F1.8 to F16	F2.0 to F16	F2.8 to F16
Minimum working distance	0.1 m						
Mount	C-mount						
Filter thread diameter	46.0 mm P0.75	34.0 mm P0.5	25.5 mm P0.5	25.5 mm P0.5	25.5 mm P0.5	34.0 mm P0.5	30.5 mm P0.5
Maximum CCD size	2/3 inch						
TV distortion*	-0.33% (-0.11%)	-0.31% (-0.02%)	-0.12% (0.01%)	-0.20% (-0.11%)	-0.09% (-0.04%)	-0.05% (-0.01%)	-0.02% (0.02%)
Resolution	Center 200 lines/mm, periphery 140 lines/mm						
Lens coating	WIDE BAND MULTI COATING						
Operating temperature/humidity range	0 to +50°C, 35 to 80% RH (no condensation)						
Weight	Approx.120 g	Approx.115 g	Approx.105 g	Approx.90 g	Approx.95 g	Approx.160 g	Approx.170 g

* The indicated values are for the applicable size CCD. The values for 1/3 inch are indicated in parenthesis ().

Close-up Spacer (OP-51612)

Macro Lenses

CA-LM1/LMA1/LM2/LMA2/LM4/LMA4/LM6/LM8



Unit: mm

Part number	CA-LM(A)2	CA-LM(A)4	CA-LM6	CA-LM8
L (length)	63.5 mm	69.3 mm	80.6 mm	95.0 mm
A (adjustment range)	7.0 mm	9.3 mm	7.7 mm	7.6 mm
B (adjustment position)	13.0 mm	15.1 mm	20.5 mm	34.9 mm
C (coaxial position)	30.7 mm	31.8 mm	-	-

▶ Note

All the values in the specifications below are based on the optical design value. Individual differences can occur depending on the accuracy of the assembled lens.

Part number	CA-LM1	CA-LM2	CA-LM4	CA-LM6	CA-LM8	CA-LMA1	CA-LMA2	CA-LMA4
Type	Straight						Coaxial	
Optical magnification	x1	x2	x4	x6	x8	x1	x2	x4
Magnification range	-	Approx. ±5% relative to the reference magnification						-
Working distance ^{*1}	66.9	66.9	70.3	64.4	64.5	66.9	66.9	70.3
Compatible image / CCD size	2/3 inch	1/2 inch	1/2 inch	1/2 inch	1/2 inch	2/3 inch	1/2 inch	1/2 inch
Field of view ^{*2}	1/3 inch	3.6 x 4.8	1.8 x 2.4	0.9 x 1.2	0.6 x 0.8	0.45 x 0.6	3.6 x 4.8	1.8 x 2.4
	1/2 inch	4.8 x 6.4	2.4 x 3.2	1.2 x 1.6	0.8 x 1.07	0.6 x 0.8	4.8 x 6.4	2.4 x 3.2
Valid F value	11.5	15.4	26.5	39.3	52.4	11.5	15.4	26.5
Depth of field (μm) ^{*3, *4}	920	400	172	111	79	920	400	172
TV distortion (Max)	0.02%	-0.04 %	-0.22 %	-0.10 %	-0.04 %	0.02%	-0.04 %	-0.22 %
Resolution (μm) ^{*5}	7.7	5.1	4.5	4.4	4.4	7.7	5.1	4.5
Mount	C-mount							
Operating temperature and humidity	0 to +50°C, 80% RH (no condensation)							
Weight	Approx. 66 g	Approx. 57 g	Approx. 58 g	Approx. 64 g	Approx. 67 g	Approx. 75 g	Approx. 62 g	Approx. 66 g

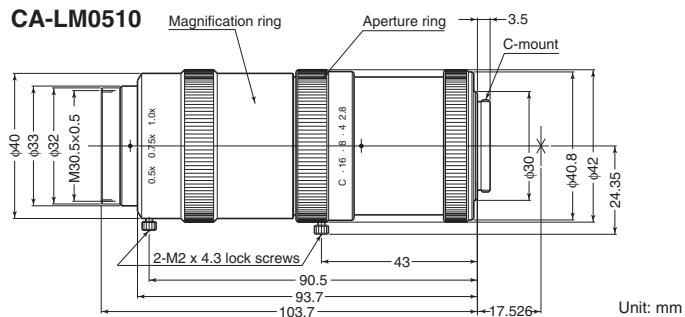
*1 WD indicates the working distance when each lens is used at reference magnification. Working distance will vary depending on the magnification adjustment.

*2 Field of view indicates the standard field of view for each CCD size. The field of view can be changed by approximately ±5% by adjusting the magnification.

*3 The indicated depth of field is a theoretical value that assumes 1/2" or 2/3" image / CCD size and a horizontal resolution of 320 TV lines. (Circle of least confusion is 40 μm in the image)

*4 Depth of field varies depending on the F value.

*5 The smallest resolvable feature able to be detected under 550 nm wavelength light.

CA-LM0510**► Note**

All the values in the specifications below are based on the optical design value. Individual differences can occur depending on the accuracy of the assembled lens.

Part number	CA-LM0510	
Type	Straight	
Optical magnification	x0.5 to x1	
Magnification range	-	
Working distance (at reference magnification) ^{*1}	111(x0.5), 78(x1.0)	
Maximum CCD size	2/3 inch	
Field of view (at reference magnification) ^{*2}	1/3 inch	3.6x4.8 to 7.2x9.6
	1/2 inch	4.8x6.4 to 9.6x12.8
Valid F value	2.8 to CLOSE	
Depth of field (μm) ^{*3, *4}	2560(x0.5), 1280(x1.0)	
TV distortion (Max)	-0.4%(x0.5), -0.1%(x1.0)	
Resolution (μm) ^{*5}	3.8(x0.5), 3.4(x1.0)	
Mount	C-mount	
Operating temperature and humidity	0 to +50°C, 80% RH (no condensation)	
Weight	Approx. 220 g	

^{*1} WD indicates the working distance when each lens is used at reference magnification. Working distance will vary depending on the magnification adjustment.

^{*2} Field of view indicates the standard field of view for each CCD size. The field of view can be changed by adjusting the magnification.

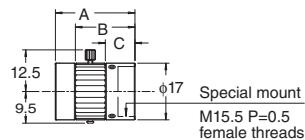
^{*3} The indicated depth of field is a theoretical value that assumes 1/2" or 2/3" image / CCD size and a horizontal resolution of 320 TV lines. (Circle of least confusion is 40 μm in the image)

^{*4} The depth of field for the CA-LM0510 is for a valid F value of 32. Depth of field varies depending on the F value.

^{*5} The smallest resolvable feature able to be detected under 550 nm wavelength light.

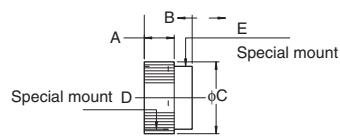
High Resolution Ultra Small Camera (XG-S200C/S200M) Options

Lens CA-LHS*



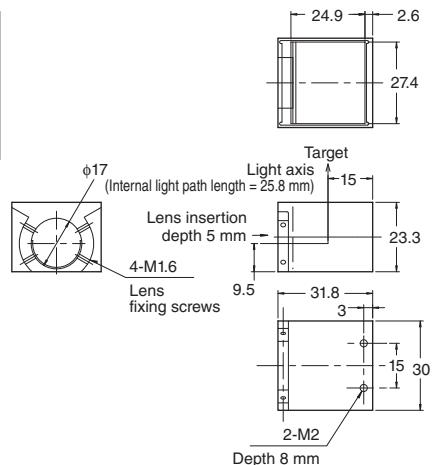
	CA-LHS8	CA-LHS16	CA-LHS25	CA-LHS50
A	40.4	23.9	24.9	40.4
B	28.6	17.9	18.6	27.1
C	19.6	8.9	9.6	18.1

Close-up spacer OP-66830 (5 mm)/OP-66831 (10 mm)



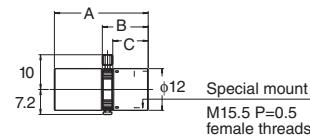
	OP-66830	OP-66831
A	5	10
B	8	13
C	17	17
D	M15.5 P=0.5 female threads	
E		M15.5 P=0.5 male threads

Side view attachment OP-66833



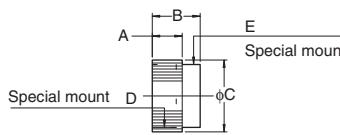
Ultra Small Camera (XG-S035C/S035M) options

Lens CA-LS*



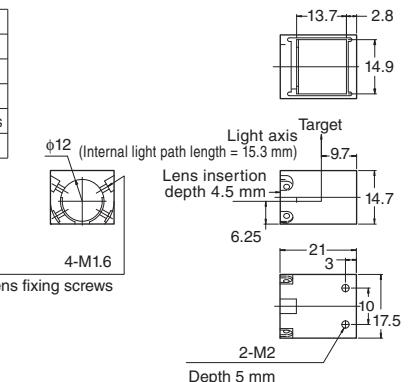
	CA-LS4	CA-LS6	CA-LS16	CA-LS30
A	16.7	21.3	20.4	27
B	11.5	15.9	10.2	13.2
C	8.5	12.9	7.2	10.2

Close-up spacer OP-51500 (5 mm)/OP-51501 (10 mm)

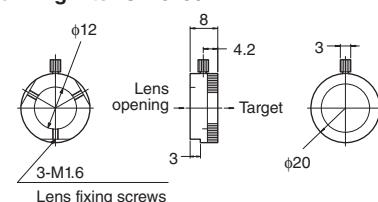


	OP-51500	OP-51501
A	5	10
B	8	13
C	12	12
D	M10.5 P=0.5 female threads	
E		M10.5 P=0.5 male threads

Side view attachment OP-51503



Polarizing filter OP-51502



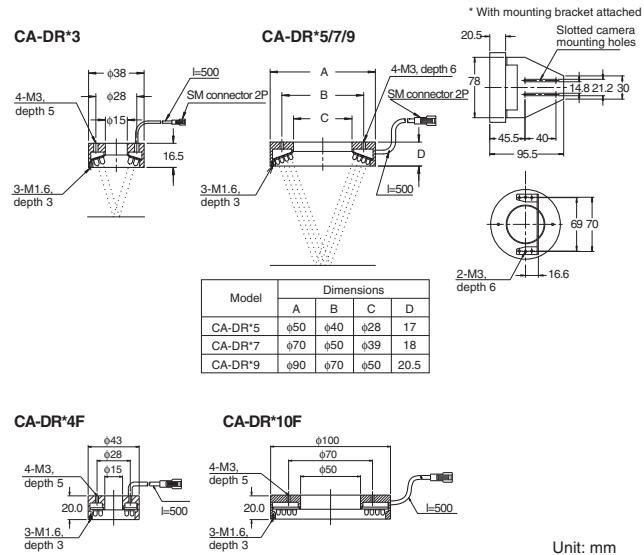
4-M1.6

2-M2

LED Lights

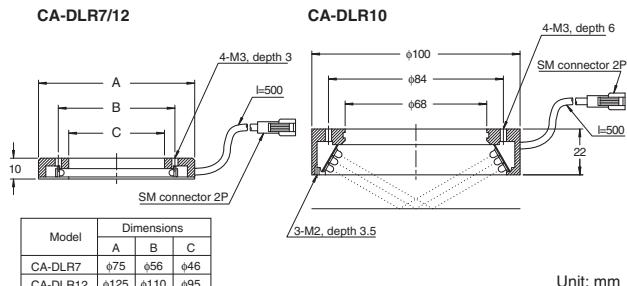
Direct-ring lights (CA-DR)

Part number	LED color	Weight	Current consumption
CA-DRR3	Red	Approx. 20 g	1.5 W
CA-DRW3	White	Approx. 20 g	2.9 W
CA-DRB3	Blue	Approx. 20 g	2.9 W
CA-DRR5	Red	Approx. 40 g	3.2 W
CA-DRW5	White	Approx. 40 g	3.6 W
CA-DRB5	Blue	Approx. 40 g	3.6 W
CA-DRR7	Red	Approx. 60 g	7.2 W
CA-DRW7	White	Approx. 60 g	7.7 W
CA-DRB7	Blue	Approx. 60 g	7.7 W
CA-DRR9	Red	Approx. 90 g	8.3 W
CA-DRW9	White	Approx. 80 g	7.9 W
CA-DRB9	Blue	Approx. 80 g	7.9 W
CA-DRR4F	Red	Approx. 20 g	1.5 W
CA-DRW4F	White	Approx. 20 g	2.9 W
CA-DRB4F	Blue	Approx. 20 g	2.9 W
CA-DRR10F	Red	Approx. 90 g	8.3 W
CA-DRW10F	White	Approx. 80 g	7.9 W
CA-DRB10F	Blue	Approx. 80 g	7.9 W



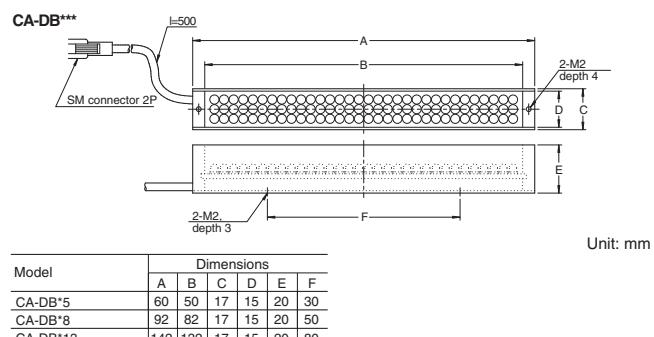
Low-angle lights (CA-DL)

Part number	LED color	Weight	Current consumption
CA-DLR7	Red	Approx. 40 g	2 W
CA-DLR10	Red	Approx. 80 g	7.7 W
CA-DLR12	Red	Approx. 85 g	3.3 W



Bar lights (CA-DB)

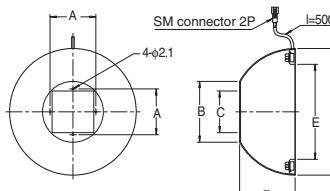
Part number	LED color	Weight	Current consumption
CA-DBR5	Red	Approx. 35 g	1.7 W
CA-DBW5	White	Approx. 40 g	2.9 W
CA-DBB5	Blue	Approx. 40 g	2.9 W
CA-DBR8	Red	Approx. 60 g	3.6 W
CA-DBW8	White	Approx. 60 g	4.8 W
CA-DBB8	Blue	Approx. 60 g	4.8 W
CA-DBR13	Red	Approx. 80 g	4.2 W
CA-DBW13	White	Approx. 90 g	7.3 W
CA-DBB13	Blue	Approx. 90 g	7.3 W



Dome lights (CA-DD)

Part number	LED color	Weight	Current consumption
CA-DDR8	Red	Approx. 70 g	5.8 W
CA-DDW8	White	Approx. 70 g	5.8 W
CA-DDB8	Blue	Approx. 70 g	5.8 W
CA-DDR15	Red	Approx. 130 g	11 W
CA-DDW15	White	Approx. 170 g	18.8 W
CA-DDB15	Blue	Approx. 170 g	18.8 W

CA-DD*8/15



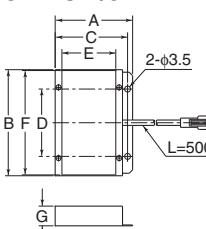
Model	Dimensions					
	A	B	C	D	E	F
CA-DD*8	26	ø30	20	ø87	ø54	40
CA-DD*15	55	ø73	50	ø154.5	ø114	66

Unit: mm

Back lights (CA-DS)

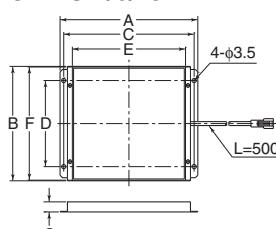
Part number	LED color	Weight	Current consumption
CA-DSR2	Red	Approx. 30 g	2.2 W
CA-DSW2	White	Approx. 30 g	2.9 W
CA-DSB2	Blue	Approx. 30 g	2.9 W
CA-DSR3	Red	Approx. 40 g	3.6 W
CA-DSW3	White	Approx. 40 g	5.8 W
CA-DSB3	Blue	Approx. 40 g	5.8 W
CA-DSR9	Red	Approx. 110 g	14 W
CA-DSW7	White	Approx. 90 g	18 W
CA-DSB7	Blue	Approx. 90 g	18 W
CA-DSR15	Red	Approx. 320 g	27.4 W
CA-DSW15	White	Approx. 320 g	27.4 W
CA-DSB15	Blue	Approx. 320 g	27.4 W

CA-DS*2/3



Model	Dimensions						
	A	B	C	D	E	F	G
CA-DSR2	46	33	43	15	32	32	8.2
CA-DSW2	46	33	43	40	32	62	11.7
CA-DSR3	46	63	43	40	32	62	8.2
CA-DSW3	46	63	43	40	32	62	11.7

CA-DS*7/9/15



Model	Dimensions						
	A	B	C	D	E	F	G
CA-DSR9	112	93	106	70	92	92	8.2
CA-DSW7	97	78	91	60	77	77	11.7
CA-DS*15	170	151	164	120	150	150	17.2

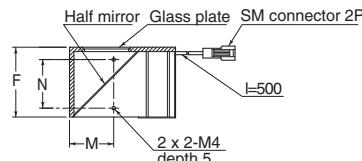
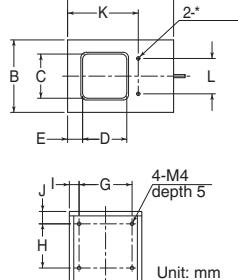
E and F are the dimensions of the light emitting surface.

Unit: mm

Coaxial lights (CA-DX)

Part number	LED color	Weight	Current consumption
CA-DXR3	Red	Approx. 60 g	1.8 W
CA-DXW3	White	Approx. 60 g	1.9 W
CA-DXB3	Blue	Approx. 60 g	1.9 W
CA-DXR5	Red	Approx. 230 g	5 W
CA-DXW5	White	Approx. 230 g	4.9 W
CA-DXB5	Blue	Approx. 230 g	4.9 W
CA-DXR7	Red	Approx. 380 g	6.7 W
CA-DXW7	White	Approx. 380 g	10.1 W
CA-DXB7	Blue	Approx. 380 g	10.1 W

CA-DX**



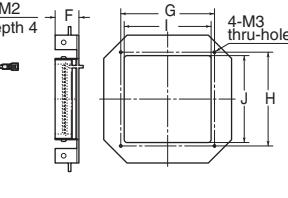
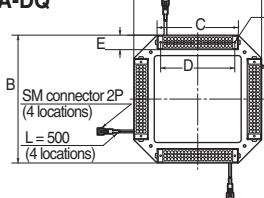
Model	Dimensions						
	A	B	C	D	E	F	G
CA-DX*3	58.5	30	20	18	6	27	12
CA-DX*7	97	60	36	32	16	59	40
CA-DX*7	120	82	50	50	17	79	60

Model	Dimensions						
	H	I	J	K	L	M	N
CA-DX*3	10	9	10	41	12	-	-
CA-DX*5	32	10	15	80	40	-	-
CA-DX*7	50	11	14	-	-	50	55

Square lights (CA-DQ)

Part number	LED color	Weight	Current consumption
CA-DQR10	Red	Approx. 370 g	8.6 W
CA-DQW10	White	Approx. 370 g	11.5 W
CA-DQB10	Blue	Approx. 370 g	11.5 W
CA-DQR15	Red	Approx. 520 g	14.4 W
CA-DQR15	White	Approx. 520 g	19.2 W
CA-DQB15	Blue	Approx. 520 g	19.2 W

CA-DQ**

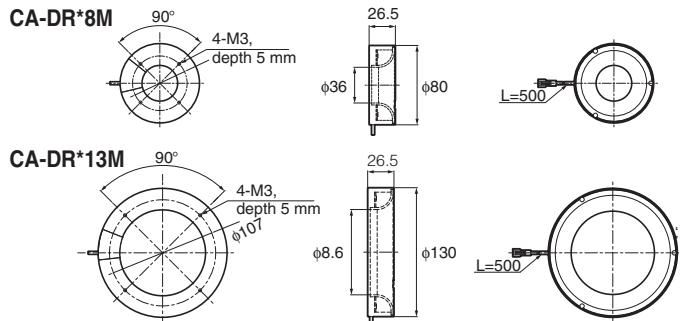


Model	Dimensions										
	A	B	C	D	E	F	G	H	I	J	
CA-DQ*10	109	109	63.4	55	17	27.9	70	70	60	60	
CA-DQ*15	150	150	95.4	87	17	27.9	110	110	102	102	

Unit: mm

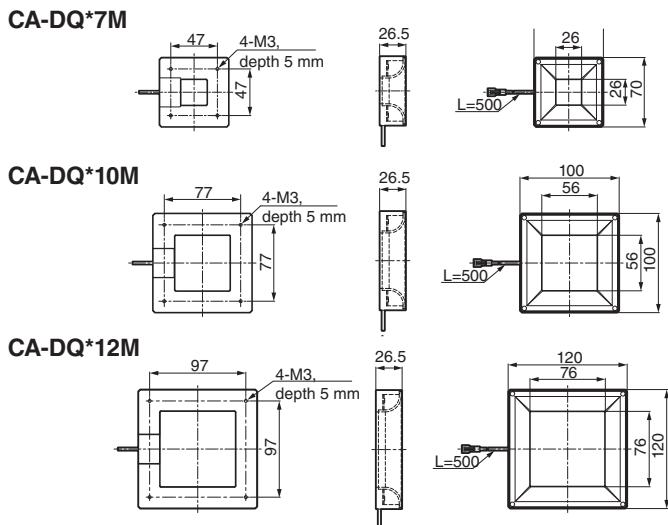
Multi-angle ring lights (CA-DR**M)

Part number	LED color	Weight	Current consumption
CA-DRR8M	Red	Approx. 150 g	6.6 W
CA-DRW8M	White	Approx. 150 g	10.6 W
CA-DRB8M	Blue	Approx. 150 g	10.6 W
CA-DRR13M	Red	Approx. 260 g	12.5 W
CA-DRW13M	White	Approx. 260 g	19.8 W
CA-DRB13M	Blue	Approx. 260 g	19.8 W



Multi-angle square lights (CA-DQ**M)

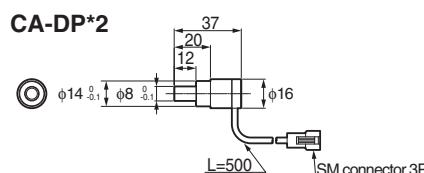
Part number	LED color	Weight	Current consumption
CA-DQR7M	Red	Approx. 160 g	5.9 W
CA-DQW7M	White	Approx. 160 g	11.3 W
CA-DQB7M	Blue	Approx. 160 g	11.3 W
CA-DQR10M	Red	Approx. 250 g	11.7 W
CA-DQW10M	White	Approx. 250 g	16.9 W
CA-DQB10M	Blue	Approx. 250 g	16.9 W
CA-DQR12M	Red	Approx. 310 g	14.7 W
CA-DQW12M	White	Approx. 310 g	19.9 W
CA-DQB12M	Blue	Approx. 310 g	19.9 W



Spot lights (CA-DP)

Part number	LED color	Weight	Current consumption*
CA-DPR2	Red	Approx. 20 g	8.4 W (2.0 W)
CA-DPW2	White	Approx. 20 g	8.4 W (2.0 W)
CA-DPB2	Blue	Approx. 20 g	8.4 W (2.0 W)

* Current consumption indicates the total power consumed by both the spot light and the power adapter. Figures in parenthesis () indicate the power consumption of the spot light.



CA-DPU2



Part number	Compatible lights	Weight
CA-DPU2	CA-DPR2 CA-DPW2 CA-DPB2	Approx. 120 g

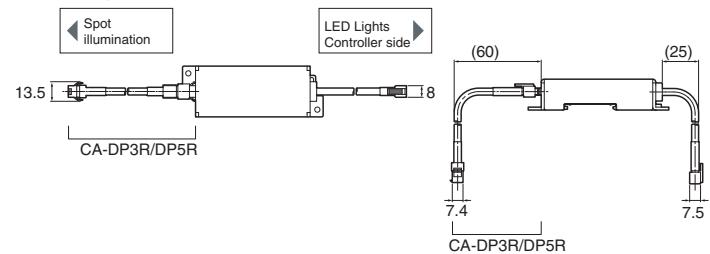
Compatible spot light cables

Extension cable (high flex robotic)

Cable length	Part number
3 m	CA-DP3R
5 m	CA-DP5R

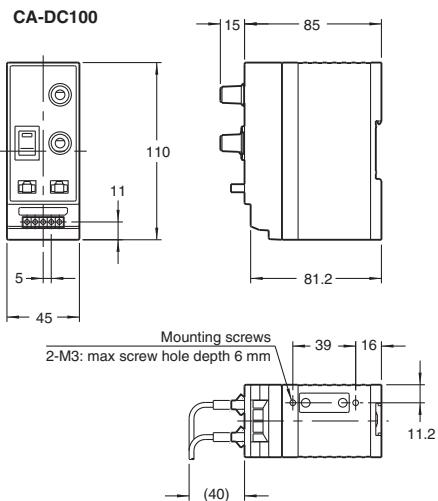
CA-DP3R/DP5R

(With spot light cable (3 m/5 m) connected)

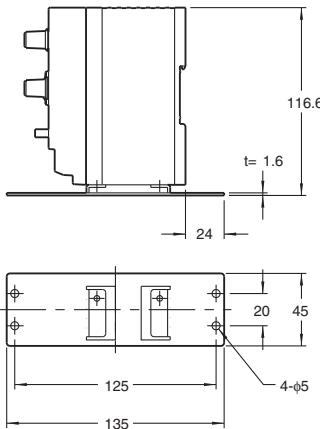


LED Light Controller (CA-DC100)

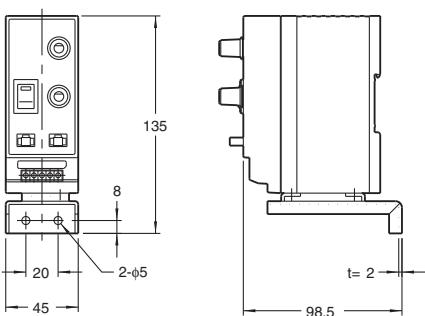
Outside dimensions



Bottom mount (OP-42169)



Front mount (OP-42168)

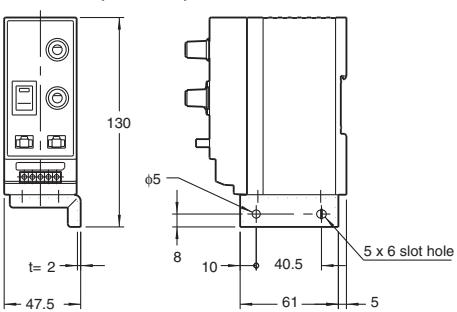


Specifications

Light control:	Light emission frequency 100 kHz, pulse width modulation method
Output	Lighting connections: 2 channels
Voltage:	12 V
Capacity:	Maximum 30 W (but 20 W/1 CH)
Inputs	2 external control non-voltage contact inputs (EXT).
Rating	Power supply voltage: 24 V DC x ±10% Power consumption: 1.8 A (at maximum load)
Environmental resistance ^{*1}	Operating ambient temperature: 0 to +45°C Operating ambient humidity: 35 to 85% RH (no condensation)
Weight	Approx. 220 g

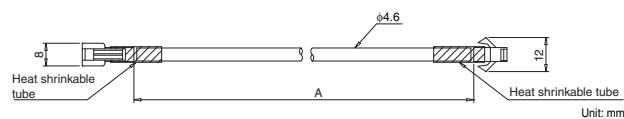
*1 The environmental resistance characteristics of the LED light section assume an ambient operating temperature of 0 to +40°C, and an ambient operating humidity of 35 to 65% RH (no condensation).

Side mount (OP-42170)



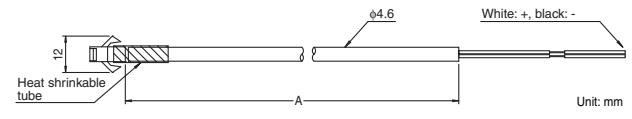
LED Light Cable

Standard cable



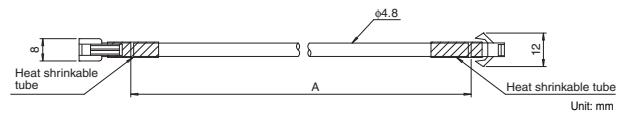
Part number	Cable length (A)	Weight
CA-D2	2 m	60 g
CA-D5	5 m	130 g

Bare wire to connector cable



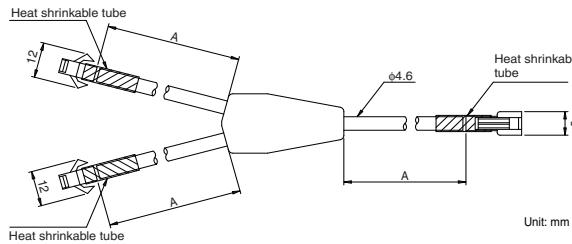
Part number	Cable length (A)	Weight
OP-84457	1 m	30 g

High flex robotic cable



Part number	Cable length (A)	Weight
CA-D3R	3 m	80 g
CA-D5R	5 m	140 g
CA-D10R	10 m	270 g
CA-D17R	17 m	450 g

Y-split cable

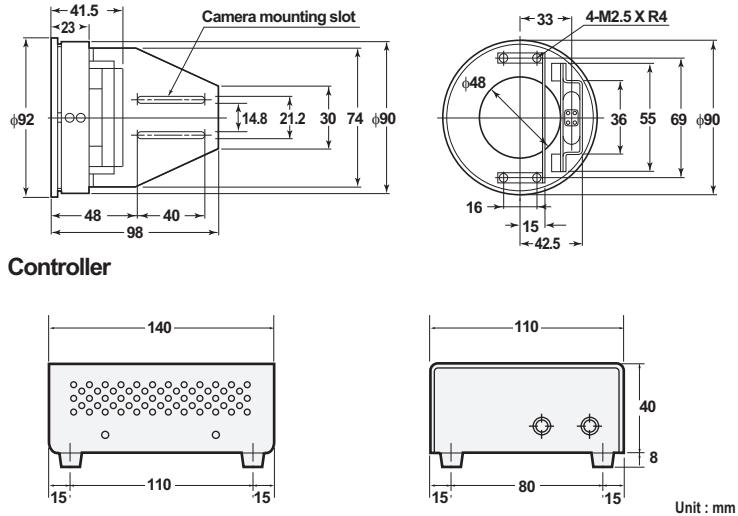


Part number	Cable length (A)	Weight
CA-D1W	0.5 m	50 g

Fluorescent Ring Light (CV-R11/CA-R20)

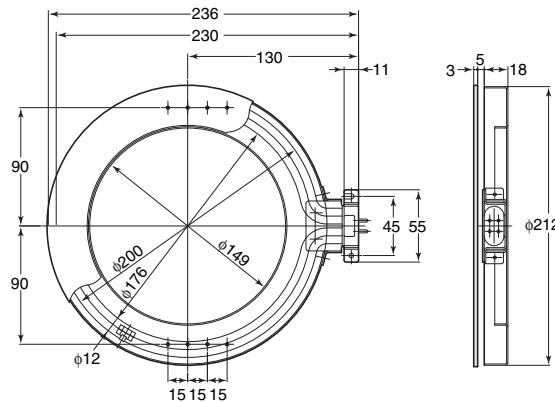
CV-R11

Light section (When mounting bracket (large) is attached)

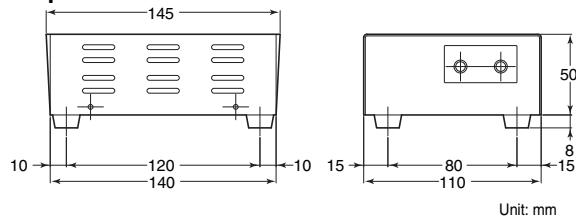


CA-R20

Lamp unit



Amplifier



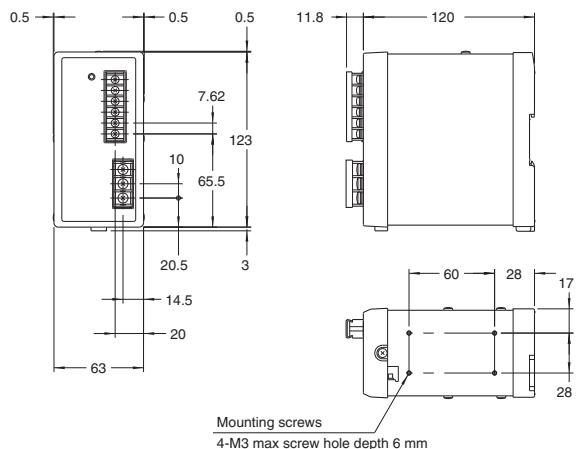
Specifications

Part number	CV-R11	CA-R20
Lighting method	High-frequency inverted power supply (25 to 35 kHz)	
Light color	N-EX (neutral white color)	
Lamp shape	Outer diameter: ϕ 80 mm, internal diameter: ϕ 56 mm	Outer diameter: ϕ 200 mm, internal diameter: ϕ 176 mm
Lamp life ^{*1}	Average approx. 2,000 hours	Approx. 1,500 hours
Rating	Power supply voltage	24 V DC \pm 10%
	Current consumption	0.7 A
Environmental resistance	Ambient temperature	+5 to +50°C
	Relative humidity	35 to 90% RH (no condensation)
Weight	Lamp unit	Approx. 150 g
	Amplifier	Approx. 650 g (including cable)
Replacement bulb	OP-25526	OP-51495

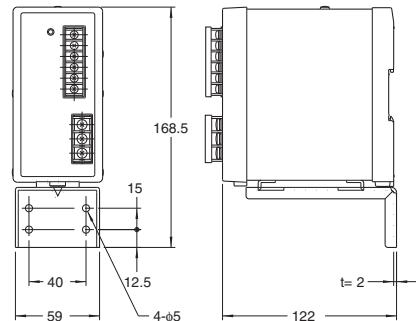
^{*1} Lamp life indicates the average time it takes for the initial luminance ^{*2} to drop to 70% when the lamp is lit continuously under a vibration-free environment at around 25°C of ambient temperature. The lamp life may be shorter depending on the operating condition.

^{*2} Initial luminance is the luminance when a new, unused lamp is lit for the first time.

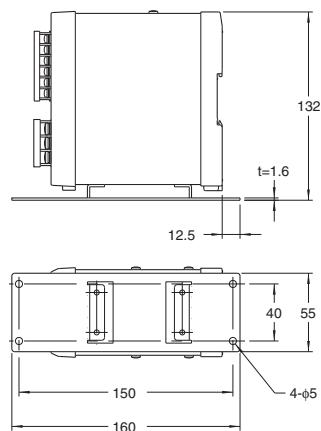
24-V DC Power Supply (CA-U3)



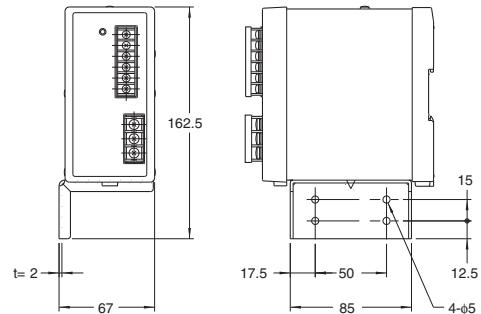
Mounted facing forward (using OP-42174)



Mounted on the bottom (using OP-42175)



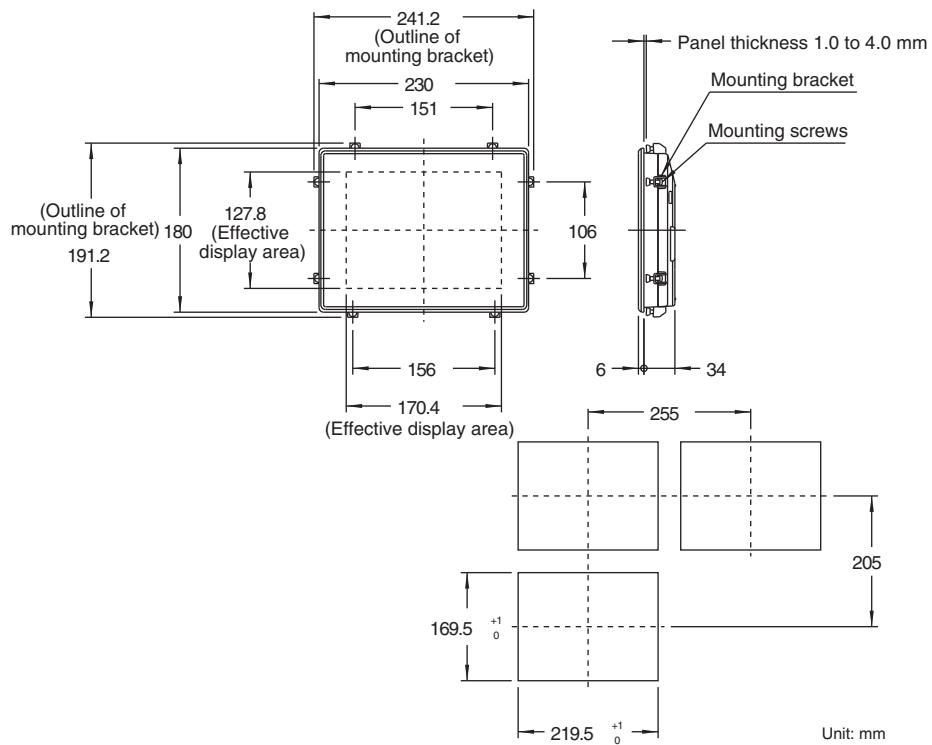
Mounted from the side (using OP-42176)



Specifications

Input condition	Rated input voltage	100 to 240 V AC ($\pm 10\%$), 50/60 Hz
	Duty	76 to 81%TYP
	Rated input current	2.1A or less at (100 V AC)
	Power factor (100/200 V AC)	0.99/0.95 typ. at max. load
	Leak current (100/200 V AC)	0.4/0.75 mA or less
	Rush current (100/200 V AC)	18/36 A or less (25°C cold start)
Output condition	Overvoltage category	II
	Rated output voltage	24V
	Rated output current	6.0 A (total of three output terminals)
	Ripple noise voltage	1% (P-P) or less
	Input fluctuation	0.4% or less
	Load fluctuation	0.7% or less
Protection	Startup time (100/200 V AC) ^{*1}	1300/700ms or less
	Output holding time	20 ms or more (100 to 240 V AC)
	Overcurrent protection ^{*2}	6.0 A or more, fixed current drop or output block
	Overvoltage protection ^{*3}	Available
	Ambient temperature	-10 to 55°C (No freezing)
	Relative humidity	25 to 85% RH (No condensation)
Environmental resistance	Ambient storage temperature	-20 to 70°C (No freezing)
	Pollution degree	2
	Withstanding voltage	3.0 KV AC 50/60 Hz, 1 min (between input and output) 2.0 KV AC 50/60 Hz, 1 min (between input and GND) 500 V DC, 1 min (between output and GND)
	Impact resistance	300 m/s ² , twice each in 3 axis directions
	Vibration resistance	10 to 55 Hz Double amplitude of 1.5 mm or less 2 hours in X, Y, and Z direction respectively (9.8 m/s ² or less in DIN rail installation)
	Insulating resistance	100 M Ω or more in 500 V DC (between input and output) (between input and GND) (between output and GND)
Safety standard	Noise terminal voltage	FCC part15B class A, EN55011 class A
	Radiated susceptible electrolytic strength	FCC part15B class A, EN55011 class A
	High-frequency current regulation	Complying with EN61000-3-2
	Weight	Approx. 700g
	*1 Under 100% load with specified voltage (100 to 200 VAC)	
	*2 An automatic reset is activated when overcurrent occurs. When overcurrent protection is activated, wait for 1 minute or longer after the input is turned off / disconnected and then turn on / reconnect the input to reset power.	
	*3 The output circuit is disconnected and reset when overvoltage occurs. When overvoltage protection is activated, wait for 1 minute or longer after the input is turned off / disconnected and then turn on / reconnect the input to reset power.	

Monitor (CA-MP81)



Specifications

	Display element	Low-temperature a-Si TFT Active Matrix
Liquid crystal panel	Effective display area	170.4 (W) x 127.8 (H) mm
	Number of display dots	800 (W) x 600 (H) dots
	Display color	262,144 colors
Backlight	Life	Average life: approx. 50,000 hours (25°C vertical installation)
	Input signal	VGA (0.7 Vp-p, 75Ω), horizontal, vertical period signal
Input/Output	Input signal mode	800 (W) x 600 (H) vertical frequency 60 Hz
	Connector	Mini D-sub 15-pin, female (3WAY, inch screw), input only
	Power supply voltage	24 V DC ±10%
Rating	Current consumption	1 A or less
	Ambient temperature	0 to +40°C
	Relative humidity	35 to 85% RH
Structure		Panel embedded type, dust-proof, drop-proof structure equivalent to IP65f at front only
Weight		Approx. 1,250 g

Chapter **8**

Appendix

Using Standard Built-In Menus

Some programs may have menu interfaces built into them for allowing configuration of the program. This appendix explains the operation of the following standard menu interfaces.

- Inspection Region menu (Page 8-2)
- Register Image menu (Page 8-11)
- Color menu (Page 8-13)
- Library menu (Page 8-20)
- Edit Unit Menu (Page 8-25)

► Note

- Changing the settings via the built in menus during inspection may impact the inspection results. It is recommended to stop the inspection before changing any settings via the menus.
- As the XG-7000 Series allows for the restriction of operations and functions available via the menus, some or all of the functions described here may not be available or their operation and behavior may differ from these descriptions.

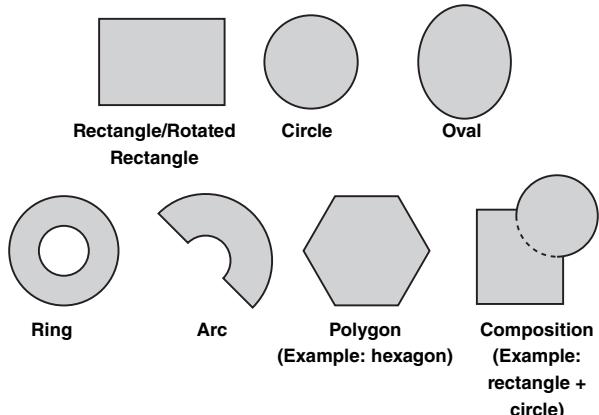
Reference

For more details on how to display and customize menu, refer to "Screen Editor" in the XG VisionEditor Reference Manual.

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.

Reference

In addition to the shapes listed above, this menu supports ShapeTrax2 multiple mask regions [Multiple Areas] (Page 8-9).

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 4-9) 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

- **Current Image:** Displays the latest captured image.
- **Regist. Image:** Displays the registered image.
- **Archived Img.:** Displays an image from the image archive (only displayed in the Inspection Region Menu). 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 selected units regions.
- **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 5-12), the part of the region outside the imaging region is always removed from the process area.

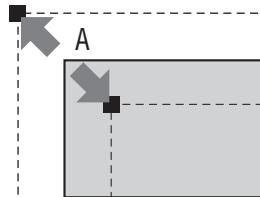
Drawing a Rectangle

1 Click [Edit] under [Inspection Region].

This allows the region to be drawn on the image.

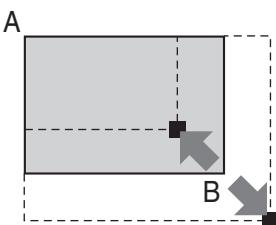
2 Set the upper left node of the rectangle.

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



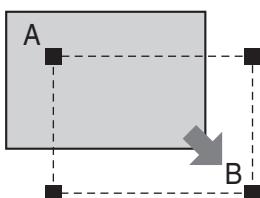
3 Set the lower right node of the rectangle.

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 2,3 and 4.



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

Reference

The positions of the nodes can also be input as values. Refer to "Drawing Regions by Using Values" (Page 8-8) for more details.

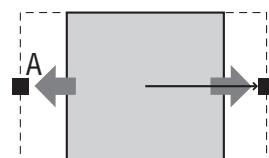
Drawing a Rotated Rectangle

1 Click [Edit] under [Inspection Region].

This allows the region to be drawn on the image.

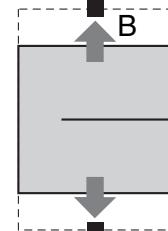
2 Set the width of the rotated rectangle.

Move the 8-way key up and down to adjust the width, then press the No. 0 (ENTER) button.



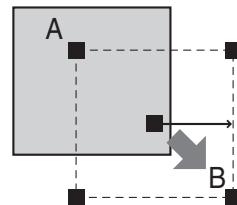
3 Set the height of the rotated rectangle.

Move the 8-way key up and down to adjust the height, then press the No. 0 (ENTER) button.



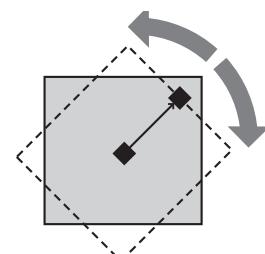
4 Position the rotated rectangle.

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 2,3,4 and 5



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

Reference

The height, width, and angle can also be input as values. Refer to "Drawing Regions by Using Values" (Page 8-8) for more details.

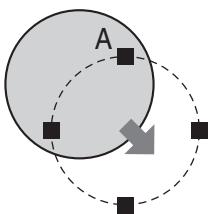
Drawing a Circle

1 Click [Edit] under [Inspection Region].

This allows the region to be drawn on the image.

2 Position the circle.

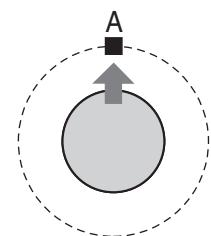
Use the 8-way key to move the entire circle, then press the No. 0 (ENTER) button.



3 Set the size of the circle.

Move the 8-way key up and down to set the size of the circle and 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. Refer to "Drawing Regions by Using Values" (Page 8-8) for more details.

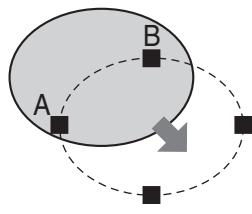
Drawing an Oval

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.



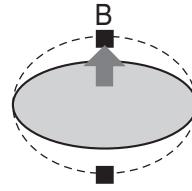
3 Set the horizontal size of the oval.

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



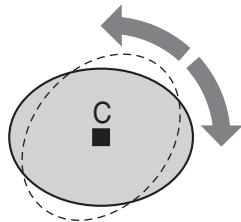
4 Set the vertical size of the oval.

Move the 8-way key up and down to set the horizontal size of the oval, then 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. Each press of the No. (ENTER) button will cycle through steps 2,3,4 and 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 values. Refer to "Drawing Regions by Using Values" (Page 8-8) for more details.

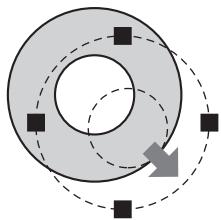
Drawing a Ring

1 Click [Edit] under [Inspection Region].

This allows the region to be drawn on the image.

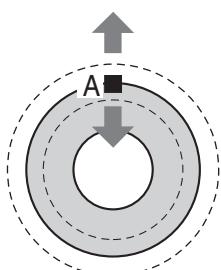
2 Position the ring.

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



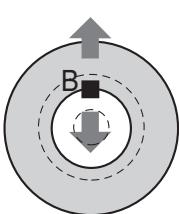
3 Set the size of the outer circle of the ring.

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. Refer to "Drawing Regions by Using Values" (Page 8-8) for more details.

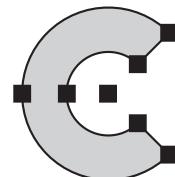
Drawing an Arc

1 Click [Edit] under [Inspection Region].

This allows the region to be drawn on the image.

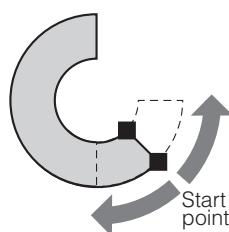
2 Position the arc.

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



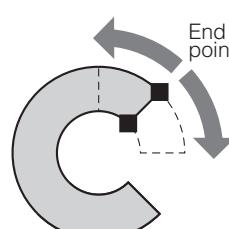
3 Set the starting point of the arc.

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.



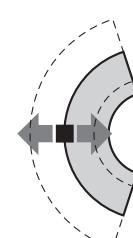
5 Set the curvature of the arc.

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



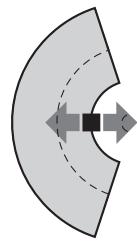
6 Set the size of the outer arc.

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

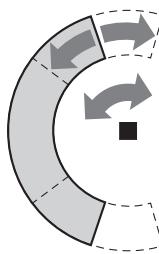


7 Set the size of the inner arc.

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, 3, 4, 5, 6, 7 and 8.

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

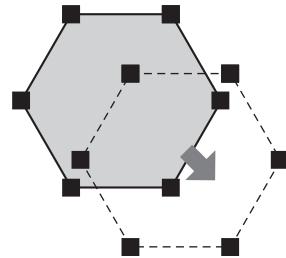
The position of the center, starting and ending angles, and the radius of the inner and outer arc can also be input as values. Refer to "Drawing Regions by Using Values" (Page 8-8) for more details.

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**

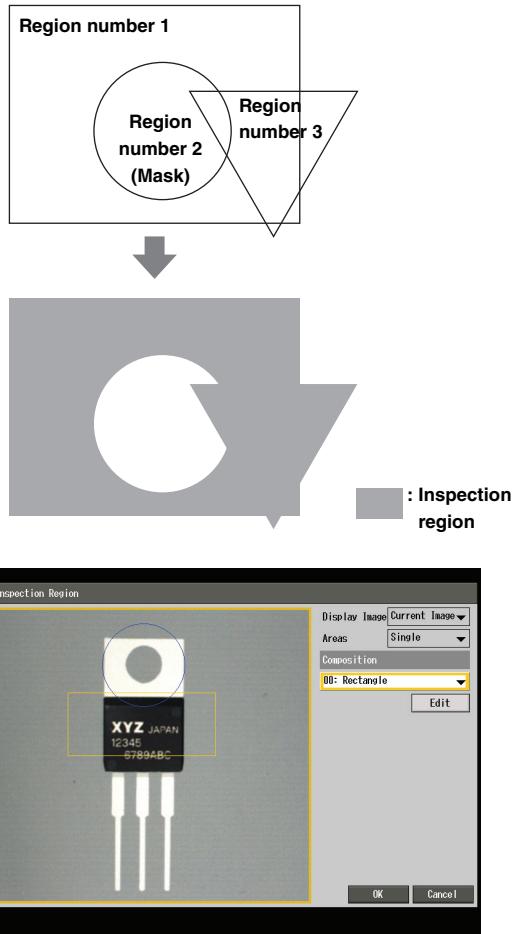
- The center of the polygon and the position of each node can also be input as values. Refer to "Drawing Regions by Using Values" (Page 8-8) for more details.
- Nodes can only be added or deleted via the Inspection Region sub menu when editing a unit.
- A four point polygon can be used for the regions in a calibration unit and [Trapezoid Correction] in Image Operations (Page 4-251).
- If using [Trapezoid Correction] (Page 4-251) 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.



- 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. Refer to "Drawing Regions by Using Values" (Page 8-8) for more details.

▶ Note

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

- 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.**

Drawing Regions by Using Values

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

► Note

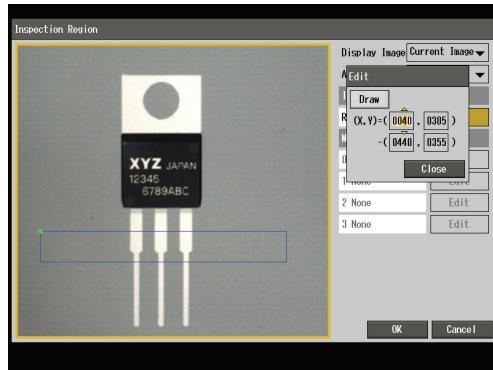
Values that can be entered differ depending on the region shape.

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.

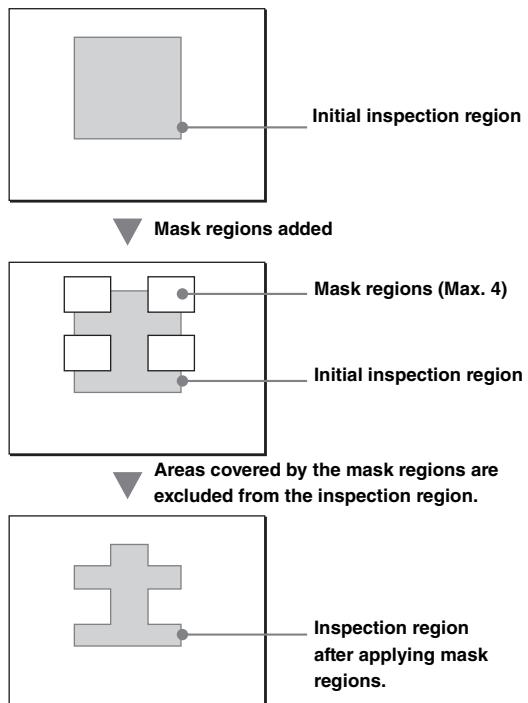
4 To finish editing, click [Close].

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 mask region cannot be adjusted via the Inspection Region Menu unless variables are assigned to the nodes of the mask region.

Reference

The position and size of each mask region can also be input as values. Refer to "Drawing Regions by Using Values" (Page 8-8) for more details.

Drawing Multiple Areas

Up to 15 circles or rectangles can be used as mask regions in the ShapeTrax2 pattern region.

▶ Note

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

Adding a Region

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

The [Edit] menu appears.

2 Click [Add] on the [Edit] menu.

A new region will be added based on the latest configured region.

3 Position the region.

Use the 8-way key to position the entire mask region, then Press the No. 0 (ENTER). Repeat steps 2 and 3 to set all the mask regions.

4 To finish editing, press the No. 2 (ESCAPE) button, and click [Close].

Editing the Position of a Region

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

The [Edit] menu appears.

2 Click [Edit] on the Edit menu.

Reference

The position of any of the regions can also be input as values by directly select the coordinate field.

3 Position the region.

Each press of the No. (ENTER) button will cycle through the selection of each region then all regions.

4 To finish editing, press the No. 2 (ESCAPE) button, and click [Close].

Deleting a Region

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

The [Edit] menu appears.

2 Click [Delete] on the [Edit] menu.

The [Delete] menu appears.

3 Choose the regions to delete.

4 To finish editing, click [Close].

Changing the shape or size of a Region

The size and shape apply to all regions. For a [Circle], the overall size is the diameter (in pixels) calculated by (value $\times 2 + 1$) and for a [Square] the width / height (in pixels) is calculated as (value $\times 2 + 1$).

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

The [Edit] menu appears.

2 Choose [Circle] or [Rectangle] from the [Shape] field to change the shape.

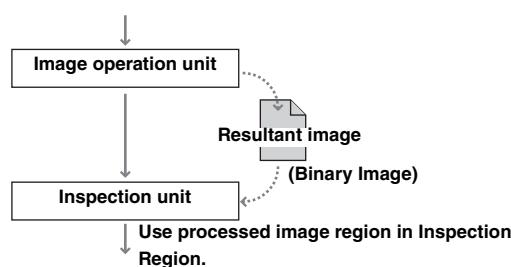
3 Specify a value between 3 and 100 in the size field.

4 To finish editing, click [Close].

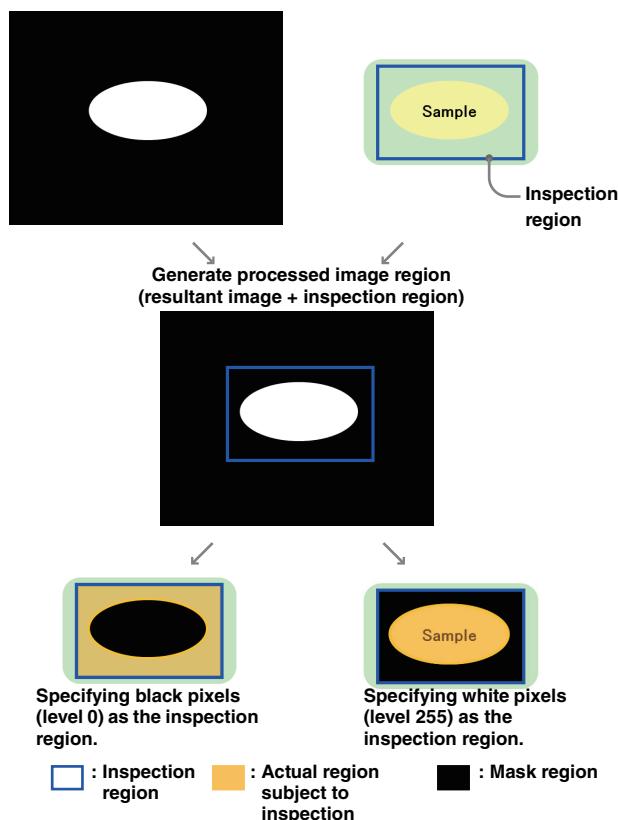
Generating a Region from an Image

The white (grayscale value 255) or black (grayscale value 0) area of a binary image created from the image operation unit (Page 4-244) 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 overview



Using Processed Image Region

▶ Note

Processed Image Region settings can not be changed via the Inspection Region sub menu when editing a unit.

- 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 confirm 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.

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 4-9) for further details.

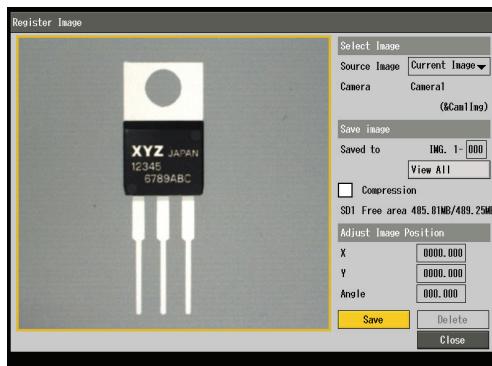
1 Select the image display and camera to be used as a reference.

2 Choose the image type in [Source Image].

- Current Image:** Displays the latest captured image based on the image variable.
- Regist. Image:** Displays a registered image.
- Archived Img.:** Displays an image from the image archive (only displayed in the Register Image menu). Toggle through the image archive by using the No.1 (FUNCTION) or No.7 (BACK) button and left or right.

Reference

Current and image 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 and source image.

4 Specify a number for the image in [Saved to].

Reference

Select [View All] to view current registered images.

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

The registered image will be compressed before being saved to conserve 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 maybe less depending on the available memory.

To register multiple images, repeat steps 4, 5, 6, and 7 specifying the registered image number (000-999) in step 4.

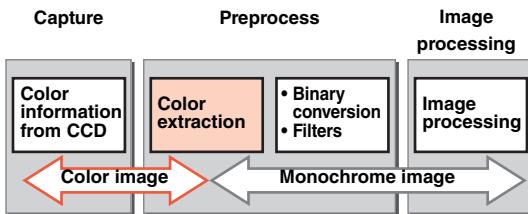
Deleting registered images

- 1** In the Register Image Menu select [Regist. Img.] from the [Source] drop down menu.
- 2** Specify the number of the image to delete in [Saved to].
The specified registered image.
- 3** Click [Delete].
A confirmation screen appears.
- 4** Click [OK].
The registered image is deleted from the controller.

Working with Color Images

What is Color Extraction?

The color extraction process converts the captured raw color image to a monochrome (grayscale or binary) image. All the image processing (excluding HSB and RGB measurement) is performed on the converted monochrome image.



Color extraction is performed by using the color extraction operation in the vision, image operation and C Plug In units.

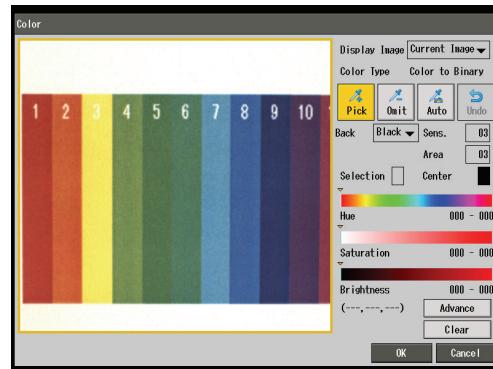
Some functions in the Color Extraction menu and the sub menu [Color] of the Edit Unit menu work and behave differently. Refer to "Difference between sub menus of the Edit Unit menu and other built-in menus" (Page 4-9) for further details.

Color Extraction Methods

The following three processes are available for the extraction or conversion of color information.

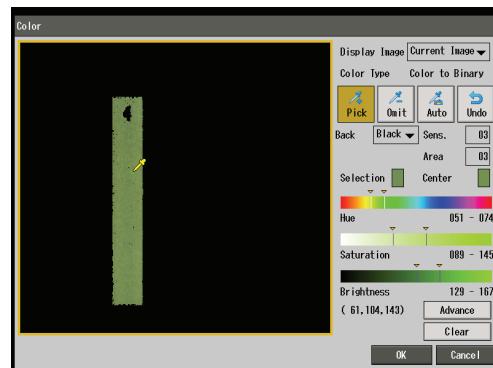
► Note

When using the Color Extraction menu, the settings defined via the XG VisionEditor software determine which color type to use. The color extraction process cannot be performed unless variables have been assigned. Additionally, variables have to be assigned to the color extract values, for values to be changed via the [Advance] menu.



(Example of an image before color extraction)

- **Conversion to a binary image by selecting the color range (Color to Binary):** This process creates a binary image by setting the pixels that fall within the selected color range to "white" (grayscale value 255). All pixels that fall out of the selected color range will be set to "black" (grayscale value 0). This binary image can then be used for operations such as pixel counting of a specified color (Area tool) or blob analysis of a grouping of pixels of a specified color (Blob tool)



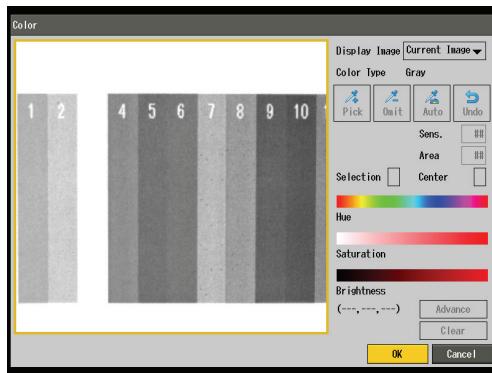
- **Conversion to a grayscale image with the focus on the selected color range (Color to Gray):** The pixels that fall within the selected color range are set to "white" (grayscale value 255) while other colors are grayed respectively (grayscale values 0 to 254). This type of image processing is used for inspections that require high accuracy such as measurement or stain detection, as slight color variations can be accounted and adjusted for.



- **Conversion to a grayscale image (Gray, RGB Gray):** This process creates a traditional grayscale image by extracting only the brightness from the color image. This option can be used to treat a color image as a monochrome image.

► **Note**

No additional settings are available when using Gray or RGB Gray.



Reference

Color extraction settings can be copied within the same image operation unit if the operation is set to [Source Image 1 and 2] by selecting [Copy to Source 1] or [Copy to Source 2].

Conversion to a Binary Image by Selecting the Color Range

Reference

The color extraction menu supports the selection of the unit for the color extraction process if enabled.

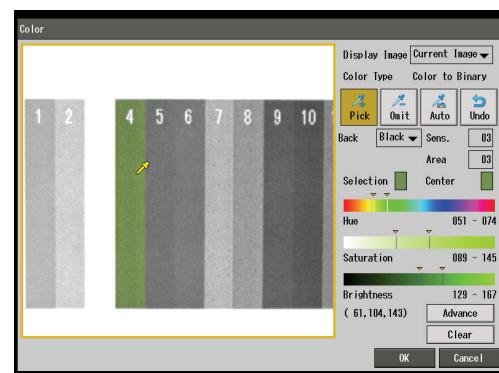
- 1 Select the image type from the [Display Image] drop down menu.

- **Current Image:** Displays the latest captured image.
- **Regist. Image:** Displays the registered image.
- **Archived Img.:** Displays an image from the image archive (only displayed in the Color Extraction Menu). Toggle through the image archive by using the No.1 (FUNCTION) or No.7 (BACK) button and left or right.

- 2 Select the button.

- 3 Use the 8-way key and No. 0 (ENTER) button to select the color to be white (255).

Only the color that has been extracted is displayed in color.



- 4 Enlarge the color range of extraction as required.

- If the No. 0 (ENTER) button is pressed consecutively, the neighboring colors of the first selected color are incrementally selected.
- If is selected, the range of colors can be automatically enlarged, depending on the [Sens.] value.

To omit colors from the extraction:

Press the No. 2 (ESCAPE) button to exit the color extraction and select . Here colors to be omitted can be selected using the 8-way key and the No. 0 (ENTER) button.

5 To finish the selection / omission process, press the No. 2 (ESCAPE) button.

6 To finish color extraction select [OK].

Reference

- During the color extraction process the image can be changed using the View toolbar (Page 3-9).
- During color extraction the selection / omission functions can be toggled between by using the No.1 (FUNCTION) button.

Viewing the extracted color

To view the extracted color press the No.4 (SCREEN) button. Each time the button is pressed the screen cycles through raw image → extracted color only → extracted color in the region → raw image ...

► Note

While the controller is running, all the extracted colors are displayed in white on the process screen.

Clearing color extraction

Choose [Clear] in the [Color] menu.

► Note

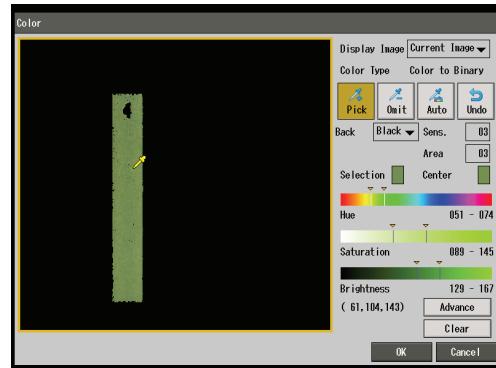
Once the color extraction has been cleared the [OK] button is disabled and the menu cannot be closed until color extraction has been performed.

Changing the color extraction settings

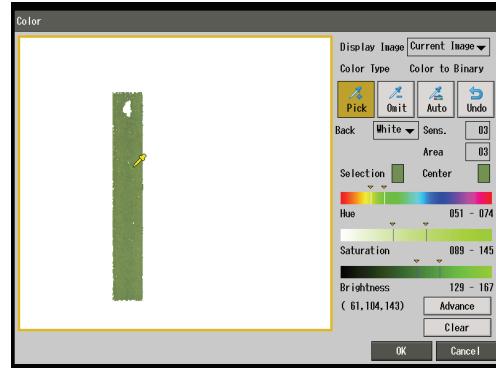
Changing the background color

To properly see the extraction of colors it is useful to change the background color. The background color for the extracted image after color extraction can be selected from either white or black via [Back] in the [Color] menu.

Background color [Black]



Background color [White]



Adjusting the extraction sensitivity of neighboring colors

The sensitivity of the color extraction can be adjusted via [Sens.] in the [Color] menu.

Adjusting the size of the color extraction selection region

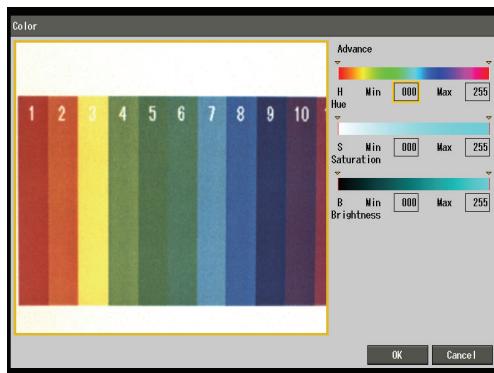
The size of the color extraction area when selecting / omitting colors can be adjusted via [Area] in the [Color] menu. All colors that fall within the area will be extracted when the No. 0 (ENTER) button is clicked.

Specifying the color range to be extracted with numerical values

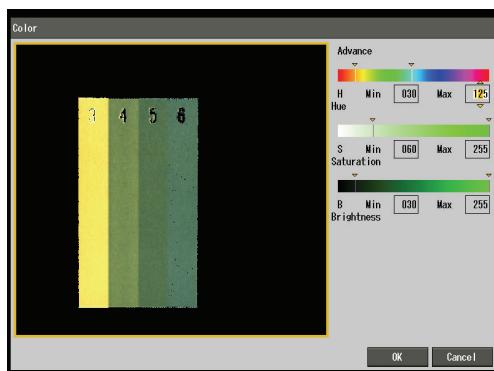
The extracted color range can also be set by inputting numerical values for the Hue, Saturation and Brightness ranges.

1 From the [Color] menu select [Advance].

The right side of the [Color] menu changes to the advanced settings screen.



2 Specify the color range by setting minimum and maximum values for H, S, and B, respectively.



Color is controlled by the following three elements:

- H (Hue): Indicating the color.
- S (Saturation): Indicating the saturation of the color.
- B (Brightness): Indicating the brightness of the color.

When the maximum and minimum values are specified, the color extraction range on the screen changes accordingly, and the position of the ▼ mark shifts on the color bar.

Reference

H (Hue) is a clockwise hue circle starting from red, that may result in the lower limit value needing to exceed the upper limit value.

3 Select [OK].

The right side of the [Color] menu reverts to normal.

Conversion to a Grayscale Image with the focus on the selected color range

Reference

The color extraction menu supports the selection of the unit for the color extraction process if enabled.

1 Select the image type from the [Display Image] drop down menu.

- **Current Image**: Displays the latest captured image.
- **Regist. Image**: Displays the registered image.
- **Archived Img.**: Displays an image from the image archive (only displayed in the Color Extraction Menu). Toggle through the image archive by using the No.1 (FUNCTION) or No.7 (BACK) button and left or right.

2 Select the button.

3 Use the 8-way key and No. 0 (ENTER) button to select the color to be white (255).

The displayed image is converted to grayscale with the selected color as white (255). The pixels that represent the level of 255 are displayed in yellow.



4 Enlarge the range of extraction color as required.

- If the No. 0 (ENTER) button is pressed consecutively, the neighboring colors of the first selected color are gradually converted to a color approaching full white (255).
- If is selected, the range of colors can be automatically enlarged, on the [Sens.] value.

To omit colors from the extraction:

Press the No. 2 (ESCAPE) button to exit the color extraction and select . Here colors to be omitted can be selected using the 8-way key and the No. 0 (ENTER) button.

► Note

If too many omissions are applied, the levels of contrast change across the image will be lost resulting in a binary like image. In such a case the results from tools which use contrast information (such as edge or pattern search) may deteriorate.

5 To finish the selection / omission process, press the No. 2 (ESCAPE) button.

6 To finish color extraction select [OK].

Reference

- During the color extraction process the image can be changed using the View toolbar (Page 3-9).
- During color extraction the selection / omission functions can be toggled between by using the No.1 (FUNCTION) button.

Viewing the extracted color

To view the extracted color press the No.4 (SCREEN) button. Each time the button is pressed the screen cycles through raw image → grayscale image after conversion (with white highlighted as yellow) → grayscale image after conversion → raw image ...

Clearing color extraction

Choose [Clear] in the [Color] menu.

► Note

Once the color extraction has been cleared the [OK] button is disabled and the menu cannot be closed until color extraction has been performed.

Changing the color extraction settings**Adjusting the extraction sensitivity of neighboring colors**

The sensitivity of the color extraction can be adjusted via [Sens.] in the [Color] menu.

Adjusting the size of the color extraction selection region

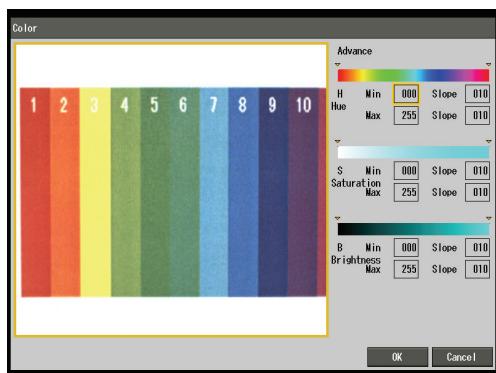
The size of the color extraction area when selecting / omitting colors can be adjusted via [Area] in the [Color] menu. All colors that fall within the area will be extracted when the No. 0 (ENTER) button is clicked.

Specifying the color range to be extracted with numerical values

The extracted color range can also be set by inputting numerical values for the Hue, Saturation and Brightness ranges.

1 From the [Color] menu select [Advance].

The right side of the [Color] menu changes to the advanced settings screen.



2 Specify the color range by setting minimum and maximum values for H, S, and B, respectively.



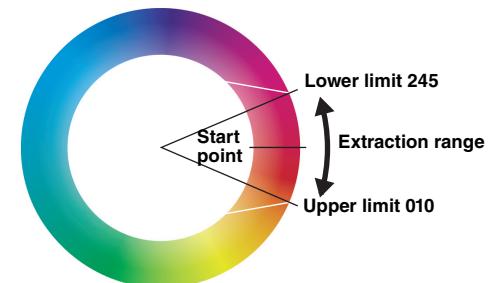
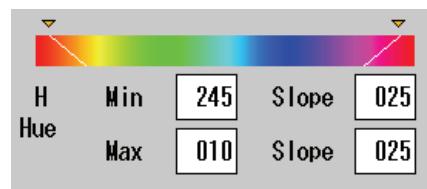
Color is controlled by the following three elements:

- H (Hue): Indicating the color.
- S (Saturation): Indicating the saturation of the color.
- B (Brightness): Indicating the brightness of the color.

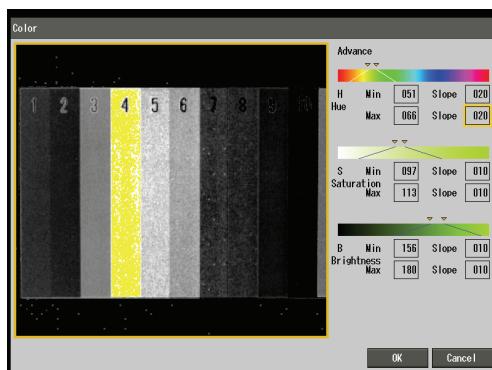
When the maximum and minimum values are specified, the color extraction range on the screen changes accordingly, and the position of the ▼ mark shifts on the color bar.

Reference

H (Hue) is a clockwise hue circle starting from red, that may result in the lower limit value needing to exceed the upper limit value.



3 Specify the rate of contrast change for H, S, and B, on the grayscale image.



The contrast slope can be individually set for the upper and lower limits. As the slope is changed so the contrast levels are changed on screen to assist with setting the desired range.

- **As the slope is increased (up to 100):** The difference in contrast between the selected color range and non-color range increases, resulting in an image that is more focused on the exact color range and approaching a binary like image.
- **As the slope is decreased (min 10):** The image becomes more robust against lighting or color variation, as more contrast levels are allowed around the specified color range.

Note

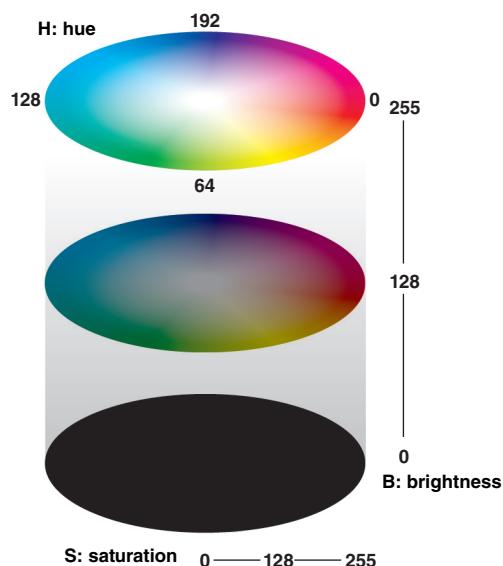
In the same way as omitting to many colors can cause deterioration in the performance of contrast tools (edge, pattern search etc) so specifying a sharp slope can do the same.

4 Select [OK].

The right side of the [Color] menu reverts to normal.

The HSB Color System

The HSB color system is a way of representing a color based on H (hue), S (saturation), and B (brightness). The ranges for the H, S, and B values are automatically determined when selecting the color via the color menu.



By specifying numerical values for the H, S, and B ranges via [Advance] menu, a more precise color extraction can be performed.

Tips for specifying numerical values

Consider the following points when specifying the color range to be extracted using numerical values.

- **H (Hue):** The most important parameter to determine the color to be extracted. The other parameters (Saturation and Brightness) are applied to the same area specified for Hue. Be sure to specify the H value accurately.
- **S (Saturation):** This is essentially the quantity of color contained in the color. Changing this value can be useful when trying to eliminate glare and hot spots from detection. By excluding the range with low saturation (little color and nearing white) from the color extraction, the white portions of the color caused by glare and hot spots can be excluded.
- **B (Brightness):** This sets the level of black contained in the selected color. If the brightness level is enlarged, the color extraction and inspection will remain stable as lighting deteriorates.

Registering Characters for Optical Character Recognition

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 4-9) 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.

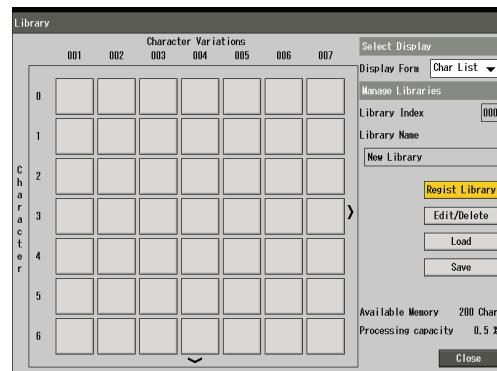
- Opening and closing the Library menu
- Regist Indv./Regist All
- Library index changes
- Library name changes
- Library deletion
- Loading and saving the library

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:
 - create a new library file; 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 [Regist Library].

The [Regist Library] menu appears.



3 Choose the image to extract characters from.

- **Regist. Image:** Displays the registered image.
- **Current image:** Displays the latest captured image.
- **Archived Img.:** Displays an image from the image archive (only displayed in the Library menu). Toggle through the image archive by using the No.1 (FUNCTION) or No.7 (BACK) button and left or right.

When using an image archive image and [Display Info] is switched to ON, the total count, inspection date and time, and inspection result (string, correction level, and extraction waveform) will be displayed. This information is archived as part of the image archive data.

▶ Note

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:

- **Regist Indv.:** Allows extracted characters to be registered one by one.
- **Regist 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. Refer to "Specifying a fixed extraction block" (Page 8-24) for more details.
- In the [Library] sub menu (Page 4-221) of the OCR unit only the extraction settings used in [Block Setup] can be used.

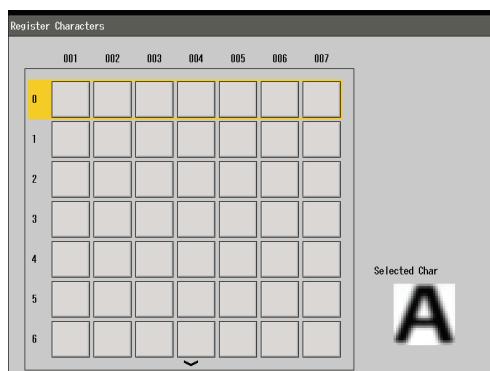
▶ Reference

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 [Regist Indv.] 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 [Regist All] is selected

The [Regist All] menu appears.

Choose the appropriate line number and manually enter the string that is currently extracted.

**Reference**

- Exclude any undesired characters from 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 the registered characters**

Characters can be edited or deleted using the procedure below.

► Note

The 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 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

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 [New Setting], extract only one line.

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.

For more details, refer to "Drawing a Rotated Rectangle" (Page 8-3).

▶ 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 the block is inside the inspection region as any part of the block outside the region will not be registered and the character will not be extracted correctly.

4 To finish drawing the block, press the No. 2 (ESCAPE) button on the handheld controller.

5 Click [Close].



Editing a Pre-Programmed Unit

The Edit Unit menu can be used to change the settings of a unit that has been pre-programmed in the flowchart.

▶ Note

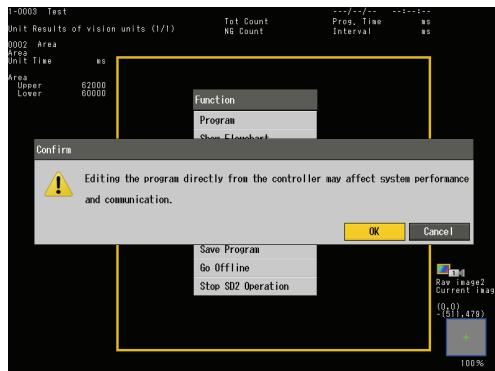
Changing the settings via the Edit Unit menu during inspection may greatly affect the inspection result. It is recommended that the inspection is stopped before changes are made. Refer to "Cautions on flowchart editing" (Page 4-4) for more details.

Reference

Refer to "What is the Edit Unit menu?" (Page 4-7) for more details on the Edit Unit menu and supported units.

1 From the Function menu (Page 4-3) select [Edit Unit].

A confirmation screen appears.

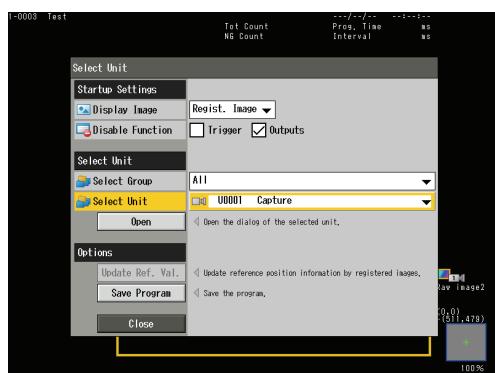


Reference

By default, [Edit Unit] does not appear on the [Function] menu. To show the [Edit Unit] menu, the system settings have to be changed via the XG VisionEditor software. For more details, refer to the XG VisionEditor Reference Manual (Programming Edition).

2 Select [OK].

The Edit Unit menu appears.



3 Select the unit to be edited and select [Open]

The top menu for the selected unit appears.

Reference

Units can be filtered by selecting the group in the [Select Group] menu. Units that are not part of a group can be displayed using the [All] and [Ungrouped] options.

4 Change appropriate settings of the unit.

See the explanation of each unit for more details.

5 Save the revised settings.

6 To finish editing select [OK].

Selecting the defaulted displayed image

The image used when editing a unit can be switched between.

- **Current image:** Displays the latest captured image.
- **Regist. Image:** Displays a registered image.

Disabling controller operation while editing units

Ignoring trigger inputs

Put a check mark in the [Trigger] option.

Disabling terminal and communication outputs

Put a check mark in the [Outputs] option.

Reference

- The [Trigger] and [Outputs] settings do not take effect until a unit is opened. This setting has no effect when all menus are closed. The disabling of controller operations does not occur when the Edit Unit menu is displayed.
- If the outputs are disabled, data currently being output will continue until finished (Page 3-26).

Updating the reference position for position adjustment with registered images

Use the [Update Ref. Val.] to update the reference points position adjustment unit based on the current registered image.

► Note

Using [Update Ref. Val.] under the following circumstances may result in inaccurate position adjustment when:

- the unit that serves as the position adjustment source references another position adjustment.
- the inspection region for a unit that uses position adjustment is based off of the current image.
- the unit that is referenced by a position adjustment uses a different registered image.

Saving settings

Use [Save Program] to save any changes made to the program.

► Note

If the controller is turned off without the settings being saved any changed will be deleted.

Image Enhancement Filters

Details of the image enhancements available for vision tools are listed below. These filters can be applied via the [Image Enhance] menu.

▶ Note

- If a color image is used, the resultant image after the filter is applied is not displayed until color extraction has been performed.
- Filters can only be added or deleted through the [Image Enhance] menu.

Reference

- A filter can be skipped during execution by setting the [Count] to 0. However, the inspection time will still be longer than if no filter is used.
- Filters can be copied in the same image operation unit if the [Operation] is set to [Source Image 1 and 2] by selecting [Copy to Source 1] or [Copy to Source 2].

None

No filter is applied.



Binary

Converts the image to binary.



- Click [Detail] to specify the Binary level and Count (1: ON, 0: OFF).
- Put a check mark in [Update histogram on the input image] option to update the histogram as the image changes.

Reference

Adjustments can also be made by manually entering Lower and Upper values on the histogram display.

Expand

Removes dark noise by adjusting pixels to the highest grayscale intensity from a group of pixels.



Click [Detail] to set the filter size (3 x 3: default, or 5 x 5 for a bigger processing area), Count (number of times (0 to 9) to apply the filter, where 0 turns the filter off), and Border.

Border processing

The way the filter uses pixel data outside of the region for pixels on the border can be selected between

- **ON** (default): Uses the pixel data outside of the region for pixels on the border.
- **OFF**: Extrapolates the pixels on the border for the pixel data.

Shrink

Removes light noise by adjusting pixels to the lowest grayscale intensity from a group of pixels.



Click [Detail] to set the filter size (3 x 3: default, or 5 x 5 for a bigger processing area), Count (number of times (0 to 9) to apply the filter, where 0 turns the filter off), and Border.

Border processing

The way the filter uses pixel data outside of the region for pixels on the border can be selected between

- **ON** (default): Uses the pixel data outside of the region for pixels on the border.
- **OFF**: Extrapolates the pixels on the border for the pixel data.

Average

Removes noise by taking the average intensity across a group of pixels.



Click [Detail] to set the Count (number of times (0 to 9) to apply the filter, where 0 turns the filter off).

Median

Removes noise yet maintains definition by taking the median (most common) intensity across a group of pixels.



Click [Detail] to set the Count (number of times (0 to 9) to apply the filter, where 0 turns the filter off).

Sharpen

Enhances regions where there is a change in intensity are.



Click [Detail] to set the Count (number of times (0 to 9) to apply the filter, where 0 turns the filter off).

Sobel X

Applies a Sobel filter in the X horizontal direction, enhancing intensity changes.



Click [Detail] to set the Count (number of times (0 to 9) to apply the filter, where 0 turns the filter off).

Sobel Y

Applies a Sobel filter in the Y vertical direction, enhancing intensity changes.



Click [Detail] to set the Count (number of times (0 to 9) to apply the filter, where 0 turns the filter off).

Sobel

Applies a Sobel filter for extracting and enhancing changes in intensity based on a linear comparison.



Click [Detail] to set the Count (number of times (0 to 9) to apply the filter, where 0 turns the filter off).

Prewitt

Applies a Prewitt filter for extracting changes in intensity based on a linear comparison.



Click [Detail] to set the Count (number of times (0 to 9) to apply the filter, where 0 turns the filter off).

Roberts

Applies a Roberts filter for extracting changes in intensity based on an angular comparison.



Click [Detail] to set the Count (number of times (0 to 9) to apply the filter, where 0 turns the filter off).

Laplacian

Applies a Laplacian filter for extracting changes in intensity.



Click [Detail] to set the Count (number of times (0 to 9) to apply the filter, where 0 turns the filter off).

Subtract

Refer to "Extracting Defects and Stains" (Page 8-31).

Preserve Intensity

Refer to "Reducing the Impact of Changes in Intensity" (Page 8-33).

Contrast conversion

Refer to "CCD Settings" (Page 4-19).

Image Extraction

Refer to "Removing Background Information" (Page 8-34).

Shading Correction

Refer to "Eliminating Shading and Gradation" (Page 8-35).

Blur

Applies a softening (blur) filter.



Click [Detail] to set the Filter strength (1 to 9), processing direction (X, Y, XY) and Count (1: ON, 0: OFF).

Custom

Refer to "Using Basic Custom Filters" (Page 8-36).

Custom (Advance)

Refer to "Using Advance Custom Filters" (Page 8-37).

Blob

Refer to "Extracting Desired Parts of the Image" (Page 8-40).

Extracting Defects and Stains

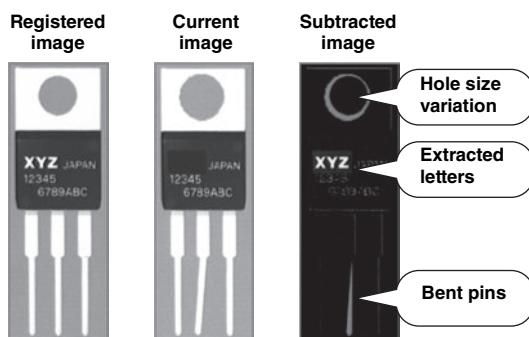
Subtraction Filter

Applying the subtraction filter results in an image which is the absolute difference between the current and registered image. This is useful for isolating differences such as dirt, cracks, and deformation, when comparing a target to a known standard. Using this filter with the stain (Page 4-122) and position adjustment tools makes it easy to find hard to recognize differences due to complex targets or regions.

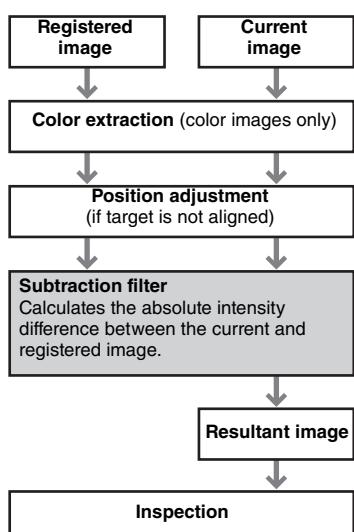
► Note

- The subtraction filter cannot be used with Pattern Search, ShapeTrax2, OCR, Image Operation, or C Plug In units.
- If there is no registered image or the registered image is not set correctly then the filter will not be processed correctly.

Processing image



Subtraction filter process



Setting up the Subtraction Filter

1 Setup a unit for which the subtraction filter should be applied.

In this example, a stain unit is used.

For more details on how to setup a [Stain Unit], refer to "Stain" (Page 4-122).

2 Apply the [Subtract] filter.

From the [Image Enhance] menu select [Subtract].

Reference

When [Subtract] is selected, the currently displayed image is processed, sometimes which could cause the screen to go black.

3 Click [Detail].

Mask Area

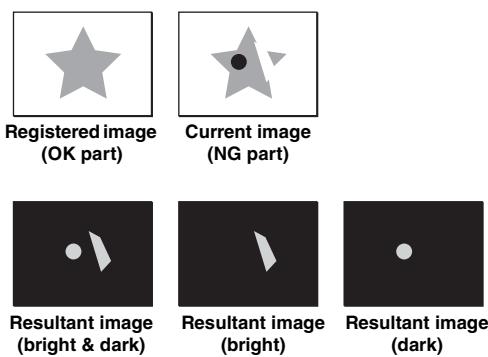
A mask area can be used to cancel noise around profiles that could occur due to differences in the registered image and the current image. Choose the number of repetitions (0 to 9, default 2). A larger number gives better noise suppression, yet reduces the sensitivity to smaller defects.

Extract

Choose a method for extracting areas based on intensity.

- Bright & Dark** (Default): Displays areas that are either lighter or darker than the registered image.
- Bright**: Displays areas that are lighter than the registered image.
- Dark**: Displays areas that are darker than the registered image.

Changes in the subtraction image based on extraction settings.



Reference

- To exclude random shiny areas and extract only dark areas, chose the [Dark] setting.
- To view the results of the filter change the display image to [Current Img.].

High Speed Mode

Choose how to process the subtraction filter.

- **Constant (fast)** (default): Uses the processing memory for the subtraction and variables cannot be referenced for region, color extraction or image enhancement settings.
- **Update every time (slow)**: Uses the image memory to re-calculate the image before subtraction, allowing for variables to be referenced for region, color extraction and image enhancement settings.
- **Update by user (fast)**: Uses both the processing and image memory for the subtraction calculation allowing for variables to be referenced for region, color extraction and image enhancement settings. Any change in settings requiring the recalculation of image information needing to use the image memory is applied when the recalculation command (RU) is issued. Refer to the XG VisionEditor Reference Manual (Control/Data Edition) for more details.

Reference

If [Update by user (fast)] is selected, changes in settings made via the Inspection Region menu (Page 8-2), Color menu (Page 8-13) and Edit Unit menu (Page 4-7) are applied without the need of the recalculation (RU) command. (The recalculation of the registered image information are 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 [High Speed Mode] cannot be set to [Constant (fast)] if a variable is assigned to settings that affect the recalculation of image information such as region, color extraction or image enhancement settings. In such cases, remove the referenced variable and change the setting.

4 After completing the settings, click [OK].**5 Set a pattern search unit to use as the position adjustment unit.**

If there is a position change between the registered image and the current image, the subtraction filter will also show such differences. To ensure images align use position adjustment with a position tool (such as pattern search). For more details on how to setup the pattern search unit, refer to "Pattern search" (Page 4-37).

Example of error due to position mismatch**Reference**

Other tools can be used for position adjustment such as edge position (Page 4-63).

6 In the position adjustment unit, choose the pattern search unit set in step 5 as the reference.

Refer to "Position Adjustment" (Page 4-232) for more details.

7 In the [Inspection Region] menu set the [Position Adjustment ID] for the position adjustment unit set in step 6.**Reference**

In addition to position correction intensity correction can also be applied to fix changes in lighting and differences between the images. To reduce the effects of changes in intensity, use the preserve intensity filter before the subtraction filter. Refer to "Reducing the Impact of Changes in Intensity" (Page 8-33) for more details.

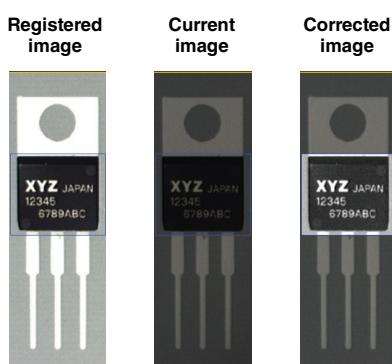
Reducing the Impact of Changes in Intensity

The impact of lighting fluctuations can be reduced by using the Preserve Intensity filter to correct the change in intensity from when the inspection was first configured. This is especially useful for inspections with a monochrome image where only contrast information is processed.

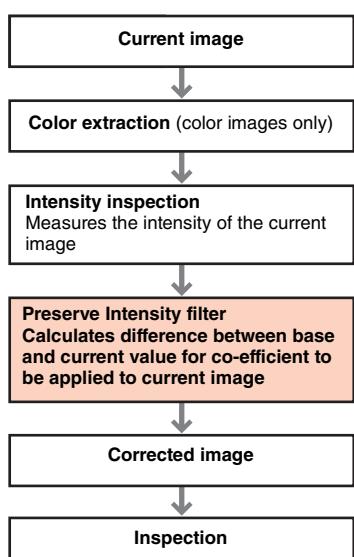
► Note

Preserve Intensity cannot be used for a color unit.

Processing image



Process of preserve intensity



Setting up the Preserve Intensity Filter

► Note

- Be sure to arrange the order on the flow chart so that the Intensity unit is processed before the Preserve Intensity filter is used.
- The preserve intensity filter cannot process of a completely black area.
- Set the intensity region in a location with an average intensity level. (around 128). If the region is set in a location that is too bright or too dark, the preserve intensity adjustment cannot be performed properly and adjustment maybe unstable, particularly for images with high contrast through color extraction.

1 Apply the [Preserve Intensity] filter.

From the [Image Enhance] menu select [Preserve Intensity].

2 Click [Detail].

The [Preserve Intensity] menu appears.

3 Choose the intensity unit in the [Reference Unit ID] and select [Refer unit results] under [Specify Base Value].

To use the current intensity value as the base brightness

Click [Set Base Value].

This registers the current intensity value from the specified unit as the base value.

4 To finish settings, click [OK].

► Note

Adjustment is not performed (a co-efficient of 1 is used) in the following circumstances:

- The referenced intensity unit has an error,
- The execute condition of the referenced intensity unit is set to [Never Execute],
- The [Count] is set to 0.

Specifying a base value via [User set]

Specify an intensity (0.000 to 255.000) that will serve as the base value in the [Base Value].

Removing Background Information

The background of a target can be removed with the Image Extraction filter, by subtracting the current image from a processed version. This filter is very useful for extracting small points or thin lines from a fluctuating background.

1 Apply the [Image Extraction] filter.

From the [Image Enhance] menu select [Image Extraction].

2 Click [Detail].

The [Image Extraction] menu appear.

Choose the aspect to extract [Dark] or [Bright] and the extraction size (3 to 39 pixels)

3 Choose.

4 Use [Count] to set the number of times to apply the filter.

5 To finish settings click [OK].

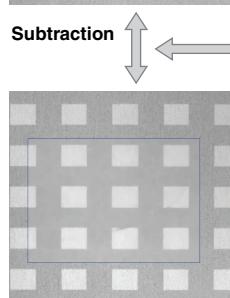
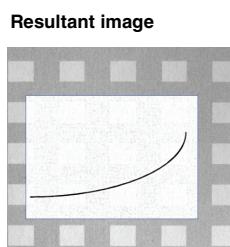
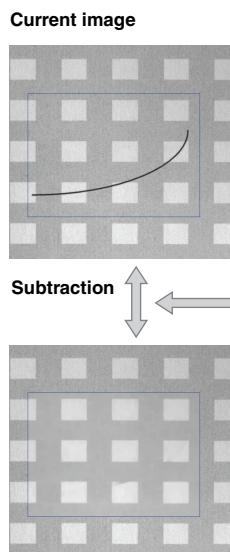
Reference

Unlike the subtraction filter which requires a registered image, the image for subtraction is automatically generated. Thus this filter works in real-time accounting for any changes in the target.

► Note

Increasing the extraction size will lengthen.

Processing image



Internally generated image

Image is automatically generated by using Expand and Shrink filters.

Border processing

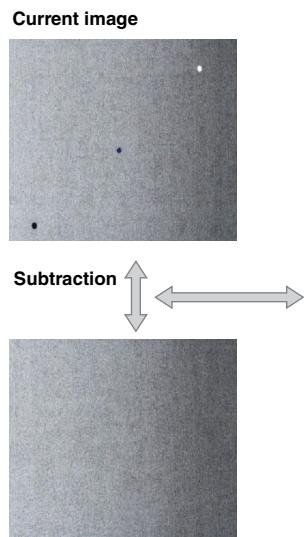
The way the filter uses pixel data outside of the region for pixels on the border can be selected between.

- **ON** (default): Uses the pixel data outside of the region for pixels on the border.
- **OFF**: Extrapolates the pixels on the border for the pixel data.

Eliminating Shading and Gradation

The shading variation across an image can be neutralized with the Shading Correction filter by subtracting the current image from a processed version. Using this filter leaves areas where there is a sharp contrast while the rest of the background is set to a constant value. The background can be smoothed based on using shading, averaging or median filters across the region.

Processing image



Internally generated image
Removes high contrast changes in an image leaving the background.

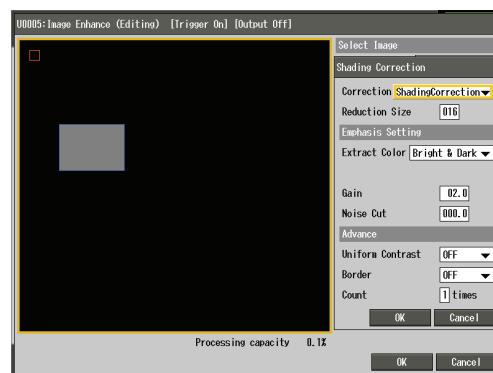
Changing the filter settings

1 Apply the [Shading Correction] filter.

From the [Image Enhance] menu select [Shading Correction].

2 Click [Detail].

The [Shading Correction] menu appears.



3 Change the settings as required.

Correction

The shading correction filter processes the current image against a corrected image to highlight areas of sharp contrast. This corrected image is created by removing sharp contrast changes, leaving the background to be processed against the current image.

- **ShadingCorrection (Default setting):** This method extrapolates a shading curve based on the reduction size, and uses it as the reference to process with the current image.
- **AverageCorrection:** This method takes the average intensity from the entire inspection region and uses it as the reference to process with the current image.
- **MedianCorrection:** This method takes the median intensity from the entire inspection region and uses it as the reference to process with the current image.

Reduction Size

Specify the size (4 to 200) of the flaw (such as black, white or stains) to detect. This option is only available when [Shading Correction] is selected in [Correction].

Reference

Reducing the reduction size will increase the precision of the shading correction but will also lengthen the processing time.

Extract

Choose the areas to extract based on intensity.

- **Bright**: Displays points that are brighter than their respective background.
- **Dark**: Displays points that are darker than their respective background.
- **Bright & Dark** (default): Displays points that are either darker or lighter than their respective background.
- **Individual**: Choose individually how darker and lighter points should be displayed.

Reference

- When [Bright] is selected, the background of the processed image becomes black (0). When [Dark] is selected, the background of the processed image becomes white (255).
- When [Bright & Dark] or [Individual] is selected, the background of the processed image becomes gray (128).

Gain

Set the gain used on the image after correction (0 to 10.0, default: 2.0). Increase the value to increase the contrast on the processed image.

Noise Cut

Eliminates slight noise components from the background (0 to 255, default: 0.0).

Uniform Contrast

Use this option to compensate for backgrounds with large shading variations. This helps to keep the contrast in the image uniform and is useful for dealing with lighting fluctuations.

- **OFF** (default): Does not unify the contrast.
- **ON**: Unifies the contrast.

Border

Selects whether to reference the image outside of the inspection region for processing.

- **OFF** (default): Does not reference areas outside of the measurement area.
- **ON**: References areas outside of the measurement area.

4 Use [Count] to set the number of times to apply the filter.

- **1** (default): Use the shading correction filter (ON).
- **0**: Do not use the shading correction filter (OFF).

5 To finish settings, click [OK].

Using Basic Custom Filters

Custom filters can be created and applied to create effects not possible with the standard filters. The intensity of the current pixel is calculated from the coefficient sum of a 3 x 3 or 5 x 5 matrix of pixels (referred to as a kernel). This grayscale value can then be shifted accordingly to produce the desired intensity and image.

1 From the [Image Enhance] menu select [Custom].

2 Click [Detail].

The [Custom] menu appears.

3 Use [Size] to set the kernel size.

- **3x3** (default): Reference the intensity from a 3 x 3 matrix of pixels centered around the current pixel being processed.
- **5x5**: References a 5 x 5 matrix of pixels centered around the current pixel being processed.

4 Use [Shift] to specify the shift value (-255 to 255).

Specify the shift in intensity (default 0).

Reference

If the calculation results in the grayscale value falling out of the 0 to 255 range the value will be capped at 0 or 255 respectively.

5 Use [Count] to set the number of times to apply the filter.

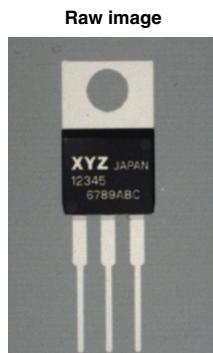
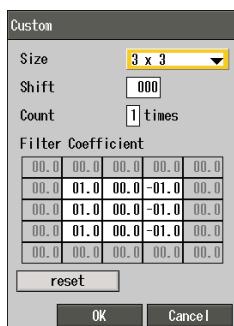
6 Specify the pixel coefficient to be used (-32.0 to 32.0) (default: 1.0 current / center pixel, 0.0 other pixels).

Reference

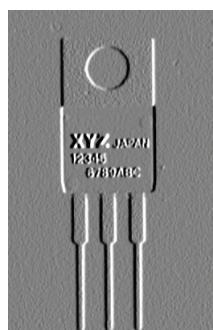
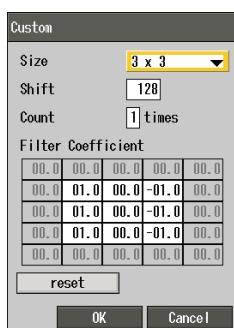
Click [Reset] to reset the kernel.

Basic Custom Filter example

The example below shows how a custom filter can be used to extract light to dark edges in the X direction.



By setting the shift to 128, the pixels whose intensity was originally capped at 0 due to a being a negative value are now adjusted with the rest of the image. Resulting in the extraction of dark to light edges in the X direction as well.



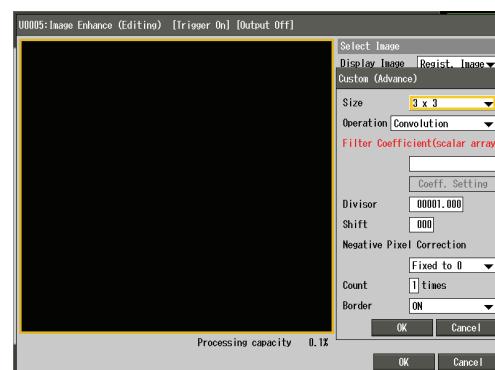
Using Advance Custom Filters

Custom filters can be created and applied to create effects not possible with the standard filters. The intensity of the current pixel is calculated based off of a matrix (3 x 3 to 21 x 21) of pixels (referred to as a kernel). The resultant grayscale value can then be further adjusted accordingly to produce the desired intensity and image.

1 From the [Image Enhance] menu select [Custom Advance].

2 Click [Detail].

The [Custom (Advance)] menu appears.



3 Use [Size] to choose the filter size.

- **3x3:** Reference the intensity from a 3 x 3 matrix of pixels centered around the current pixel being processed.
- **5x5:** Reference the intensity from a 5 x 5 matrix of pixels centered around the current pixel being processed.
- **7x7:** Reference the intensity from a 7 x 7 matrix of pixels centered around the current pixel being processed.
- **9x9:** Reference the intensity from a 9 x 9 matrix of pixels centered around the current pixel being processed.
- **11x11:** Reference the intensity from a 11 x 11 matrix of pixels centered around the current pixel being processed.
- **13x13:** Reference the intensity from a 13 x 13 matrix of pixels centered around the current pixel being processed.
- **15x15:** Reference the intensity from a 15 x 15 matrix of pixels centered around the current pixel being processed.
- **17x17:** Reference the intensity from a 17 x 17 matrix of pixels centered around the current pixel being processed.
- **19x19:** Reference the intensity from a 19 x 19 matrix of pixels centered around the current pixel being processed.
- **21x21:** Reference the intensity from a 21 x 21 matrix of pixels centered around the current pixel being processed.

▶ Note

If the filter size is changed after being set the kernel will be reset.

4 Use [Operation] to choose the kernel processing.

- **Convolution**: Performs the same operation as the custom filter (Page 8-36).
- **Expand**: Applies the expand filter (Page 8-28) by referencing intensity of pixels with a coefficient of 1 in the kernel.
- **Shrink**: Applies the shrink filter (Page 8-28) by referencing intensity of pixels with a coefficient of 1 in the kernel.

▶ Note

If the operation is changed after being set the kernel and any convolution settings will be reset.

5 Specify a numerical variable array in the [Filter Coefficient] field and use [Coeff. Setting] to set the kernel.

The [Coeff. Setting] menu appears.

Refer to "Specifying the pixel coefficients (kernel)" (Page 8-39) for more details about using the [Coeff. Setting] menu.

▶ Note

Make sure the numerical array has more elements than required by the kernel (example: 225 or more elements for a 15 x 15 filter).

6 Specify a divisor in [Divisor] as necessary.

Specify the value to divide the calculation result by, before shifting the resultant value.

▶ Reference

This option is only available if [Convolution] is selected for [Operation].

7 Use [Shift] to specify the shift value (-255 to 255).

Specify a value to add to the calculation result. This value is added to all pixels.

▶ Reference

This option is only available if [Convolution] is selected for [Operation].

8 Choose how negative values should be handled with [Negative Pixel Correction].

- **Fixed to 0**: Caps values less than 0 to 0.
- **Absolute Value**: Reverts negative values to their absolute (positive_ equivalent).

▶ Reference

This option is only available if [Convolution] is set for [Operation].

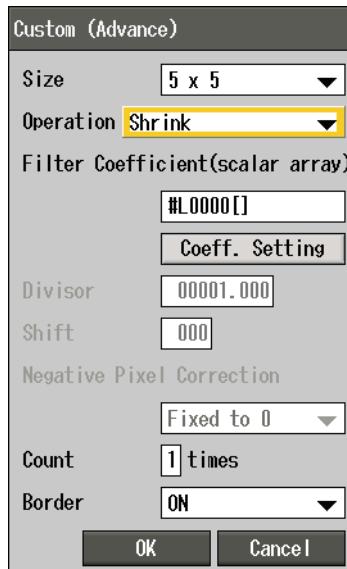
9 Use [Count] to set the number of times to apply the filter.**10 Specify the [Border] option as necessary.**

Specify whether to apply the filter by referencing the image outside the inspection area.

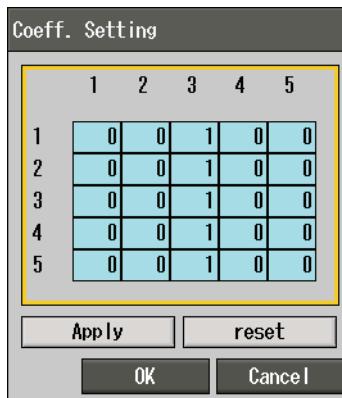
- **ON**: The image outside the area affects the filtering process.
- **OFF**: The image outside the area has no effect on the filtering process.

Advance Custom Filter Example

The example below shows how to apply a shrink filter of a specified size only in the Y direction.

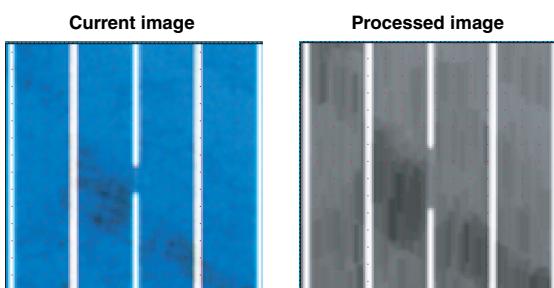


Use the [Coeff. Settings] menu to set the kernel.

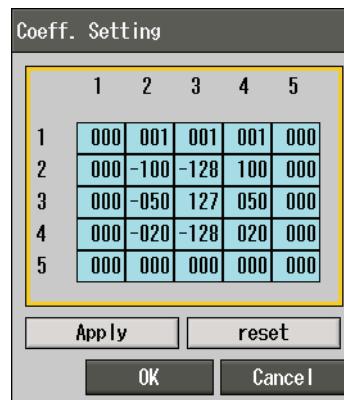


Processing result

The defect (gap) of the white line is widened in the Y direction but no change is made to the width in the X direction.



Specifying the pixel coefficients (kernel)

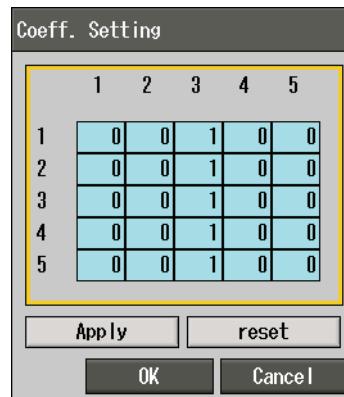


Available range is -128 to 127.

► Note

Values outside the range will result in an error.

Expand or shrink



Available range is 0 or 1

► Note

Values outside the range will result in an error.

Reset

Click [Reset] to rest the kernel.

Reference

The kernel is reset under the following conditions:

- Changes to the kernel [Size].
- Changes to the filter [Operation].
- Changes to the scalar array used for the kernel.

Extracting Desired Parts of the Image

The blob filter enables the only the desired parts of a binary image to be extracted based on size, shape and other characteristics. While at the same time filling in holes and allowing for the inclusion / exclusion of blobs on the border.

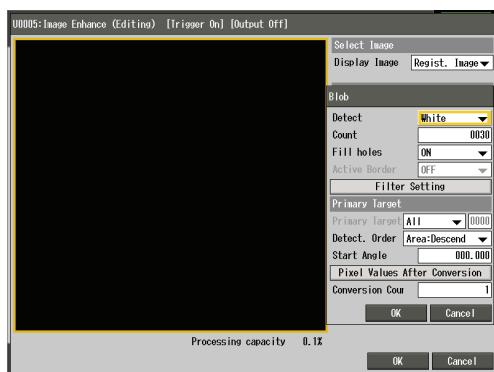
► Note

Convert the image to a binary image using the Binary filter before applying the Blob filter, otherwise the Blob filter will not function correctly.

1 From the [Image Enhance] menu select [Blob].

2 Click [Detail].

The [Blob] menu appears.



3 Select extraction criteria.

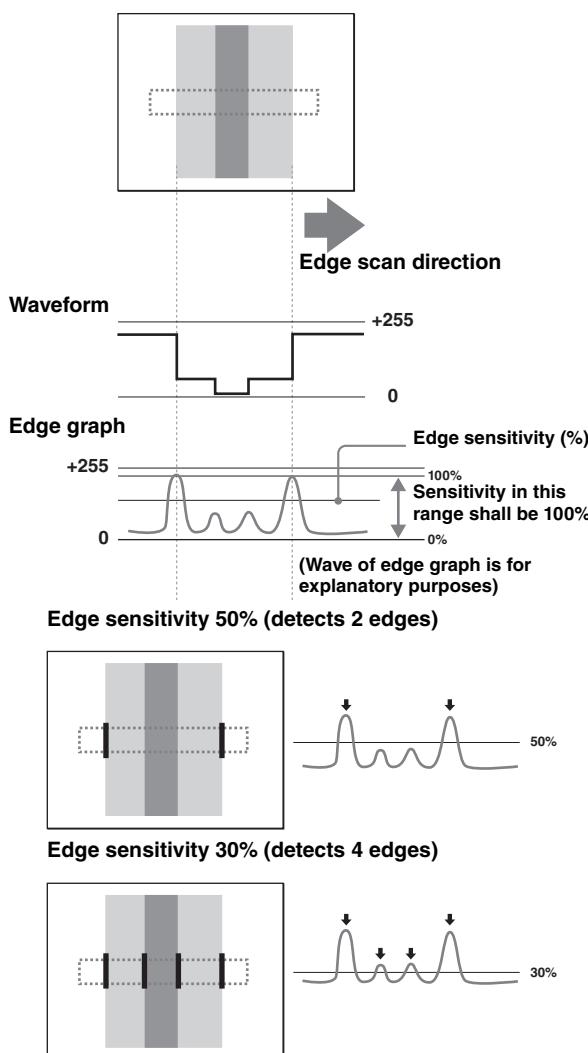
Change the parameters as required such as the blob color, count size and so on. The image enhancement blob filter functions the same way as the blob tool does. Refer to "(9) Blob" (Page 8-79) for more details.

What is an Edge?

In the system edge processing is used to detect transitional changes of a target in an inspection region for positioning or measured. Edge detection is performed based on the change of intensity in the region perpendicular to the edge scan direction. The amount of change detected is known as the edge intensity.

Edge sensitivity

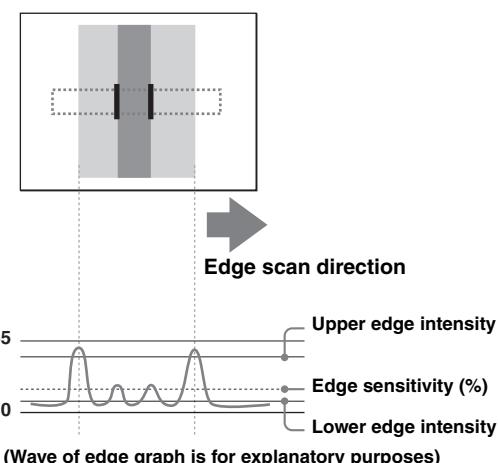
Edge sensitivity refers to the level of intensity that is detected as an edge, where 100% represents the maximum edge intensity in the region. By specifying the edge sensitivity in relation to the maximum edge intensity in the region edge detection is very stable and robust against fluctuations in illumination.



Edge intensity upper and lower limit

For increased functionality edges can be filtered out based on their edge intensity value. The maximum edge intensity serves as an upper limit and the minimum edge intensity serves as a lower limit.

Only the edges that lie between the upper and lower limit will be detected. Any edge outside this range will be ignored.



Differences between edge sensitivity and edge intensity upper / lower limits

Edge sensitivity is specified using a relative value with the maximum edge intensity being 100%, the upper limit and lower limit of edge intensity is specified using an absolute value (0 to 255) of the edge intensity.

Reference

Edges excluded from detection due to the edge intensity upper limit are also excluded from the edge sensitivity calculation. Thus, if the edge intensity upper limit is changed, the edge detection result may also change.

Checking edges

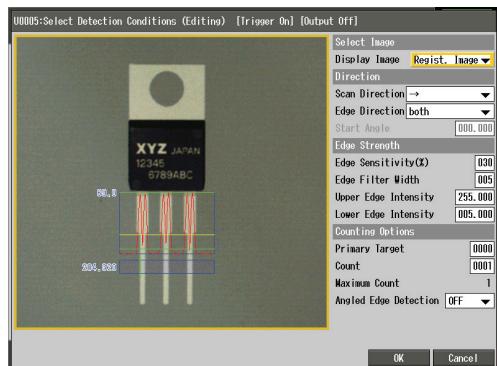
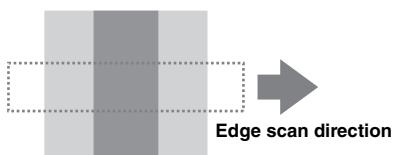
The maximum edge intensity within the inspection region is shown next to the edge graph on the screen.

Filter width

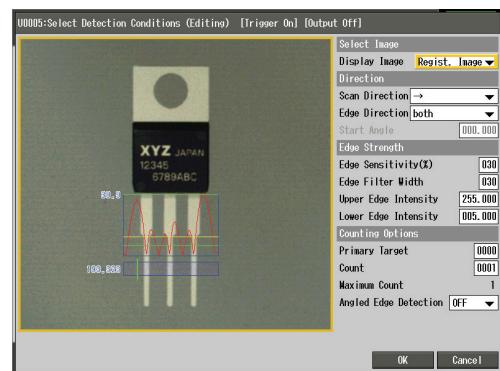
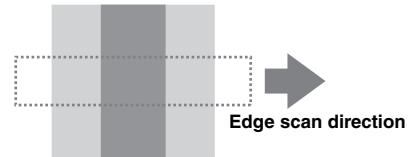
By changing the filter width, the edge graph can be averaged as desired helping eliminate noise. As the filter width is increased so more data is used and noise has less of an impact on the edge detection.

To avoid mis-detection for rounded or tilted targets where there is a gradual change in contrast the filter width can also be adjusted accordingly.

Filter width default setting (filter width = 5)



After the filter width setting is changed (filter width = 30)



What is the Stain Grouping Function?

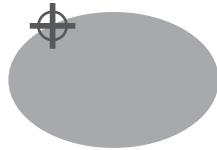
The stain grouping function in the stain unit (Page 4-122) allows successive small areas that have been detected as a stain to be grouped together.

A normal stain inspection identifies the segment with the maximum intensity difference (stain level) among multiple segments. The stain area represents the total number of segments (stains) that exceed the threshold (stain level) in the inspection region. The stain grouping function treats successive segments that exceed the stain level threshold value as a group for processing.

The grouping function is useful for finding the position of flaws and stains larger than the segment size, and for features (stains, etc.) that are larger in area than their intensity difference.

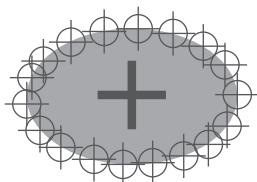
Detecting positions

Stain grouping function [OFF]



The position of the segment that has the maximum intensity difference is detected.

Stain grouping function [ON]



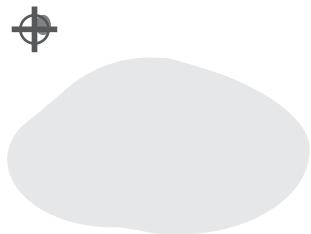
The center of gravity from the grouping of several segments is used for the position.

Reference

The detection segment in the illustration is a conceptual image and may differ from actual inspection. Check the stain detection in the [Contrast img.] to setup stain grouping correctly.

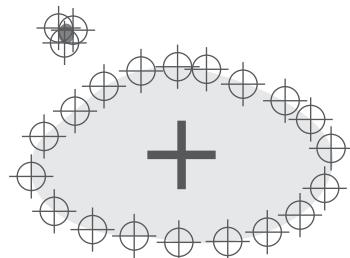
Detecting large flaws

Stain grouping function [OFF]



The segment that has the maximum intensity difference is detected.

Stain grouping function [ON]



The group that has the larger number of segments (amount of stains) that exceed the stain level (a subtle stain, in the example above) can be detected.

Reference

The detection segment in the illustration is a conceptual image and may differ from actual inspection. Check the stain detection in the [Contrast img.] to setup stain grouping correctly.

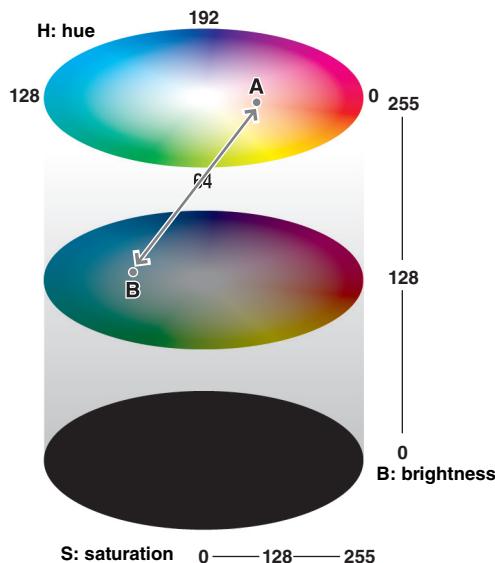
Note

- When [Ring] is selected for the inspection region and [Ring direction] or [Radial direction] is selected for the scan direction, the stain 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 stain grouping function is disabled.

What is Fine Color Mode?

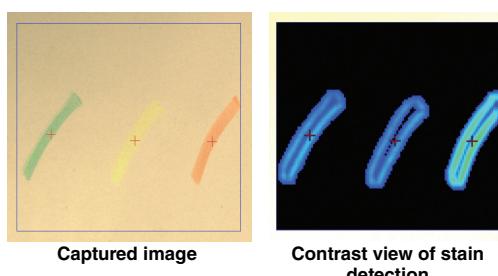
The Fine Color mode (only available in the stain tool) utilizes all the color information, H (Hue), S (Saturation), and B (Brightness) for detection. The HSB information of each segment is compared and is used for determining if there is a change differences in the color information then determine the stain level.

The calculated stain level is illustrated in the below graphic as the straight line between points A and B, which are two different colors in the HSB color space.



The Ignore Intensity function can be used so that B (Brightness) information can be excluded and only changes in H (Hue) and S (Saturation) are used for calculation of the stain level. In this situation, stains are only detected as color differences, without the influence of brightness that doesn't contain color components.

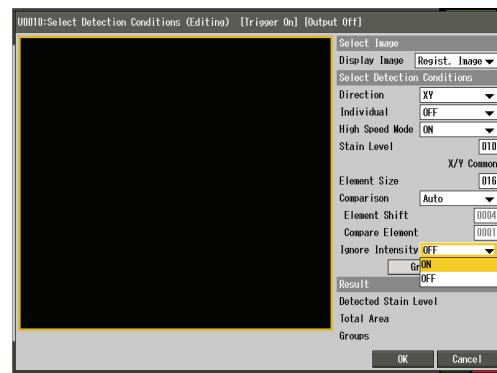
Detection image with fine color stain



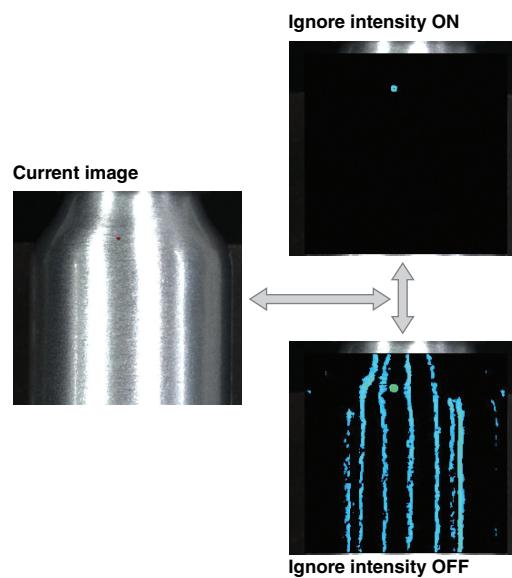
Eliminating intensity (brightness) and detecting stains

The stain detection can be set to ignore intensity (brightness) information and use only the color differences for detection. This allows the elimination of effects caused by glare or lighting changes for stable detection.

To eliminate brightness information using the Edit Unit menu, set [Ignore Intensity] to [ON] in the [Select Detection Conditions] menu (Page 4-129).



- **OFF** (default): Detects changes in H (Hue), S (Saturation) and B (Brightness).
- **ON**: Detects only changes in H (Hue) and S (Saturation).



► Note

When Ignore Intensity is enabled, black and white stains are also removed. To detect black and white stains use [Gray] for [Color Extraction] and use the Shading Correction filter for stable processing (Page 8-35).

Operator and Function List

Parts

Calculations and scripts can be made up of the following parts.

- Constants
- Variables (Page 8-46)
- Operators (Page 8-47)
- Expressions (Page 8-47)
- Statements (Page 8-49)
- Functions
 - Mathematical functions (Page 8-52)
 - Trigonometric functions (Page 8-59)
 - Geometric functions (Page 8-60)
 - Calendar functions (Page 8-72)
 - BIT functions (Page 8-73)

Programming

Functions and lines

- Calculations and scripts are made up of multiple lines.
- Each line can contain a set of elements for defining a single function.
- A function is the smallest unit of execution in a calculation / script.

Comments

- Comments are indicated by a single quotation (') mark.
- Functions after a single quotation (') on the same line are ignored.

Example

```
@a = 100 'Set initial values
'Date created May 23
```

Line continuation

To separate a long line into several lines, use a space and an underscore ("space" + "_").

Example 1 (Correct)

```
IF (@a > 100) AND (@a < 200) THEN ..... (1)
...
END IF
```

Example 2 (Correct)

```
IF (@a > 100) AND _ ..... (2)
(@a < 200) THEN
...
END IF
```

Example 3 (Error)

```
IF (@a > 100) AND ..... (3)
(@a < 200) THEN
...
END IF
```

Example 4 (Correct)

```
@max = Max(@a, @b, @c, _ ..... (4)
@d, @e, @f)
```

Example explanation

- (1) Processed correctly because the function is written on a single line.
- (2) Processed correctly because the line continuation syntax is used.
- (3) Results in an error because the line continuation syntax is missing.
- (4) Example of separating function elements over two lines.

Character Set

Calculations and scripts can be created using the following characters.

Type	Character set
Space	<Space> <TAB>
Letters	ABCDEFGHIJKLMNPQRSTUVWXYZ
	abcdefghijklmnoprstuvwxyz
Numbers	0123456789
Symbols	,.()[]+-*^=<>_@#\$!':%

- Letters are case-sensitive.

Scripts

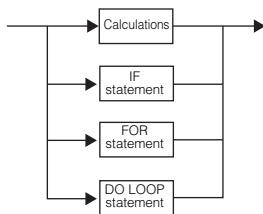
Scripts

Scripts are comprised of statements.



Statements

Statements are categorized into Functions, Calculations, IF, FOR, and DO LOOP statements.



Other

- The maximum number of characters that can be used is 5,000.
- The levels of nesting allowed for parentheses, IF, FOR, and DO LOOP statements is subject to the amount of free memory. If the available memory space is exceeded, a programming error will occur when the calculation is applied, and the cursor moves to the beginning of the expression where the error occurs.

Variables

Temporary variables

- Temporary variables are defined with a @ sign.
- Temporary variables may only be used within the same calculation unit.
- Temporary variables may only be used for processing numbers.
- Temporary variables do not need to be defined in the variables menu.
- The default value for a temporary variable is 0.
- Temporary arrays cannot be defined or used.
- Variable names have to be 32 characters or less including the @ sign.

Example (Correct)

`@a_10`

Example (Error)

`@a_10[10] ... (1)`

Example explanation

- (1) Arrays cannot be used.

Local variables

Local variables can be used anywhere in the calculation / script. Refer to "User variables" (Page 4-306) and "Defining and editing local variables" (Page 4-308) for more information.

Global variables

Global variables can be anywhere in the calculation / script. Refer to "User variables" (Page 4-306) and "Defining and editing global variables" (Page 4-309) for more information.

System variables

System variables can only be used as a reference in a calculation / script.

Unit settings, Unit results

Unit settings and unit results are read only (and can only be used as a reference in a calculation / script). For more information about unit settings and unit results, refer to the XG VisionEditor Reference Manual (Control/Data Edition).

ANS

- ANS is numerical variable that is associated as the result of the calculation unit.
- ANS has to be referenced in uppercase letters.
- ANS on its own can only be populated in a calculation.

Example

ANS=MAX(#a1,#a2,#a3,#a4,#a5)

Reference

ANS is used as the reference value for limits set in a calculation unit.

Expressions and Operators

Mathematical Operators

Mathematical operators can be used for processing numerical values. The following operators are available.

Operator	Description	Syntax	Explanation
$^$	Power	A^B	Raises A to the power of B.
$+$	Positive	$+A$	A
$-$	Negative	$-A$	Inverts A.
$*$	Multiply	$A * B$	Multiplies A by B.
$/$	Divide	A / B	Divides A by B.
MOD	Modulo	$A \text{ MOD } B$	The remainder dividing A by B.
$+$	Add	$A + B$	Adds A and B.
$-$	Subtract	$A - B$	Subtracts B from A.

Comparative Operators

Comparative operators can be used for comparing numerical values and producing a Boolean logic (1 (true) or 0 (false)) result.

Operator	Description	Syntax	Explanation
$=$	Equal to	$A = B$	A is equal to B.
$<>$	Not equal to	$A <> B$	A is not equal to B.
$>$	Greater than	$A > B$	A is greater than B.
$<$	Less than	$A < B$	A is less than B.
$>=$	Greater than or equal to	$A >= B$	A is greater than or equal to B.
$<=$	Less than or equal to	$A <= B$	A is less than or equal to B.

Reference

Comparative operators are executed as 64-bit floating point decimal numbers.

Example

- If $@a$ is equal to $@b$, the result of the statement is TRUE (1), otherwise it is FALSE (0):
 $\text{IF } @a = @b \text{ THEN}$
 \dots
 END IF
- If $@a$ is not equal to $@b$, the result of the statement is TRUE (1), otherwise it is FALSE (0):
 $\text{IF } @a <> @b \text{ THEN}$
 \dots
 END IF

- If @a is greater than @b, the result of the statement is TRUE (1), otherwise it is FALSE (0):

```
IF @a > @b THEN
...
END IF
```
- If @a is less than @b, the result of the statement is TRUE (1), otherwise it is FALSE (0):

```
IF @a < @b THEN
...
END IF
```
- If @a is greater than or equal to @b, the result of the statement is TRUE (1), otherwise it is FALSE (0):

```
IF @a >= @b THEN
...
END IF
```
- If @a is less than or equal to @b, the result of the statement is TRUE (1), otherwise it is FALSE (0):

```
IF @a <= @b THEN
...
END IF
```

► Note

Comparative operators can only be used in conditional statements (such as IF and WHILE) and can not be processed on their own. If a statement such as "@a = @b <> @c", a 0 or 1 is used for defining @a, a programming error will occur.

To define @a, the script must be written using the IF statement as shown.

```
IF @b <> @c THEN
  @a=1
ELSE
  @a=0
END IF
```

Logic Operators

Logic operators can be used in conditional functions for performing true / false operations.

The following logic operators are available.

Operator	Description	Syntax	Explanation
NOT	Logical inverse	NOT A	Inverts A.
AND	Logical multiplication	A AND B	Multiplies A and B.
OR	Logical addition	A OR B	Adds A and B.
XOR	Exclusive OR	A XOR B	Exclusive OR of A and B.

Examples

- If @a is a value other than 1, the result of the statement is TRUE (1), and if it is 1, the expression is FALSE (0):

```
IF NOT (@a = 1) THEN
...
END IF
```
- If @a is greater than -1 and less than +1, the result of the statement is TRUE (1), otherwise it is FALSE (0):

```
IF (@a > -1) AND (@a < +1) THEN
...
END IF
```
- If @a is less than -1 or greater than +1, the result of the statement is TRUE (1), otherwise it is FALSE (0):

```
IF (@a < -1) OR (@a > +1) THEN
...
END IF
```
- If one of @a or @b are 0 and the other value is not 0, the result of the statement is TRUE (1)
If both @a and @b are 0 or both not 0, the result of the statement is FALSE (0):

```
IF (@a = 0) XOR (@b = 0) THEN
```

► Note

- Logic operators can only be used in conditional statements (such as IF and WHILE).
- To process bit / binary data, refer to "BIT Functions" (Page 8-73).

Processing Priority

If a statement contains more than one operator, the order of execution is based on the priority of the operators. Operators are evaluated in the following order.

- (1) Mathematical operators
- (2) Comparative operators
- (3) Logic operators

The priority of operators is shown in the table below.

Operator	Description	Processing Priority
Mathematical Operators	$^$ Power	1
	$+$ Positive	2
	$-$ Negative	
	$*$ Multiply	3
	$/$ Divide	
	MOD Modulo	4
	$+$ Add	5
Comparative Operators	$-$ Subtract	
	$=$ Equal to	
	$<>$ Not equal to	
	$>$ Greater than	
	$<$ Less than	6
	$>=$ Greater than or equal to	
	$<=$ Less than or equal to	
Logic Operators	NOT Logical inverse	7
	AND Logical multiplication	8
	OR Logical addition	9
	XOR Exclusive OR	10

Examples

- IF @a > -1 AND @a < +1 THEN(1)
...
END IF
- IF (@a > -1) AND (@a < +1) THEN.....(2)
...
END IF
- @a = 1 + 2 * 3(3)
- @a = 1 + (2 * 3)(4)
- @a = (1 + 2) * 3(5)

Example explanation

- (1) and (2) result in being processed the same way.
- (3) and (4) result in being processed the same way.
- The result of (3) is 7.
- The result of (4) is 7.
- The result of (5) is 9.

Statements

Assign Values

An item (result, setting, value etc) can be defined to a variable.

- The item on the right of the expression is assigned to the variable on the left of the " $=$ " sign.
- Only items of the same type can be assigned to each other.
- It is not possible to assign an entire array at once.

Syntax

variable = expression

Structure



Example (Correct)

- Assignment of a numerical variable:
`@a = @a + 1`
- Assignment of the X component (numerical value) of a circle to a numerical variable:
`@a = #circle.CX`
- Assignment of the three numerical components of a circle (CX, CY, CR) to a circle type variable:
`#circl_A = #circle`

Example (Error)

- Incorrect assignment of a circle value into a numerical variable:
`@a = #circle`
- Incorrect assignment of a scalar value into a circle variable.
`#circle = @a`
- Incorrect assignment of arrays:
`#A[] = #B[]`

IF THEN Statements

Process a single set of functions as a block from multiple blocks based on the result of a conditional expression.

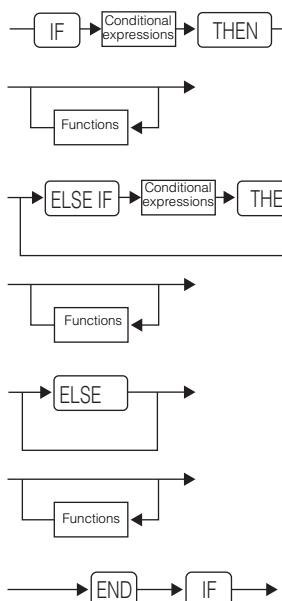
Syntax

```
If <conditional expressions> THEN
  - functions -
  [ELSE IF] <conditional expressions> THEN
  - functions -
  [ELSE]
  - functions -
END IF
```

Reference

The [and] brackets in the syntax shown above can be omitted.

Structure



Explanation

- If the condition in the IF statement is TRUE, the block after THEN are executed after which processing goes to END IF. If the condition is FALSE, processing goes to the next ELSE IF.
- If ELSE IF is not used and the condition is FALSE, processing goes to ELSE.
- If ELSE is not used and the condition is FALSE, processing goes to END IF.
- If the condition in the ELSE IF statement is TRUE, the block after the associated THEN is executed after which processing goes to the END IF.
- If the condition is FALSE, processing goes to the next ELSE IF.
- If ELSE IF is not used and the condition is FALSE, processing goes to ELSE.
- If ELSE is not used and the condition is FALSE, processing goes to END IF.
- The ELSE IF statement can be used as many times as necessary.
- The ELSE statement can only be used as the last ELSE term before END IF.

Examples

```
@a = 4
IF @a < 3 THEN
  @b = 333
ELSE IF @a < 4 THEN
  @b = 444
ELSE IF @a < 5 THEN
  @b = 555
ELSE
  @b = 999
END IF
```

Example Explanation

In the above example, @b is assigned the value of 555.

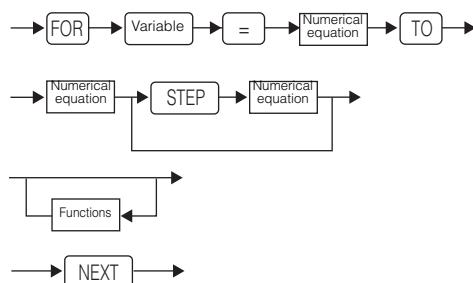
FOR NEXT Statements

Processing a set of functions multiple times in a loop fashion for a specified number of iterations.

Syntax

```
FOR <variable> = <initial value> TO <final value> [STEP <increment>]
  - functions -
NEXT
```

Structure



Explanation

- Before the loop is processed, an initial value is assigned to a variable, which is then incremented each time through the loop. This loop is repeated until the variable value exceeds the final value.
- STEP can be omitted (in which case the incremental value is 1).
- A loop can be exited using the EXIT FOR statement. Processing resumes at the line following the NEXT statement.

Examples

```
@a = 0
FOR @i = 1 TO 10
  @a = @a + @i
  IF @a > 11 THEN
    EXIT FOR
  END IF
NEXT
```

Example explanation

In the above example, @a is assigned the value of 15.

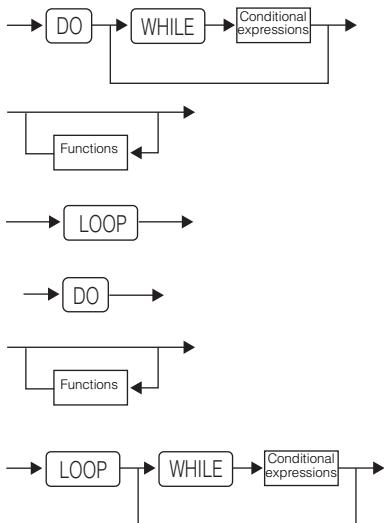
DO LOOP statement

Processing a set of functions multiple times in a loop fashion while a conditional statement is true.

Syntax

- Pre-loop evaluation:
DO WHILE <conditional expressions> - functions - LOOP
- Post loop evaluation:
DO -functions- LOOP WHILE <conditional expressions>

Structure



Explanation

The DO statement uses pre-loop evaluation when the condition is written after the DO statement and post-loop evaluation when the condition is written after the LOOP statement.

- In the pre-loop evaluation, the loop condition must be true in order to process the functions below. When processing reaches the LOOP statement, it returns to the DO statement. If the conditional expression is false, the loop is finished and processing resumes on the line after the LOOP statement.
- In the post loop evaluation, the functions in the loop are processed first and then the loop condition is checked. If true, processing returns to the DO statement, otherwise the loop is finished and processing resumes on the next line.
- The loop condition can be omitted (resulting in an endless loop).
- A DO... LOOP can be exited using the EXIT DO statement in the loop after the desired condition. Processing resumes on the next line after the LOOP statement LOOP. If WHILE is omitted the loop function must include EXIT DO.

Examples

(Pre-loop evaluation)

$@a = 0$

$@i = 0$

DO WHILE $@i < 10$

$@i = @i + 1$

$@a = @a + @i$

LOOP(1)

(Post loop evaluation)

$@a = 0$

$@i = 10$

DO

$@i = @i + 1$

$@a = @a + @i$

LOOP WHILE $@i < 10$ (2)

Example explanation

(1) In the above example @a is assigned the value of 10.

(2) In the above example @a is assigned the value of 11.

Mathematical Functions

► Note

The sample calculations given in the following explanations may be not be precise due to computational errors inherent with processors.

Abs (P)

Calculates the absolute value of P.

Terms

P: constant, numerical variable, or a function that results in a numerical value

Result type

Numerical value

Examples

`@a = -128`

`@a = Abs(@a)`

Example explanation

`@a` is set to a value of 128.

AsCircle (P1, P2, P3)

Assigns P1 as the X center coordinate of a circle, P2 to as Y center coordinate, and P3 as the radius R.

Terms

- P1: X center coordinate (constant, numerical variable, or a function that results in a numerical value)
- P2: Y-coordinate value of center (constant, numerical variable, or a function that results in a numerical value)
- P3: radius value (constant, scalar variable, or a function that results in a numerical value)

Result type

Circle data

Examples

`#C[0] = AsCircle(10, 20, 30)`

Example explanation

This example produces the same results as these operations.

`#C[0].CX = 10`

`#C[0].CY = 20`

`#C[0].CR = 30`

AsLine (P,D)

Assigns P to ρ of a line, and D to θ .

Terms

- P: value of ρ (constant, numerical variable, or a function that results in a numerical value)
- D: value of θ (expressed in degrees) (constant, numerical variable, or a function that results in a numerical value)

Result type

Line data

Examples

`#L[0] = AsLine(10, 45)`

Example explanation

This example produces the same results as these operations.

`L[0].RH = 10`

`L[0].T = 45`

AsPoint (P1, P2)

Assigns P1 as the X coordinate of a position, and P2 as the Y coordinate.

Terms

- P1: X-coordinate (constant, numerical variable, or a function that results in a numerical value)
- P2: Y-coordinate (constant, scalar variable, or a function that results in a numerical value)

Result type

Position data

Examples

`#P[0] = AsPoint(10, 20)`

Example explanation

This example produces the same results as these operations.

`#P[0].X = 10`

`#P[0].Y = 20`

Atoi (N, P[])

Converts each value in the scalar array P[] from ASCII decimal code (numbers only) to its correct integer.

- The conversion is carried out until a non-numerical ASCII code is reached or the number of variables (N) is processed).
- No error occurs if the array contains a non-numerical ASCII code.

Terms

- N: number of variables (a constant that represents the number of digits in a number, numerical variable, or a function that results in a numerical value)
- P[]: scalar array variable

Result type

Numerical value

Causes of Errors

- An error occurs if N is set to a value less than 1.
- An error occurs if there are fewer elements in the array than specified by N.

Examples

```
#P[0] = 50 .....(1)
#P[1] = 48 .....(2)
#P[2] = 48 .....(3)
#P[3] = 54 .....(4)
@YEAR = Atoi(4,#P[]) .....(5)
#Q[0] = 50.....(6)
#Q[1] = 48.....(7)
#Q[2] = 65.....(8)
#Q[3] = 54.....(9)
@a = Atoi(4,#Q[]).....(10)
#P[0] = 50 .....(11)
#P[1] = 48 .....(12)
#P[2] = 48 .....(13)
#P[3] = 54 .....(14)
@a = Atoi(10,#P[]).....(15)
```

Example explanation

- ASCII '2'
- ASCII '0'
- ASCII '0'
- ASCII '6'
- @YEAR=2006.
- ASCII '2'
- ASCII '0'
- ASCII 'A'
- ASCII '6'
- @a is set to a value of 20 (no error generated).
- ASCII '2'
- ASCII '0'
- ASCII '0'
- ASCII '6'
- Generates an error.

Ave (P0, P1, ..., Pn)

Calculates the average value of P0-Pn (Maximum of 40 terms).

Terms

P0 - Pn: constant, numerical variable, or a function that results in a numerical value

Result type

Numerical value

Causes of Errors

- An error occurs if none of the terms P0 - Pn are specified.
- An error occurs if P0 - Pn is more than 40 terms.

Examples

```
@a = 8
@b = 9
@c = 2
@d = 3
@ave = Ave(@a, @b, @c, @d)
```

Example explanation

@ave is set to a value of 5.5.

Ave2 (N, P[])

Calculates the average of an array P[0] - P[N-1].

Terms

- N: constant, numerical variable, or a function that results in a numerical value
- P[]: numerical array variable

Result type

Numerical value

Causes of Errors

- An error occurs if N is set to a value of less than 1.
- An error occurs if there are fewer elements in the P[] array than N.

Examples

```
#a[0] = 8
#a[1] = 9
#a[2] = 2
#a[3] = 3
@ave2 = Ave2(4, #a[])
```

Example explanation

@ave2 is set to a value of 5.5.

AveR (Max, Min, P0, P1, ..., Pn)

Calculates the average value of terms that fall between a specified Min-to-Max range from P0-Pn (Maximum of 40 terms).

- The function will still calculate the average if Min and Max are reversed.
- Results in 0 if none of terms P0 to Pn fall between the Min-to-Max range.

Terms

- Max: maximum value. Constant, numerical variable, or a function that results in a numerical value
- Min: minimum value. Constant, numerical variable, or a function that results in a numerical value
- P0 - Pn: constant, numerical variable, or a function that results in a numerical value

Result type

Numerical value

Causes of Errors

- An error occurs if none of the terms P0 - Pn are specified.
- An error occurs if P0 - Pn is more than 40 terms.

Examples

```
@max = 25
@min = 20
@a = 21
@b = 26
@c = 23
@aver = AveR(@max, @min, @a, @b, @c)
```

Example explanation

@aver is set to a value of 22.

AveR2 (Max, Min, N, P[])

Calculates the average value of terms that fall between a specified Min-to-Max range from array P[0]-P[N-1].

- The function will still calculate the average if the Min and Max are reversed.
- Results in 0 if all the terms in P[] are outside the range.

Terms

- Max: maximum value. Constant, numerical variable, or a function that results in a numerical value
- Min: minimum value. Constant, numerical variable, or a function that results in a numerical value
- N: constant, numerical variable, or a function that results in a numerical value
- P[]: numerical array variable

Result type

Numerical value

Causes of Errors

- An error occurs if N is set to a value of less than 1.
- An error occurs if there are fewer elements in the P[] array than N.

Examples

```
@max = 25
@min = 20
#a[0] = 21
#a[1] = 26
#a[2] = 23
@aver2 = AveR2(@max, @min, 3, #a[])
```

Example explanation

@aver2 is set to a value of 22.

Ceil (P)

Rounds P up to the nearest integer.

Terms

P: constant, numerical variable, or a function that results in a numerical value

Result type

Numerical value

Comparison between rounding functions
(Int, Floor, Round, and Ceil)

Value of P	Int (P)	Floor (P)	Round (P)	Ceil (P)
1.5	1	1	2	2
1.4	1	1	1	2
-1.4	-1	-2	-1	-1
-1.5	-1	-2	-2	-1

Deg (P)

Converts the angle P from radians into degrees.

Terms

P: constant, scalar variable, or function that results a scalar value in radians

Result type

Numerical value (units: degrees (°))

Examples

```
@a = Deg(3.14)
```

Example explanation

@a is set to a value of 179.909.

Exp ()

Returns the exponential base value e (2.71828183...).

Terms

None

Result type

Numerical value

Examples

`@a = Exp()`

Example explanation

`@a` is set to a value of 2.718....

Floor (P)

Rounds P down to the closest integer.

Terms

P: constant, numerical variable, or a function that results in a numerical value

Result type

Numerical value

Reference

Refer to "Comparison between rounding functions (Int, Floor, Round, and Ceil)" (Page 8-54) for more details about the differences between Floor and Int.

Int (P)

Returns the integer of P.

Terms

P: constant, numerical variable, or a function that results in a numerical value

Result type

Numerical value

Reference

Refer to "Comparison between rounding functions (Int, Floor, Round, and Ceil)" (Page 8-54) for more details about the differences between Floor and Int.

Ln (P)

Calculates the natural logarithm of P.

Terms

P: constant, numerical variable, or a function that results in a numerical value

Result type

Numerical value

Causes of Errors

An error occurs if the value of P is less than 0.

Examples

`@e = Exp()`

`@a = Ln(@e)`

Example explanation

`@a` is set to a value of 1.

Log (P)

Calculates the common logarithm (base 10) of P.

Terms

P: constant, numerical variable, or a function that results in a numerical value

Result type

Numerical value

Causes of Errors

An error occurs if the value of P is less than 0.

Examples

`@a = Log(10)`

Example explanation

`@a` is set to a value of 1.

Max (P0, P1, ..., Pn)

Calculates the largest value in P0 - Pn (Maximum of 40 items)

Terms

P0 - Pn: constant, numerical variable, or a function that results in a numerical value

Result type

Numerical value

Causes of Errors

- An error occurs if none of the terms from P0 - Pn are specified.
- An error occurs if P0 - Pn is more than 40 terms.

Examples

`@a = 8`

`@b = 9`

`@c = 2`

`@d = 3`

`@max = Max(@a, @b, @c, @d)`

Example explanation

`@max` is set to a value of 9.

Max2 (N, P[])

Calculates the largest value of an array P[0] - P[N-1].

Terms

- N: constant, numerical variable, or a function that results in a numerical value
- P[]: numerical array variable

Result type

Numerical value

Causes of Errors

- An error occurs if N is set to a value of less than 1.
- An error occurs if there are fewer elements in the P[] array than N.

Examples

```
#a[0] = 8
#a[1] = 9
#a[2] = 2
#a[3] = 3
@max2 = Max2(4, #a[])
```

Example explanation

@max2 is set to a value of 9.

MaxN (P0, P1, ..., Pn)

Returns the location (from 0 to n) of the largest value in P0 - Pn (maximum of 40 terms).

Terms

P0 - Pn: constant, numerical variable, or a function that results in a numerical value

Result type

Numerical value

Causes of Errors

- An error occurs if none of the terms from P0 - Pn are specified.
- An error occurs if P0 - Pn is more than 40 terms.

Examples

```
@a = 8
@b = 9
@c = 2
@d = 3
@maxn = MaxN(@a, @b, @c, @d)
```

Example explanation

@maxn is set to a value of 1.

MaxN2 (N, P[])

Returns the location (from 0 to N-1) of the largest value in an array P[0] - P[N-1].

Terms

- N: constant, numerical variable, or a function that results in a numerical value
- P[]: numerical array variable

Result type

Numerical value

Causes of Errors

- An error occurs if N is set to a value of less than 1.
- An error occurs if there are fewer elements in the P[] array than N.

Examples

```
#a[0] = 8
#a[1] = 9
#a[2] = 2
#a[3] = 3
@maxn2 = MaxN2(4, #a[])
```

Example explanation

@maxn2 is set to a value of 1.

Min (P0, P1, ..., Pn)

Calculates the smallest value in P0 - Pn (maximum of 40 terms).

Terms

P0 - Pn: constant, numerical variable, or a function that results in a numerical value

Result type

Numerical value

Causes of Errors

- An error occurs if none of the terms from P0 - Pn are specified.
- An error occurs if P0 - Pn is more than 40 terms.

Examples

```
@a = 8
@b = 9
@c = 2
@d = 3
@min = Min (@a, @b, @c, @d)
```

Example explanation

@min is set to a value of 2.

Min2 (N, P[])

Calculates the smallest value of an array P[0] - P[N-1].

Terms

- N: constant, numerical variable, or a function that results in a numerical value
- P[]: numerical array variable

Result type

Numerical value

Causes of Errors

- An error occurs if N is set to a value of less than 1.
- An error occurs if there are fewer elements in the P[] array than N.

Examples

```
#a[0] = 8
#a[1] = 9
#a[2] = 2
#a[3] = 3
@min2 = Min2(4, #a[])
```

Example explanation

@min is set to a value of 2.

Min (P0, P1, ..., Pn)

Returns the location (from 0 to n) of the smallest value in P0-Pn (maximum of 40 terms).

Terms

P0 - Ph: constant, numerical variable, or a function that results in a numerical value

Result type

Numerical value

Causes of Errors

- An error occurs if none of the terms from P0 - Pn are specified.
- An error occurs if P0 - Pn is more than 40 terms.

Examples

```
@a = 8
@b = 9
@c = 2
@d = 3
@minn = MinN(@a, @b, @c, @d)
```

Example explanation

@minn is set to a value of 2.

MinN2 (N, P[])

Returns the location (from 0 to N-1) of the smallest value in an array P[0] - P[N-1].

Terms

- N: constant, numerical variable, or a function that results in a numerical value
- P[]: numerical array variable

Result type

Numerical value

Causes of Errors

- An error occurs if N is set to a value of less than 1.
- An error occurs if there are fewer elements in the P[] array than N.

Examples

```
#a[0] = 8
#a[1] = 9
#a[2] = 2
#a[3] = 3
@minn2 = MinN2(4, #a[])
```

Example explanation

@minn2 is set to a value of 2.

Pi ()

Returns the value of π (3.141592654).

Terms

None

Result type

Numerical value

Reference

180 (deg) = π (radian).

Rad (D)

Converts the angle P from degrees to radians.

Terms

D: constant, numerical variable, or a function that results in a numerical value in degrees ($^{\circ}$)

Result type

Numerical value in radians

Examples

@a = Rad(30)

Example explanation

@a is set to a value of 0.523.

Round (P)

Rounds P up or down to the nearest integer.

Terms

P: constant, numerical variable, or a function that results in a numerical value

Result type

Numerical value

Sort (N, P[], P1)

Sorts an array P[0] - P[N-1] in descending order. Then returns the value at location P1 from the newly sorted array P[0] - P[N-1].

Terms

- N: number of variables
- P[]: numerical array variable
- P1: location (0-n in descending order)

Result type

Numerical value

Causes of Errors

- An error occurs if N is set to a value of less than 1.
- An error occurs if there are fewer elements in the P[] array than N.
- If I%InDataFieldbus[] is used as the array variable P[] an error occurs as the system variable cannot be rewritten.
- An error occurs if the value of P1 is less than 0 or greater than or equal to N.
- An error occurs if there is not enough memory to processing the function.

Examples

```
#P[0] = 5
#P[1] = 10
#P[2] = 0
#P[3] = 9
#P[4] = 1
@a = Sort(5,#P[],2)
```

Example explanation

Sorting the elements in #P[] produces [10, 9, 5, 1, 0]. An index location of 2 returns the 3rd element from the largest value, so @a is set to a value of 5.

Reference

To return a value based on ascending order use the function below using Q as the location of the value:
Sort(N, P[], N-Q-1).

Sqr (P)

Calculates P to the power of 2.

Terms

P: constant, numerical variable, or a function that results in a numerical value

Result type

Numerical value

Examples

```
@a = 2
@a = Sqr(@a)
```

Example explanation

@a is set to a value of 4.

Sqrt (P)

Calculates the square root of P.

Terms

P: constant, numerical variable, or a function that results in a numerical value

Result type

Numerical value

Causes of Errors

An error occurs if the value of P is negative.

Examples

```
@a = 256
@a = Sqr(@a)
```

Example explanation

@a is set to a value of 16.

Sum (N, P[])

Calculates the total sum of items in a numerical array P[0] - P[N-1].

Terms

- N: number of variables
- P[]: numerical array variable

Result type

Numerical value

Causes of Errors

- An error occurs if N is set to a value of less than 1.
- An error occurs if there are fewer elements in the P[] array than N.

Examples

```
#P[0] = 1
#P[1] = 2
#P[2] = 3
#P[3] = 4
#P[4] = 5
@a = Sum(5,#P[])
```

Example explanation

@a is set to a value of 15.

Trigonometric Functions

Acos (P)

Calculates angle of an arc of a right angled triangle based on (P) (adjacent / hypotenuse).

Terms

P: constant, numerical variable, or a function that results in a numerical value in the range of -1 to 1

Result type

Numerical value (0 to 180) (units: degrees (°))

Causes of Errors

An error occurs if the value of P1 falls outside of -1.0 to +1.0.

Examples

`@d = Acos(0.5)`

Example explanation

`@d` is set to a value of 60(°).

Asin (P)

Calculates the angle of an arc of a right angled triangle based on (P) (opposite / hypotenuse).

Terms

P: constant, numerical variable, or a function that results in a numerical value within the range of -1 to 1

Result type

Numerical value (-90 to 90) (units: degrees (°))

Causes of Errors

An error occurs if the value of P1 falls outside of -1.0 to +1.0.

Examples

`@d = Asin (0.5)`

Example explanation

`@d` is set to a value of 30(°).

Atan (P)

Calculates the angle of an arc for a right angled triangle based on (P) (opposite / adjacent).

Terms

P: constant, numerical variable, or a function that results in a numerical value

Result type

Numerical value (-90 to 90) (units: degrees (°))

Examples

`@d = Atan(1)`

Example explanation

`@d` is set to a value of 45(°).

Atan2 (P1, P2)

Calculates the angle of an arc of a right angled triangle based of off two values (P1, P2) representing opposite and adjacent.

- $P1 > 0 \rightarrow 90$
- $P1 < 0 \rightarrow -90$
- $P1 = 0 \rightarrow \text{error}$

Terms

P1, P2: constant, numerical variable, or function that results in a numerical value

Result type

Numerical value (-180 to 180) (units: degrees (°))

Causes of Errors

An error occurs if both P1 and P2 are 0.

Examples

`@d = Atan2 (1, 1)`

Example explanation

`@d` is set to a value of 45 (°).

Cos (D)

Calculates adjacent, hypotenuse ratio for a right angled triangle based on an arc (D) (°).

Terms

D: constant, numerical variable, or function that results in a numerical value in degrees (°)

Result type

Numerical value

Examples

`@a = Cos (60)`

Example explanation

`@a` is set to a value of 0.5.

Sin (D)

Calculates opposite, hypotenuse ratio for a right angled triangle based on an arc (D) (°).

Terms

D: constant, numerical variable, or a function that results in a numerical value in degrees (°)

Result type

Numerical value

Examples

`@a = Sin (30)`

Example explanation

`@a` is set to a value of 0.5.

Tan (D)

Calculates opposite, adjacent ratio for a right angled triangle based on an arc (D) (°).

Terms

D: constant, numerical variable, or a function that results in a numerical value in degrees (°)

Result type

Numerical value

Examples

`@d = Tan(45)`

Example explanation

`@a` is set to a value of 1.

Geometric Functions

AddVector (Q1, Q2)

Calculates the sum of two X,Y positions.

Terms

Q1, Q2: position variable or a function that results in position data

Result type

Position data

Examples

```
#P1=(1,1)
#P2=(2,2)
#p = AddVector(#P1, #P2)
```

Example explanation

`#p` is set to a value of (3,3).

AngC (D1, D2)

Calculates the center angle between D1 (°) and D2 (°) as calculated from the angle D1 in the clockwise direction.

Terms

D1, D2: constant, numerical variable, or a function that results in numerical value in degrees (°)

Result type

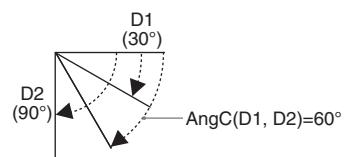
Numerical value (units: degrees (°))

Examples

`@a = AngC(30, 90)`

Example explanation

`@a` is set to a value of 60(°).



Angle (Q1, Q2)

Calculates the angle formed by the horizontal axis and the line through positions Q1 to Q2.

- Calculates the angle with Q1 as the point of rotation.
- The angle is calculated in a clockwise direction.

Terms

Q1, Q2: position variable or a function that results in position data

Result type

Scalar numerical (units: degrees (°))

Causes of Errors

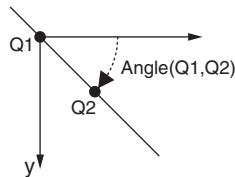
An error occurs if Q1 and Q2 are the same value.

Examples

```
#Q1.X = 0
#Q1.Y = 0
#Q2.X = 1
#Q2.Y = 1
#ang = Angle(#Q1, #Q2)
```

Example explanation

#ang is set to a value of 45(°).



AngW (D1, D2)

Calculates the arc between D1 (°) and D2 (°) as calculated from the angle D1 in the clockwise direction.

Terms

D1, D2: constant, numerical variable, or a function that results in a numerical value in degrees (°)

Result type

Scalar numerical (units: degrees (°))

Example 1

@a = AngW(30, 90)

Example 1 explanation

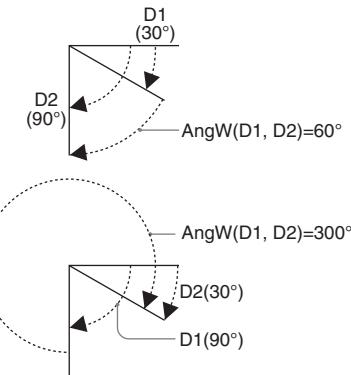
@a is set to a value of 60(°).

Example 2

@a = AngW(90, 30)

Explanation of example 2

@a is set to a value of 300(°).



Circle3 (Q1, Q2, Q3)

Calculates the circle that passes through three X,Y positions (Q1, Q2, Q3).

Terms

Q1, Q2, Q3: position variable or a function that returns in position data

Result type

Circle data

Causes of Errors

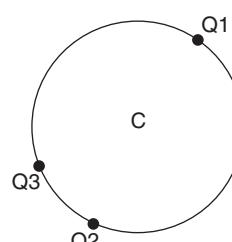
An error occurs if two or more points are the same coordinate, or if all three points are in a single line.

Examples

```
#P[0].X = 10
#P[0].Y = 0
#P[1].X = 0
#P[1].Y = 10
#P[2].X = 10
#P[2].Y = 20
#c = Circle3(#P[0], #P[1], #P[2])
```

Example explanation

The values are set as follows: #c.CX = 10, #c.CY = 10, and #c.CR = 10.



CircleLs (N, Q[], P)

Calculates a circle based on a group of X,Y positions Q[0] to Q[N-1] using the least-squares method.

Terms

- N: number of points
- Q[]: position array
- P: Use correction (0: no correction, 1: correction).

Result type

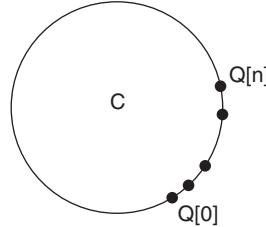
Circle data

Causes of Errors

- An error occurs if the number of points N exceeds 10,000.
- An error occurs if there are fewer than 3 points N.
- An error occurs if the value of P is neither 0 nor 1.
- An error occurs if there are fewer elements in the Q[] array than N.
- An error occurs if the function cannot find a circle from the group of points.

Examples

```
#C = CircleLs(5, #Q[], 1)
```



CircleTangent (C, Q, P)

Calculates two points on circle (C) based on tangent lines connecting position (Q) and circle (C).

Terms

- C: circle variable or a function that results in circle data
- Q: position variable or a function that results in position data
- P: constant, numerical variable, or a function that results in a numerical value
 - 0: returns the left intersect point (Q0) on the circle (C) when looking at position (Q) from the circle (C).
 - 1: returns the left intersect point (Q1) on the circle (C) when looking at position (Q) from the circle (C).

Result type

Position data

Causes of Errors

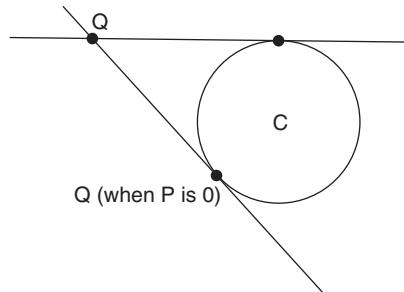
- An error occurs if point Q is inside the circle.
- An error occurs if the value of P is neither 0 nor 1.

Examples

```
#circle.CX = 10
#circle.CY = 10
#circle.CR = 10
#P[0].X = -10
#P[0].Y = 10
#p0 = CircleTangent(#circle, #P[0], 0)....(1)
#p1 = CircleTangent(#circle, #P[0], 1)....(2)
```

Example explanation

- (1) Intersect position (5, 18.660).
- (2) Intersect position (5, 1.329).



ConvCrd (Q1, Q2, D, P)

Converts the X, Y position Q1 in terms of the origin set at Q2, rotated D degrees and scaled by P (Q1, Q2: position variable or a function that results in position data).

Terms

- Q1, Q2: position variable or a function that results in position data
- D: constant, numerical variable, or a function that results in a numerical value in degrees ($^{\circ}$)
- P: constant, numerical variable, or a numerical value

Result type

Position data (units: pixels)

Causes of Errors

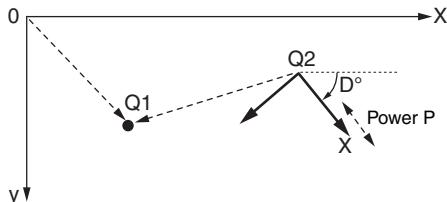
An error occurs if the value of P is zero.

Examples

```
#P[1].X = 10
#P[1].Y = 10 + 10 * Sqrt(2)
#P[2].X = 10
#P[2].Y = 10
#p = ConvCrd(#P[1], #P[2], 45, 1)
```

Example explanation

#p is set with a value of (10, 10).



ConvCrd2 (Q1, Q2, D, P1, P2)

Converts the X, Y position of Q1 in terms of the origin set at Q2, rotated D degrees, scaled by P1 and axis system P2.

Terms

- Q1, Q2: position variable or a function that results in position data
- D: constant, numerical variable, or a function that results in a numerical value in degrees ($^{\circ}$)
- P1: constant, numerical variable, or a numerical value
 - 0: if the positive side of the Y axis faces the same way in the source and destination
 - 1: if the positive side of the Y axis faces in the opposite direction between the source and destination
- P2: constant, numerical variable, or a numerical value

Result type

Position data

Causes of Errors

- An error occurs if the value of P is zero.
- An error occurs if the value of P2 is neither 0 nor 1.

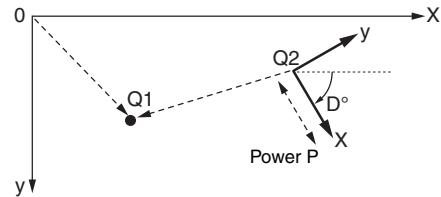
Examples

```
#Q1.X = 10
#Q1.Y = 10 + 10 * Sqrt(2)
#Q2.X = 10
#Q2.Y = 10
#Q3 = ConvCrd2(#Q1, #Q2, 45, 1, 0)..... (1)
#Q3 = ConvCrd2(#Q1, #Q2, 45, 1, 1)..... (2)
```

Example explanation

(1) #Q3 is set with a value of (10, 10).

(2) #Q3 is set with a value of (10, -10).



ConvPixToWld (Q, CALIB[])

Converts an X,Y position on a pixel coordinate system to an X,Y position on a world coordinate system.

Terms

- Q: position variable or a function that results in position data
- CALIB[]: numerical array variable with 28 elements, or result data from a calibration unit [Calibration Model Parameters] (RSLT.CALIB[])

Result type

Position data

Causes of Errors

- An error occurs if CALIB[] has more or fewer than 28 elements.
- An error occurs if the values in the CALIB[] cannot be converted, i.e., when the elements contain illegal values.

Examples

#P=ConvPixToWld(#p, #CALIB[])

Example explanation

Pixel coordinates #p are converted to world coordinates #P using the calibration model parameters (#CALIB[]).

► Note

- When using the calibration model parameters (RSLT.CALIB[]) where the calibration unit is configured to generate a calibrated image, the conversion is done between the pixel and world coordinates of the calibrated image. If the calibration unit is not configured to generate a calibrated image, the conversion is done between the pixel and world coordinates of the current image.
- Positions converted using ConvPixToWld may not match exactly with the original positions when converted back (or vice versa) using ConvWldToPix.
- Positions that have been adjusted using position adjustment or scaling may not convert properly. Positions should be specified using an absolute value (AB).

ConvWldToPix (Q, CALIB[])

Converts an X,Y position on a world coordinate system to an X,Y position on a pixel coordinate system.

Terms

- Q: position variable or a function that results in position data
- CALIB[]: numerical array variable with 28 elements, or result data from a calibration unit [Calibration Model Parameters] (RSLT.CALIB[])

Result type

Position data

Causes of Errors

- An error occurs if CALIB[] has more or fewer than 28 elements.
- An error occurs if the values in the CALIB[] cannot be converted, i.e., when the elements contain illegal values.

Examples

#P=ConvWldToPix(#p, #CALIB[])

Example explanation

World coordinates #p are converted to pixel coordinates #P using the calibration model parameters (#CALIB[]).

► Note

- When using the calibration model parameters (RSLT.CALIB[]) where the calibration unit is configured to generate a calibrated image, the conversion is done between the pixel and world coordinates of the calibrated image. If the calibration unit is not configured to generate a calibrated image, the conversion is done between the pixel and world coordinates of the current image.
- Positions converted using ConvWldToPix may not match exactly with the original positions when converted back (or vice versa) using ConvPixToWld.

Dist (Q1, Q2)

Calculates the distance between two X,Y positions Q1 and Q2.

Terms

Q1, Q2: position variable or a function that results in position data

Result type

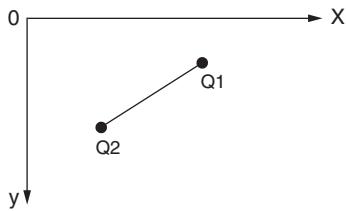
Numerical value (units: pixels)

Examples

```
#Q1.X = 70
#Q1.Y = 20
#Q2.X = 30
#Q2.Y = 50
#distance = Dist(#Q1, #Q2)
```

Example explanation

#distance is set to a value of 50.



I2Circle (C1,C2,P)

Calculates two intersecting points of two circles (C1 and C2). The points will be the same value if the circles are touching but not passing through each other.

Terms

- C1, C2: circle variable or a function that results in a circle data
- P: constant, numerical variable, or a function that results in a numerical value
 - 0: returns the left intersect point when looking at the line passing through the intersecting points (Q0, Q1) from the center of circle (C1).
 - 1: returns the right intersect point when looking at the line passing through the intersecting points (Q0, Q1) from the center of circle (C1).

Result type

Position data (units: pixels)

Causes of Errors

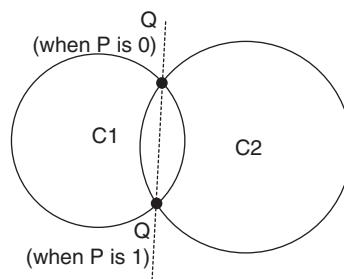
- An error occurs if the circles do not intersect.
- An error occurs if the value of P is neither 0 nor 1.

Examples

```
#Circle[0].CX = 10
#Circle[0].CY = 10
#Circle[0].CR = 10
#Circle[1].CX = 20
#Circle[1].CY = 20
#Circle[1].CR = 10
#point0 = I2Circle(#Circle[0], #Circle[1], 0)...(1)
#point1 = I2Circle(#Circle[0], #Circle[1], 1)...(2)
```

Example explanation

- (1) Intersect position is (20,10).
- (2) Intersect position is (10,20).



ILineCircle (C,L,P)

Calculates the two intersecting points of a circle (c) and a line (L). The points will be the same value if the circles and line are touching but not passing through each other.

Terms

- C: circle variable or a function that results in circle data
- L: line variable or a function that results in line data
- P: constant, numerical variable, or a function that results in a numerical value
 - 0: returns the left intersect point when looking at the line (L) from the center of circle (C).
 - 1: returns the right intersect point when looking at the line (L) from the center of circle (C).

Result type

Position data (units: pixels)

Causes of Errors

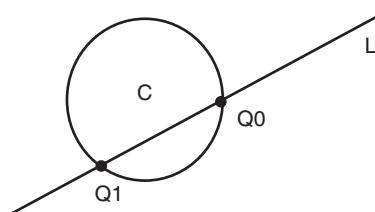
- An error occurs if the circle and line do not intersect.
- An error occurs if the value of P is neither 0 nor 1.

Examples

```
#circle.CX = 10
#circle.CY = 10
#circle.CR = 10
#line.RH = 15 * Sqrt(2) .....(1)
#line.T = 45
#point0 = ILineCircle(#circle, #line, 0)....(2)
#point1 = ILineCircle(#circle, #line, 1)....(3)
```

Example explanation

- (1) Represents line $y = -x + 30$.
- (2) Intersect position is (20,10).
- (3) Intersect position is (10,20).



InnerProd (Q1, Q2)

Calculates the inner product of two X,Y positions Q1 and Q2.

Terms

Q1, Q2: position type variable or a function that results in position data

Result type

Numerical value

Examples

```
#P1=(1,1)
#P2=(2,2)
@a = InnerProd( #P1, #P2 )
```

Example explanation

@a is set to a value of 4 ($\#P1.X * \#P2.X + \#P1.Y * \#P2.Y$).

ISect (L1, L2)

Calculates the intersecting point of line L1 and line L2.

Terms

L1, L2: line variable or a function that results in line data

Result type

Position data (units: pixels)

Causes of Errors

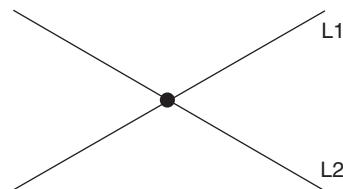
An error occurs if L1 and L2 are parallel.

Examples

```
#Point[0].X = 20
#Point[0].Y = 0
#Point[1].X = 0
#Point[1].Y = 10
#Point[2].X = 0
#Point[2].Y = 0
#Point[3].X = 20
#Point[3].Y = 10
#point = ISect(Line(#Point[0],#Point[1]), Line _(#Point[2],#Point[3]))
```

Example explanation

Intersecting position is (5,5).



Line (Q1, Q2)

Calculates the line between X,Y positions Q1 and Q2.

Terms

Q1, Q2: position variable or a function that results in position data

Result type

Line data

Causes of Errors

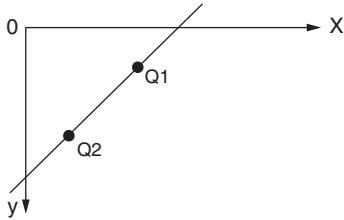
An error occurs if Q1 and Q2 are the same value.

Examples

```
#Q1.X = 50
#Q1.Y = 20
#Q2.X = 20
#Q2.Y = 50
#line = Line(#Q1, #Q2)
```

Example explanation

#line.T is set to a value of 45°, #line.RH to 49.497.



LineLs (N,Q[],P)

Calculates a line based on a group of X,Y positions Q[0] to Q[N-1] using the least-squares method.

Terms

- N: number of points
- Q[]: Position array
- P: Use correction (0: no correction, 1: correction)

Result type

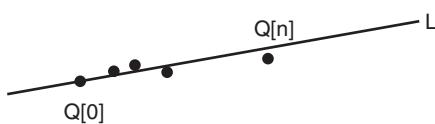
Line data

Causes of Errors

- An error occurs if the number of points N exceeds 10,000.
- An error occurs if there are fewer than 2 points N.
- An error occurs if the value of P is neither 0 nor 1.
- An error occurs if there are fewer elements in the Q[] array than N.
- An error occurs if the function cannot find a line from the group of points.

Examples

#L=LineLs(6, #Q[], 1)



LLAngle (L1, L2)

Calculates the angle ($0^\circ < \theta < 180^\circ$) formed by lines L1 and L2 where the angle is the absolute difference of the angle formed by L1 and L2 with a horizontal line measured in the same direction (clockwise / anti-clockwise).

Terms

L1, L2: line variable or a function that results in line data

Result type

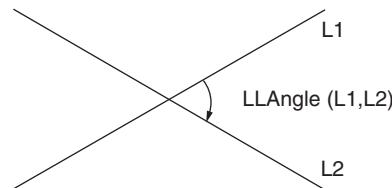
Numerical value (units: degrees (°))

Examples

```
#Line[0].T = 60
#Line[0].RH = Sqrt(3) / 2
#Line[1].T = 120
#Line[1].RH = 0
#angle = LLAngle(#Line[0], #Line[1])
```

Example explanation

#ang is set to a value of 60(°).



LnAngle (L)

Calculates the angle ($-90^\circ < \theta < 90^\circ$) formed by line L and a horizontal line with the horizontal line being 0 degrees and positive values calculated in the clockwise direction.

Terms

L: line variable or a function that results in line data

Result type

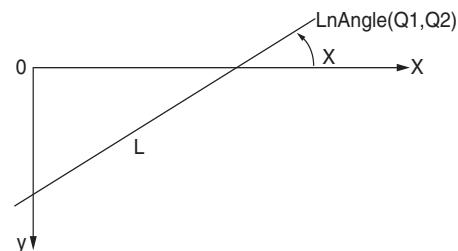
Numerical value (units: degrees (°))

Examples

```
#line.T = 60
#line.RH = Sqrt(3) / 2
#ang = LnAngle(#line)
```

Example explanation

#ang is set to a value of -30(°).



LnDist (L, Q)

Calculates the perpendicular distance between line L and X,Y position Q.

Terms

- L: line variable or a function that results in line data
- Q: position variable or a function that results in position data

Result type

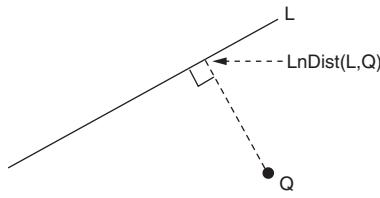
Numerical value (units: pixels)

Examples

```
#p0.X = 0
#p0.Y = 0
#line.T = 60
#line.RH = 1.5
#distance = LnDist(#line, #p0)
```

Example explanation

#distance is set to a value of 1.5.



LnDistP (L, Q)

Calculates the signed perpendicular distance between line L and X,Y position Q.

Terms

- L: line variable or a function that results in line data
- Q: position variable or a function that results in position data

Result type

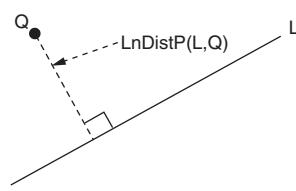
Numerical value (units: pixels)

Examples

```
#p0.X = 0
#p0.Y = 0
#line.T = 60
#line.RH = 1.5
#distance = LnDistP(#line, #p0)
```

Example explanation

#distance is set to a value of -1.5.



LnDistXY (L, Q)

Calculates the intersecting point between the line L and the perpendicular line from X,Y position Q.

Terms

- L: line variable or a function that results in line data
- Q: position variable or a function that results in position data

Result type

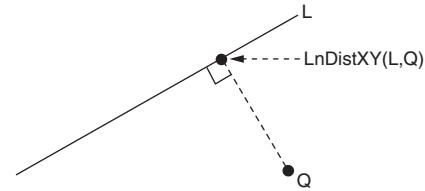
Position data (units: pixels)

Examples

```
#P[0].X = 10
#P[0].Y = 10
#line.T = 45
#line.RH = 5 * Sqr(2)
#pointXY = LnDistXY(#line, #P[0])
```

Example explanation

Intersect position is (5,5).



MidLine (L1,L2,P)

Calculates two bisecting lines based on the intersection of two straight lines L1 and L2.

Terms

- L1, L2: line variable or a function that results in line data
- P: constant, numerical variable, or a function that results in a numerical value
 - 0: returns the line bisecting the angle between L1 and L2
 - 1: returns the line perpendicular to the line bisecting the angle between L1 and L2

Result type

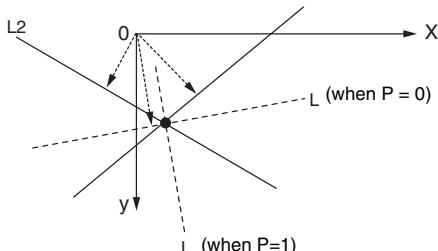
Line data

Causes of Errors

- An error occurs if L1 and L2 are parallel.
- An error occurs if the value of P is neither 0 nor 1.

Examples

```
#Line[0].T = 60
#Line[0].RH = 10
#Line[1].T = 120
#Line[1].RH = 0
#line = MidLine(#Line[0], #Line[1], 0) ....(1)
#line = MidLine(#Line[0], #Line[1], 1) ....(2)
```

Example explanation(1) $\theta = 90^\circ$, $p = 5.7735 (10/\sqrt{3})$.(2) $\theta = 0^\circ$, $p = 10$.**MidXY (Q1, Q2)**

Calculates the point Q halfway between X,Y positions Q1 and Q2.

Terms

Q1, Q2: position variable or a function that results in position data

Result type

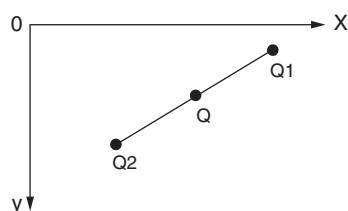
Position data (units: pixels)

Examples

```
#P[0].X = 90
#P[0].Y = 20
#P[1].X = 10
#P[1].Y = 80
#p = MidXY(#P[0], #P[1])
```

Example explanation

#p is set to a value of (50, 50).

**MultiPtCalib (N, Q1[], Q2[], CALIB[])**

Calculates calibration model (CALIB[]) from multiple pixel X,Y positions (Q1[]) and world X,Y positions (Q2[]).

The CALIB[] model obtained from this function can be used in ConvPixToWld and ConvWldToPix as a parameter for the following conversions.

- ConvPixToWld (Q, CALIB[]): converts X,Y position Q from pixel coordinates (Q1 coordinates) to world coordinates (Q2 coordinates).
- ConvWldToPix (Q, CALIB[]): converts X,Y position Q from world coordinates (Q2 coordinates) to pixel coordinates (Q1 coordinates)

Terms

- N: number of points (1 - 16)
- Q1[]: position array (coordinates in a pixel coordinate system)
- Q2[]: position array (coordinates in a world coordinate system)
- CALIB[]: scalar array variable with 28 elements (where the calibration information is to be stored)

Result type

Numerical value (0 = success, -1 = fail)

The function returns -1 if it fails to find the calibration information. (If the error conditions are met, the function ends on an error and the return value cannot be confirmed.)

Causes of Errors

- An error occurs if the number of elements is outside the range of 1 to 16.
- An error occurs if there are fewer elements in the Q1[] array than N.
- An error occurs if there are fewer elements in the Q2[] array than N.
- An error occurs if CALIB[] has more or fewer than 28 elements.

Example 1

Single point calibration

```
@a = MultiPtCalib(1, #P1[], #P2[], #CALIB[])
```

**Explanation of example 1**

@a = 0 (success) or @a = -1 (fail)

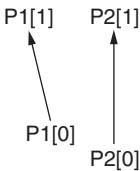
This function creates the calibration model (#CALIB[]) based on #P1 (pixel coordinates) being #P2 (world coordinates).

▶ Note

Used in this manner the function cannot change the axis direction.

Example 2

Two-point calibration

`@a = MultiPtCalib(2, #P1[], #P2[], #CALIB[])`**Example 2 explanation**`@a = 0 (success) or @a = -1 (fail)`

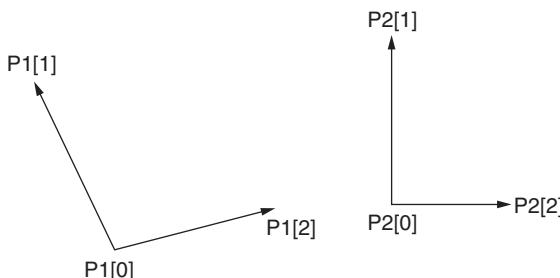
This function creates the calibration model (#CALIB[]) based on conversion (X/Y translation, rotation, and shrink & expand) of vector #P1 (pixel coordinates) so that it correctly superimposes on vector #P2 (world coordinates).

► Note

Used in this manner the function cannot change the axis direction.

Example 3

Three-point calibration

`@a = MultiPtCalib(3, #P1[], #P2[], #CALIB[])`**Example 3 explanation**`@a = 0 (success) or @a = -1 (fail)`

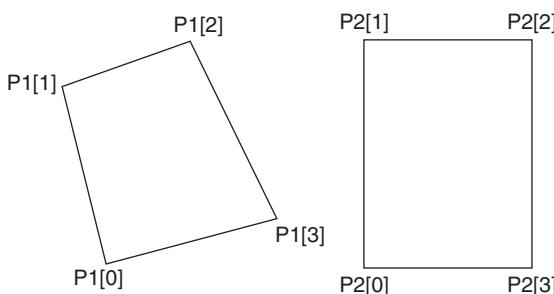
This function creates the calibration model (#CALIB[]) based on (X/Y translation, rotation, shrink & expand, aspect ratio, and shearing) on axis #P1 (pixel coordinates) so that it superimposes on axis #P2 (world coordinates).

Reference

Used in this manner the function can be used to change the axis direction.

Example 4

Four-point calibration

`@a = MultiPtCalib(4, #P1[], #P2[], #CALIB[])`**Example 4 explanation**`@a = 0 (success) or @a = -1 (fail)`

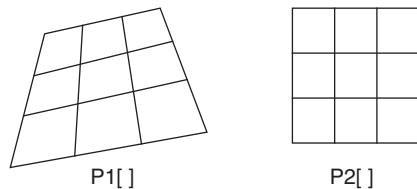
This function creates the calibration model (#CALIB[]) based on projection conversion of square #P1 (pixel coordinates) so that it superimposes on the square #P2 (world coordinates) (eg trapezoid correction).

Reference

Used in this manner the function can be used to change the axis direction.

Example 5

Five-point calibration

`@a = MultiPtCalib(5, #P1[], #P2[], #CALIB[])`**Example 5 explanation**`@a = 0 (success) or @a = -1 (fail)`

This function creates the calibration model (#CALIB[]) based on projection conversion of multiple points #P1 (pixel coordinates) so that they superimpose as closely as possible (using the least-squares method) on the multiple points #P2 (world coordinates).

Reference

- Used in this manner the function can be used to change the axis direction.
- Points need not exist on the same line.

► Note

This cannot be used to correct lens distortion.

OuterProd (Q1, Q2)

Calculates the outer product of two X,Y positions Q1 and Q2.

Terms

Q1, Q2: position variable or a function that results in position data

Result type

Numerical value

Examples

```
#P1=(1,0)
#P2=(2,2)
@a = OuterProd(#P1, #P2)
```

Example explanation

@a is set to a value of 2 (#P1.X * #P2.Y + #P1.Y * #P2.X).

Rotate (Q1,Q2,D,P)

Rotates X,Y position Q1 about center Q2 for D degrees and scaled by P.

Terms

- Q1, Q2: position variable or a function that results in position data
- D: constant, numerical variable, or a function that results in a numerical value in degrees (°).
- P: power. Constant, numerical variable, or a function that results in a numerical value

Result type

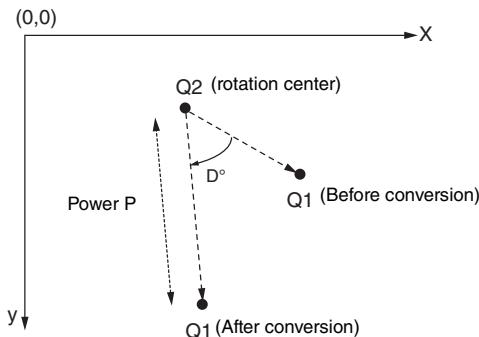
Position data (units: pixels)

Examples

```
#Q1.X = 15
#Q1.Y = 15
#Q2.X = 10
#Q2.Y = 10
#Q3 = Rotate(#Q1, #Q2, 90, 2)
```

Example explanation

Q3 is set to a value of (0, 20).



RotCenter (Q1,Q2,D)

Calculates the X,Y position rotation center when Q1 is rotated to Q2 by D degrees.

Terms

- Q1, Q2: position variable or a function that results in position data
- D: constant, numerical variable, or a function that results in a numerical value in degrees (°)

Result type

Position data

Causes of Errors

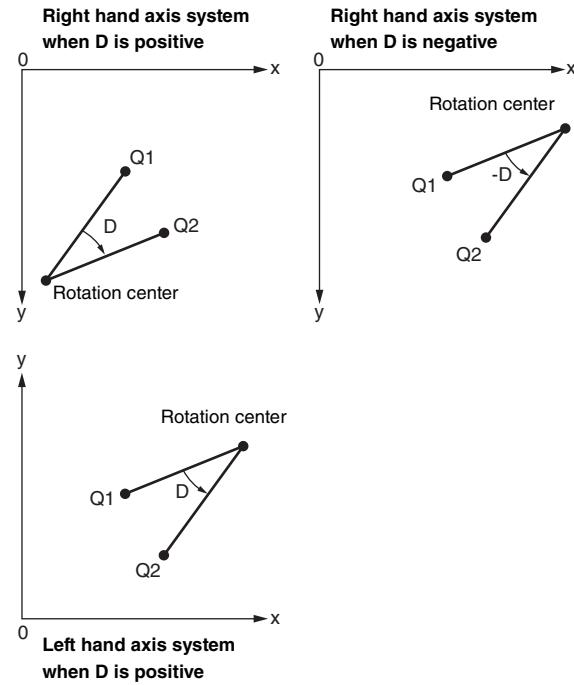
- An error occurs if Q1 and Q2 are the same value.
- An error occurs if D is a multiple of 360 degrees (-360, 0, 360, 720, ..., etc.).

Examples

```
#P=RotCenter(#Q1, #Q2, 30)
```

Example explanation

This function calculates the rotation center when point Q1 is rotated 30 degrees to point Q2.



Reference

When using the right hand axis system and a positive angle the rotation will be clockwise with the rotation center being nearer the Y axis. For a negative angle the rotation will be counterclockwise and the rotation center nearer the X axis.

SubVector (Q1, Q2)

Calculates the difference between two X,Y positions Q1 and Q2.

Terms

Q1, Q2: position variable or a function that results in position data

Result type

Position data

Examples

```
#P1=(3,3)
#P2=(2,2)
#p = SubVector(#P1, #P2)
```

Example explanation

#p is set to a value of (1,1).

VMidLine (Q1, Q2)

Calculates the vertical line that bisects the line passing through X,Y positions Q1 and Q2.

Terms

Q1, Q2: position variable or a function that results in position data

Result type

Line data

Causes of Errors

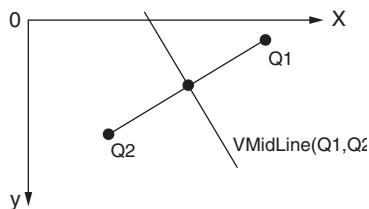
An error occurs if Q1 and Q2 are the same coordinates.

Examples

```
#P[0].X = 10*.Sqrt(3)
#P[0].Y = 0
#P[1].X = 0
#P[1].Y = 10
#l = VMidLine(#P[0], #P[1])
```

Example explanation

#1.T is set to -30°, #1.RH is set to 5.



Calendar Functions

ShiftDay (P)

Adds or subtracts the number of days (P) to the current month, date, year, and returns the day.

Terms

P: constant, numerical variable, or a function that results in a numerical value

Result type

Numerical value

Causes of Errors

An error occurs if the number of days P exceeds 9,999.

Examples

```
ShiftDay(-1)
```

Example explanation

Returns the day one day prior to the current date set.

ShiftMonth (P)

Adds or subtracts the number of days (P) to the current month, date, year, and returns the month.

Terms

P: constant, numerical variable, or a function that results in a numerical value

Result type

Numerical value

Causes of Errors

An error occurs if the number of days P exceeds 9,999.

Examples

```
#month = ShiftMonth(10)
```

Example explanation

Returns the month 10 days after the current date set.

ShiftYear (P)

Adds or subtracts the number of days (P) to the current month, date, year, and returns the year.

Terms

P: constant, numerical variable, or a function that results in a numerical value

Result type

Numerical value

Causes of Errors

An error occurs if the number of days P exceeds 9,999.

Examples

#year = ShiftYear(-365)

Example explanation

Returns the year 365 days prior to the current set date.

BIT Functions

B_And (P1, P2)

Calculates the logical product of the BIT's of P1 and P2.

- The function converts P1 and P2 from a numerical value to a 4-byte integer (32 BIT's) and returns the calculated result as a numerical value.
- If the value specified exceeds the maximum for an unsigned 4-byte integer, the lower 4-bytes are used and all bits above that are ignored.

Terms

P1, P2: constant, numerical variable, or a function that results in a numerical value

Result type

Numerical value

Examples

@p1 = 10.1

@p2 = 3.14

@p3 = B_And (@p1, @p2)..... (1)

Example explanation

@p3 is set to a value of 2.

B_Not (P)

Calculates the logical inverse of the BIT's of P.

- The function converts P from a numerical value to a 4-byte integer (32 BIT's) and returns the calculated result as a numerical value.
- If the value specified exceeds the maximum for an unsigned 4-byte integer, the lower 4-bytes are used and all bits above that are ignored.

Terms

P: constant, numerical variable, or a function that results in a numerical value

Result type

Numerical value

Examples

@p1 = 10.1

@p2 = B_And(B_Not(@p1), 15)

Example explanation

@p2 is set to a value of 5.

B_Or (P1, P2)

Calculates the logical sum of the BIT's of P1 and P2.

- The function converts P1 and P2 from a numerical value to a 4-byte integer (32 BIT's) and returns the calculated result as a numerical value.
- If the value specified exceeds the maximum for an unsigned 4-byte integer, the lower 4-bytes are used and all bits above that are ignored.

Terms

P1, P2: constant, numerical variable, or a function that results in a numerical value

Result type

Numerical value

Examples

```
@p1 = 10.1  
@p2 = 3.14  
@p3 = B_Or (@p1, @p2)
```

Example explanation

@p3 is set to a value of 11.

B_XOr (P1, P2)

Calculates the exclusive logical OR of the BIT's of P1 and P2.

- The function converts P1 and P2 from a numerical value to a 4-byte integer (32 BIT's) and returns the calculated result as a numerical value.
- If the value specified exceeds the maximum for an unsigned 4-byte integer, the lower 4-bytes are used and all bits above that are ignored.

Terms

P1, P2: constant, numerical variable, or function that returns a numerical value

Result type

Numerical value

Examples

```
@p1 = 10.1  
@p2 = 3.14  
@p3 = B_XOr (@p1, @p2)
```

Example explanation

@p3 is set to a value of 9.

Bind (P0, P1, P2, P3, P4, P5, P6, P7)

Binds the BIT's from P0 to P7 into an 8-bit value (P0: MSB, P7: LSB).

Terms

P0 - P7: constant, numerical variable, or function that returns a numerical value

Result type

Numerical value

Causes of Errors

An error occurs if the value of P0 to P7 is neither a 0 nor a 1.

Examples

```
@p3 = Bind(0,1,0,1,0,1,0,1)
```

Example explanation

@p3 is set to a value of 85.

Image Manipulation

Image operation creates and stores a resultant image in a user specified image variable. This image is the result of a process or calculation being performed on a single source image or across multiple source images.

This section explains the types of processing that can be used in an image operation unit, and the flow used to combine two images.

▶ Note

- Both source images 1 and 2 used in an image operation must be of the same type (resolution).
- The image variable used to store the resultant image must be the same type (resolution) as image variable used by either source image 1 or 2.

Image Combinations

Processing options using multiple images

O: Available, X: Not Available

Combination	Processing images			Conversion	Operation	Image array operation
	Source 1	Source 2	Source 1/2			
1	1	0	O/X	X	X	X
2	1	1	O/O	O	X	
3	n	0	O/X	O * ¹	X	
4	n	1	O/O	O * ²	O * ³	
5	n	n	O/O	O * ²	X * ³	

*1 Any operation other than Subtract and AbsoluteDifference may be used.

*2 Only the Subtract and AbsoluteDifference operations may be used.

*3 Image array operation must be used otherwise an error will occur.

Reference

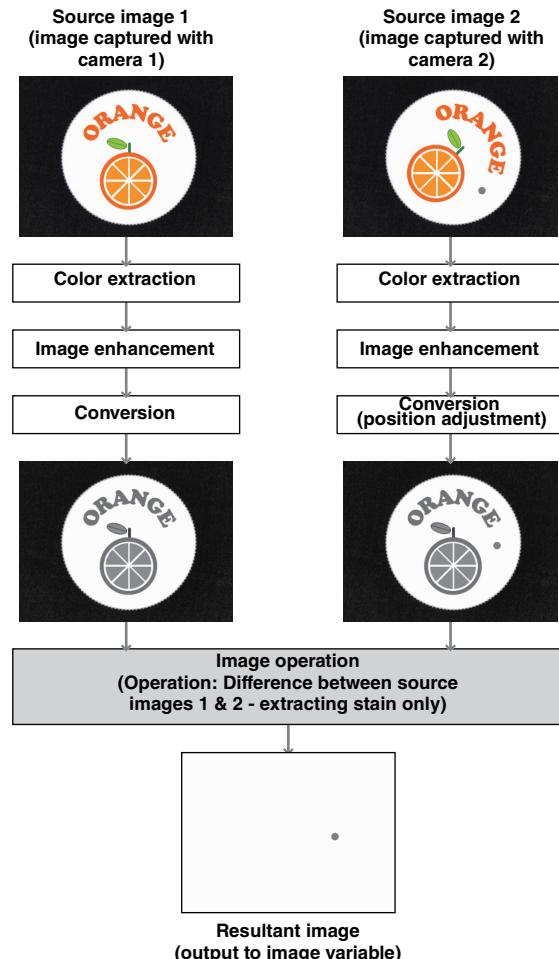
The number of images "n" can be set from 2 to 32.

▶ Note

Conversion of a single image (combination 1) requires for [Operation] to be set to "None".

Image Operation Flow

This example uses combination 2 in the chart "Processing options using multiple images".



Functional Explanation of Conversions

Conversions apply parametric image processing, such as image composition and correction, to color extracted and or image enhanced images.

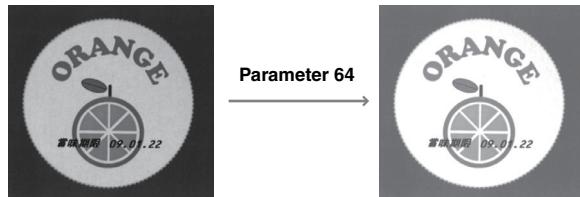
Reference

The screens shots shown in these explanations are from the Edit Unit menu.

(1) Add

Adds the specified parameter (grayscale level) to every pixel in the source image.

Add		
Parameter	000	
Conversion Count	1	
OK	Cancel	



200	50	150
45	80	65
0	215	100

Forces pixel values greater than 255 to 255

255	114	214
109	144	129
64	255	164

Parameter

Specify a value for the conversion (0 to 255).

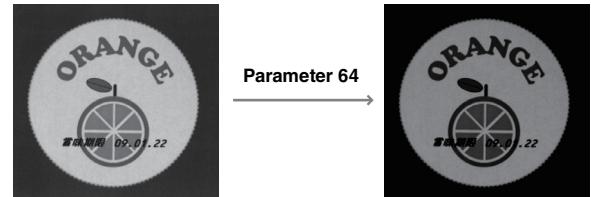
Conversion Count

Choose to execute (1) or not to execute (0) the conversion.

(2) Subtract

Subtracts the specified parameter (grayscale level) from every pixel in the source image.

Subtract		
Parameter	000	
Conversion Count	1	
OK	Cancel	



200	50	150
45	80	65
0	215	100

Forces pixel values less than 0 to 0

136	0	86
0	16	1
0	151	36

Parameter

Specify a value for the conversion (0 to 255).

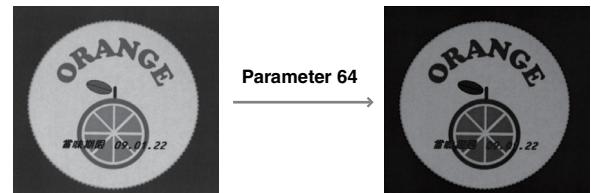
Conversion Count

Choose to execute (1) or not to execute (0) the conversion.

(3) AbsoluteDifference

Subtracts the specified parameter (grayscale level) from every pixel in the source image and outputs the absolute result.

AbsoluteDifference		
Parameter	000	
Conversion Count	1	
OK	Cancel	



200	50	150
45	80	65
0	215	100

Outputs values less than 0 as an absolute value

136	14	86
19	16	1
64	151	36

Parameter

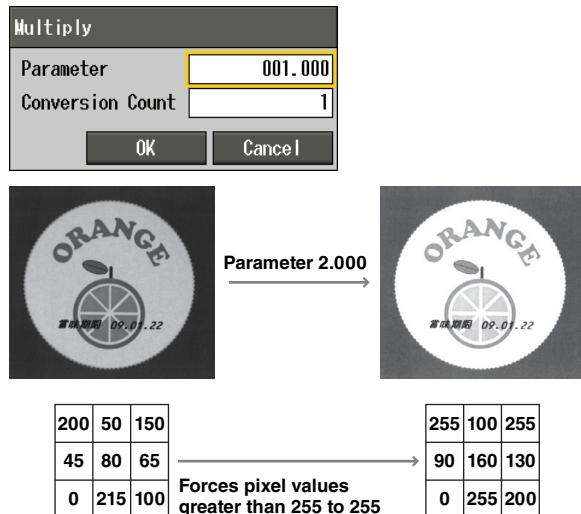
Specify a value for the conversion (0 to 255).

Conversion Count

Choose to execute (1) or not to execute (0) the conversion.

(4) Multiply

Multiplies every pixel in the source image by the specified parameter (grayscale level).



Parameter

Specify a value for the conversion (0 to 255).

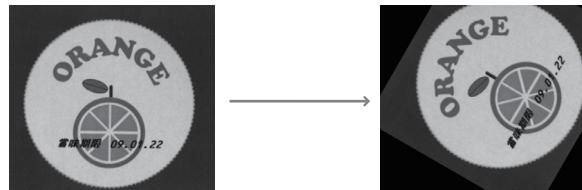
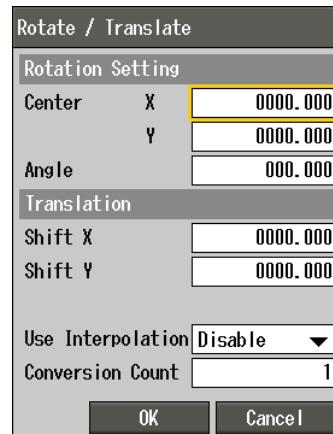
- $0.000 \leq \text{Parameter} < 1.000$: darkens the pixel.
- $1.000 < \text{Parameter} \leq 255.000$: brightens the pixel.

Conversion Count

Choose to execute (1) or not to execute (0) the conversion.

(5) Rotate, Translate

Rotate the image about a set of co-ordinates and shift it in the X and Y direction (translation). Interpolation can be used for improving image quality / processing speed.



Rotation center
X: 100.000
Y: 100.000
Rotation angle: 300.000
Translation
X: 000.000
Y: 150.000

Rotation Center

Specify the X, Y rotation center.

- **X coordinate**: -9600.000 to 9600.000
- **Y coordinate**: -7200.000 to 7200.000

Rotation Angle

Specify the angle of rotation from 0.000 to 359.999.

Translation

Specify the X and Y shift (in pixels).

- **Shift X**: -9600.000 to 9600.000
- **Shift Y**: -7200.000 to 7200.000

Use Interpolation

Choose whether to use interpolation.

- **Enable:** Use interpolation.
- **Disable:** Do not use interpolation.

Conversion Count

Choose to execute (1) or not to execute (0) the conversion.

(8) Zoom

Enlarge or shrink the image about an X Y center point and X Y zoom ratio.

Zoom	
Zoom Ratio X	0100
Y	0100
Zoom Center X	0000
Y	0000
Conversion Count	1
OK Cancel	



Zoom ratio X: 100%
 Zoom ratio Y: 150%
 Zoom center
 X: 256.000
 Y: 240.000

Zoom Ratio X

Specify the zoom ratio in the X direction from 16 to 2500%.

Zoom Ratio Y

Specify the zoom ratio in the Y direction from 16 to 2500%.

Zoom Center

Specify X, Y zoom center.

- **X coordinate:** -9600.000 to 9600.000
- **Y coordinate:** -7200.000 to 7200.000

Conversion Count

Choose to execute (1) or not to execute (0) the conversion.

(7) Trapezoid Correct

Correct the trapezoidal distortion of an image based on matching up four specified points before and after.

Trapezoid Correct	
NOTE: Please specify 4 points clockwise from top-left in the case of [User set].	
Shape Before Adjust	
None	▼ Edit
Shape After Adjust	
None	▼ Edit
Use Interpolation	Enable
Conversion Count	1
OK Cancel	



Shape Before Adjust:
square



Shape After Adjust:
rectangle

Shape Before Adjust

Specify the shape / points before correction.

- **None:** No shape.
- **User Set:** Manually select the four points to correct from in a clockwise fashion (starting at what should be the upper left). Refer to "Drawing a Polygon" (Page 8-6) for more details on this setting method.

Shape After Adjust

Specify the matching shape / points after correction.

- **None:** No shape.
- **User Set:** Manually select the four points for the correction to adjust to in a clockwise fashion (starting at what should be the upper left). Refer to "Drawing a Polygon" (Page 8-6) for more details on this setting method.
- **Rectangle:** Use the four points of a rectangle for the correction to adjust to. The first point being the upper left corner of the rectangle.

Use Interpolation

Choose whether to use interpolation.

- **Enable:** Use interpolation.
- **Disable:** Do not use interpolation.

Conversion Count

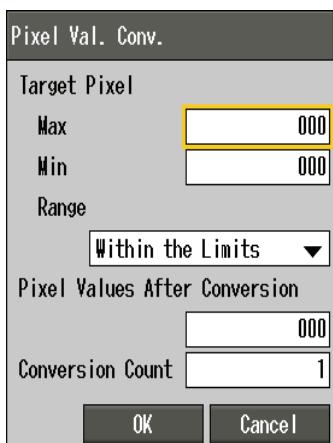
Choose to execute (1) or not to execute (0) the conversion.

▶ Note

- This adjustment may not be able to completely correct severely warped images.
- If the shape is defined in the opposite order for either image the resultant image will be inverted.

(8) Pixel Value Conversion

Replace pixel values with a specified value for pixels that fall within or beyond a user-specified range.



200	50	150
45	80	65
0	215	100

Max pixel value: 150
 Min pixel value: 70
 Conversion range: within limits
 Pixel value after conversion: 255

200	50	255
45	255	65
0	215	255

Target Pixel

- Max: Specify the upper value (grayscale level) of the range (0 to 255).
- Min: Specify the lower value (grayscale level) of the range (0 to 255).
- Range: Choose whether to convert the pixels that fall within or outside of the range.

Pixel Values After Conversion

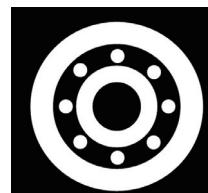
Specify the value (grayscale level) to use after the conversion (0 to 255).

Conversion Count

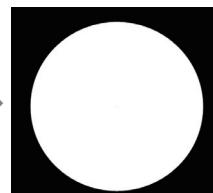
Choose to execute (1) or not to execute (0) the conversion.

(9) Blob

The blob filter produces a monochrome image (binary conversion), giving the ability to fill holes, remove noise and filter the image.

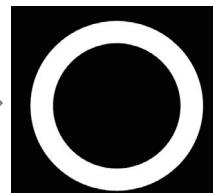


Fill holes
OFF → ON



Holes in primary target
are filled

Count
30 → 1



Blobs from inside and
beyond are removed

Area filter
low limit
100 → 2000



White blobs (bearings)
smaller than lower
limit are removed

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 detection.
- **Black**: Set black blobs to be the target of detection.

Count

Specify the maximum number of blobs to search for from 1 to 9999. For example, set [3] to detect up to 3 blobs.

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 different in color to the [Detect] color, the area, center of gravity, or roundness referenced by the blob filter may 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.

Active Border

Specify whether to detect blobs located on the border of the inspection region.

- **OFF:** Detect blobs located on the border of the inspection region.
- **ON:** Exclude blobs located on the border of the inspection region from detection.

► 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.

Filter Setting

Specify whether to enable or disable each filter and change the maximum and minimum values for it.

- **Area:** This filter ignores blobs that are larger than the specified maximum value or smaller than the specified minimum value (Area filter).
- **Roundness:** This filter ignores blobs that have roundness values higher than the specified maximum value (their shapes are closer to a perfect circle) or the blobs that have roundness values lower than the specified minimum value (Roundness filter).
- **Min Bounding Box Width:** This filter ignores blobs that have minimum bounding box width values higher than the specified maximum value or the blobs that have values lower than the specified minimum value (Min bounding box width filter).
- **Aspect Ratio:** This filter ignores blobs that have aspect ratios higher than the specified maximum value (thin-shaped blobs) or the blobs that have aspect ratios lower than the specified minimum value (Aspect ratio filter).
- **Major Axis:** This filter ignores blobs that have major axis values higher than the specified maximum value or the blobs that have major axis values lower than the specified minimum value (Major axis filter).
- **Axes Ratio:** This filter ignores blobs that have axes ratios higher than the specified maximum value (thin-shaped blobs) or the blobs that have axes ratios lower than the specified minimum value (Axes ratio filter).

► Note

Each filter enabled adds to the total processing time.

Primary Target

- Primary Target: This specifies which blobs are to be converted.
 - All: Converts all blobs detected from all primary targets.
 - Specified: Converts only specified blob number (0 to 9998). Conversion is only done on the blob specified here.
- Detect. Order: Select the blob numbering order. The following 12 sorting methods are available for assigning numbers to blobs.
 - Y>X: Ascend: Sorts blobs in ascending Y order. When Y values are the same, reorders in ascending X order.
 - X>Y: Ascend: Sorts blobs in ascending X order. When X values are the same, reorders in ascending Y order.

- X:Ascend: Sorts blobs in ascending X order.
- X:Descend: Sorts blobs in descending X order.
- Y:Ascend: Sorts blobs in ascending Y order.
- Y:Descend: Sorts stains in descending Y order.
- Area:Ascend: Sorts blobs from smallest area to largest.
- Area:Descend: Sorts blobs from largest area to smallest.
- Round.:Asc.: Sorts blobs from lowest roundness value to highest.
- Round.:Desc.: Sorts blobs from highest roundness value to lowest.
- Clockwise: Sorts blobs clockwise from the start angle.
- Counter CW: Sorts blobs counter-clockwise from the start angle.
- Start Angle: Specify the start angle to begin assigning numbers to blobs when [Detect. Order] is set to [Clockwise] or [Counter CW]

▶ Note

- This setting is ignored when [Detect. Order] is not [Clockwise] or [Counter CW].
- Targets cannot be specified if [Primary Target] is set to [All].

Pixel Values After Conversion

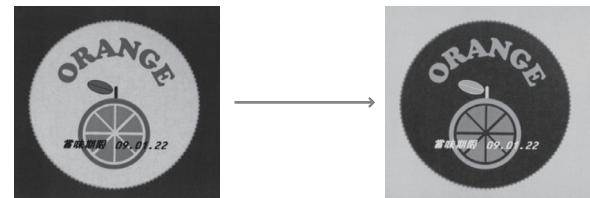
- Detected color: Specify the value (grayscale level) for the target pixels after filtering (0 to 255).
- Background color: Specify the value (grayscale level) for the background pixels after filtering (0 to 255).

Conversion Count

Choose to execute (1) or not to execute (0) the conversion.

(10) NOT

Inverts (grayscale level) every pixel in the source image.



200	50	150	Results in same value as subtracting input pixel values from 255.	55	205	105
45	80	65		210	175	190
0	215	100		0	40	150

Input pixel values: 100	bit	7	6	5	4	3	2	1	0
		0	1	1	0	0	1	0	0

NOT

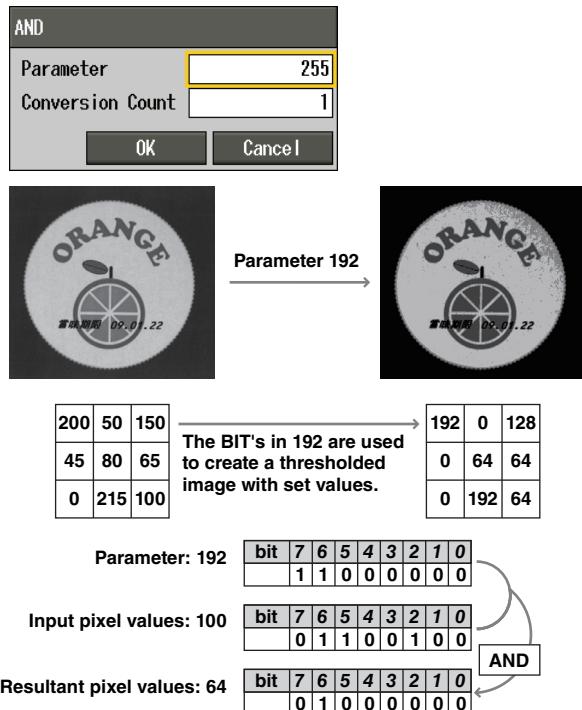
Resultant pixel values: 155	bit	7	6	5	4	3	2	1	0
		1	0	0	1	1	0	1	1

Conversion Count

Choose to execute (1) or not to execute (0) the conversion.

(11) AND

Performs a logical AND function on the BIT's of every pixel in the source image and the BIT's of the value specified in [Parameter].

**Parameter**

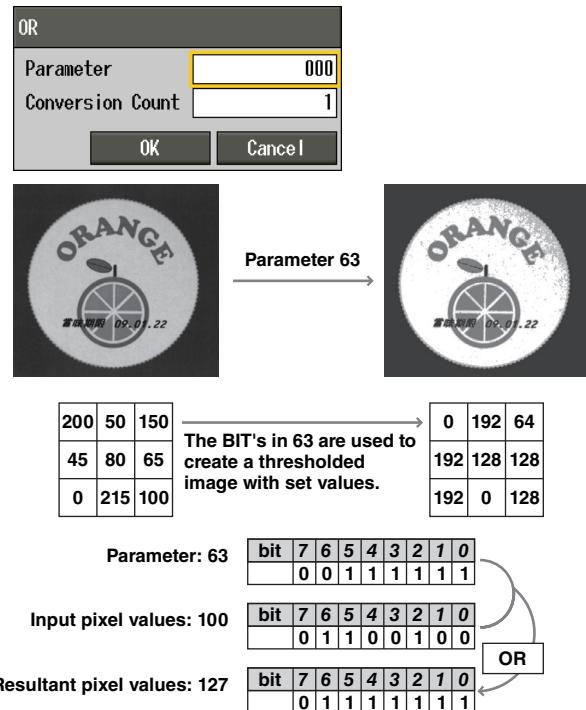
Specify a value for the conversion (0 to 255).

Conversion Count

Choose to execute (1) or not to execute (0) the conversion.

(12) OR

Performs a logical OR function on the BIT's of every pixel in the source image and the BIT's of the value specified in [Parameter].

**Parameter**

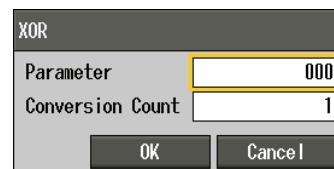
Specify a value for the conversion (0 to 255).

Conversion Count

Choose to execute (1) or not to execute (0) the conversion.

(13) XOR

Performs a logical XOR function on the BIT's of every pixel in the source image and the BIT's of the value specified in [Parameter].

**Parameter**

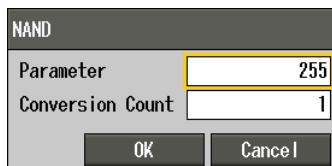
Specify a value for the conversion (0 to 255).

Conversion Count

Choose to execute (1) or not to execute (0) the conversion.

(14) NAND

Performs a logical NAND function on the BIT's of every pixel in the source image and the BIT's of the value specified in [Parameter].

**Parameter**

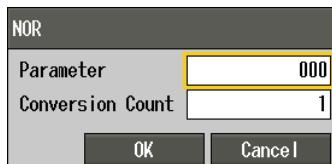
Specify a value for the conversion (0 to 255).

Conversion Count

Choose to execute (1) or not to execute (0) the conversion.

(15) NOR

Performs a logical NOR function on the BIT's of every pixel in the source image and the BIT's of the value specified in [Parameter].

**Parameter**

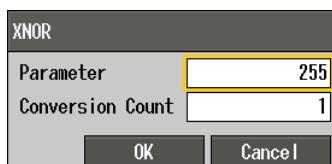
Specify a value for the conversion (0 to 255).

Conversion Count

Choose to execute (1) or not to execute (0) the conversion.

(16) XNOR

Performs a logical XNOR function on the BIT's of every pixel in the source image and the BIT's of the value specified in [Parameter].

**Parameter**

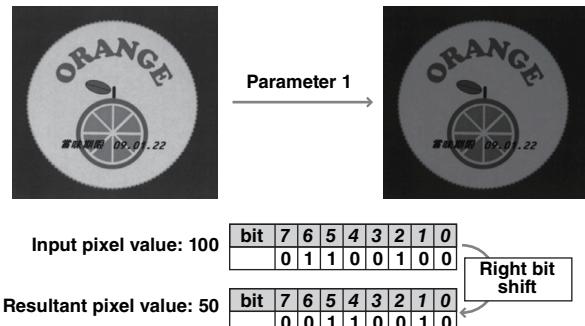
Specify a value for the conversion (0 to 255).

Conversion Count

Choose to execute (1) or not to execute (0) the conversion.

(17) Right Bit Shift

Shifts the BIT's of every pixel in the image to the right by the number of bits specified in [Parameter]. This darkens the image, and with each shift the image brightness is halved.

**Parameter**

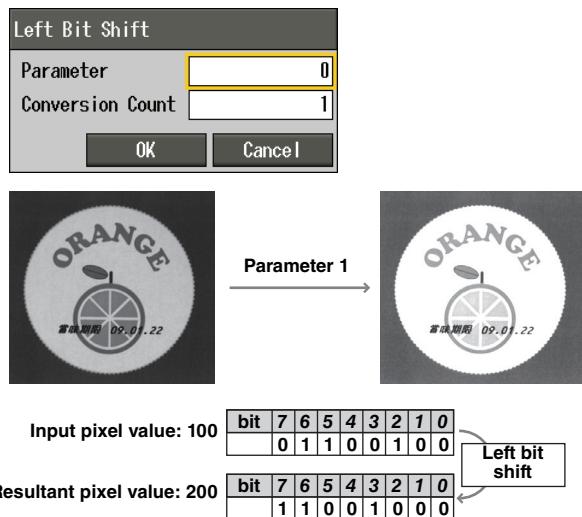
Specify the number of BIT's to shift (0 to 8).

Conversion Count

Choose to execute (1) or not to execute (0) the conversion.

(18) Left Bit Shift

Shifts the BIT's of every pixel in the image to the left by the number of bits specified in [Parameter]. This lightens the image, and with each shift the image brightness is doubled.



Parameter

Specify the number of BIT's to shift (0 to 8).

Conversion Count

Choose to execute (1) or not to execute (0) the conversion.

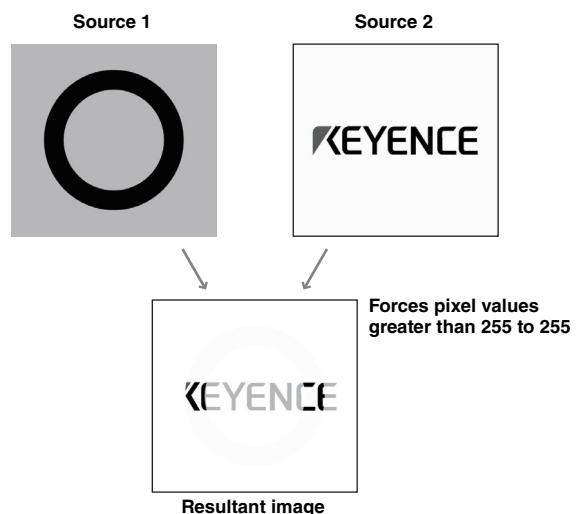
Functional Explanation of Operations

Operations are used to decide how to combine images together.

(1) Add

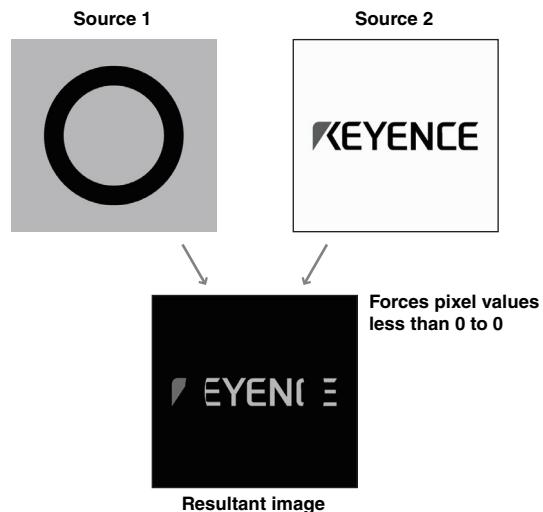
Adds the corresponding pixels of the source images together.

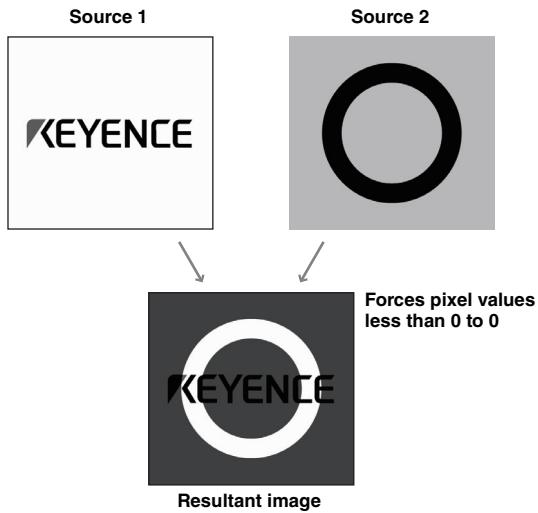
Compared to the source image, the results of adding dark pixel values is unnoticeable ($2 + 2 = 4$), but bright pixel values result in brighter images ($127 + 128 = 255$).



(2) Subtract

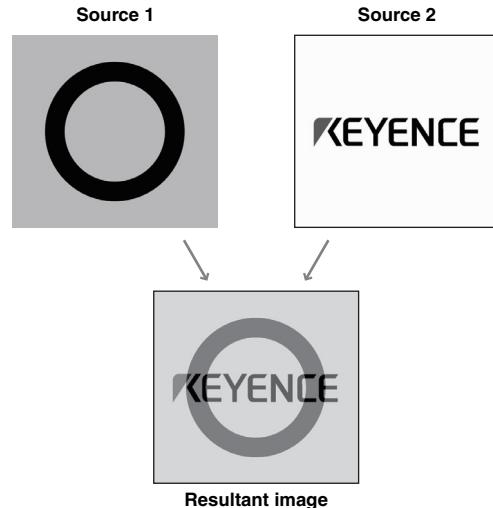
Subtracts the corresponding pixels of source image 2 from those in source image 1. This produces different results depending on the order the images are input.





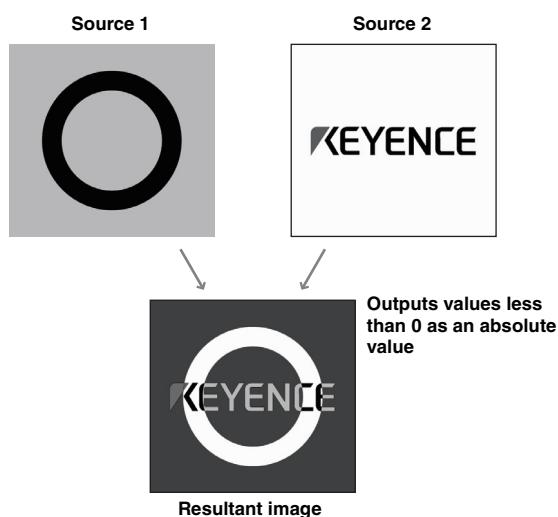
(4) Average

Takes the average of the corresponding pixels of the source images.



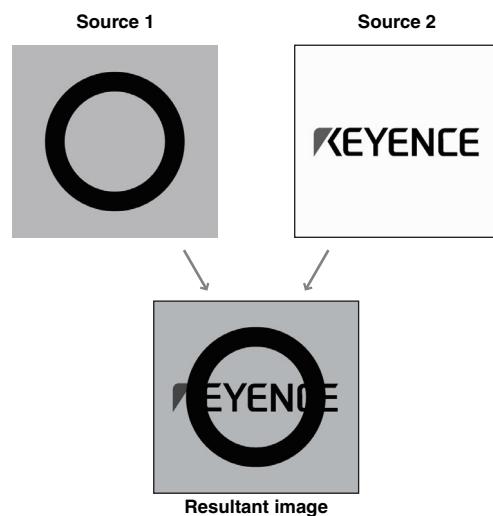
(3) AbsoluteDifference

Subtracts the corresponding pixels of source image 2 from those in source image 1 and outputs the absolute result.



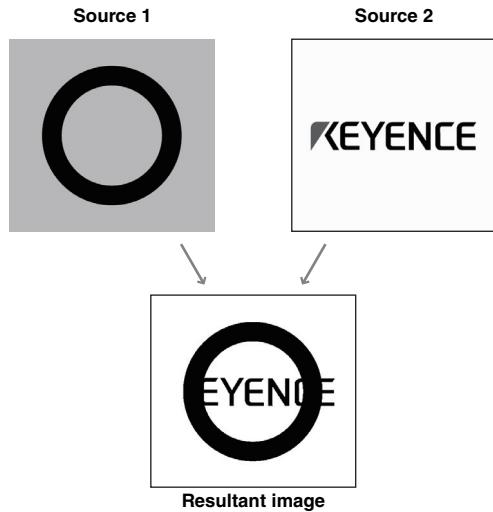
(5) Multiply (with normalizing)

Multiplies each pixel in the corresponding pixels of the source images together, then divides the result by 256 to prevent saturation at 255 from the multiplication process.

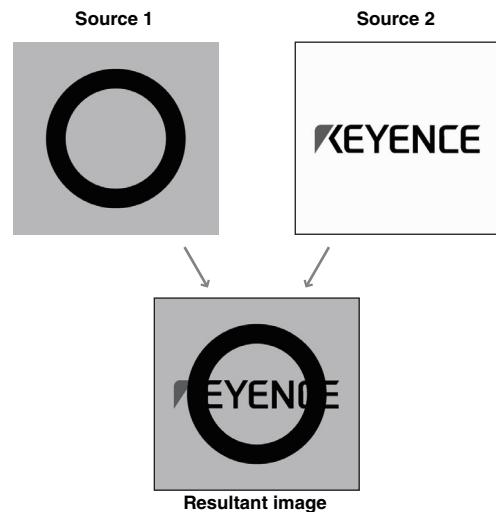


(6) Multiply (without normalizing)

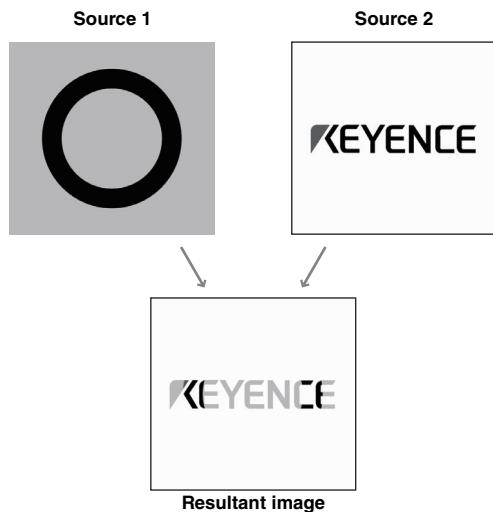
Multiplies the corresponding pixels of the source images together.

**(8) Min**

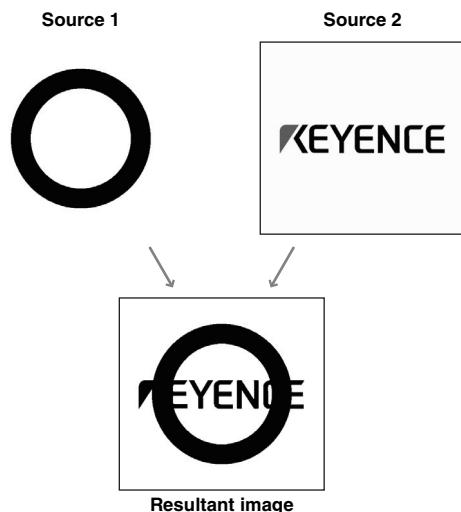
Takes the minimum (darker) of the corresponding pixels of the source images together.

**(7) Max**

Takes the maximum (brighter) of the corresponding pixels of the source images.

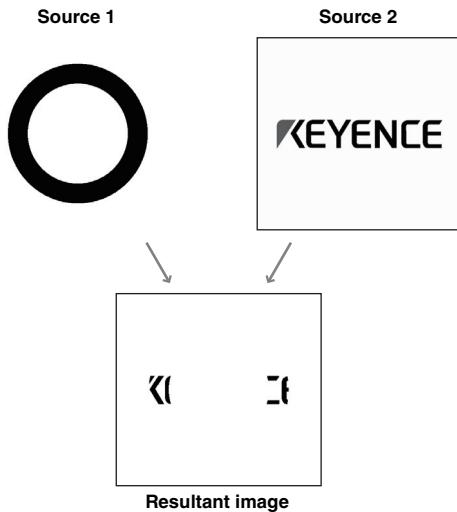
**(9) AND**

Performs a logical AND function on the BIT's for the corresponding pixels of the source images.

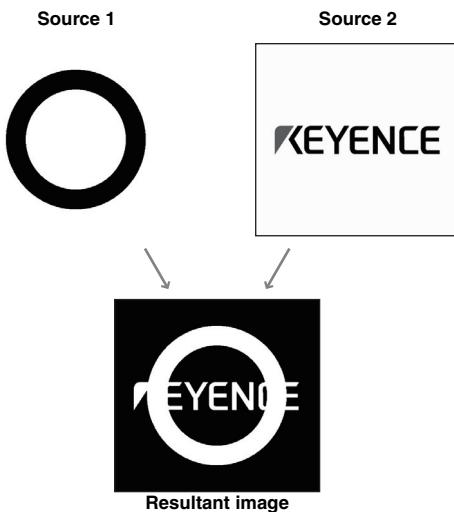


(10) OR

Performs a logical OR function on the BIT's for the corresponding pixels of the source images.

**(12) NAND**

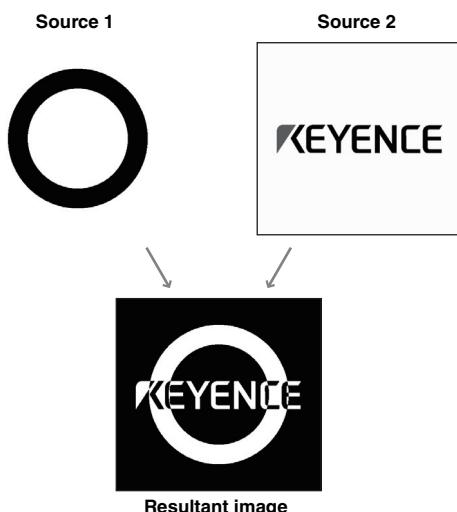
Performs a logical NAND function on the BIT's for the corresponding pixels of the source images.

**Reference**

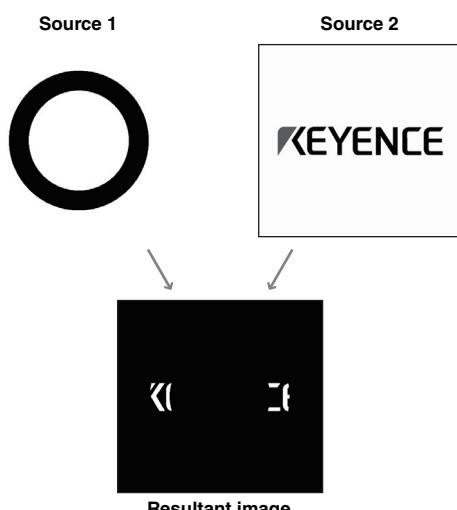
If the operation uses only image array variables for source 1, the operation is performed on a pair of two images.

(11) XOR

Performs a logical XOR function on the BIT's for the corresponding pixels of the source images.

**(13) NOR**

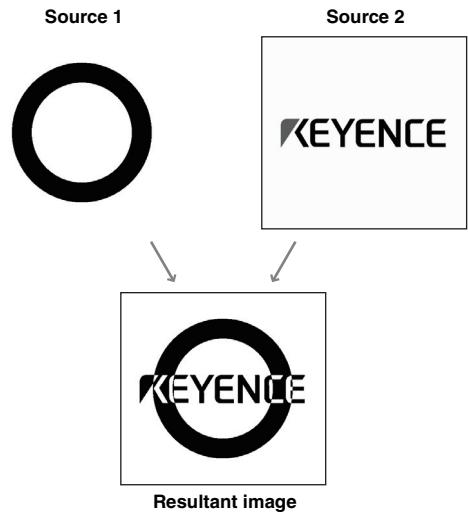
Performs a logical NOR function on the BIT's for the corresponding pixels of the source images.

**Reference**

If the operation uses only image array variables for source 1, the operation is performed on a pair of two images.

(14) XNOR

Performs a logical XNOR function on the BIT's for the corresponding pixels of the source images.



Reference

If the operation uses only image array variables for source 1, the operation is performed on a pair of two images.

List of Custom Commands

This list shows the default custom commands (and their assignments) that can be used for control purposes and in the command unit (Page 4-303).

Reference

For more information on the individual commands and their parameters, refer to the XG VisionEditor Reference Manual (Control/Data Edition).

Custom command No.	Command	Description
0	SS	Save program
1	WO,100,*01	Terminal write offset
2	PW,1,*01	Switch program number (SD1)
3	PW,2,*01	Switch program number (SD2)
4	BS,&Cam1Img,*01	Register image (Camera1)
5	BS,&Cam2Img,*01	Register image (Camera2)
6	BS,&Cam3Img,*01	Register image (Camera3)
7	BS,&Cam4Img,*01	Register image (Camera4)
8	RR,AL	Update the reference position adjustment value in the current image
9	BC	Capture screen
10	HS,IM,*01,AL,AL	Save image archive data
11	UW,FC,*01	Switch display unit ID
12	VW,*01	Switch screen
13	GW,*01	Switch page frame
14	TS,2,\xg\stat	Save statistical data
15	T1	Issue trigger 1
16	T2	Issue trigger 2
17	T3	Issue trigger 3
18	T4	Issue trigger 4
19	Reserved	
20	Reserved	
21	Reserved	
22	Reserved	
23	TA	Issue all triggers (1 through 4)
24	TE,*01	Enable/disable trigger input
25	TQ	Read trigger input enable status
26	LK,*01,*02,*03	Enable/disable device input
27	OE,*01	Enable/disable outputs
28	R0	Switch to Run mode
29	S0	Switch to Offline mode
30	RM	Read Run/Offline mode
31	PW,*01,*02	Switch program number
32	PR	Read program number
33	RS	Reset
34	RB	Reboot
35	SS	Save program
36	NW,AL,*01	Switch registered image No.
37	NW,*01,*02	Switch registered image No.
38	NR,*01	Read registered image No.
39	NU,AL	Update registered image No. to variable referenced value
40	NU,*01	Update registered image No. to variable referenced value

Custom command No.	Command	Description
41	CE,*01	Clear error
42	RE	Reset and return to the beginning of the flowchart
43	WG,*01	Release waiting status
44	RR,AL,*01	Update reference position adjustment value
45	RR,*01,*02	Update reference position adjustment value
46	RU,AL	Update all registered image references
47	RU,*01	Update all registered image references
48	TG,*01	Register settings
49	UT,*01,*02	Test unit
50	UE	Erase unit test results
51	CA,*01,*02,*03,*04	Register characters from library
52	CA,*01,*02,*03,*04,*05,*06	Register characters from library
53	CD,*01,*02	Delete one character in library
54	CW,*01	Write REG
55	CW,*01,*02,*03	Write REG
56	CR,*01,*02	Read REG
57	WO,*01,*02	Terminal write offset
58	VW,*01	Switch screen
59	VW,PV	Switch screen (previous)
60	VW,NX	Switch screen (next)
61	VR	Read screen ID
62	GW,*01	Switch page frame
63	GW,PV	Switch page frame (previous)
64	GW,NX	Switch page frame (next)
65	GR	Read page frame
66	UW,FC,*01	Switch display unit ID
67	UW,FC,PV	Switch display unit ID (previous)
68	UW,FC,NX	Switch display unit ID (next)
69	UR,FC	Read display unit ID
70	FW,*01	Switch image display
71	FW,PV	Switch image display (previous)
72	FW,NX	Switch image display (next)
73	FR	Read display image number
74	WI,FC,*01	Change image type
75	RI,FC	Read image type
76	ZM,FC,*01,*02,*03,*04	Zoom
77	SC,FC,*01,*02	Scroll
78	FT,FC	Fit
79	DC,*01,*02	Close menu
80	DC,AL	Close menu (all)
81	DO,*01	Open menu
82	DR	Read menu ID
83	BU,*01,*02	Open Edit Unit menu
84	TC	Clear statistical data
85	TS,*01,xgstat	Save statistical data
86	HE,*01	Start/stop image archiving
87	HR,*01	Read image archiving state

Custom command No.	Command	Description
88	HC,*01	Clear image archive data
89	HC,AL	Clear image archive data (all)
90	HS,IM,*01,AL,AL	Save image archive data
91	HS,AL,*01,AL,AL	Save image archive data
92	LE,*01	Start/stop modification logging
93	LQ	Read modification logging status
94	BC	Capture screen
95	PS,Administrator,*01,*02	Change password
96	PS,Operator,*01,*02	Change password
97	WH	Read user account
98	UC,Administrator,*01	Change login user
99	UC,Operator,*01	Change login user
100	TW,*01,*02,*03,*04,*05,*06	Write date, time
101	TR	Read date, time
102	PC,*01,*02,*03,*04	Copy programs
103	PM,*01,*02,*03,*04	Move programs
104	PD,*01,*02	Delete programs
105	OW,*01,*02	Change fixed name in file naming rule
106	OR,*01	Read fixed name in file naming rule
107	ES,*01	Switch between Run/Edit Program
108	EI	Read Run/Edit Program status
109	FV,*01	Show/Hide flowchart in Run Mode
110	FI	Read Show/Hide flowchart status
111	KY,*01	Remote control console pseudo input
112	KY,*01,*02	Remote control console pseudo input
113	VI	System version information

Troubleshooting

Symptom	Cause	Corrective Action
The controller does not power-up.	The power cable is not connected properly.	Connect the power cable properly (Page 2-22).
The monitor screen is blank.	The power used is outside of the specified range.	Supply power within the specified range (Page 2-22).
	The monitor cable is not connected.	Connect the monitor cable properly (Page 2-22).
	A signal is not being received from the controller.	Turn on the controller. (Page 2-22).
	The monitor is not adjusted properly.	Adjust the brightness and the color of the monitor.
Only camera images are blank/ abnormal (fuzzy, blurry, out of focus, blank).	The lens focus or aperture is not adjusted.	Adjust the focus or the aperture of the lens (Page 2-33).
	The shutter speed is not correct for the speed of the target.	Set the shutter speed properly (Page 5-9).
	The lens or part of the CCD is dirty.	Clean with an air duster. Do not use anything that will scratch or chemically damage the CCD.
	The camera cable is not connected properly.	<ul style="list-style-type: none"> Turn off the controller, and then connect the camera cable (Page 2-22). Make sure to use the proper camera cable for the controller / camera being used.
	The lens cap is on.	Remove the lens cap.
	The lens aperture is closed too far.	Adjust the aperture to allow more light into the camera (Page 2-33).
	The camera cable is broken.	Check to refer to if the lock ring on the cable connector is over-tightened, if the cable is under stress, or there are no other problems (kinks, breaks etc) with the camera cable.
Cannot operate the handheld controller.	The handheld controller is not connected properly.	Connect the handheld controller properly (Page 2-22).
Communication failure.	The communication cable is not connected properly.	Check the cable type and connect the communication cable correctly.
	The proper communication cable is not being used.	Check the cable type and connect the communication cable correctly.
	The communication settings on the Controller / PLC / PC are not configured properly.	Change the communication settings (IP address, network settings, baud rate etc) of the controller / PLC / PC.
	A voltage potential difference exists between the SG (signal - ground) on the controller and the other device being communicated with.	If a different power supply unit is being used for the controller and the other device, check that the frame ground on both units is grounded properly.
Results and measured values are not being output.	The output circuit is not connected properly.	<ul style="list-style-type: none"> Connect the output circuit properly referring to the output circuit diagram (Page 6-24). Use the I/O Diagnostic feature (Page 3-37) to check the terminal assignments signals and I/O status.
	The controller is not in RUN mode.	Switch the controller to RUN mode either through the Function menu or with the slide switch on the handheld controller. (Page 3-4).
	The %TEST input is being used.	<ul style="list-style-type: none"> Open the %TEST input. Use the I/O Diagnostic feature (Page 3-37) to check the terminal assignments signals and I/O status.

Symptom	Cause	Corrective Action
Trigger inputs not recognized.	The trigger input signal is not connected properly. The %EXT input is being used.	<ul style="list-style-type: none"> • Connect the input circuit properly referring to the circuit diagram (Page 6-23). • Use the I/O Diagnostic feature (Page 3-37) to check the terminal assignments signals and I/O status.
The screen is not being updated.	The image display is set to show image archive or registered images.	Choose a screen that has an image display set for showing camera images.
Screen updates and the handheld controller operations show slow response.	XG Vision Editor or XG Vision Terminal are connected and using the remote connection function.	This is normal behavior as the screen display is transmitted to the PC Programs. As separate processors are used for inspections and the control of the screen so processing performance is not affected.
Inspections are being performed but the display results are not updating.	<ul style="list-style-type: none"> • The focus is on a image display showing images from the image archive. • The screen focus is showing the image archive replay. 	<ul style="list-style-type: none"> • Move the focus to an image display set for showing camera images. • Exit the Image Archive replay mode.
The desired items do not appear on the function menu (Page 3-3).	The function menu has been restricted for the logged in user.	Use [Change Login User] (Page 3-39) on the function menu to change the login user to an account with the desired access privileges (Example: Administrator).
	The system settings file is an older version.	From the Offline mode select [System Information] (Page 5-36) in the System Configuration menu, and make sure the systems settings are the latest version by checking the [Version Information] section.

Error Messages

Errors that occur within the controller can either be hardware, (camera connection errors, etc.), or software related (illegal settings, etc.). When an error occurs the system variable %Error0 (or %Error1) is switched ON (1).

This section explains the errors, causes and corrective actions associated with each system variable.

Reference

Errors and system variable assignments can be modified and the error code can be output as well through the %Error0Code or %Error1Code outputs. For more details, refer to "Controller Global Settings" in the XG VisionEditor Reference Manual.

Error Messages Assigned to System Variable %Error0.

The errors messages below are assigned to %Error0 by default.

The errors assigned to %Error0 can be removed or switched to %Error1 as desired.

Error Message	Cause	Corrective Action	Error Code
Inspection settings are referring to an unconnected camera.	The camera connected does not match the camera specified in the camera settings for the program. (Example: a 2-megapixel camera is connected when the settings refer to a 320,000-pixel camera.)	Confirm the camera type connected matches the settings.	16
A camera (from 1 to 4) has been disconnected. Turn off the controller and check the camera connection.	The capture unit specifies a camera that is not connected. (Example: no camera is connected on port 2 but Camera2 is specified in capture unit U0001.)	Turn off the controller and connect the specified camera.	
The camera is not supported. Turn off the controller and check the camera model.	An error occurred in the connection with the camera. The camera is being used beyond its ratings. (Example: the ambient temperature of the camera is beyond the specification, or a non-supported camera cable is being used.)	<ul style="list-style-type: none"> Turn on the controller and make sure the camera has not been disconnected. Make sure the camera is properly connected. Make sure there are no problems (kinks, breaks etc) with the camera cable. <ul style="list-style-type: none"> Check the ambient temperature. Use a camera cable that supports the camera. 	17
Unable to load previously selected program.	The controller does not support the connected camera. (Example: an XG-200C cannot be used with the XG-7000 controller.)	<ul style="list-style-type: none"> Confirm the model of the connected camera. Specify the correct connected camera in the camera settings. 	18
Program memory or image memory is full.	The program file that corresponds to the program specified in the startup settings under system settings does not exist. The last saved program that corresponds to the program (or the program selected from the handheld controller) does not exist.	<ul style="list-style-type: none"> Before powering up the controller, make sure the program file that corresponds to this program number exists on the SD card. Change the program number to a working program. 	32
	The program file for the specified program could not be found when changing or reloading programs.	Change the program number to a working program.	
	The program being loaded exceeds the available program memory or image memory.	<ul style="list-style-type: none"> Change the program to a different working program. Correct the program in XG VisionEditor so it does not exceed the available program or image memory. 	33

Error Message	Cause	Corrective Action	Error Code
Incorrect program version.	The program loaded at startup is an incompatible version. The program being loaded is an incompatible version.	<ul style="list-style-type: none"> Change the program to a different working program. Use XG VisionEditor to create a compatible version of the program. 	34
Unable to load program due to checksum errors.	The program loaded at startup has a checksum error. The program being loaded has a checksum error.	<ul style="list-style-type: none"> Change the program to a different working program. Use XG VisionEditor to recreate the program. 	35
Unable to load program due to damaged file.	The program loaded at startup is damaged. The program being loaded is damaged.	<ul style="list-style-type: none"> Change the program to a different working program. Use XG VisionEditor to recreate the program. 	36
Unable to load system settings.	The system settings file used at startup cannot be found on SD Card 1. The system settings loaded at startup is from a incompatible version. The system settings file has a checksum error. The system settings file is startup is damaged.	<p>Before powering up the controller, make sure the system settings file exists on the SD card.</p> <ul style="list-style-type: none"> Use a different system settings file. Use XG VisionEditor to create a compatible version of the system settings file. 	40
Unable to load global variables.	Could not find the global variables file. The global variables file exceeds the available resource memory. The global variables file is from an incompatible version. The global variables file has a checksum error. The global variables file is damaged.	<ul style="list-style-type: none"> Use a different global variables file. Change the global variables in XG VisionEditor so they do not exceed the available resource memory. Use a different global variables file. Use XG VisionEditor to create a compatible version of the global variables file. Use a different global variables file. Use XG VisionEditor to recreate the global variables file. 	41
A unit error has occurred.	An error occurred with a unit specified in the total error setting in the program (system variable %UnitError changed to 1).	Review the settings of the unit where the error has occurred.	48
Please insert SD Card 1.	No SD card in SD card slot 1. An unsupported SD card is being used.	<p>Properly insert an SD card into the SD1 slot.</p> <p>The functionality and performance when using commercially available (non-industrial rated) SD cards is not guaranteed.</p>	64
Failed to access SD Card 1.	A problem occurred while trying to access SD Card 1. SD Card 1 could be faulty. The controller could not recognize the format of SD Card 1. An unsupported SD card is being used. The destination file is set to read-only.	<ul style="list-style-type: none"> Run the [Check] utility on SD Card 1. The SD Card check utility can be found in the [View Files] menu. If the error persists, format the SD Card. (Note, this will erase all contents on SD Card 1.) If the problem cannot be resolved by any of these remedies, the SD card may be damaged. <p>The functionality and performance when using commercially available (non-industrial rated) SD cards is not guaranteed.</p> <p>Disable the read-only setting on the destination file, or delete it.</p>	65
SD Card 1 is full.	There is not enough free space on SD Card 1.	Make space available by deleting or moving unnecessary files.	69

Error Message	Cause	Corrective Action	Error Code
SD Card 1 is write-protected.	The write-protection switch on SD Card 1 is enabled.	Disable the write-protection switch on SD Card 1.	70
Cannot find SD Card 1. Please check SD Card 1 and keep inserted at all times while the controller is ON.	SD Card 1 was removed while the power was ON.	Do not remove SD Card 1 while the power is ON. Removing an SD card while it is being accessed may damage the SD card and the data saved on it.	71
Please insert SD Card 2.	No SD card in SD2 slot. Run the [Stop SD2 Operation], then re-insert the SD card into SD card slot 2.	Properly insert an SD card into the SD2 slot. If the SD card is already inserted, remove it first, and then insert it again.	80
	An unsupported SD card is being used.	The functionality and performance when using commercially available (non-industrial rated) SD cards is not guaranteed	
Failed to access SD Card 2.	A problem occurred while trying to access SD Card 2. SD Card 2 could be faulty. The controller could not recognize the format of SD Card 2.	<ul style="list-style-type: none"> Run the [Check] utility on SD Card 2. The SD Card check utility can be found in the [View Files] menu. If the error persists, format the SD Card. (Note, this will erase all contents on SD Card 2.) If the problem cannot be resolved by any of these remedies, the SD card may be damaged. 	81
	An unsupported SD card is being used.	The functionality and performance when using commercially available (non-industrial rated) SD cards is not guaranteed.	
	The destination file is set to read-only.	Disable the read-only setting on the destination file, or delete it.	
SD Card 2 is full.	There is not enough free space on SD Card 2.	Make space available by deleting or moving unnecessary files.	85
SD Card 2 is write-protected.	The write-protection switch on SD Card 2 is enabled.	Disable the write-protection switch on SD Card 2.	86
PC program communication has failed.	A communication error occurred in either the Ethernet or USB connection when outputting data to the PC program specified as the destination for a data output unit, image output unit, or as the output location for the image archive.	<ul style="list-style-type: none"> Make sure the Ethernet cable or USB cable is connected to the controller and the PC. Make sure there are no problems (kinks, breaks etc) with the Ethernet or USB cable. Check the Ethernet cable type (cross, straight). Check whether the PC at the other end of the connection is ready to transmit/receive data. Check that the correct PC program is running on the PC and that the PC is connected to the controller. 	97
PLC-Link communication has failed.	An error occurred in the connection with the PLC when the [PLC-Link (RS-232C)] or [PLC-Link (Ethernet)] function was enabled.	<ul style="list-style-type: none"> Check the connection with the PLC and the settings of the PLC. If PLC link is not used, change communication mode to [Disable]. If the error message displayed after a trigger input, check that the data memory destination specified is in the range that meets the PLC format. 	112
Ethernet cable is not connected.	An error occurred with the Ethernet cable when using Ethernet as the destination for a data output unit.	<ul style="list-style-type: none"> Make sure the Ethernet cable is connected to the controller and the PC / PLC. Make sure there are no problems (kinks, breaks etc) with the Ethernet or USB cable. Check the Ethernet cable type (cross, straight). Make sure the orange LED indicator (connection) of the Ethernet connector is lit. 	144

Error Message	Cause	Corrective Action	Error Code
Ethernet communication has failed.	An error occurred in the Ethernet connection when using Ethernet as the destination for a data output unit.	<ul style="list-style-type: none"> Check whether the PC / PLC at the other end of the connection is ready to transmit/receive data. Check that the communication software for Ethernet is running on the PC / PLC and that the PC / PLC is connected with the controller. 	145
An Ethernet communication time out error has occurred.	Ethernet communication has been down for 10 or more seconds when using Ethernet as the destination for a data output unit.	<ul style="list-style-type: none"> Check whether the PC / PLC at the other end of the connection is ready to transmit/receive data. Check that the communication software for Ethernet is running on the PC / PLC and that the PC / PLC is connected with the controller. 	146
An RS-232C communication time out error has occurred.	RS-232C communication has been down for 60 or more seconds when using RS-232C as the destination for a data output unit.	<ul style="list-style-type: none"> Make sure flow control is not set to [Enable] in the RS-232C settings. Make sure hardware flow control is not enabled on the PC / PLC. Make sure the serial cable is not disconnected. 	162
CC-Link communication has failed.	An error has occurred while starting communication or during communication, and communication cannot be performed correctly.	<ul style="list-style-type: none"> Check whether the CC-Link cable is connected correctly. Check whether the terminating resistor is attached properly. Make sure the cable complies with the specified standards. Check whether the baud rate is set correctly according to the cable length specifications. Make sure the settings on the master side have not been changed during the communication session. Check whether the controller and master were restarted after updating the communication settings. 	177
CC-Link module (CA-NCL10E) disconnected.	The CC-Link module is not recognized and the controller cannot use CC-Link communication.	<ul style="list-style-type: none"> Make sure the CC-Link module is attached correctly. Make sure the CC-Link module is not damaged. Do not disconnect the CC-Link module while the controller and module are powered on. 	181
Illumination expansion module (CA-DC20E) disconnected.	The illumination expansion module specified is not recognized, connected or has no power supplied to it.	<ul style="list-style-type: none"> Make sure the illumination expansion module is attached correctly. Make sure the illumination expansion module is not damaged. Do not disconnect the illumination expansion module while the controller and module are powered on. 	208
Illumination expansion module (CA-DC20E) has been reset. Please check the illumination expansion controller connections.	The power to a known connected illumination expansion module has been cycled while the controller has remained on. Resulting in the resetting of the settings written to the illumination expansion module.	<ul style="list-style-type: none"> Check the power supply to the controller and the illumination expansion module. Make sure the illumination expansion module is attached correctly. Make sure the illumination expansion module is not damaged. Do not disconnect the illumination expansion module while the controller and module are powered on. 	209

Error Message	Cause	Corrective Action	Error Code
An error occurred in the internal memory of the illumination expansion module (module number). Illumination expansion module settings have been reset.	has occurred with the EEPROM Of the illumination expansion module and the settings have been reset.	<ul style="list-style-type: none"> If using the DC illumination mode, perform linearization again and save the settings after restoring power. If errors continue to occur after restoring power, the module maybe damaged. 	210
Failed to initialize the illumination expansion module (module number).	Failed to perform initialization within the illumination expansion unit after starting up.	If errors continue to occur after restoring power, the module maybe damaged.	211
Failed to connect to FTP server.	<p>The FTP server is not operating.</p> <p>An error occurred in the LAN connection with the FTP server.</p>	<p>Make sure the PC and FTP server on the NAS device (network archived storage) are configured and operating correctly.</p> <ul style="list-style-type: none"> Make sure the Ethernet cable is connected to the controller and the PC or the NAS device (network archived storage) running the FTP server. Make sure there are no problems (kinks, breaks etc) with the Ethernet or USB cable. Check the Ethernet cable type (cross, straight). Make sure the orange LED indicator (connection) of the Ethernet connector is lit. 	224
	The IP address for the FTP server is incorrect.	Check the IP address settings of the controller and the NAS device (network archived storage) running the FTP server software (Page 4-317).	
Failed to login to FTP server.	The user ID and/or password for logging in to the FTP server is incorrect.	Make sure the user ID and password specified in the FTP settings matches the same settings defined in the FTP server software (Page 4-317).	225
FTP data output time out error has occurred.	The controller logged in and began writing a file but was unable to complete the process with a specified time.	<ul style="list-style-type: none"> Check the connection between the controller and the NAS device (network archived storage) running the FTP server software. Make sure the FTP server is operating correctly. 	226
Failed to create file / folder on FTP server.	The controller was able to log into the FTP server, but was not able to create a file.	<ul style="list-style-type: none"> Make sure the user account has write privileges on the FTP server. Check the available disk space on the NAS device (network archived storage) running the FTP server software. Check the connection between the controller and the NAS device (network archived storage) running the FTP server software. Make sure the FTP server is operating correctly. 	227

Error Messages Assigned to System Variable %Error1.

The errors messages below are assigned to %Error1 by default, however %Error1 is not assigned to an output terminal by default.

The errors assigned to %Error1 can be removed or switched to %Error0 as desired.

Error Message	Cause	Corrective Action	Error Code
Please select "Stop SD2 Operation" before removing the SD card. The card and files may be damaged.	The SD card was removed without using the [Stop SD2 Operation].	Use the [Stop SD2 Operation], to safely remove SD Card 2. Removing an SD card while it is being accessed may damage the SD card and the data saved on it. To check the SD Card for errors and broken files run the [Check] function in the [View Files] menu.	87

Errors Messages not Assigned to System Variables %Error0 or %Error1

These errors by default are not assigned to %Error0 or %Error1 but can be assigned through the XG Vision Editor software.

Error Message	Cause	Corrective Action	Error Code
Image archive data was overwritten before being output.	The image archive data in the buffer was overwritten before it could be output.	<ul style="list-style-type: none"> Correct the number of items to archive to allow enough time to output the stored data before the next item overwrites it. To ensure output of all items in the archive, set the buffer mode to [Process until buffer full]. Note, the image archive stops when the number of items is reached. If this happens, the data must be cleared to resume archiving. 	49
Failed to save.	SD Card 1 or 2 has the following errors: connection error, access error, card full error, or write protect error.	Check the SD card where you are saving files to.	50
	No data found available to save when using the Statistics or Image Archive functions.	Try saving after data has been stored.	
Unable to write to SD Card 1	The controller output buffer for outputting to SD Card 1 is full.	Reduce the amount of data to be output to the SD1 card, so the data is output at a faster rate than it builds up. Or extend the time between triggers / processing to allow for data to be output. Note: Results data are not written when the buffer is full.	67
SD Card 1 output buffer is full.	The controller output buffer for outputting to SD Card 1 is full.	Reduce the amount of data to be output to the SD1 card, so the data is output at a faster rate than it builds up. Or extend the time between triggers / processing to allow for data to be output. Note: Inspections processing can be put on hold until the buffer becomes free.	68
Unable to write to SD Card 2	The controller output buffer for outputting to SD Card 2 is full.	Reduce the amount of data to be output to the SD2 card, so the data is output at a faster rate than it builds up. Or extend the time between triggers / processing to allow for data to be output. Note: Results data are not written when the buffer is full.	83
SD Card 2 output buffer is full.	The controller output buffer for outputting to SD Card 2 is full.	Reduce the amount of data to be output to the SD2 card, so the data is output at a faster rate than it builds up. Or extend the time between triggers / processing to allow for data to be output. Note: Inspections processing can be put on hold until the buffer becomes free.	84

Error Message	Cause	Corrective Action	Error Code
Unable to write to PC Program output buffer.	The controller output buffer for outputting to PC Programs is full.	Reduce the amount of data to be output to a PC Program, so the data is output at a faster rate than it builds up. Or extend the time between triggers / processing to allow for data to be output. Note: Results data are not written when the buffer is full.	99
PC Program output buffer is full.	The controller output buffer for outputting to PC Programs is full.	Reduce the amount of data to be output to a PC Program, so the data is output at a faster rate than it builds up. Or extend the time between triggers / processing to allow for data to be output. Note: Inspections processing can be put on hold until the buffer becomes free.	100
Unable to write to PLC-Link output buffer.	The controller output buffer for outputting via PLC-Link is full.	Reduce the amount of data to be output via PLC-Link, so the data is output at a faster rate than it builds up. Or extend the time between triggers / processing to allow for data to be output. Note: Results data are not written when the buffer is full.	115
PLC Link output buffer is full.	The controller output buffer for outputting via PLC-Link is full.	Reduce the amount of data to be output via PLC-Link, so the data is output at a faster rate than it builds up. Or extend the time between triggers / processing to allow for data to be output. Note: Inspections processing can be put on hold until the buffer becomes free.	116
External command error has occurred.	An error occurred when executing a command from one of these devices: <ul style="list-style-type: none"> • PC Program • PLC-Link • Ethernet • RS-232C • CC-Link • Parallel Port 	Review the command being sent, the program settings or the device status.	128
Internal command error has occurred.	An error occurred when executing a command via one of these internal methods: <ul style="list-style-type: none"> • Command unit • Timer command • Buttons on the handheld controller • Menu button 	Review the command being issued and the program settings.	129
Unable to write to Ethernet output buffer.	The controller output buffer for outputting via Ethernet is full.	Reduce the amount of data to be output via Ethernet, so the data is output at a faster rate than it builds up. Or extend the time between triggers / processing to allow for data to be output. Note: Results data are not written when the buffer is full.	147
Ethernet output buffer is full.	The controller output buffer for outputting via the Ethernet port is full.	Reduce the amount of data to be output via Ethernet, so the data is output at a faster rate than it builds up. Or extend the time between triggers / processing to allow for data to be output. Note: Inspections processing can be put on hold until the buffer becomes free.	148
Unable to write to RS-232C output buffer.	The controller output buffer for outputting via the RS-232C port is full.	Reduce the amount of data to be output via RS-232C, so the data is output at a faster rate than it builds up. Or extend the time between triggers / processing to allow for data to be output. Note: Results data are not written when the buffer is full.	163

Error Message	Cause	Corrective Action	Error Code
RS-232C output buffer is full.	The controller output buffer for outputting via the RS-232C port is full.	Reduce the amount of data to be output via RS-232C, so the data is output at a faster rate than it builds up. Or extend the time between triggers / processing to allow for data to be output. Note: Inspections processing can be put on hold until the buffer becomes free.	164
Unable to write to CC-Link output buffer.	The controller output buffer for outputting via the CC-Link is full.	Reduce the amount of data to be output via CC-Link, so the data is output at a faster rate than it builds up. Or extend the time between triggers / processing to allow for data to be output. Note: Results data are not written when the buffer is full.	179
CC-Link output buffer is full.	The controller output buffer for outputting via the CC-Link is full.	Reduce the amount of data to be output via CC-Link, so the data is output at a faster rate than it builds up. Or extend the time between triggers / processing to allow for data to be output. Note: Inspections processing can be put on hold until the buffer becomes free.	180
Unable to write to the parallel / terminal I/O output buffer.	The controller output buffer for outputting using the parallel / terminal outputs is full	Reduce the amount of data to be output through the parallel / terminal outputs, so the data is output at a faster rate than it builds up. Or extend the time between triggers / processing to allow for data to be output. Note: Results data are not written when the buffer is full.	195
Parallel / terminal I/O output buffer is full.	The controller output buffer for outputting using the parallel / terminal outputs is full.	Reduce the amount of data to be output through the parallel / terminal outputs, so the data is output at a faster rate than it builds up. Or extend the time between triggers / processing to allow for data to be output. Note: Inspections processing can be put on hold until the buffer becomes free.	196

Additional Error Messages

The following errors / error messages cannot be assigned to system variables.

Error Message	Cause	Corrective Action	Error Code
Broken files were found and converted to [FILEXXX.CHK].	The memory utility found broken files during the check process and was able to restore the broken files.	-	-
• SD Card 1 check failed. • SD Card 2 check failed.	The memory utility found broken files during the check process but was unable to restore the files.	<ul style="list-style-type: none"> If the error persists after repeating the check process, contact your local Keyence office. In some cases, the error may be resolved by formatting the SD card and running the check again. However, all the data stored on the card will be lost. 	-
Failed to add new program.	The target location (SD Card 1 or SD Card 2) is full.	Make space available by deleting files.	-
Load failed.	The source location (SD Card 1 or SD Card 2) is full.	Make space available by deleting files.	-
Save failed.	The destination location (SD Card 1 or SD Card 2) is full.	Make space available by deleting files.	-
Failed to change program.	<p>The data in the specified program file is corrupted and cannot be used.</p> <p>The data in the specified program is from an incompatible version.</p>	<p>Change the program to a different working program. Create a compatible version of the program file.</p>	-
• Failed to copy file(s) due to write protection. • Failed to move file(s) due to write protection. • Failed to delete file(s) due to write protection. • Failed to rename file or folder due to write protection. • Failed to create folder due to write protection. • Failed to copy file(s) due to write protection on the source SD card. • Failed to copy file(s) due to write protection on the destination SD card. • SD Card 1 is write-protected. • SD Card 2 is write-protected.	The write-protection switch on the SD card is enabled.	Disable the write-protection switch on the SD card.	-
Failed to save the image.	<p>The SD card is not inserted.</p> <p>The SD card is full.</p> <p>The write-protection switch on the SD card is enabled.</p>	<p>Properly insert the SD card into the SD slot.</p> <p>Make space available by deleting or moving unnecessary files.</p> <p>Disable the write-protection switch on the SD card.</p>	-
Set the difference of light output ON-delays to 500μs or less.	Multiple flash terminals are assigned to the same camera and the difference between smallest and largest delay times is 500μs or more.	Set the ON-Delay so that the difference between the smallest and largest ON-Delays is 500μs.	-

Error Message	Cause	Corrective Action	Error Code
No more menus can be opened until others are closed.	There are 16 menus open. There are numerous menus open with too many elements to handle.	Close any unnecessary menus.	-
Failed to access statistics / image archive data. If the image archive is open in the PC please close and try again.	The Image Archive viewer in XG VisionEditor is open. An ActiveX control is currently reading the image archive data.	Close the Image Archive viewer in XG VisionEditor. Wait for the ActiveX control to finish reading statistics / image archive data before using the following menus: Statistic Settings. Statistics, Image Archive Settings, Image Archive and Edit Unit menu.	-
	A non-protocol image archive related command is being executed.	Wait for the non-protocol archive related command to finish before using the following menus: Statistic Settings. Statistics, Image Archive Settings, Image Archive and Edit Unit menu.	-
An error occurred during linearization. Please check the light settings.	Linearization failed because the light was not connected.	Connect the light correctly, check settings and rerun linearization.	-
Please verify the power supply and connectivity of the illumination expansion module.	Either the illumination expansion module corresponding to the linearized channel has been disconnected or the power is not turned on.	<ul style="list-style-type: none"> Check the power supply to the controller and the illumination expansion module. Make sure the illumination expansion module is attached correctly. Make sure the illumination expansion module is not damaged. Do not disconnect the illumination expansion module while the controller and module are powered on. 	-
Failed to save illumination voltage & linearization settings.	Either the illumination expansion module corresponding to the linearized channel has been disconnected or the power is not turned on.	<ul style="list-style-type: none"> Check the power supply to the controller and the illumination expansion module. Make sure the illumination expansion module is attached correctly. Make sure the illumination expansion module is not damaged. Do not disconnect the illumination expansion module while the controller and module are powered on. Rerun linearization after checking the illumination expansion module and save the settings. 	-
The number of characters exceeds the library file capacity. The characters cannot be registered.	The number of registered characters in the library has reached the 200-character limit.	The maximum number of characters that can be registered to a single library is 200. Delete unnecessary characters or setup a new library.	-
Library file not found.	Access to the library failed when trying to select a library index or during editing.	Check the SD card and verify the location and existence of the library file.	-

Error Message	Cause	Corrective Action	Error Code
This menu cannot be accessed as there is a setting error in this unit.	In a version 2.1 or higher program the unit being selected for editing via the Edit Unit menu has errors (except the ones listed below). <ul style="list-style-type: none"> Non-specific errors: (Region, Pattern Region, Color Extraction, Light Intensity Source Unit, Image Operation operations, Image array operations). Processing capacity full errors: (Failed to register reference image, failed to set inspection region, failed to register image for subtraction filter, failed to register a character in the library). Others: Library file does not exist, library file format is illegal. 	<ul style="list-style-type: none"> Use XG Vision Editor to run a check on the program data. Fix unit errors either through the Edit mode or by using XG Vision Editor. 	
An error exists in the calculation / script.	The warning message detailing errors in the calculation unit was closed by clicking on the [OK] button.	Correct errors in the expression, function or script in the calculation unit.	-
The calculation / script has reached the maximum number of characters per line (1000), or number of lines (2000) that can be edited via the controller. Please change accordingly or edit with XG Vision Editor software.	Either the expression, function or script in the calculation unit exceeds 1000 characters per line or is over 2000 lines.	Use XG VisionEditor to modify the unit so the expression, function or script fits within the limits.	-

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Revision History

Printing date	Edition	Revision
February 2010	First edition	Edited for Ver. 3.0.0000.
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WARRANTY

KEYENCE products are strictly factory-inspected. However, in the event of a failure, contact your nearest KEYENCE office with details of the failure.

1. WARRANTY PERIOD

The warranty period shall be for one year from the date that the product has been delivered to the location specified by the purchaser.

2. WARRANTY SCOPE

- (1) If a failure attributable to KEYENCE occurs within the abovementioned warranty period, we will repair the product, free of charge. However, the following cases shall be excluded from the warranty scope.
 - Any failure resulting from improper conditions, improper environments, improper handling, or improper usage other than described in the instruction manual, the user's manual, or the specifications specifically arranged between the purchaser and KEYENCE.
 - Any failure resulting from factors other than a defect of our product, such as the purchaser's equipment or the design of the purchaser's software.
 - Any failure resulting from modifications or repairs carried out by any person other than KEYENCE staff.
 - Any failure that can certainly be prevented when the expendable part(s) is maintained or replaced correctly as described in the instruction manual, the user's manual, etc.
 - Any failure caused by a factor that cannot be foreseen at a scientific/technical level at the time when the product has been shipped from KEYENCE.
 - Any disaster such as fire, earthquake, and flood, or any other external factor, such as abnormal voltage, for which we are not liable.
- (2) The warranty scope is limited to the extent set forth in item (1), and KEYENCE assumes no liability for any purchaser's secondary damage (damage of equipment, loss of opportunities, loss of profits, etc.) or any other damage resulting from a failure of our product.

3. PRODUCT APPLICABILITY

KEYENCE products are designed and manufactured as general-purpose products for general industries. Therefore, our products are not intended for the applications below and are not applicable to them. If, however, the purchaser consults with us in advance regarding the employment of our product, understands the specifications, ratings, and performance of the product on their own responsibility, and takes necessary safety measures, the product may be applied. In this case, the warranty scope shall be the same as above.

- Facilities where the product may greatly affect human life or property, such as nuclear power plants, aviation, railroads, ships, motor vehicles, or medical equipment
- Public utilities such as electricity, gas, or water services
- Usage outdoors, under similar conditions or in similar environments

Specifications are subject to change without notice.

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**Ultra High-Speed,
Flexible Machine Vision System**

XG-7000 Series

User's Manual
Added Functions Guide
(Supports Ver.4.0)

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Introduction

This manual describes the basic operation methods and precautions for the major additional functions which were changed from Ver. 3.0 or added to Ver. 4.0 of the XG-7000 Series ultra high-speed, flexible machine vision system (hereinafter, "the controller"). Read this manual thoroughly in order to understand how the XG-7000 Series 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 controller.

Changes in the XG-7000 Ver. 4.0

This document has been written for the XG-7000 Series running Ver. 4.0.

Reference

- The firmware on your controller can be checked by clicking "System Information" (Page 5-36) on the System Configuration in the XG-7000 Series User's Manual.
- While some exceptions apply, dedicated software is required to use the functions described in this manual.

Additional and modified functions

The following functions have been added or modified.

- Image Bar and retest functions (Page A-28)
 - Retest mode has been added to provide a retest function using images saved in the controller's memory, the SD card, or an FTP server.
 - The Image Bar function enables listing and selecting images to be retested.
 - A Retest mode (Online) and a retest image are now supported.
 - A function to obtain statistics on the retest image results has been added.
- Additional support for screen editing on the controller (Page A-41)
 - Functions to load/save display templates have been added.
 - Parts can be placed, aligned, or arranged based on their positions, or can be moved to the foremost/rearmost position.
- Support for EtherNet/IP communication.

Reference

For more details on EtherNet/IP, see the XG VisionEditor Reference Manual for Added Functions Guide (Supports Ver. 4.0).

- Built-in Menus
 - The Change Variable, Change Variable Setting, and Image Bar have been added.
 - The [FTP Settings] menu has been renamed to the [FTP Server Settings] menu.
- Function Menu
 - [Change Variable] (Page A-38) and [Image Bar] have been added.
- System Configuration
 - Support for traditional and simplified Chinese has been added in [Language]. Moreover, [Flowchart View display string] has been added to allow a unit type or a unit name to be selected for the unit display on Flowchart View.
 - The EtherNet/IP settings, OCR date and time encryption settings, and custom instruction settings can be changed in offline mode.

- The BOOTP function has been added to the Ethernet setting.
- CSP files can be created in the CC-Link setting.
- When the [On time] is set to 0 ms in the Terminal I/O Setting, the timeout for the handshake can be disabled (the output time for %Ack and %Nack switches simultaneously with the output cycle time).
- Master images can be handled in the save/load settings operation.
- MAC addresses can be displayed in the system information and Ethernet settings.
- The design of the [Change Program] menu has been changed.
- The design of the top menu for the edit unit menu has been changed.
- Master images can be copied, saved, and loaded in the [New/Edit/Delete Programs] menu.
- Master images can be copied in the [Copy/Delete Settings] menu.
- Master images can be handled in the [Save/Load Settings] menu.
- Types of compatible PLC-Link connections
 - MP900 Series (RS-232C only)/MP2000 Series PLCs manufactured by YASKAWA Electric Corporation are now supported.
 - For PLC link (Ethernet), the model description of Keyence's PLC was changed from the KV-LE20 Series to the KV Series.
- [Resources] and [Register as a changeable variable] have been added to the Edit menu.
- The key layout of the software keyboard was changed to QWERTY when English is selected in [Language].

Addition and modification of processing functions

The following functions have been added or modified:

- 2D code reader unit** (Page A-9): A vision tool has been added which reads up to 512 characters of 2D codes (QR code: Model 1/Model 2, Micro QR, DataMatrix/Rectangular DataMatrix (ECC200)) and supports up to 16 patterns of registered characters.
- Pattern search unit**: [Very high(4)] has been added to the search sensitivity setting options.
- Capture unit**: EtherNet/IP has been added to the external trigger input.

- **Calibration unit:** A setting parameter [Same as axis direction] has been added to the origin/axis setting.
- **Wait terminal I/O unit and Variable delay unit:** A setting parameter [Update display while waiting] has been added.
- **Branch unit:** A function has been added to set forced branch number for retesting.
- **On-screen graphics unit:** The parameter [OCR] was renamed to [OCR/code].
- **Data output unit:** EtherNet/IP has been added as output destination.
- **Image output unit, image archive condition, and image archive output**
 - The maximum number of the folder division has been changed from 10,000 to 50,000.
 - The default value for the data archiving of the image archive condition has been changed to [Do not include].
 - A parameter has been added to [Statistics] to set the number of statistical data points for retesting.
- **Calculation unit:**
 - The unit measurement time on the controller has been improved.
 - A double quotation ("") key has been added to the software keyboard.
- **Command unit:** A double quotation ("") key has been added to the software keyboard.
- **Plugin unit:** A method "int getControllerId(void)" has been added to obtain the controller ID.
- **Screen Properties:**
 - In the dialog template properties, the option [Update camera screen when applying changes] has been changed to [Update camera screen and display template when applying variable changes].
 - An option [Update camera screen and display template when applying variable changes] has been added to the display template settings.
- The following system variables have been added.
 - %Cam1Status to %Cam4Status: Indicate the status of the image capture buffer.
 - %Cam1Num to %Cam4Num: Indicate the number of images in the image capture buffer.
 - %RetestStatus: Indicates whether the operation is in Retest mode or not.
- The forced mode change operation with the press of No. 1, 7, and 8 buttons on the handheld controller simultaneously has been abolished.

Additions and changes in communication commands

The following commands have been added or changed.

- **OPW (Change Destination Folder):** Additional command to change the output destination folder for the data output unit, image output unit, and archive output.
- **OPR (Read Destination Folder):** Additional command to read the output destination folder for the data output unit, image output unit, and archive output.
- **AT (Automatic Tuning):** Additional command to perform automatic tuning for the specified 2D code reader unit using the current or registered image.
- **OW (Change Fixed Name in File Naming Rule):** Added support for changing the fixed text in the file naming rule for archive output.
- **OR (Read Fixed Name in File Naming Rule):** Added support for reading fixed text in the file naming rule for archive output.
- **CW (Write REG):** Added support for matching patterns for a 2D code reader unit.
- **CR (Read REG):** Added support for matching patterns for a 2D code reader unit.

Reference

For more details on the communication commands, refer to the XG VisionEditor Reference Manual for Added Functions Guide (Supports Ver.4.0).

Compatibility of program data

- Due to functional enhancements in Ver. 4.0, the program data (inspection settings, global variable settings, and global settings) are now in 4.0 format. (Program files for Ver. 1.0, 2.0, 2.1, and 3.0 are in 1.0, 2.0, 2.1, and 3.0 formats, respectively).
Ver. 4.0 has backward compatibility and can read programs created in earlier versions. Note, however, that using a PlugIn unit in Retest mode (Online) requires a bin file complied with XG VisionEditor Ver. 4.0 or later. For more details on a PlugIn unit, refer to the XG VisionEditor Reference Manual (Control/Data Edition).
- Downward compatibility has not been provided. Therefore, programs in 4.0 format cannot be used on Ver. 1.0 controllers (registered images, library settings, and logo files can be used).
- Earlier version program files can be upgraded using XG VisionEditor Ver. 4.0. 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. 3.0 and earlier controllers can be upgraded to Ver. 4.0 by downloading the firmware upgrade. For more details on the firmware upgrade, visit the User's Support home page.

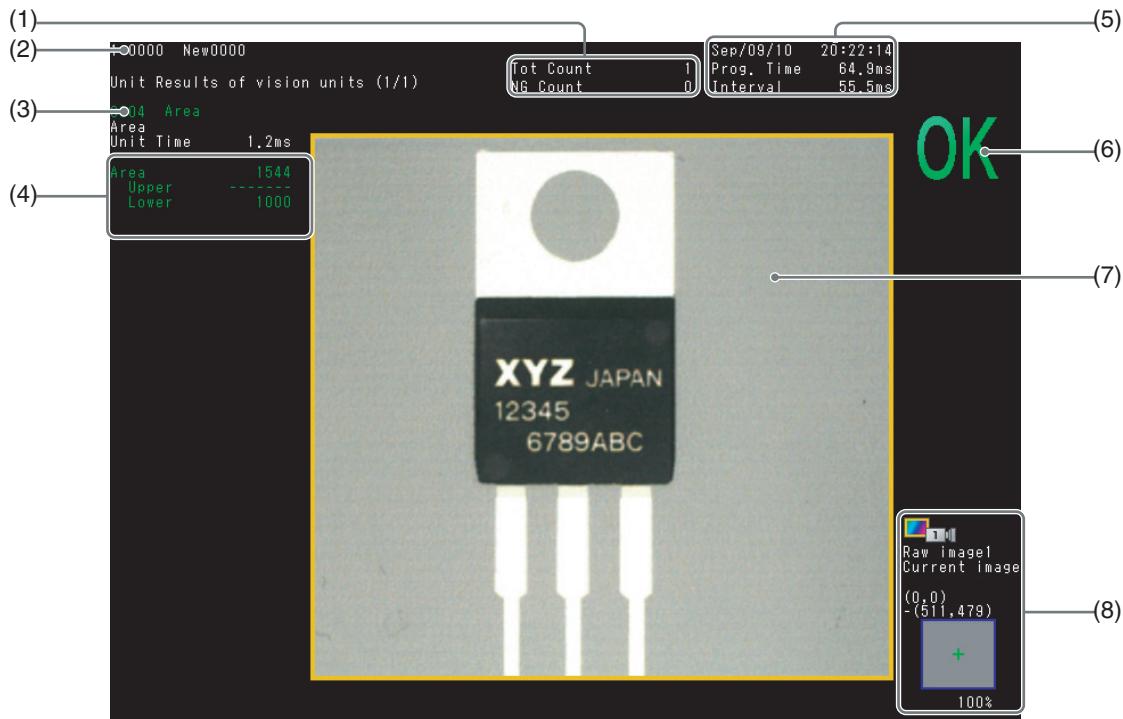
Screen Layout

Standard Screen in Run Mode

The following is a typical screen in Run mode.

Reference

Some functions may be hidden depending on the setting of the screen editing (Page A-41) or login user account.



(1) Total Count/NG Count display

Displays the cumulative count and the cumulative count of inspections judged as NG during Run mode. The measurements and judgments from Program mode are not reflected. The upper limit for cumulative count is 10000000000. After passing this value, the count returns to 1.

(2) Program No. display

Displays the program No. of the program being processed.

(3) Unit display

Displays the name and ID of the unit being displayed.

(4) Inspection result display

Displays the measurement and judgment results for the unit being displayed.

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

- Date/time:** Displays the date and time when the capture unit which was executed first in the last executed flowchart started image capturing.
- Program time:** Displays the processing time (the time from trigger input to the end of the image processing) for the last time the current program was run.

- 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

- Since some processing may not be applied in Program mode, you need to switch to Run mode if you want to obtain more reliable program time and trigger interval.
- The displayed value is a reference value calculated by assuming normal settings and operating status. The value may include some errors depending on the inspection settings and operating status.

(6) Judgement result display

Displays the total status of all the inspections in the current program.

(7) Camera image

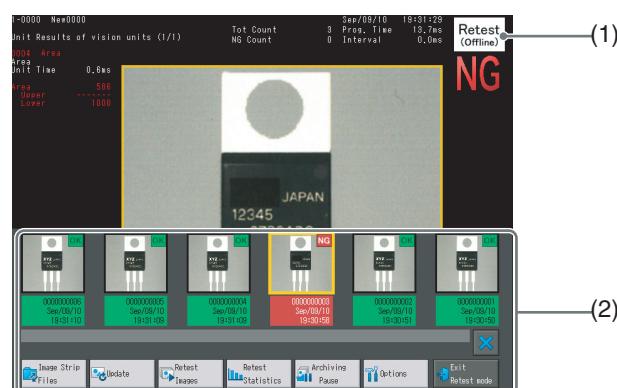
Displays the image that is input from the camera.

(8) Information display

Displays information about the cameras connected to the system, display type, displayed image, and display position.

Screen in Retest Mode

The following is a typical screen in Retest mode (Page A-28) with the Image Bar displayed.



(1) Operation mode display

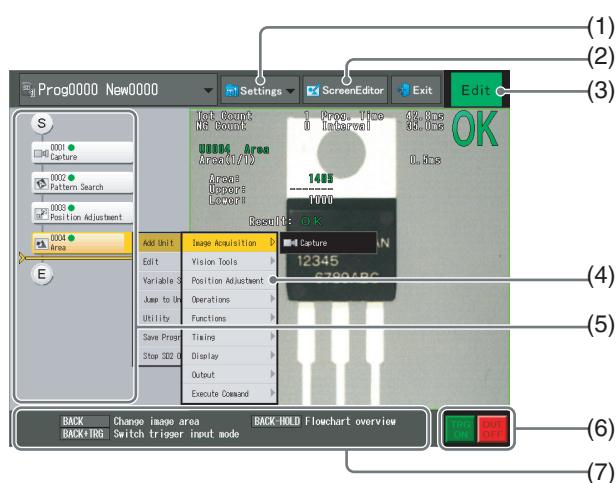
Displays [Retest]. When [System processing] is set to ON, [Retest (Online)] is displayed.

(2) Image Bar

Shows available functions related to the retest operation. Refer to "Retest Using the Measurement Result (Retest Mode)" (Page A-28) for more details.

Screen for Flowchart Editing

The following is a typical screen used for editing a flowchart.



(3) Operation mode display

Displays [Edit]. It shows [Retest] when the Flowchart is opened in Retest mode, and [Retest (Online)] when Retest mode (Online) is selected.

(4) Function Menu

The menu options to be displayed vary depending on the current screen or the item being selected. For more details, refer to the XG-7000 Series User's Manual.

(5) Flowchart

Displays the current flowchart when [Program Flow Edit Start] is selected from the function menu. For more details, refer to the XG-7000 Series User's Manual.

(6) Trigger/output status display

Displays the status of the trigger input and the output via terminals or communication. For more details, refer to the XG-7000 Series User's Manual.

Reference

In Retest mode (Online) [Total count during Run] is displayed.

(7) Help Bar

Displays a guide for operations with the handheld controller.

Additional Vision Tools

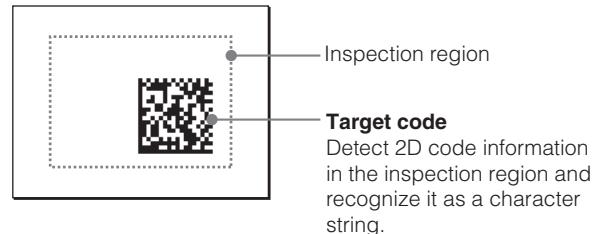
2D Code Reader

2D Code Reader Tool

A 2D code reader detects 2D code information within the inspection region and reads a character string contained in the 2D code in the captured image.

In addition to outputting the read character strings to external devices, you can perform comparison against preset data or variable strings such as calendar data or serial numbers. The read data can also be used for sorting by predefined matching patterns.

Image Layout



Applicable codes for the 2D code reader tool

The following code formats are supported.

QR

QR codes (Model 1 and Model 2) can be read.



▶ Note

The structured append feature is not supported.

Micro QR

Micro QR codes can be read.



▶ Note

The structured append feature is not supported.

DataMatrix

DataMatrix codes (ECC200) can be read.



▶ Note

- Versions ECC000 to ECC140 are not supported.
- The structured append feature is not supported.

Rectangular DataMatrix

Rectangular DataMatrix codes can be read.



▶ Note

The structured append feature is not supported.

Measurement Results

The major results output with the 2D code reader tool are as follows:

Read data length	Outputs the length of the read data in bytes. <small>Available in the limits menu</small>
Read data	Outputs the read data as a character string. <small>Available in the limits menu</small>
Pos. X	Outputs the X coordinate of the center of the detected 2D code in pixels. <small>Available in the limits menu</small>
Pos. Y	Outputs the Y coordinate of the center of the detected 2D code in pixels. <small>Available in the limits menu</small>
Pos. XY	Outputs the XY coordinates of the center of the detected 2D code in pixels.
Detected angle	Outputs the difference between the reference angle and the angle of the detected 2D code. <small>Available in the limits menu</small>
Pos. XY/ Detected angle	Outputs the XY coordinates of the center of the detected 2D code in pixels and the detected angle in degrees.
Divided data length 1 to 8	Outputs the read data length of each of divided data 1 to 8 in bytes.
Divided data 1 to 8	Outputs the character string of each of divided data 1 to 8. <small>Available in the limits menu</small>
Detected size per cell	Outputs the resolution of the detected 2D code in pixels per cell.
Unused error correction	Outputs the ratio of unused error correction for the detected 2D code within the range between 0 and 100%.
No. of cell rows	Outputs the number of cells of the detected 2D code in the vertical direction.
No. of cell columns	Outputs the number of cells of the detected 2D code in the horizontal direction.
Print color	Outputs the print color of the detected 2D code (0: Undetected, 1: Black on white, 2: White on black).
Mirror Invert	Outputs whether the detected 2D code uses mirror inversion (0: Undetected, 1: Mirror inversion not used, 2: Mirror inversion used).
Code angle	Outputs the angle of the detected 2D code by assuming the reference angle to be 0 degree.
Code data length	Outputs the length of all code data in the detected 2D code in bytes.
Read error	Outputs whether a read error occurred (0: Reading successful, 1: Reading failed).
Read error cause	Outputs the cause of the read error (0: Reading successful, 1: Code detection failed, 2: Decoding failed, 3: Timeout).
Matching No.	Outputs the smallest number of the matching criteria which were satisfied.
Matching pattern 1 to 16	Outputs the character string of each of matching patterns 1 to 16.
Matching result	Outputs the total judgment result based on all matching criteria.

Matching result	Outputs the matching result of each of patterns 1 to 16 (-1: Matching impossible, 0: Matched, 1 or higher: Number assigned to the unmatched digit).
1 to 16	
Region: Point 1X	Outputs the region information (X coordinate of the first point) of the detected 2D code in pixels.
Region: Point 1Y	Outputs the region information (Y coordinate of the first point) of the detected 2D code in pixels.
Region: Point 1XY	Outputs the region information (XY coordinates of the first point) of the detected 2D code in pixels.
Region: Point 2X	Outputs the region information (X coordinate of the second point) of the detected 2D code in pixels.
Region: Point 2Y	Outputs the region information (Y coordinate of the second point) of the detected 2D code in pixels.
Region: Point 2XY	Outputs the region information (XY coordinates of the second point) of the detected 2D code in pixels.
Region: Point 3X	Outputs the region information (X coordinate of the third point) of the detected 2D code in pixels.
Region: Point 3Y	Outputs the region information (Y coordinate of the third point) of the detected 2D code in pixels.
Region: Point 3XY	Outputs the region information (XY coordinates of the third point) of the detected 2D code in pixels.
Region: Point 4X	Outputs the region information (X coordinate of the forth point) of the detected 2D code in pixels.
Region: Point 4Y	Outputs the region information (Y coordinate of the forth point) of the detected 2D code in pixels.
Region: Point 4XY	Outputs the region information (XY coordinates of the forth point) of the detected 2D code in pixels.
Unit judgment value	When the measurement result specified for tolerance judgment is outside of the specified tolerances (upper and lower limits), or when the read string does not satisfy the matching criteria, it is judged as [NG]. When the result is within the tolerances and the read string satisfies the matching criteria, it is judged as [OK].

Reference

- For the measurement result which involves character string output (read data, divided data 1 to 8, matching pattern 1 to 16), the result will be a character string when no array element is specified (such as ID_DATA[]), and the result will be a numerical value when an array element is specified (such as 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 VisionEditor Reference Manual (Control/Data Edition).

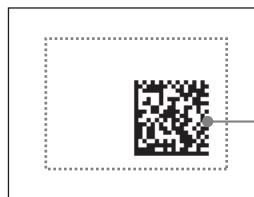
▶ Note

- When [PC Program] is specified as the destination of the result output and the measurement result involves character string output (read data, divided data 1 to 8, matching pattern 1 to 16), the number of characters which can be output for each item is limited to 80. If this is a problem, use "Data Split" (Page A-20).
- When binary data is used, numerical data after 0 (NULL) will not be displayed nor matched.

Measurement Sample

Example showing the results of a measurement performed under the following conditions:

- Code Type: DataMatrix
- Start Digit: 1
- Data Length: 100
- Data Division: ON
 - DATA1: Start Digit 9, Data Length 2
 - DATA2: Start Digit 12, Data Length 4



Read data
KEYENCE XG-7000 SERIES
Divided data 1 XG
Divided data 2 7000

Top Menu Layout

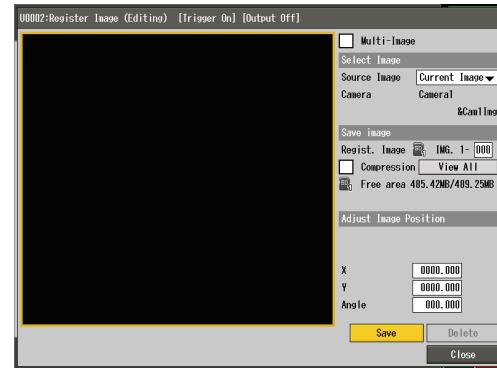
The 2D code reader tool has the following options.



Register Image (Page A-12)	Registration of an image to be used as a template for settings.
Select Image (Page A-14)	Selection of the registered or current image to be used for settings.
Inspect Region (Page A-15)	Outline the region on the captured image to be used for the inspection.
Color (Page A-16)	Color extraction and conversion settings for a color image to gray-scale or binary. (only available for color cameras)
Image Enhance (Page A-16)	Selection and setting of pre-processing filters to apply to the image.
Condition (Page A-17)	Specify the conditions to detect a 2D code for measurement.
Parameters (Page A-19)	Specify other conditions for the 2D code reader measurement as required.
Limits (Page A-22)	Set the tolerances (upper and lower limits) for the measurement value and matching patterns.
Dsp. Options (Page A-25)	Inspection region and mask region display settings.
Save (Page A-26)	Save 2D code reader tool settings.

Register Image

Registration of an image to be used as a template for settings. It is recommended to adjust lighting and other conditions completely before registering an image.



Multi-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.
- When multi-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.
- The image variable used for the select image of the vision tools unit should be the same as the image variable used for the capture unit being executed. When the image capture buffer is set to custom, the image variable which contains the image of the capture unit executed most recently will be displayed.

Select Image

Source Image

Select an image to register.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Save Image] is displayed.

Save Image

Number

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

Compression

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

There may be some deterioration in image quality due to compression. Inspection results when using a compressed image may differ from results when using an uncompressed image.

View All

You can 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 -2432.000 and 2432.000 pixels.

Y

Adjust the movement in the Y (vertical) direction between -2050.000 and 2050.000 pixels.

Angle

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

Reference

When you select [Current Image] as the source image for the unit for which the position adjustment ID has been specified in [Inspection Region] (Page A-15), you can select [Pos. Adjust. value] as well as [Number Input]. This option is useful because even when the image capture position deviates, the current image is automatically adjusted using the adjustment value based on the reference unit. However, note that when [Pos. Adjust. value] is selected in the state where a proper adjustment value cannot be measured for the current image, the position used for registration may be incorrect.

▶ Note

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

Save

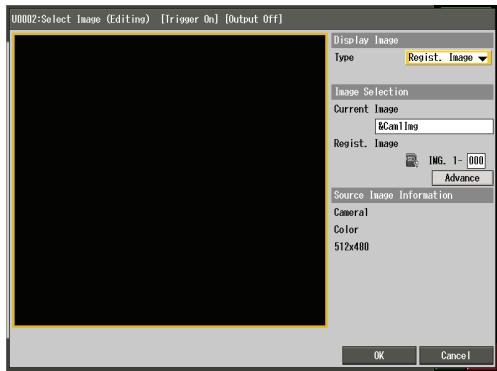
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Regist. Image] is selected for [Source Image], you can delete the registered image specified under [Save Image].

Select Image

Selection of the registered or current image to be used for settings.



Display Image

Type

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Image Selection

Current Image

Set an image variable to be used as a current image for the unit.

Regist. Image

Specify the registered image to be used as a template.

- 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 No.:** To use a variable for the registered image No., check this box and assign a scalar or scalar 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. See the XG VisionEditor Reference Manual (Control/Data Edition) for more details.
- **Process variable when changing programs:** Use this option to switch 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

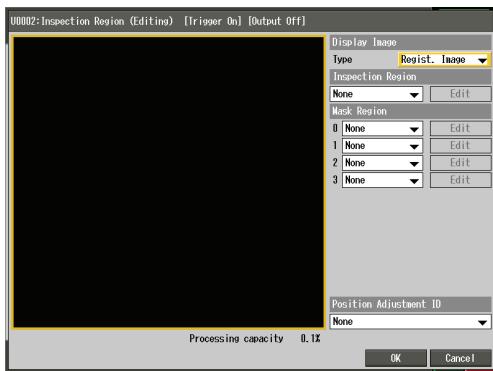
Note that the displayed registered image No. does not switch in accordance with a change in the variable.

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 the inspection.



Reference

- The smaller the inspection region, the shorter the processing time.
- If there is any background other than a 2D code in the inspection region, the processing time or the time for automatic tuning may increase greatly. Adjust the region properly for the target code.

▶ Note

If there are two or more codes in the inspection region which satisfy the detection condition, you cannot specify which code to detect (operation is unpredictable).

Inspection Region

Select [Rectangle] and then draw the region, or select [Edit] and specify the region with numerical values. For more details, refer to the XG-7000 Series User's Manual.

▶ Note

- You can only use a rectangle as an inspection region for a 2D code reader unit.
- Image regions cannot be used.

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.

Position Adjustment ID

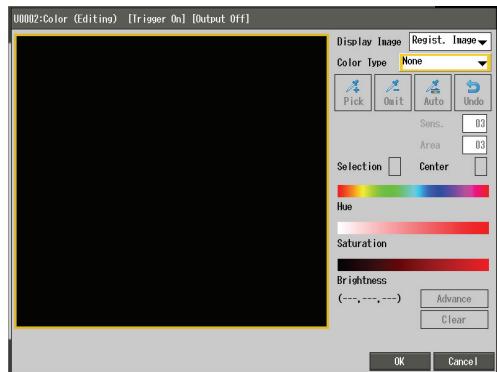
To apply position adjustment to the region, select the position adjustment unit to be modeled on from the list.

Reference

The position adjustment can be applied to both inspection and mask regions.

Color

When a color image variable is used for the current image, convert the captured color image into a black and white image through the desired extraction process.



► Note

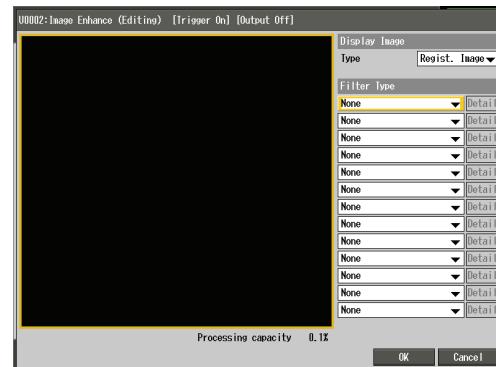
This setting is disabled when a monochrome image variable is used or when the resultant image variable is referenced as a current image.

Refer to the XG-7000 Series User's Manual for concepts involving color extraction and its operation.

Image Enhance

Selection and setting of pre-processing filters to apply to the image.

When a color image variable is used for the current image, the filter is applied to the images converted using color extraction.



Display Image

Type

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Filter Type

Select the [Filter Type] and then select the filter to apply.

Refer to "Image Enhancement Filters" (Page 8-27) for details on each filter process in the XG-7000 Series User's Manual.

► Note

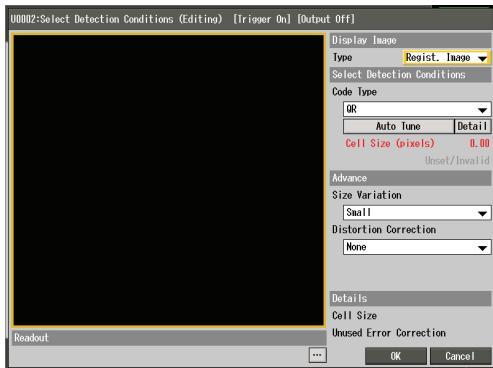
- The subtract filter cannot be selected for the 2D code reader measurement.
- The binary and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 21 types of filters can be set according to application requirements. When multiple filters are set, they are processed one by one from the top.
- You can change the order of the filters 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 up or down.

Detection Conditions

Specify the conditions to detect a 2D code.



Reference

The numerical numbers shown below in parentheses () are the corresponding numerical numbers at the time of variable assignment.

Display Image

Type

Switch the image displayed on the screen.

- **Current Image:** The latest image captured with the specified camera (image variable) is displayed. (The screen update mode [Continuous] is not supported.)
- **Regist. Image:** The registered image specified under [Image Selection] is displayed.

Code Type

Select the type of the 2D code to be detected.

- **QR** (default): Detect codes in QR format.
- **Micro QR**: Detect codes in Micro QR format.
- **DataMatrix**: Detect codes in DataMatrix format.
- **Rectangular DataMatrix**: Detect codes in Rectangular DataMatrix format.

Note

Changing the code type will initialize some of the settings on the dialog.

Auto Tune

Perform automatic tuning to automatically adjust settings best suited for the detection of the code.

Reference

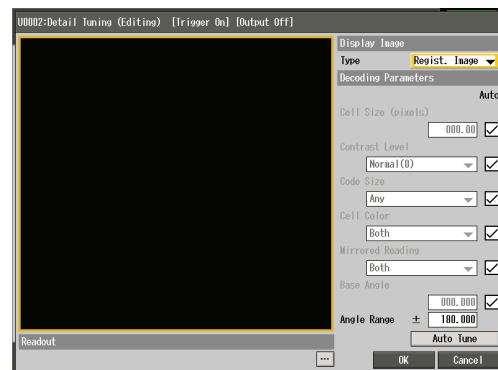
You can also perform automatic tuning from external devices or dialogs by using the AT command.

Note

- The automatic tuning will fail when there are setting errors or when even normal detection fails (due to timeout or too small angle range setting).
- If the inspection region is large, the automatic tuning may fail due to the influence of background noises or may take long time. Set the inspection region smaller as required.
- If there are two or more codes in the inspection region, you cannot specify which code to detect (operation is unpredictable). Be sure to capture an image so that there is only one code in the inspection region.

Detail

When the automatic tuning fails to obtain optimum setting or when you want to change the settings determined by the automatic tuning, select [Detail] to open the [Detail Tuning] menu and specify the tuning options manually.



Check the boxes under [Auto] for the items to be set with the automatic tuning. For unchecked items, change the settings according to the code to be detected.

Cell Size (pixels)

Specify the resolution (number of pixels in a cell) to be used as reference for the target 2D code (Default: 0.00). Setting a value closer to the value of the actual 2D code to be read ensures faster and more stable detection.

Reference

The recommended single cell size is 4.0 or more.

Contrast Level

Select the contrast information to be used as reference for characteristics extraction of the code from [Highest (2), [High (1)], [Normal (0)], [Low (-1)] or [Lowest (-2)] (Default: Normal (0)).

Selecting a low value increases the possibility of successful detection even with weak contrast. However, when the value is too low, the detection may easily be affected by noises and become unstable. When the automatic tuning is enabled, a value slightly lower than the maximum detectable value is selected based on the image obtained during the tuning.

Code Size

Select the number of cells of the target 2D code in vertical and horizontal directions. The available settings are as follows:

- QR: 21 x 21 to 177 x 177
- Micro QR: 11 x 11 to 17 x 17
- DataMatrix: 10 x 10 to 144 x 144
- Rectangular DataMatrix: 8 x 18 to 16 x 48

When the automatic tuning is enabled, the number of cells of the 2D code which was detected successfully is used (Default: None). Selecting [None] allows code detection regardless of the number of cells but the processing time becomes longer.

▶ Note

When a specific number of cells is selected, 2D codes with different number of cells are not detected.

Cell Color

Select the color of the code to be detected (code color against background).

- **None** (default): Both black codes on white backgrounds and white codes on black backgrounds are detected. The processing time is longer than the case where [Black on white] or [White on black] is selected.
- **Black on white**: Only black codes on white backgrounds are detected.
- **White on black**: Only white codes on black backgrounds are detected.

Mirrored Reading

Switch the internal processing so that the detection supports mirrored (inverted) images of the codes that are captured with a mirror, through a prism, or from the back of a transparent sheet.

- **None** (default): Both normal codes and "mirrored" codes are detected. The processing time is longer than the case where [OFF] or [ON] is selected.
- **OFF**: Only normal codes are detected. (Mirrored codes cannot be detected.)
- **ON**: Only mirrored codes are detected. (Normal codes cannot be detected.)

▶ Note

When the capture unit is used to mirror the image horizontally, the mirror inversion process is applied to the image that is mirrored horizontally.

Base Angle

Specify the angle used as reference for code detection (Default: 0.000).

Reference

The status of each code when the starting angle is set to 0 degree is the status of the code shown in "Applicable codes for the 2D code reader tool" (Page A-10).

Angle Range

Specify the range of code detection based on the starting angle (Default: 180.000). Restricting the angle range ensures faster and more stable detection.

Reference

The starting angle for the detection range specified at [Angle] is the value specified at [Starting angle].

Auto Tune

To check the result of the tuning using the current settings on the [Detail Tuning] menu, select [Auto Tune] to start tuning.

Detailed Conditions

Size Variation

Select the allowance level for the variation in the code size.

Smaller allowance level ensures faster processing and more stable code detection.

- **Small** (default): Accept the variation in size of about $\pm 10\%$.
- **Medium**: Accept the variation in size of about $\pm 20\%$.
- **Large**: Accept the variation in size of about $\pm 30\%$.
- **Unlimited**: Accept all variations in size.

Reference

When [Unlimited] is selected, detection is possible even when [Cell Size (pixels)] is not specified. Setting a value closer to the value of the actual 2D code to be read ensures faster and more stable detection.

Distortion Correction

Change the setting when the codes have some distortion.

- **Normal** (default): Do not perform special processing to correct distortion.
- **Angled Camera**: Perform special processing to correct distortion caused by the camera angle of around 30 degrees.

Persistent Search (only when DataMatrix or

Rectangular DataMatrix is selected)

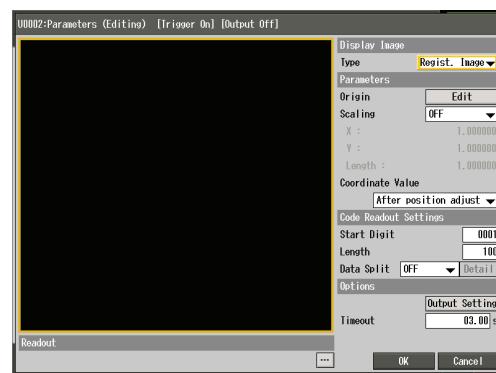
- **OFF** (default): When the code cannot be detected after the specified number of attempts, an error is returned.
- **ON**: The attempt is repeated until the code is detected. This setting may improve the detection ability compared with the case where [OFF] is selected, however; it may require much longer processing time if the detection results in failure.

Read Data

The contents of the data read with the current settings are displayed.

Parameters

Additional optional parameters for the inspection.



Display Image

Type

Switch the image displayed on the screen.

- **Current Image**: The latest image captured with the specified camera (image variable) is displayed.
- **Regist. Image**: An image which has been registered is displayed.

Parameters

Origin

By default, the origin is set to the top left point of the camera but you can specify its position 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** (default): Do not use scaling.
- **ON**: Use scaling.

Reference

- The scaling factor can be changed from the [Option] menu of the Flowchart.
- 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 VisionEditor Reference Manual (Control/Data Edition).

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** (Default): The inspection uses the adjusted coordinate system 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 start reading data of the detected code.

Length

Specify the number of characters (1 to 512 in bytes) of data to read from the start digit.

Data Split

Select whether to divide data to read the code. Divided read data can be used as a matching pattern for individual matching or can be output to external devices.

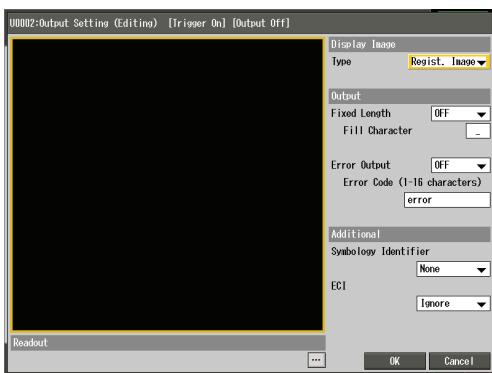
- **OFF** (default): Do not divide read data.
- **ON**: Divide read data into up to 8 pieces and use them for output or judgment. Select [Detail] to display the [Data Split Setting] menu, and then enable/disable division and specify the start digit and data length for each of data pieces.



Other Details

Output Setting

Display the [Output Setting] menu to set details on the output of read data.



- **Fixed length:** Select whether to fix the length of data output.
 - **OFF** (default): Output data of successfully read characters up to the number specified at [Data length]. (The data output length varies depending on the number of read characters.)
 - **ON:** Always output data of the fixed number of characters which was specified at [Length]. If the number of read characters is less than the fixed number, the data is padded with character data specified at [Fill Character].
- **Fill Character:** Specify a character to pad data when [Fixed Length] is set to [ON] and read characters are less than the fixed number (Default: _ (under bar)).
- **Error Output:** Select whether to output an error occurred during data reading.
 - **OFF** (default): Do not output anything.
 - **ON:** Output the specified text.
- **Error Code (1-16 characters):** Specify text within 16 characters to output when [Read error output] is set to [ON] and an error occurs (Default: error).
- **Symbology identifier:** Select whether to add an identifier (3 characters = 3 bytes) to identify symbols.
 - **None** (default): Do not add a symbol identifier.
 - **Output:** Add a symbol identifier (3 bytes) defined in ISO/IEC 15424 "Information Technology - Automatic identification and data capture techniques - Data Carrier Identifiers (including Symbology Identifiers)" to the beginning of the read data.

Reference

The table below shows symbol identifiers which will be added based on the [Symbology identifier] setting.

Code type	Added	Condition data
QR code (including Micro QR)]Q0	Model 1 (or Micro QR)
]Q1	Model 2
]Q2	Model 2 supporting ECI protocol
]Q3	Model 2, FNC1 in 1st position
]Q4	Model 2 FNC1 in 1st position plus supporting ECI protocol
]Q5	Model 2 FNC1 in 2nd position
DataMatrix (including Rectangular DataMatrix)]d6	Model 2 FNC1 in 2nd position plus supporting ECI protocol
]d1	ECC 200
]d2	ECC 200 FNC1 in 1st or 5th position
]d3	ECC 200 FNC1 in 2nd or 6th position
]d4	ECC 200 supporting ECI protocol
]d5	ECC 200 FNC1 in 1st or 5th position
]d6	ECC 200 FNC1 in 2nd or 6th position

- **ECI (Extended channel interpretation):** Select how to treat codes with ECI (This setting does not affect reading of codes without ECI.).
 - **Ignore** (default): Do not output ECI.
 - **Output:** Output ECI.

Timeout

Set an upper limit for the processing time. When the processing time for a given single unit exceeds the limit set for it (0.01 to 60 seconds, default: 3 seconds) due to the state of the current image, the unit will return a timeout error.

Note

This value is only an approximate target. There may be a certain delay until the actual timeout occurs.

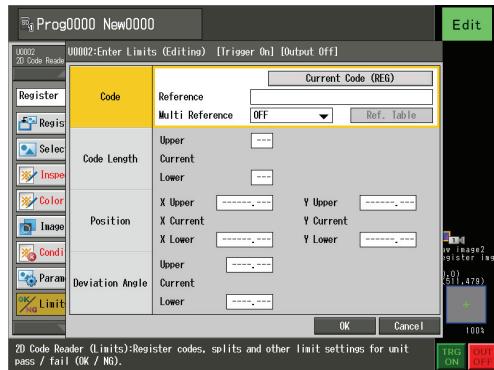
Readout

The contents of the data read with the current settings are displayed.

Enter Limits

Set the matching pattern used for the comparison with the read code data and the tolerances (upper and lower limits) for the measurement value of the detection results.

When the code reading result does not match with the matching criteria or when the measurement value is outside of the specified tolerance range, it is judged as [NG]. When the result matches with 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

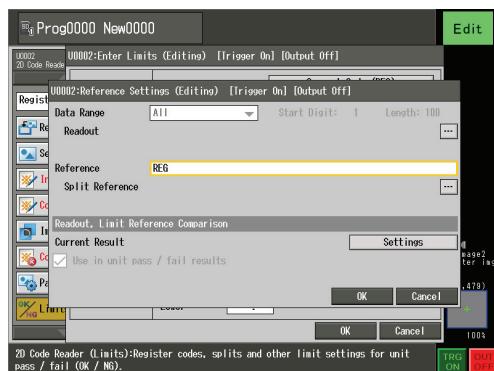
Current Code (REG)

Register up to 512 characters (512 bytes) of the data read with the current settings as a matching pattern for REG.

- If [Reference] is empty and [Multi Reference] (Page A-24) is [OFF], REG is entered automatically and the result of reading the current display image is registered.
- For more details on REG, refer to "REG (registered tolerance)" (Page A-22).

Reference Settings

When [Reference] is selected, the [Reference Settings] menu appears where you can specify a matching pattern, a matching method, or other matching criteria.



▶ Note

- You cannot select [Reference] if [ON] was selected for [Multi Reference] (Page A-24).
- To set multiple matching criteria, select [Ref. Table] (Page A-24) to display the [Multi Reference Table Settings] menu and then select [Edit] to display the dialog for editing the desired matching criterion.

- **Data Range:** Select the range of data to be matched against the matching pattern (Default: All). When you set [Data Split] to [ON] on the [Parameters] menu (Page A-20), you can specify the divided region (DATA 1 to 8) to match a desired range of the read data.

▶ Note

If [Data Split] is not set to [ON] on the [Parameters] menu, this setting is fixed to [All data].

- **Readout:** The data read with the current setting is displayed.

- **Reference:** Click the field and a software keyboard is displayed. Enter up to 32 characters and symbols (32 bytes) as a matching pattern.

- You can combine a fixed character string with reference tolerance that varies according to external information such as calendar data or with calculation tolerance that references variables.

- Readout: The following special characters can be used in the string.

- Special characters: The following control characters can be used.

* 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: Difference between the judgment results of *#/ and !

Result of reading	Matching pattern	
	AB* (AB#)	AB!
AB	→	NG OK
ABC	→	OK OK
ABCD	→	NG OK

REG (registered string): Specify the result of reading the current display image as a matching pattern.

When you select [OK] on the confirmation screen, the result of reading the current display image is registered as a matching pattern. (Although the normal entry of a matching pattern is limited to 32 characters (32 bytes), using REG allows entry of up to 512 characters (512 bytes).)

You can also re-register the reading result by selecting [Current Code (REG)] on the [Enter Limits] menu.

Reference

The CW command can be used to rewrite the REG data on the controller. See the XG VisionEditor Reference Manual (Control/Data Edition) for more details.

▶ Note

- You cannot use special character "!" twice or more in a matching pattern. If two or more "!"s are used in a pattern, matching fails.
 - REG (registered string) cannot be used in combination with other character strings or reference tolerance. It cannot be used in multiple matching patterns, either.
 - If the previous measurement result does not exist while the current image is selected as the display image, REG is cleared (A space is registered.). You must detect a code before registering a reading result.
- Date & time tolerance: The following date time functions from the internal calendar can be used in the string.

Year4: Four digit year

Year2: Two digit year

Month: Two digit month

Day: Two digit day

Hour: Two digit hour

Example: Verifying the year/month/day (January 1, 2011) using the internal calendar tolerances.

String	Matching pattern
Year4/Month/Day	→ 2011/01/01

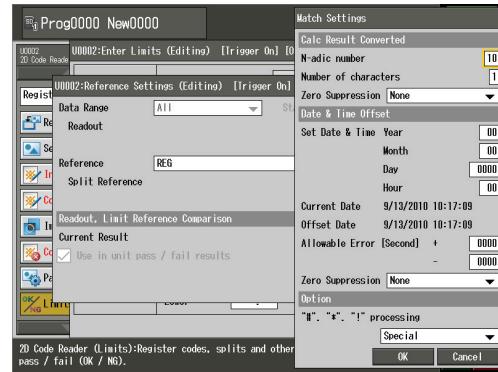
This example used both the calendar tolerance and a fixed character "/".

Reference

- A user specified offset and allowable error can be set for the date time functions of the internal calendar. Refer to "Allowable Error" (Page A-23) for more details.
 - Zero suppression (Page A-24) can be set for the Month, Day, and Hour.
 - **Variable:** Convert a value of a variable into character string tolerance. The conversion is processed according to the setting of the calculation result conversion.
- Example: When judging a string of seven characters consisting of a fixed character string (TEST) and a three-digit sequential number which is incremented by one at every inspection with a calculation unit (#Count01) (Settings: Calculation result conversion: Decimal/3 digits, Zero suppression: None)

Character string	Registered string
TEST#Count01	→ TEST000 to 999 (After 999, the value returns to 000.)

- **Matching Settings:** Open the [Matching Settings] menu to set the matching options in details.



- **Calc Result Converted:** Specify the base or number of digits for converting the value of a variable into character string tolerance (calculation tolerance).

N-adic number: Set the base (10 to 36) used for converting the value of a referenced variable into calculation tolerance (Default: 10).

Example: When numbers are changed to alphabets using base 36

Calculation result	0	to	9	10	to	35
Calculation tolerance	0	to	9	A	to	Z

Number of characters: Specify the number of digits (1 to 6) to use for the calculation tolerance conversion (Default: 1 digit).

▶ Note

The digits that run beyond the specified number of digits as a result of conversion are not reflected in the tolerance (Example of when two digits are specified in decimal: Calculation result 350 → Calculated tolerance 50)

Zero Suppression: Perform judgment by removing preceding zeros in the calculation tolerance. For more details, see the explanation for "Zero suppression" in "Date/time conversion setting" (Page A-23).

- Date & Time Offset

Set Date & Time: Add an offset to the calendar tolerance value used in the character string of a judgment criterion. The offset result is displayed at [Offset Date] in the [Setup Calendar] menu. 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: Specify the allowable error in time difference between the internal calendar and the external device at the turn of the day or hour. This error is used for judgment of the calendar tolerance. Enter absolute values up to ±3599 seconds (Default: 0).

Example: Judgment results when the allowable error is set to ± 60 seconds at the turn of the day

	2007.12.31	2008.1.1
Current internal calendar time	to 23:58:59 23:59:00 to 23:59:59	0:00:00 to 0:01:00 0:01:01 to
Printing 2007/12/31	OK	OK
Printing 2008/1/1	NG	OK

Allowable error Allowable error
 -60 seconds +60 seconds

Zero Suppression: 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	Calendar tolerance	Calculation tolerance
None	08/08/25	00350
Space forward	08/_/25	_350
Space backward	08/_/26	350_
Remove zeros	08/8/25	350

Underscore "_" is considered as a space.

- #/*! characters:** Select whether to use #/*! characters as special characters used for matching pattern judgment (Default), or to treat them as normal #/*! characters.

- Use in unit pass/fail results:** Check this box to use the matching result to judge the unit (Default: Checked). Remove the check mark if you want to use multiple matching criteria and perform matching only without affecting the judgment.

▶ Note

This option is fixed to be checked when the Multi Reference (Page A-24) is set to [OFF].

Multi Reference

To set multiple matching criteria, select [ON] (Default: OFF).

▶ Note

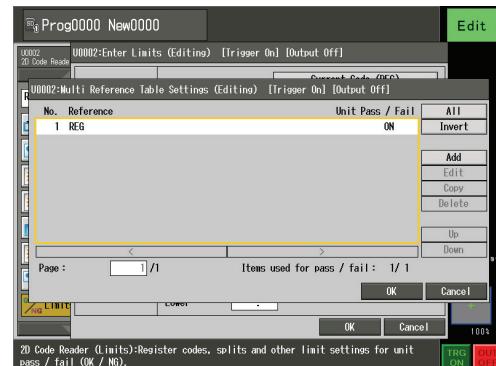
When the setting is changed from [ON] to [OFF], the second and later matching criteria will be cleared.

Ref. Table

When multiple matching criteria are set, you can check them in a list. Select [Ref. Table] and the [Multi Reference Table Settings] menu is displayed where you can view or edit matching criteria.

▶ Note

You cannot select [Ref. Table] when [Multi Reference] is set to [OFF].



- All:** Select all matching criteria shown in the list.
- Invert:** Invert the current selection.
- Add:** Add matching criteria (up to 16). The [Reference Settings] menu (Page A-22) is displayed where you can specify a matching pattern, a matching method, and other matching criteria. Set the matching pattern and other criteria.
- Copy:** Copy the currently selected matching criterion.
- Delete:** Delete the currently selected matching criterion.
- Up/Down:** Move the currently selected matching criterion upward or downward.

Reference

- You can add up to 16 matching criteria.
- When multiple matching criteria are set, you can perform matching by combining several ranges of read data or can sort data by the number assigned to matching criterion.
- To use the matching for sorting, remove the check mark for [Use in unit pass/fail results] on the [Reference Settings] menu (Default: Checked) so that you can perform matching only without the influence of unmatched results on the judgment.

Code Length

Set the tolerance for the number of characters to read in a code.

The measurement value is the number of characters which can be read successfully (in bytes).

▶ Note

The target characters are those within the reading range specified at [Data Reading Setting] on the [Parameters] menu.

Position

Specify the tolerance for the coordinates of the detected code.

The measurement value is the number of pixels indicating the position.

Deviation Angle

Specify the tolerance for the tilt angle of the code.

The measurement value is an angle.

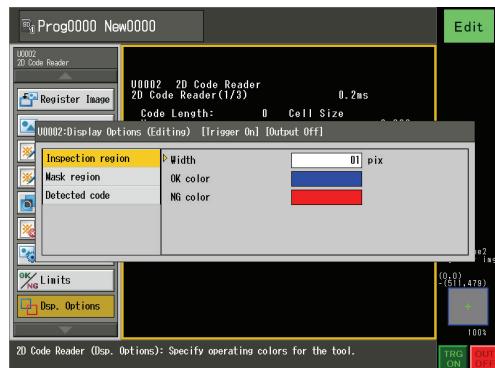
▶ Note

The detected angle is the difference from the [Starting angle] specified on the [Detection Conditions] menu.

Display Options

Inspection region and mask region display settings.

The display color can be changed based on the judgment result for that unit. The color can also be removed (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

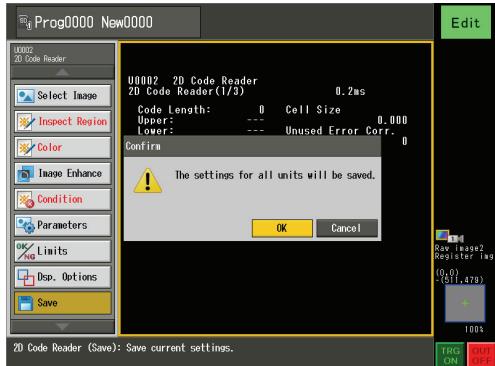
Specify the range, thickness of the detected point (code center), and display color of the detected code.

Save

Save the current unit changes in the program file.

▶ Note

- If the controller is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the controller 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 screen display, and display parts, can be excluded when saving.

When Reading Fails

When code tuning or reading fails, check for the problems below.

The resolution of the code is low.

Capture the image as large as possible so that there are four or more pixels in one cell as a guide, or use a high-pixel camera.

The contrast of the code is low.

Use Contrast Conversion or other image enhancement filters (Page A-16) to improve the contrast.

When [Gray] is selected for the color extraction for color cameras (Page A-16), changing it to [RGB Gray] may improve the contrast.

The code is out of focus.

Adjust the focus of the lens and check the shutter speed.

The cells of the printed code are misaligned or disfigured.

Check the status of the code.

The intervals between the cells are large or the cell has a void.

Try Expand, Shrink, or other image enhancement filters (Page A-16) to link cells or fill the holes in cells.

The margins around the code are less than two cells.

Ensure that there are sufficient margins around the code (at least a space of two cells) in the inspection region. If the code is positioned close to the end of the inspection region, consider using a position adjustment unit to adjust the position.

The interpolation is turned off during position adjustment.

Set [Use Interpolation] of the position adjustment unit to [ON].

The [Conditions] menu is not set properly.

Confirm if reading is possible by selecting [Linear] for [Distortion Correction] or by setting [Fine Search] to [ON] (DataMatrix only).

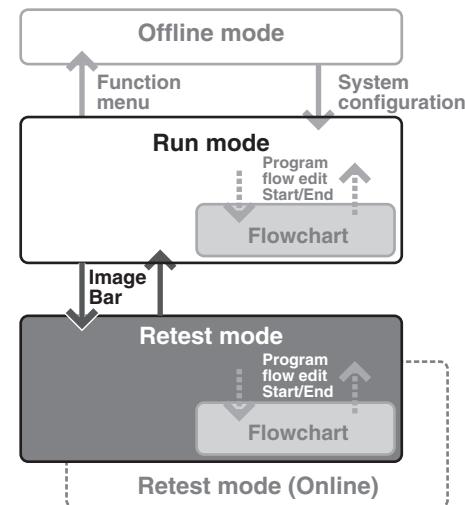
Additional Functions during Run Mode

Retest Using the Measurement Result (Retest Mode)

You can check or set the result of image processing by using the archived images recorded in the controller or the image files saved in a specified location, instead of using the current image sent from the camera. Retest mode (Online) (Page A-35) is also available which conducts a retest independently without interrupting the vision inspection.

Checking the Image Processing Result Again by Using the Image Recorded in the Controller (Retest Mode)

Specify an image recorded in the controller (archived image) and execute image processing. This is useful to check at a later time for the condition when the result was NG.

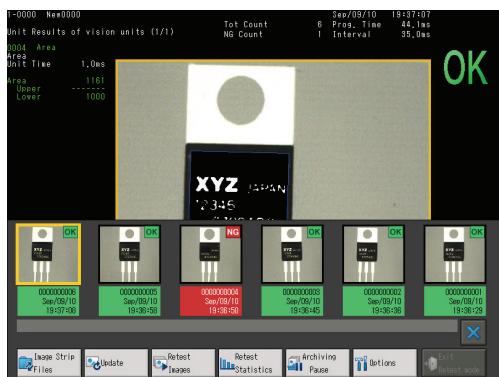


▶ Note

- In Retest mode, the image processing based on trigger input is disabled.
- The changes made during Retest mode are directly applied to the active program and are effective from the image processing performed after the retest finishes.
- The following options are disabled in Retest mode: [Change Programs], [Rename], [Copy/Delete Programs], [Save/Load Programs], [Image Archive], [Change Login User], and [Go Offline].
- The availability of some command may be different from that in Run mode. For more details, refer to the XG VisionEditor Reference Manual for Added Functions Guide (Supports Ver. 4.0).

1 In Run mode, press the No. 6 (MENU) button on the handheld controller.

The Image Bar is displayed which lists the archived images as thumbnails.



Reference

The images shown on the Image Bar are the images specified with the image variable referenced by the unit which is being selected when the Image Bar is displayed.

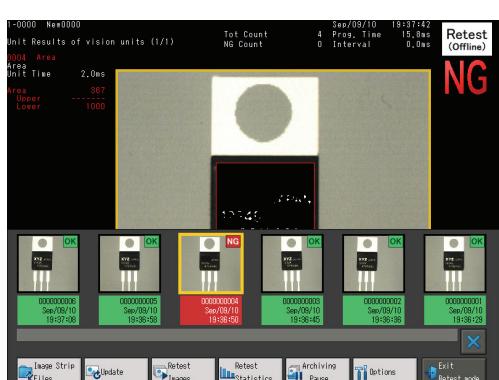
To display the images specified with a different image variable, close the Image Bar once, change the unit, and then display the Image Bar again.

2 Select the image used for the retest.

A confirmation screen appears.

3 Select [OK].

The system switches to Retest mode and conducts a retest based on the current inspection setting.



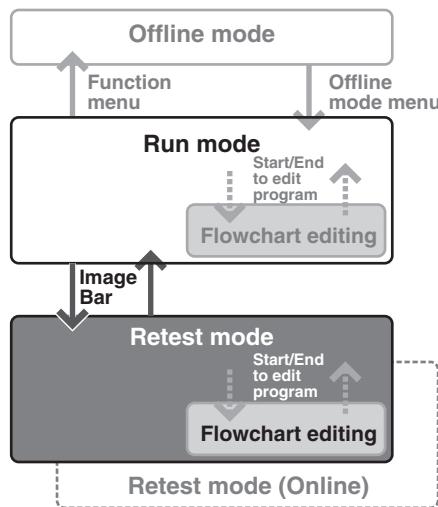
4 To retest another image, select the thumbnail of the image from the Image Bar.

To repeat the retest of the same image, press the No. 3 (TRIGGER) button on the handheld controller. The retest is conducted using the currently selected image.

5 To quit Retest mode and return to Run mode, select [Exit Retest mode] on the Image Bar.

Editing the Program by Using the Image Recorded in the Controller (Flowchart in Retest Mode)

Edit the flowchart and unit by specifying the image recorded in the controller (archived image). This is useful because you can adjust the measurement conditions while checking the results using the image actually recorded during Run mode.

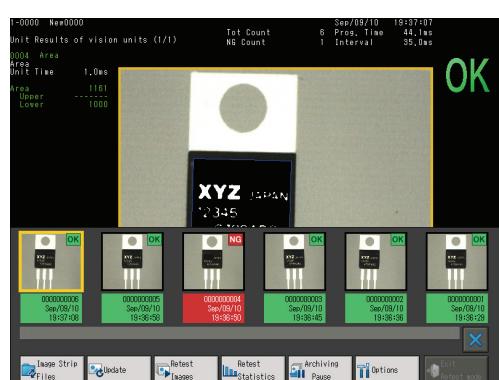


▶ Note

- In Retest mode, the image processing based on trigger input is disabled.
- The changes made during Retest mode are directly applied to the active program and are effective from the image processing performed after the retest finishes.

1 In Run mode, press the No. 6 (MENU) button on the handheld controller.

The Image Bar is displayed which lists the archived images as thumbnails.



Reference

- If the retest is set to use [Image Archive Memory], at least one image must be archived in the memory to show thumbnails.
- To apply the latest archive result to the Image Bar, select [Screen Update] to update the contents of the Image Bar.
- If the retest is set to use [Image Archive Memory], the archived images are overwritten while the controller is in continuous operation. It is recommended to use [Archiving Pause].
- It is also possible to display the Image Bar directly from the flowchart editing status in Run mode. In this case, step 4 below is unnecessary.

2 Select the thumbnail of the image which you want to use for editing the program.

A confirmation menu appears.

3 Select [OK].

The system switches to Retest mode and conducts a retest based on the current inspection setting.

4 Press the No. 1 (FUNCTION) button on the handheld controller and select [Edit Flowchart].

5 On the Flowchart, change the settings of the flowchart and unit.

Reference

If [Current image] is selected on the Flowchart, the image selected in step 2 is used.

6 To retest another image, select the thumbnail of the image from the Image Bar.

7 To quit Retest mode and return to Run mode, exit from the Flowchart and then select [Exit Retest mode] on the Image Bar.

The system switches to Run mode and accepts trigger inputs. If you select [Exit Retest mode] without exiting from the Flowchart, the system returns to the flowchart editing status in Run mode.

Reference

By selecting [Exit] on the Flowchart, you can return directly to Run mode.

Using Other Retest Functions

Specifying an image to be retested

In addition to the images recorded in the controller (archived images), you can select the image saved in the SD card, an FTP server, the OK master image folder, and the NG master image folder to display it on the Image Bar and specify it to be retested.

1 Select [Image Strip Files] on the Image Bar.

The [Image Strip Files Settings] menu appears.



2 Specify an image which you want to retest.

- **Image Archive Memory** (default): Display the images recorded in the controller (archived images) on the Image Bar. You also need to specify the image archive criterion number.
- **SD Card/FTP**: Display the images saved in the SD card or an FTP server on the Image Bar. You also need to specify the device and folder.
- **Master Reference: Pass (OK)**: Display the images saved as OK masters (Page A-32) on the Image Bar.
- **Master Reference: Fail (NG)**: Display the images saved as NG masters (Page A-32) on the Image Bar.
- **Sort**
 - **Ascending**: Display the images on the Image Bar in ascending order of the measurement counts.
 - **Descending**: Display the images on the Image Bar in descending order of the measurement counts.

• Filter

- **All**: Display all images on the Image Bar.
- **OK Only**: Display the images for which the measurement results (retest results) were OK or the images which have not been retested yet.
- **NG Only**: Display the images for which the measurement results (retest results) were NG or the images which have not been retested yet.

Reference

The device and folder path specified for the OK master/NG master can be changed on the [Options] menu (Page A-35) which is opened from the Image Bar.

► Note

- The sorting and filtering are applied at the timing when [Image Strip Files] is selected.
- To perform a retest, the file name of the image must be in one of the following formats:
 - [YYMMDD]_[hhmmss]_[COUNT]_[No.]_[Image variable name].bmp/jpg
 - [Seq No]_[Name]_[Image variable name].bmp/jpg
 - [Seq No]_[Image variable name].bmp/jpg
- If a file name is changed improperly, that file may not be used for a retest.

3 Select [OK].

Retesting Archived Images and OK Master/NG Master Images Simultaneously (Retest Images)

You can retest images on the Image Bar and OK master/NG master images simultaneously instead of retesting them one by one. You can retest several images together after editing measurement conditions. This is useful when you want to track the results from the previous measurement or judgment results.

Reference

- An OK master image is an OK image which was obtained in actual measurement or in ideal environment and is stored in a specified location. It is used in a retest to confirm that the image which must be judged as OK (OK master) will not be judged as NG. On the contrary, an NG master image is used in a retest to confirm that the image which must be judged as NG (NG master) will not be judged as OK.
- The location where OK master/NG master images are saved can be specified on the [Options] menu which is opened from the Image Bar (Page A-35).
- It is also possible to add the images on the Image Bar as OK master/NG master images. Place the cursor on the thumbnail on the Image Bar, press the No. 1 (FUNCTION) button on the handheld controller to open the [Retest Menu], and select [Add to Master Ref.: OK Images] or [Add to Master Ref.: NG Images].

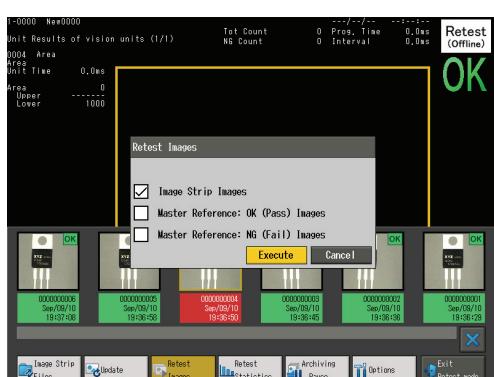
Note

The result of the retest image will be cleared when:

- An image stored on an FTP server had been set for any of the images on the Image Bar or OK/NG master images, and the FTP server setting was changed.
- The screen was updated.
- The target was changed (except for the case where the targets are sorted or only filters are changed).
- The setting on the [Options] menu (Page A-35) was changed.

1 Select [Retest Images] on the Image Bar.

The [Retest Images] menu appears.



2 Check the images used for the retest images and then select [Execute].

The retest image is executed and the [Result] menu appears.



3 After checking the result, select [Close].

Reference

The retest images can be interrupted.

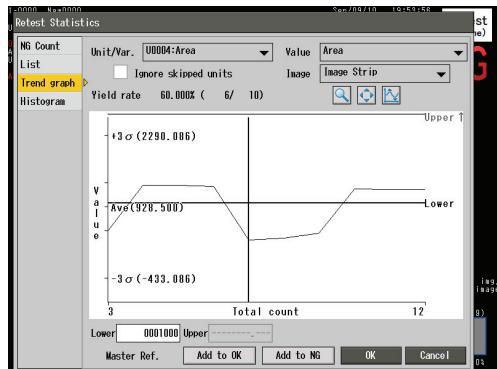
In this case, the [Restart] button is displayed on the [Result] menu. You can click this button to resume the retest from the point where it was interrupted.

- The display target can be switched among [All], [Image Strip], [Master Ref.: OK] and [Master Ref.: NG].
- By checking the box for [Master Ref.], you can add the result data of a desired measurement count as a master image.
- When [Save] is clicked, files are created for each of the display targets and named as follows:
 - YYMMDD_hhmmss_SD No._ProgramNo._image.csv: Measurement results of the retest using the Image Bar image (measurement count/total status/statistics item/ individual judgment)
 - YYMMDD_hhmmss_SD No._ProgramNo._ok.csv: Measurement results of the retest using the OK master image (measurement count/total status/statistics item/ individual judgment)
 - YYMMDD_hhmmss_SD No._ProgramNo._ng.csv: Measurement results of the retest using the NG master image (measurement count/total status/statistics item/ individual judgment)
 - YYMMDD_hhmmss_SD No._ProgramNo._idx.csv: Name of the measurement item

Reference

When the result data of a vision unit is displayed in the list of measurement values, you can select a desired measurement count to show the edit unit menu for the vision unit.

[Trend graph] tab



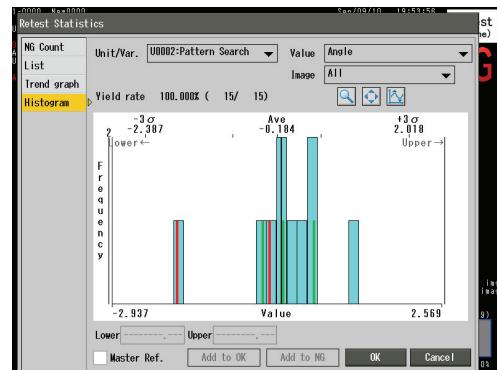
The major differences from the [Trend graph] tab of the normal [Statistics] menu are as follows:

- The display target can be switched among [Image Strip], [Master Ref.: OK] and [Master Ref.: NG].
- The result data of the measurement count selected on the trend graph can be added as a master image.

Reference

When the result data of a vision unit is displayed in the trend graph, you can select a desired measurement count to show the edit unit menu for the vision unit.

[Histogram] tab



The major differences from the [Histogram] tab of the normal [Statistics] menu are as follows:

- The display target can be switched among [All], [Image Strip], [Master Ref.: OK] and [Master Ref.: NG].
- By checking the box for [Master Ref.], you can add the result data of a desired measurement count as a master image.
- The result of the OK master image is shown in green; the result of the NG master image is shown in red.

Reference

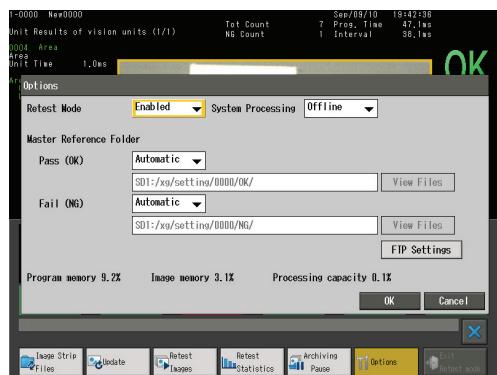
When the result data of a vision unit is displayed in the histogram, you can select a desired measurement value to show the edit unit menu for the vision unit.

Changing the Retest Settings (Options)

You can change the settings of the retest options.

1 Select [Options] on the Image Bar.

The [Options] menu appears.



2 Change the settings as necessary.

Retest Mode

To disable Retest mode, select [Disabled] (Default: Enabled).

System Processing

To disable Retest mode (Online) (Page A-35), select [Offline] (Default: Offline).

▶ Note

- These settings cannot be changed in Retest mode.
- When appropriate memory is insufficient, both Retest mode and Retest mode (Online) cannot be used.

Master Reference Folder

Specify the location to save the master images.

- **Pass (OK):** Specify the location to save the OK master images.
- **Fail (NG):** Specify the location to save the NG master images.
- **FTP Settings:** When the master images are stored in an FTP server, specify the FTP server. For more details, refer to the XG-7000 Series User's Manual.

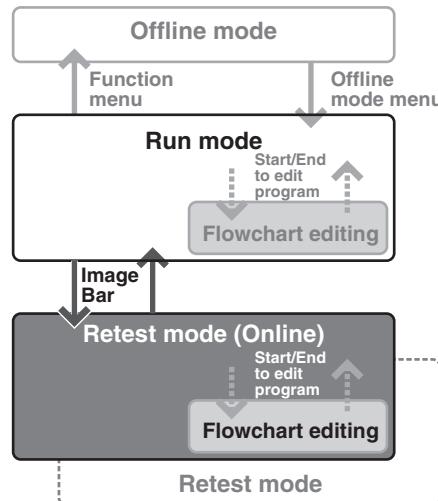
3 Select [OK].

▶ Note

When you changed the system processing setting, you need to load the program again.

Retesting while Continuing Normal Measurement (Online)

Specify an image recorded in the controller (archived image) and then execute image processing. By enabling Retest mode (Online), you can perform a retest or edit the flowchart during Run mode without interrupting actual image processing operation.



▶ Note

- When Retest mode (Online) is enabled, some flowchart editing functions are restricted. Refer to "Restrictions on Editing in Retest Mode (Online)" (Page A-37) for more details.
- The following options are disabled in Retest mode (Online): [Switching Programs], [Rename], [Copy/Delete Programs], [Save/Load Programs], [Image Archive], [Change Login User], [Go Offline], [I/O Diagnostic], and [Save Program].
- The availability of some command may be different from that in Run mode. For more details, refer to the XG VisionEditor Reference Manual for Added Functions Guide (Supports Ver. 4.0).

1 On the Image Bar, select the thumbnail of the image which you want to retest.

A confirmation screen appears.

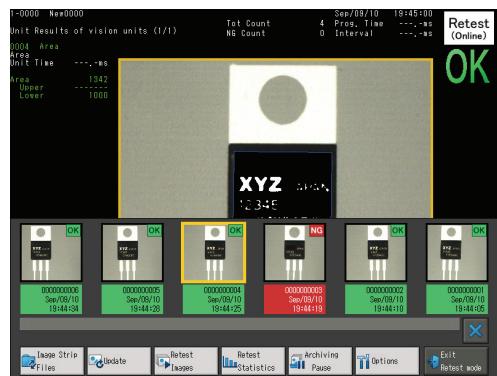


▶ Note

While the Flowchart is open, you cannot enter Retest mode (Online) or to return from Retest mode (Online) to Run mode. Only by selecting [Exit] on the Flowchart, you can return from Retest mode (Online) to Run mode as soon as the Flowchart closes.

2 Check the [Keep system online] box and then select [OK].

The system switches to Retest mode (Online) and conducts a retest based on the current inspection setting.



▶ Note

This box cannot be checked when system processing is set to [Offline] on the [Options] menu (Page A-35).

3 Perform a retest or edit the flowchart/unit settings as necessary.

Reference

- In some cases, the archived image is overwritten during Retest mode due to vision inspection and the image displayed on the Image Bar disappears during selection, resulting in a black image. When this happens, select [Update] on the Image Bar to update to the latest status, or select [Archiving Pause] to stop overwriting the archived image.
- In Retest mode (Online), [Running count] is displayed at the lower right of the screen. [Running count] shows the measurement count of the current measurement and the total status (OK: Green, NG: Red).

4 Return to Run mode.

If any setting of the program was changed before you return to Run mode, a confirmation screen appears to ask whether to apply the change to the currently active program. When [OK] is selected, the changed setting is used for the image processing as soon as the operation returns to Run mode.

Reference

If the setting of the program was changed, or if the flowchart contains a unit with [Referenced Image] set to [Update every time (slow)] or [Update by user (fast)], a confirmation screen appears to ask whether to save the setting before returning to Run mode.

▶ Note

While the change is being applied, the current measurement may delay by several microseconds.

Restrictions on Editing in Retest Mode (Online)

In Retest mode (Online), the editing operations are restricted as follows:

- Capture units, output units (parallel terminal output, data output, image output), and timing units (pause, timer, timer setup, terminal I/O delay, variable delay, user menu) cannot be added, deleted, edited (including changing the execution availability and renaming the unit), cut, pasted, and copied.
- Calibration units cannot be added, deleted, copied, cut, or pasted (but can be edited).
- If there is an output unit which specifies a PC program as output destination, all units cannot be added, deleted, copied, cut, or pasted.
- When no image variable (other than resultant image variable) is defined and there is only one capture unit immediately after the start unit in the flowchart, no unit can be added or pasted between the start unit and the capture unit. Similarly, no unit can be deleted or cut if this leads to the condition where there is only one capture unit immediately after the start unit.
- Unit IDs cannot be renumbered.
- [Register Image] cannot be registered and the [Library] setting for OCR units is disabled (other than changing the library index, library name, and saving the library).
- Screen editing is disabled.
- The operation cannot be changed to offline or remote capture mode.
- The settings of the options on the Flowchart cannot be changed except for [Variable Settings] (current value only), [Total Status (OR) Output], [Total Error Output], [Statistics], and [Update Reference Position Information].

Changing Variable Values (Update Variables)

You can set the controller to allow changing the value of a specific variable. When a variable is set to be changeable, you can change its value easily on the [Change Variable] menu.

Changing the Setting to Allow Changing Variables

To set the controller to allow changing the value of a variable, you need to specify the variable beforehand.

1 From the function menu, click [Edit Flowchart].

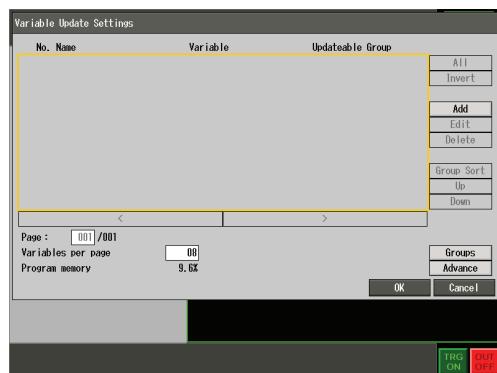
A confirmation screen appears.

2 Select [OK].

You can now edit the flowchart.

3 Select [Variable Update Settings] from the [Options] menu located at the top of the screen.

The [Variable Update Settings] menu appears.



4 Select [Add].

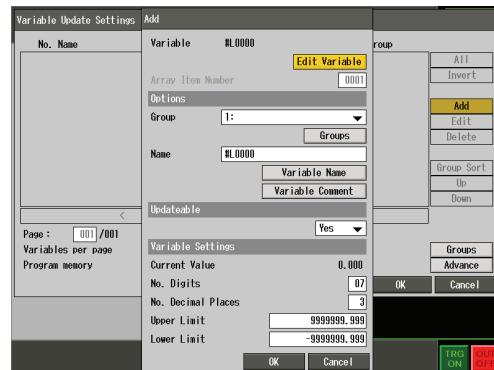
The [Specify Variable] menu appears.

5 Choose the type of variable to allow changing its value and then select [OK].

A selection menu is displayed which lists the variables of the selected type.

6 Choose the variable to allow changing its value and then select [OK].

The [Add] menu appears.



7 Modify the options to change the variable.

Array Item Number

When the selected variable is an array type, specify the number of elements to be changed.

Group

Specify the group to which the variable will belong. By selecting [Groups], you can change the group name or group order.

Name

Enter the item name to be displayed on the [Name Variable Update Settings] menu. Clicking [Variable Name] or [Variable Comment] makes the variable name or the comment set for the variable be entered as an item name respectively.

Updateable

Select whether to allow changing the value of the specified variable in Run mode (Default: Yes).

► Note

When a system variable is specified, this option is fixed to [No].

Variable Settings

Specify the number of digits of the specified variable by dividing it into integer and decimal sections. Also, specify the input upper and lower limit values.

8 When the setting is complete, select [OK].

The variable specified in step 6 is added to the variables displayed on the change variable dialog.

9 Select [OK].

Reference

When a variable is assigned to a parameter, you can select [Add to Update List] from the Edit menu of the Flowchart to add the variable to those displayed on the update variables.

Modifying the options to change variables

On the [Variable Update Settings] menu, select a variable you want to modify the options and select [Edit].

Deleting a variable specified in the change variable setting

On the [Variable Update Settings] menu, select a variable you want to delete from the change setting and select [Delete].

Changing the order of the displayed variables

The variables specified in the change variable setting can be arranged in a specific order on the [Variable Update Settings] menu.

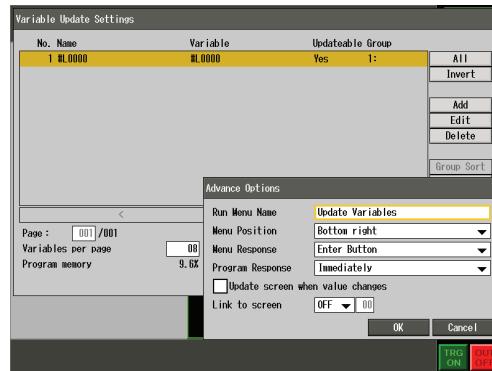
- **Group Sort:** Arrange the variables in the order from small to large group numbers of the groups to which they belong
- **Up:** Move the selected variable upward.
- **Down:** Move the selected variable downward.

Changing the number of variables displayed on one page of the change variable dialog

Use [Variables per page] to change the number of variables displayed on one page of the update variables between 1 and 13 (Default: 8).

Changing the display options of the change variable dialog

Select [Advance] on the [Variable Update Settings] menu to open the [Advance Options] menu where you can specify the conditions to display the update variables on the controller.



- **Run Menu Name:** Specify the name of the update variables to be displayed on the controller.
- **Menu Position:** Select the position to display the update variables on the controller (Default: Lower right).
- **Menu Response:** Select the timing to confirm the change of a variable (Default: Enter Button).
- **Program Response:** Select the timing to apply the change of a variable (Default: Immediately).
- **Update screen when value changes:** Check this box to apply the change of the variable to the camera screen and display template.
- **Link to screen:** Specify the display template to display the update variables.
 - **ON:** Specify a display template.
 - **OFF** (default): Do not specify a display template.

Reference

Refer to "Overview of the Creation of Display Templates" (Page A-42) for more details on display templates.

► Note

The change in the dialog name will not apply to the dropdown menu of the dialog ID for a User menu unit.

Changing the Value of a Variable on the Update Variables Menu

1 From the function menu, select [Update Variable].

The [Update Variables] menu appears.



2 Select a variable to change its value and change the value in the [Current Value] field.

To check the latest value of the variable whose value may fluctuate while the [Update Variables] menu is open, select [Update].

3 Click [Close].

The value of the variable selected in step 2 will be changed at the timing specified in [Menu Response] and [Program Response].

Reference

When you changed the current value of a variable with the [Copy current value to initial value at save] option being enabled, a confirmation screen appears to ask whether to save the setting.

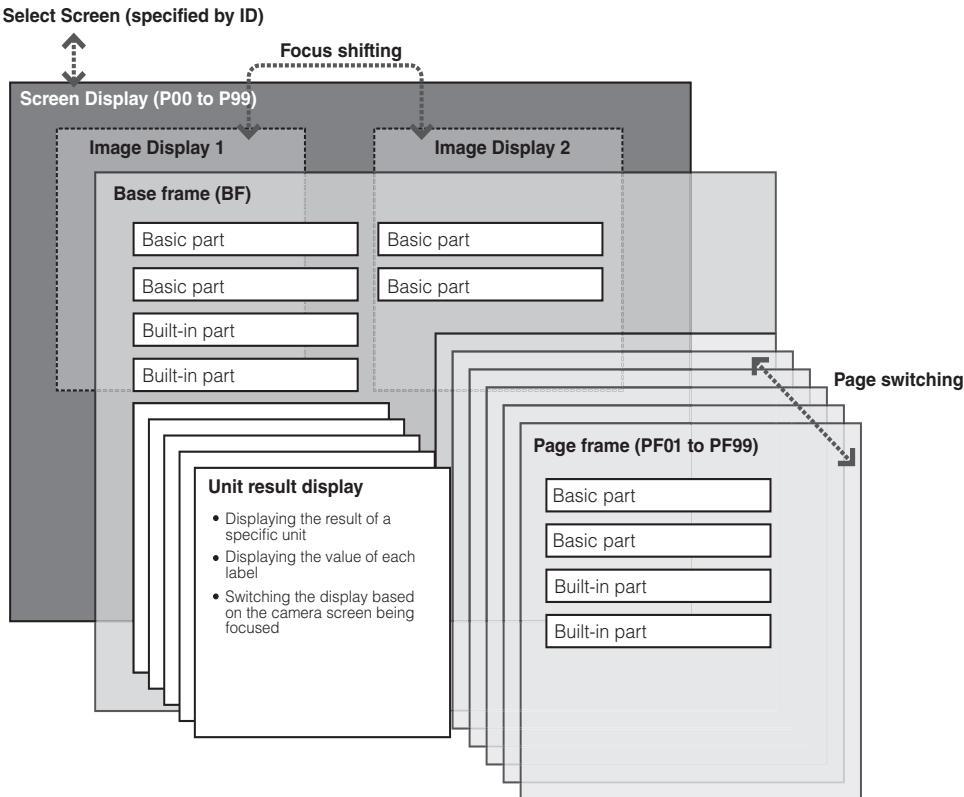
Additional Screen Editing Function

Overview of the Creation of Display Templates

You can create a controller display screen by placing various parts on the screen (screen editing).

Organization of Display Screens Created in Screen Editing

The screen editing arranges and manages the display screens created for the controller in groups and hierarchies as outlined below.



Screen elements

Screen display (P00 to P99)

Controller display screens.

Image display (maximum 5 screens)

This is an area part that displays the image captured by the camera.

Base frame (BF, only 1)

This is an 800x600-pixel area part. All display template parts can be placed in the base frame.

- **Basic parts:** these parts display shapes and processing results in the controller.
- **Built-in parts:** these parts provide functions for special purposes.

Page frame (PF01 to PF99)

This is an 800x600-pixel area part with page switching support. Like the base frame, it can be laid out with basic parts and most built-in parts.

Display mechanism

- The parts in the currently selected page frame appear visible on top of the base frame display.
- Parts you want to be visible at all times for the current display template should be placed directly in the base frame, whereas parts that need only be visible in certain situations should be placed in a page frame that is called into use when needed. This allows flexible display possibilities with a single display template.

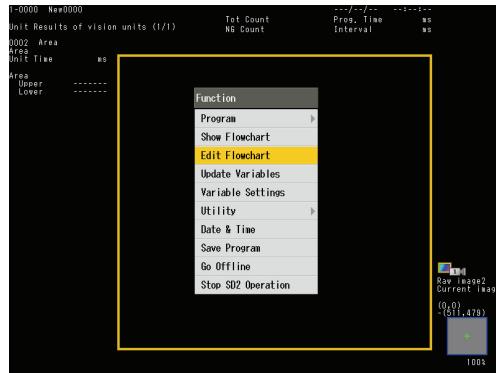
► Note

- Up to 500 parts can be placed in each frame.
- You cannot edit display templates when the memory usage reaches 100%.
- The memory usage can be checked in [Screen Display].

Creating Display Templates

This section explains how to create a display template that will serve as the display screen for the controller, by using an example of creating a new display template.

1 From the Function, click [Edit Flowchart].



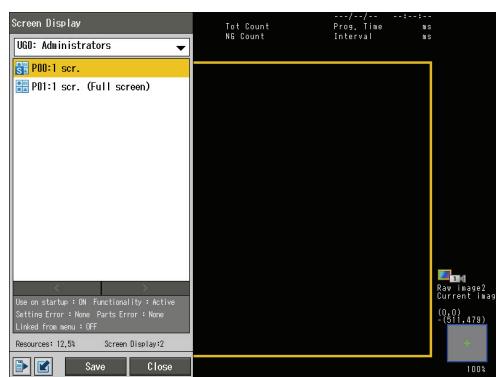
A confirmation screen appears.

2 Select [OK].

You can now edit the flowchart and units.

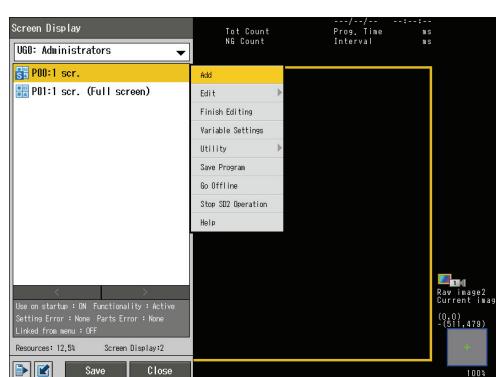
3 Select [Screen Editor] at the top of the dialog.

The [Screen Display] menu appears.



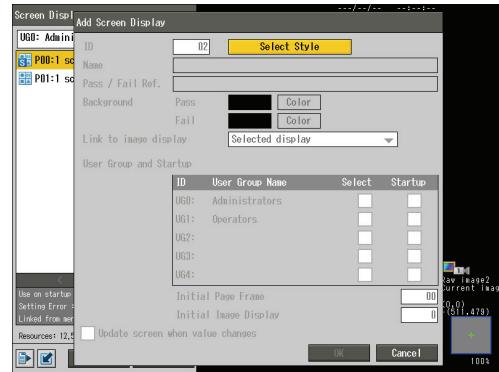
4 Press the No.1 (FUNCTION) button on the handheld controller.

The screen editing menu is displayed.



5 Select [Add].

The [Add Screen Display] menu appears.



► Note

The [Add] option is disabled when the number of registered display templates has reached the maximum number (99).

6 Click [Select Style].

The [Select Screen Display Style] menu appears.



7 Select a template according to the display template you want to create.

In this step, select [Single Display] (one screen) as an example.

Reference

You can quickly add the most typically used parts by selecting any of the display templates, except the template labeled [Blank]. For more details, refer to the XG VisionEditor Reference Manual (Programming Edition).

8 Change the settings of the display template as necessary and then press [OK].

For more details on the settings, refer to the XG VisionEditor Reference Manual (Programming Edition).

To change the settings of the existing display template:

Place the cursor on the display template to edit, press the No. 1 (FUNCTION) button on the handheld controller, and select [Edit] - [Properties] from the screen editing menu.

To delete a display template:

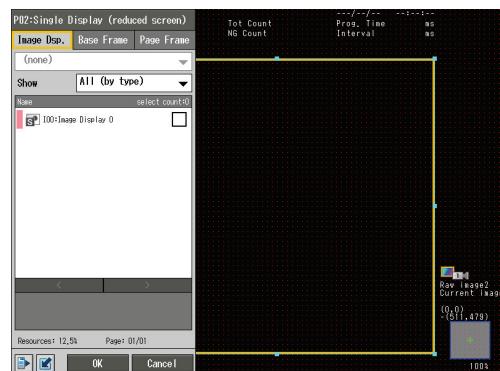
Place the cursor on the display template to delete, press the No. 1 (FUNCTION) button on the handheld controller, and select [Edit] - [Delete] from the screen editing menu.

► Note

A display template which has been specified in a dialog such as the [Update Variables] menu cannot be deleted.

9 Select the display template added in step 7.

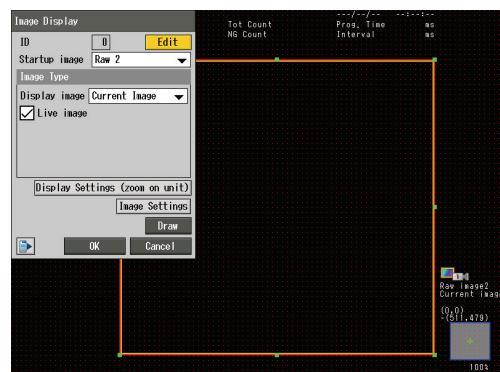
The display template setting menu appears.



10 On the [Image Dsp.] tab, select a [Image Display] part.

In this step, select [I00: Image Display 0] as an example.

The [Image Display] menu appears.



11 Change the settings of the image display as necessary and then press [OK].

For more details on the settings, refer to the XG-7000 Series User's Manual.

To add a image display:

Press the No. 1 (FUNCTION) button on the handheld controller and select [Add] from the screen editing menu.

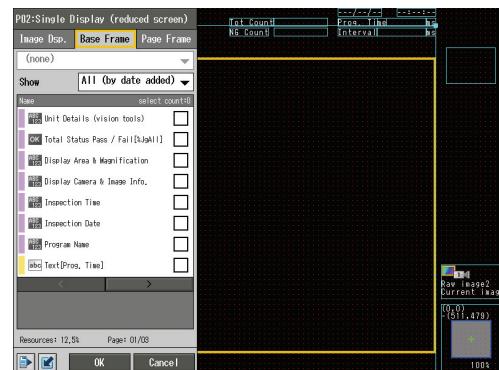
► Note

The [Add] option is disabled when five camera screens have already been placed.

To delete a image display:

Place the cursor on the image display to delete, press the No. 1 (FUNCTION) button on the handheld controller, and select [Edit] - [Delete] from the screen editing menu.

12 Select [Base Frame] tab and change the settings as necessary.



The base frame is used to control all parts that appear at all times. In the base frame, you can edit basic parts and built-in parts.

Reference

Use [Show] to select an option so that only parts which satisfy the selected condition are listed.

To add a part to the base frame:

Press the No. 1 (FUNCTION) button on the handheld controller and select [Add] - [(Part name to be added)] from the screen editing menu. The selected part is added at the center of the screen.

Use [Data (Text & Value)] in the parts list to add [Text display] (Variable name) and [Value display] (Variable value) of the selected result data or variable simultaneously.

► Note

- If no base frame exists, you cannot add any parts. Press the No. 1 (FUNCTION) button on the handheld controller and select [Edit Base Frame] - [Add] from the screen editing menu to add a base frame.
- The [Add] option is disabled when the number of registered parts has reached the maximum number.

To edit the part placed in the base frame:

Select a part you want to edit, and the dialog for editing the part is displayed. For more details, refer to the XG-7000 Series User's Manual.

► Note

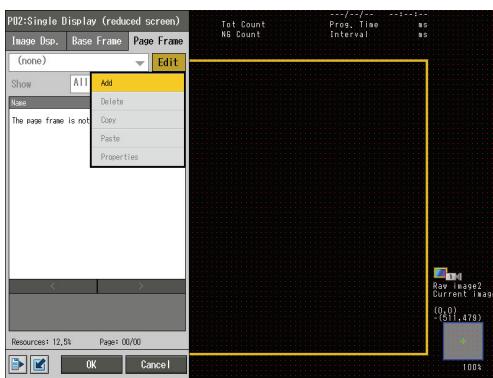
When you select two or more parts, you can only view their properties and cannot select editing options other than [Draw].

To delete the part placed in the base frame:

Place the cursor on the part to delete, press the No. 1 (FUNCTION) button on the handheld controller, and select [Edit] - [Delete] from the screen editing menu.

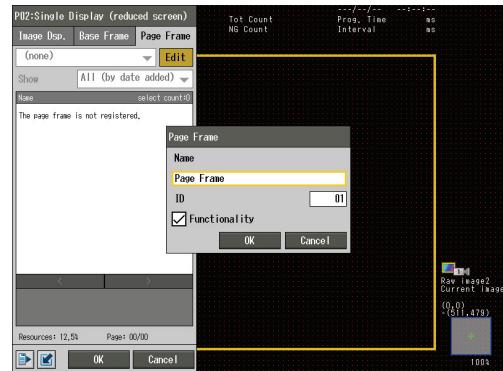
13 Select the [Page Frame] tab.

The page frame is used to control parts that appear when the user switches to a specific page. In the page frame, you can edit basic parts and most of the built-in parts.

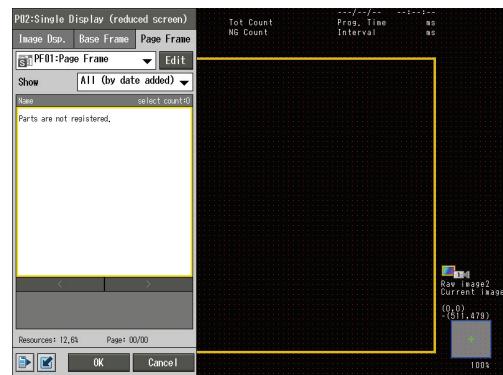
14 Select [Edit] - [Add].**► Note**

The [Add] option is disabled when the number of registered page frames has reached the maximum number (99).

The [Page Frame] menu appears.

**15 Change the settings of the page frame, and then click [OK].**

The page frame is added and the display template setting menu appears again.

16 Change the settings as necessary.**To add a page frame:**

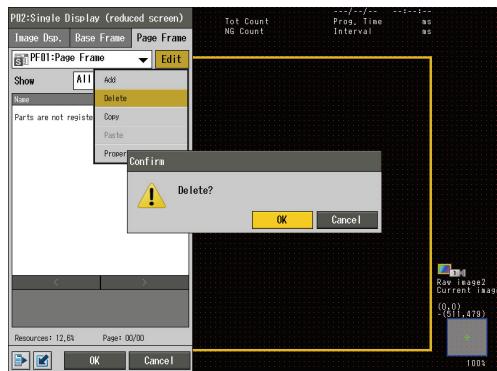
Select [Edit] - [Add] (See the instruction in steps 14 and 15.)

To change the page frame used to edit parts:

Select a desired page frame from the list at the top of the screen.

To delete a page frame:

Select a page frame you want to delete from the list at the top of the screen and select [Edit] - [Delete].



Select [OK] on the confirmation screen.

To edit the parts in the page frame (add/edit/delete parts):

The operation is the same as that for the base frame.

Reference

Some parts may not be added or deleted depending on the specified location. Refer to the description of each part for more details.

► Note

To edit the part placed in the page frame, you need to switch to the page frame containing the part.

17 When editing is complete, select [OK].

The display returns to the [Screen Display] menu.

18 Select [Save].

A confirmation screen appears.

19 Select [OK].**Changing the Position of a Placed Part****Reference**

To change the display contents of the parts, refer to the description of each part.

Editing the placement position of a part (Draw mode)

To change the placement position of a display part, select [Draw] in the editing dialog of the part, or place the cursor on the part and press the back and ENTER buttons on the handheld controller (Draw mode).

In Draw mode, the currently selected part (current part) is shown in a red frame (a pink thick frame when more than one parts are selected), the other selected parts are shown in pink thin frames, and other parts are shown in blue frames.

- Up/down/right/left key: Move or resize the selected part.
- No. 0 (ENTER): Confirm the setting.
- No. 2 (ESCAPE): Exit from Draw mode.

Refer to "Key operations on the dialog in Draw/Multi Select menu" (Page A-50) for more details on other operation.

Editing the placement positions of multiple parts simultaneously (Multi Select mode)

You can directly select multiple parts which have been placed.

To enter Multi Select mode, enter Draw mode once, and then press the No. 1 (FUNCTION) button on the handheld controller and select [Edit] - [Start Multi Select mode (Back + ENT)], or press the BACK and ENT buttons.

In Multi Select mode, the currently selected part (current part) is shown in a red frame (a pink thick frame when more than one parts are selected), the other selected parts are shown in pink thin frames, and other parts are shown in green frames.

- Up/down/right/left key: Select a part (Change the current part.).
- No. 0 (ENTER): Include the current part in the selected parts or exclude it from them.
- No. 2 (ESCAPE): Exit from Multi Select mode.

Refer to "Key operations on the dialog in Draw/Multi Select menu" (Page A-50) for more details on other operation.

Arranging parts

You can select multiple parts and arrange them in various ways.

Select two or more display parts, press the No. 1 (FUNCTION) button on the handheld controller, select [Align/ & Order] - [Align] or [Distribute], and select a desired option.

Align

All of these options align the selected parts based on the part on which the cursor is currently placed (current part).

- **Left Align:** Align the parts with the left end of the current part.
- **Center Align:** Align the horizontal center of the parts with the horizontal center of the current part.
- **Right Align:** Align the parts with the right end of the current part.
- **Top Align:** Align the parts with the top of the current part.
- **Middle Align:** Align the vertical center of the parts with the vertical center of the current part.
- **Bottom Align:** Align the parts with the bottom of the current part.

Distribute

- **Horizontally:** Arrange the selected display parts with equal spacing between the rightmost and leftmost parts. The vertical position of each part does not change.
- **Vertically:** Arrange the selected display parts with equal spacing between the topmost and bottommost parts. The horizontal position of each part does not change.

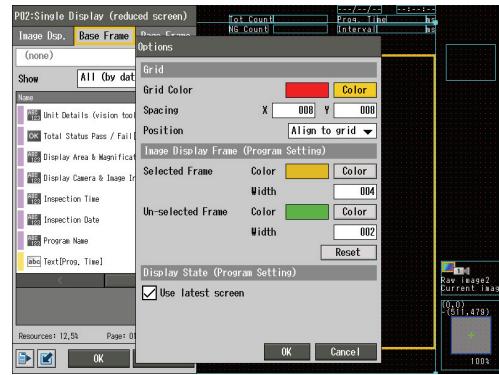
▶ Note

The image display parts cannot be aligned or arranged.

Changing the grid display settings

You can change the display options of the grid displayed during screen editing on the [Options] menu.

Press the No. 1 (FUNCTION) button on the handheld controller and select [Utility] - [Options] from the screen editing menu.



Grid

- **Grid Color:** To change the color of the grid, click [Select Color].
- **Spacing:** Specify the grid interval.
- **Position:** Specify the parts layout method.
 - **Align to grid:** Parts are positioned so that the top left of the part is aligned with the grid.
 - **Free:** Parts can be positioned freely while ignoring the grid.

Reference

- When [Align to grid] is selected with [Scale On] specified, the centers of horizontal line parts and vertical line parts are aligned with the grid.
- As for the case of circle or cross mark parts, their center coordinates are aligned with the grid.

Image Display Frame (Program Setting)

Specify the display color and line thickness of the frame for the cases where the camera screen is focused and is not focused.

Use latest screen

Check this box to overwrite the initial display status when the settings are saved (Default: Checked).

Reference

- The following items are overwritten in the display status:
 - Initial display template
 - Initial display page
 - Image display with the focus in the initial display
 - Unit initially displayed on each image display
 - Processed image type initially displayed on each image display
 - Zoom ratio initially displayed on each image display
- The [Use latest screen] setting is saved as part of the program file.

Changing the overlap order of parts

Overlapped parts can be rearranged in a different order. Place the cursor on the part to change the overlap order, press the No. 1 (FUNCTION) button on the handheld controller, and select [Overlay] - [On top] or [Underneath].

- **On top:** Move the selected part to the foremost position.
- **Underneath:** Move the selected part to the rearmost position.

Reference

When several parts are selected, these parts are moved as a group with the same overlap order to the foremost/rearmost position.

Other Screen Editing Operations

Sorting/filtering relevant parts

When you search for a part, you can filter the parts based on type, or sort the parts by the order they are added.

On the display template setting dialog, select the appropriate option from [Show] on either the [Base Frame] or [Page Frame] tab.

- **All (by date added):** Display all parts after sorting them in the order of they are added.
- **All (by type):** Display all parts after sorting them by their types.
- **Basic parts:** Display basic parts only.
- **Standard parts:** Displays built-in parts only.
- **Selected:** Display parts which are selected for multiple selection only.
- **Value:** Display [Value display] parts only.
- **Text:** Display [Text display] parts only.
- **Active Text:** Display [Active Text] parts only.
- **Horizontal line:** Display [Horizontal line] parts only.
- **Vertical line:** Display [Vertical line] parts only.
- **Point:** Display [Point] parts only.
- **Rectangle:** Display [Rectangle] parts only.
- **Circle:** Display [Circle] parts only.
- **Polygon:** Display [Polygon] parts only.
- **Table:** Display [Table] parts only.
- **Values and Text:** Display [Value] and [Text] parts only.
- **Error or Empty:** Display parts which contain [Error] or [Empty] items.

Reference

The [Show] list does not show the categories to which no part belongs.

Selecting multiple parts for simultaneous operation

You can select multiple display parts to copy, delete, align, or arrange them simultaneously.

To select multiple parts, check desired display parts listed on the display template setting dialog.

Reference

You can also use Multi Select mode (Page A-46) to select parts directly by viewing the placed parts.

Deleting selected parts simultaneously

Press the No. 1 (FUNCTION) button on the handheld controller and select [Edit] - [Cancel Multi Select] from the screen editing menu.

Cancelling the previous operation

When you made a mistake in operation, you can reverse the operation by one step.

Press the No. 1 (FUNCTION) button on the handheld controller and select [Edit] - [Undo] from the screen editing menu.

Note

When there is no operation to be undone, a message "Undo (BACK+FNC)" is displayed and you cannot select [Undo].

Copying, cutting, and pasting parts

Place the cursor on the part, press the No. 1 (FUNCTION) button on the handheld controller, and select [Edit] - [(Desired operation)] from the screen editing menu.

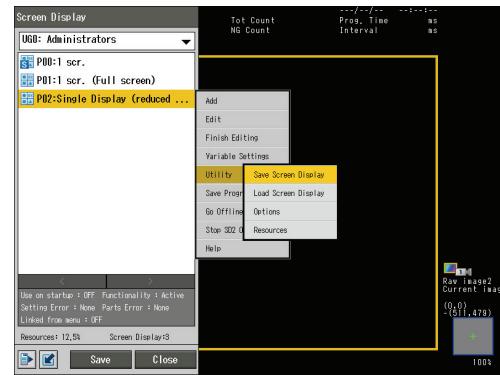
Reference

An item can be pasted to a different display template if the editing object specified at the destination supports the cut or copied part.

Saving or loading display templates

You can save the settings of a specific display template in a display template file (***.srn) or can load it into the controller.

Place the cursor on the display template list, press the No. 1 (FUNCTION) button on the handheld controller, and select [Utility] - [(Desired operation)] from the screen editing menu.



- **Save Screen Display:** On the displayed dialog, select the display template to save and its file name and click [Execute] to save the display template file.
- **Load Screen Display:** On the displayed dialog, specify the display template file, select the destination display template and click [Execute] to load the display template.

Note

- If the loaded display template does not conform to the settings of the current program, the setting error may occur, resulting in improper display. It is recommended to check for setting errors after loading the template.
- The display template file contains the active text table, the screen frame setting (program-specific) which is an option for screen editing, and the initial display application setting (program-specific). When a display template is loaded, these settings will be overwritten.

Key Operations Related to Screen Editing

Key operations on the [Screen Display] menu

No. 6 button (MENU)	Display the help.
No. 7 Back button + No. 6 button (MENU)	Change the transparency of the dialog.
No. 7 Back button + No. 4 button (SCREEN)	Switch between grid layout and free layout
No. 7 Back button + Right/left key	Move the dialog to right/left.

Key operations on the display template setting menu

No. 6 button (MENU)	Display the help.
No. 7 Back button + No. 6 button (MENU)	Change the transparency of the dialog.
No. 7 Back button + No. 0 button	Switch to Draw mode.
No. 7 Back button + Right/left key	Move the dialog to right/left.
No. 7 Back button + No. 4 button (SCREEN)	Switch between grid layout and free layout
No. 7 Back button + No. 1 button (FUNCTION)	Undo

Key operations on the dialog in Draw/Multi Select menu

No. 6 button (MENU)	Display the help.
No. 7 Back button + No. 6 button (MENU)	Change the transparency of the dialog.
No. 7 Back button + No. 0 button	Switch between Draw mode and Multi Select mode
No. 7 Back button + 8-way key	<ul style="list-style-type: none"> Change the current part (in Draw mode) Move the current part (in Multi Select mode)
No. 7 Back button + No. 4 button (SCREEN)	Switch between grid layout and free layout
No. 7 Back button + No. 1 button (FUNCTION)	Undo

Displaying the key operation list

You can display the help window and see the list of key operations.

Press the No. 1 (FUNCTION) button on the handheld controller and select [Help (MENU)] from the screen editing menu.

Reference

You can also display the list by pressing the No. 6 (MENU) button.

WARRANTY

KEYENCE products are strictly factory-inspected. However, in the event of a failure, contact your nearest KEYENCE office with details of the failure.

1. WARRANTY PERIOD

The warranty period shall be for one year from the date that the product has been delivered to the location specified by the purchaser.

2. WARRANTY SCOPE

- (1) If a failure attributable to KEYENCE occurs within the abovementioned warranty period, we will repair the product, free of charge. However, the following cases shall be excluded from the warranty scope.
 - Any failure resulting from improper conditions, improper environments, improper handling, or improper usage other than described in the instruction manual, the user's manual, or the specifications specifically arranged between the purchaser and KEYENCE.
 - Any failure resulting from factors other than a defect of our product, such as the purchaser's equipment or the design of the purchaser's software.
 - Any failure resulting from modifications or repairs carried out by any person other than KEYENCE staff.
 - Any failure that can certainly be prevented when the expendable part(s) is maintained or replaced correctly as described in the instruction manual, the user's manual, etc.
 - Any failure caused by a factor that cannot be foreseen at a scientific/technical level at the time when the product has been shipped from KEYENCE.
 - Any disaster such as fire, earthquake, and flood, or any other external factor, such as abnormal voltage, for which we are not liable.
- (2) The warranty scope is limited to the extent set forth in item (1), and KEYENCE assumes no liability for any purchaser's secondary damage (damage of equipment, loss of opportunities, loss of profits, etc.) or any other damage resulting from a failure of our product.

3. PRODUCT APPLICABILITY

KEYENCE products are designed and manufactured as general-purpose products for general industries. Therefore, our products are not intended for the applications below and are not applicable to them. If, however, the purchaser consults with us in advance regarding the employment of our product, understands the specifications, ratings, and performance of the product on their own responsibility, and takes necessary safety measures, the product may be applied. In this case, the warranty scope shall be the same as above.

- Facilities where the product may greatly affect human life or property, such as nuclear power plants, aviation, railroads, ships, motor vehicles, or medical equipment
- Public utilities such as electricity, gas, or water services
- Usage outdoors, under similar conditions or in similar environments

Specifications are subject to change without notice.

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