

**Ultra High-Speed,
Flexible Machine Vision System**

XG-7000 Series

Starting Guide



Multi
Camera
System
16

A.C.E. II
COLOR

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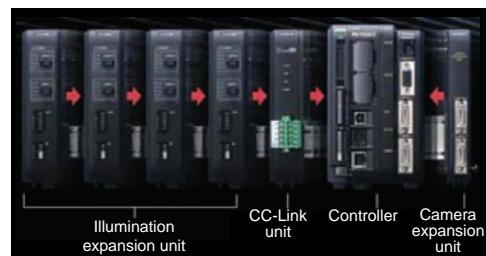
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■ Product configuration: Hardware

Controller

XG-7001(P)
: For 300,000 pixelsXG-7501(P)
: For 2,000,000/300,000 pixelsXG-7701(P)
: For 5,000,000/2,000,000/300,000 pixelsXG-7001A
: For 300,000-pixel analog camera

Expansion unit

Expansion module
: Support of four expansion modulesIllumination expansion unit
: Illumination control supportCC-Link unit
: CC-Link support

*Expansion unit connection image

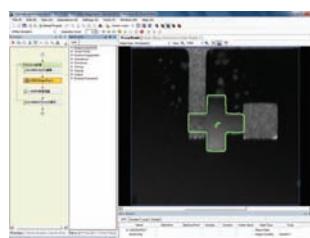
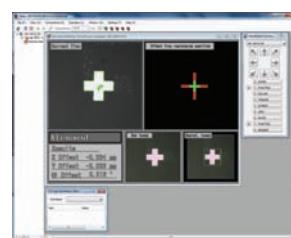
Camera



All 16 models 8 types Each color/monochrome
 5,000,000 pixels 11x high-speed type
 2,000,000 pixels 7x high-speed type
 2,000,000 pixels 2x high-speed type
 2,000,000 pixels 2x high-speed ultracompact type
 1,000,000 pixels 7x high-speed type
 300,000 pixels 7x high-speed type
 300,000 pixels 2x high-speed type
 300,000 pixels 2x high-speed ultracompact type

*All models support up to four mixed connections.

■ Product configuration: Software

XG-H7NE
: Machine Vision System Integrated Management SoftwareXG VisionEditor
: For building image processing flowchart and GUIXG VisionTerminal
: For remote operation/monitoring and logging

■ XG series usage

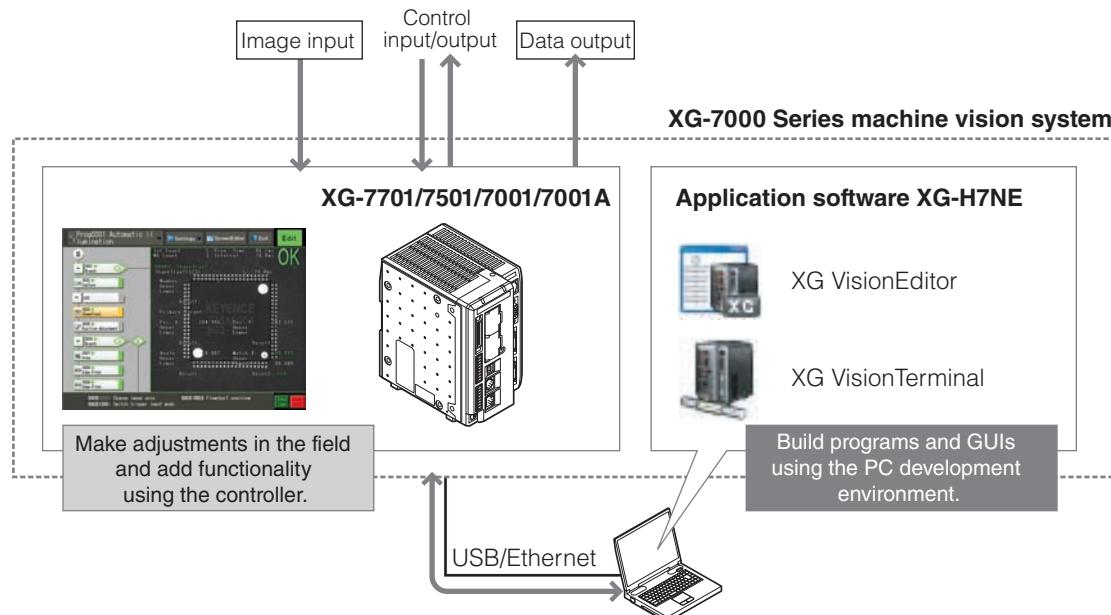
1. Install XG VisionEditor on PC
Building image processing flowchart and GUI, etc., with VisionEditor
2. Upload to a real CV via communication. Operations such as settings, program creation, and editing with a single controller are also possible.
3. Data logging and remote operation/monitoring with the XG VisionTerminal as well as setting and modification, etc. using logged data



■ XG-7000 Series System Outline

The XG-7000 Series uses 2 methods to build inspection programs. Working directly with the controller, adjustments in the field, addition of units and product changeovers can be carried out.

A PC can also be used on and offline to develop new programs and the GUI for the XG. At the same time the PC can be used to test out the inspection methods employed. PC software available for the XG includes XG VisionEditor and XG VisionTerminal (data logging software).



XG-7000 Series (controller)

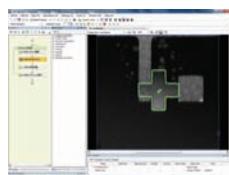
The XG-7000 Series platform features a super high speed, parallel "3+1" processor for machine vision processing.

- In addition to running user-developed inspection programs, the handheld controller can be used to check and edit vision inspection programs in the flowchart. This allows for instant adjustments and program changes as they become necessary.

XG VisionEditor

The XG VisionEditor is integrated management software dedicated for the XG-7000 Series.

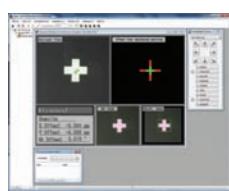
- The XG VisionEditor provides all the inspection program development functions and utilities required for designing and testing programs for the XG-7000 Series. Vision inspection programs with original dialogs and GUI's can be designed, created and tested. The environment also provides powerful tools for debugging and simulated field-testing.



XG VisionTerminal

XG VisionTerminal is a PC application designed specially for the XG-7000 Series.

- The XG VisionTerminal uses a remote desktop function allowing the user view the monitor output from the XG-7000 Series on a PC, as well as being able to issue commands for remote control and interaction.
- The XG VisionTerminal also allows for data logging directly from the XG-7000 controller.



■ About program data file version

Some program files for the XG-7000 Series may have different file versions.

- Version 4.0: Supports all functions up to and including the latest version 4.0.
- Version 3.0: Supports all functions up to and including version 3.0
- Version 2.1: Supports all functions up to and including version 2.1.
- Version 2.0: Supports all functions up to and including version 2.0.
- Version 1.0: Supports all functions up to and including version 1.0.
- Earlier versions of the XG VisionEditor and controllers can be upgraded for free by downloading data from the Users Support page.
- Program files are forwards compatible allowing versions 3.0 and earlier to be read and used in XG VisionEditor and controllers running version 4.0 or later. Program files are not backwards compatible.

■ Basics of XG VisionEditor (image processing building software)



Outline

The XG VisionEditor allows users without in-depth programming knowledge to easily build complex image processing programs in the development environment based mainly on drag and drop in a short amount of time.

Major functions

Building an image processing flowchart

Image processing flowcharts are built primarily by dragging and dropping items from a pre-defined parts list.

The image processing flowchart is then automatically converted into a program file when uploaded to the controller. Using the PC simulation function, users can check inspection setting values and verify results of processed images at any point in the creation process.

Creating user interfaces

The XG VisionEditor allows for the creation of a user interface by using layout templates, elements and dialog based menus. The interface is created by dragging and dropping items from a parts list onto the screen layout, similar to creating the image processing flowchart. The user interface and dialog functions are also integrated into the inspection settings to allow checking within the simulation function.

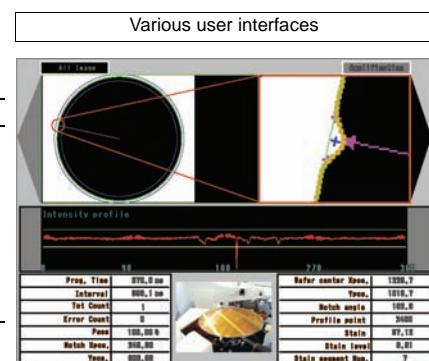
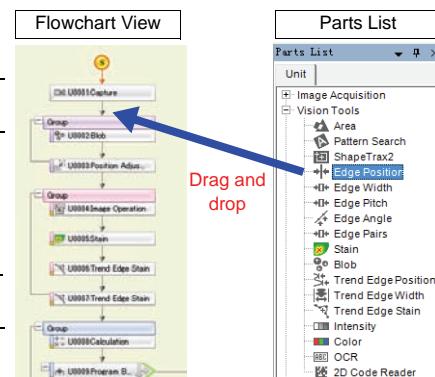
Debugging and results checking

VisionEditor allows for the user to check the integrity and debug errors in the constructed flowchart and user interface. Through simulation, processing data and measurement results are also generated and logged. Any errors found are displayed visually and output to a log file. VisionEditor also supports some jumps to error locations.

Controller management

Multiple controllers (only one for USB) connected via Ethernet or USB can be registered in a single instance of the VisionEditor. The XG VisionEditor manages the program files for each controller as a separate workspace.

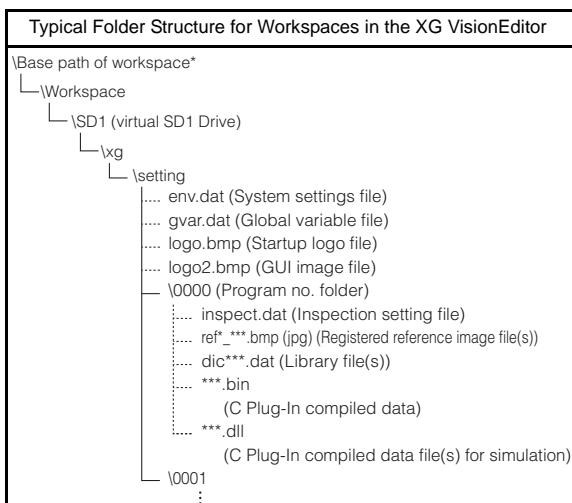
This allows for programs to be uploaded/downloaded, the acquiring of images and stored data to be transferred. In addition the registered controller can be remote controlled with the remote desktop function.



■ Program data for XG Series, data in PC and data in controller

Outline

Various settings in the XG-7000 Series are managed as separate program files based on their specific purpose. When uploaded or copied to the controller all these files combined together result in the full machine vision program.



Per inspection setting

Inspection setting (inspect.dat)

This file contains all the unit settings for flowcharts, local variables, and other data that makes up the image processing program excluding other files.

Registered images (ref*_***.bmp/jpg)

Teaching images for the pattern search unit, etc., and image data that can be referenced as the working screen for various measurement units.

Library File (dic***.dat)

This file contains the libraries used for character recognition in OCR units.

bin/dll files (***.bin, ***.dll)

These files are precompiled C-language files required for the C Plug In units. The bin files are used by the controller, and the dll files are used for simulation in the VisionEditor.

Common Files (All Programs)

System Setting File (env.dat)

This file contains global variable information for the controller that applies to all programs.

Global Variable File (gvar.dat)

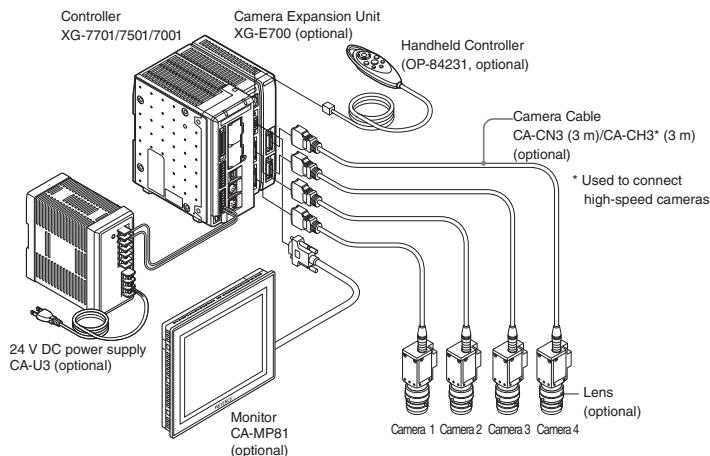
This file contains global variable information that can be referenced by all programs.

Logo files (logo.bmp or logo2.bmp)

There are two logo files: logo.bmp and Logo2.bmp. Logo.bmp is the logo file displayed on screen when the system is powered up. Logo2.bmp is the logo file for table patterns.

■ Basics of XG-7000 controller

(Basic system configuration of real machine: Example of connecting four cameras)



Controller

: Machine that performs image processing. Features FA-dedicated high speed/high performance (3+1 processor, etc.).

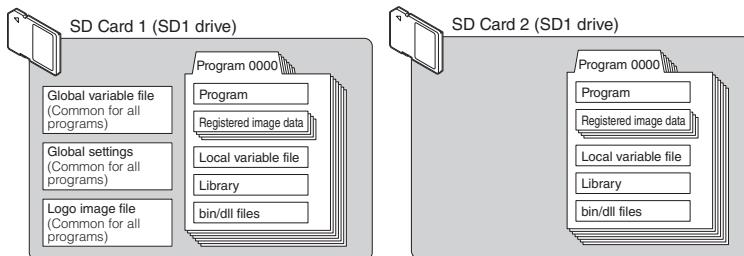
Camera

: Up to four cameras can be freely mixed and used (out of a choice of 16 types).

Handheld controller

: Build an advanced image processing flowchart program without PC software or modify a program.

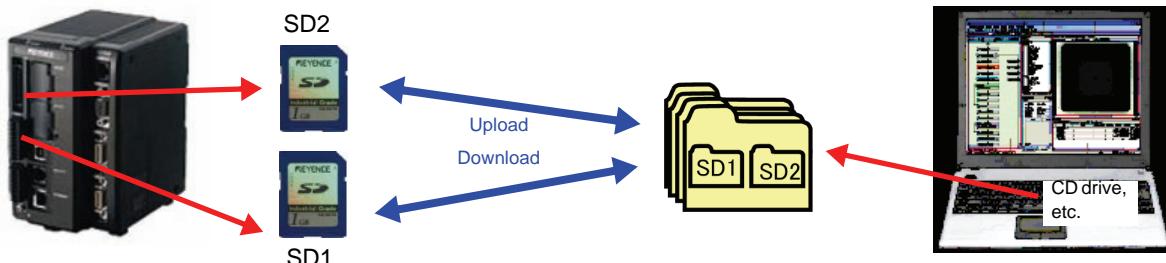
(Program File Management inside the XG-7000 Series Controller)



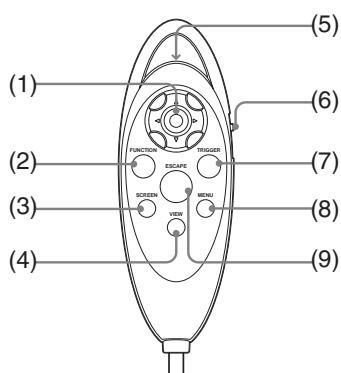
1-2 Check program file management inside the XG-7000 Series Controller in contrast with program file management by VisionEditor in Basics of Software.

The controller manages all program data using two SD cards. For this reason, the PC also manages program data using the virtual SD1/SD2 folders.

Synchronizing program data by the controller and PC: Upload and download



(About console buttons)



(1) No.0 button (ENTER)/8-way key

You can move the crosshair key to move the selection. Press the center button to apply the setting.

(2) No.1 button (FUNCTION)

Press this button to show or hide the function menu.

(3) No.4 button (SCREEN)

Press this button to switch, in turn, the image types (raw image 1, etc.) on the currently displayed screen.

(4) No.5 button (VIEW)

Press this button to display the VIEW Toolbar, zoom in or out of the screen, and switch between options such as display templates.

(5) No.7 back button

Press this button to switch between normal display and zoom display on the Flow Editor.

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

Press this button to show or hide the Flow Editor during run mode.

(7) No.3 button (TRIGGER)

Press this button to input a trigger.

(8) No.6 button (MENU)

Press this button to change the intensity of the dialog menu.

(9) No.2 button (ESCAPE)

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

■ Starting and Exiting VisionEditor

Starting VisionEditor

On the [Start] menu, click [All Programs] → [Keyence Applications] → [V-Works for XG Ver.4.0] → [XG VisionEditor Ver.4.0].

Alternatively, double-click the [XG VisionEditor Ver.4.0] shortcut on the desktop.



Icon

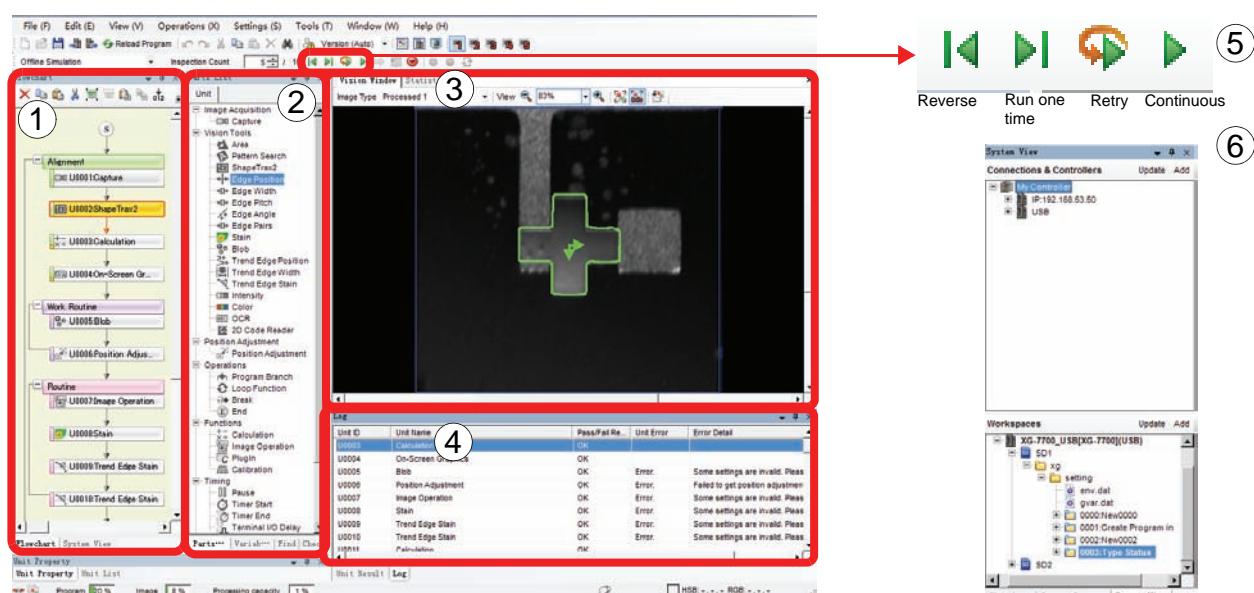
Exiting VisionEditor

Select the [File] menu and then [Exit].

Alternatively, click the close button at the top-right corner of the window.

■ The XG VisionEditor Interface

Five most-used views and keys (layout 1)



(1) Flowchart view

Displays the full image processing flow including capturing, inspecting and processing elements as a flowchart.

(2) Parts list

Displays a list of items, such as vision tools and screen elements that can be used when creating an image processing flowchart or user interface.

(3) Vision window

Displays the image, graphics and results for units selected in Flowchart view.

(4) Unit result view

Displays the result and variable data from the unit currently selected in Flowchart view.

(5) Simulation run buttons

These buttons are used to run set flowcharts in simulation mode.

(6) System View

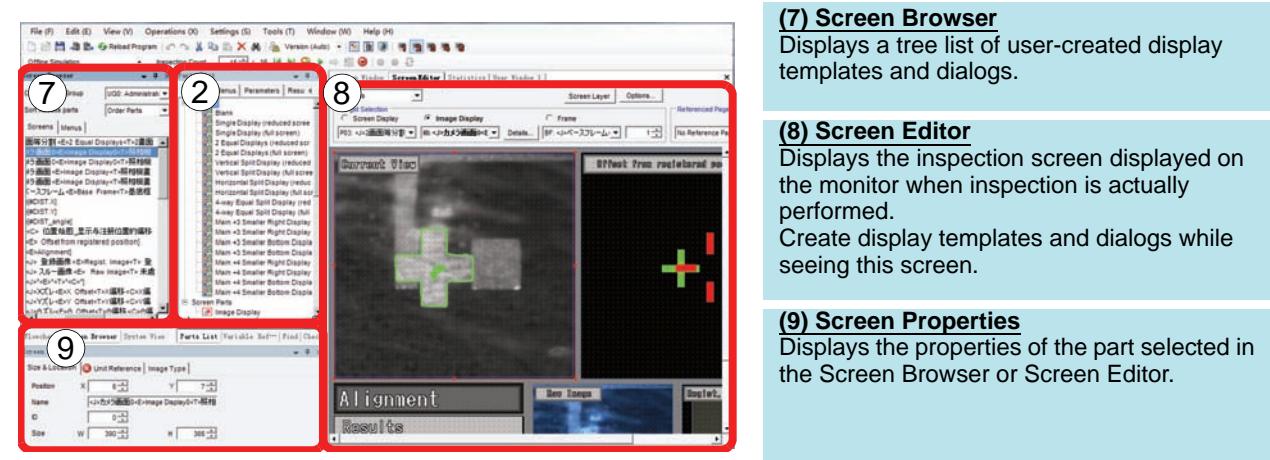
Lists the controllers and setting files managed by VisionEditor.

Basically, an image processing flowchart is built by adding parts from the parts list to Flowchart View.

Set each unit area and parameter adjustment while viewing the Vision Window.

Run the completed flowchart with the Simulation run button and check the results of the respective units from the Unit Results. System View is used to browse and manage setting files in the controller and PC.

Five most-used views and keys (layout 2)



(7) Screen Browser

Displays a tree list of user-created display templates and dialogs.

(8) Screen Editor

Displays the inspection screen displayed on the monitor when inspection is actually performed.

Create display templates and dialogs while seeing this screen.

(9) Screen Properties

Displays the properties of the part selected in the Screen Browser or Screen Editor.

1. Creating a setting file with VisionEditor

(1) Creating an inspection setting file

Create a new inspection setting file in XG VisionEditor.

Creating a new inspection setting file requires that a target controller be registered and a workspace (virtual control area on PC) be created.

↓

(2) Preparing image data

In the newly created inspection setting file, specify the camera type and model to be used and then register the image data to be inspected as a simulation image.

- Simulate the images registered here as an input image for the image processing flowchart to be created.
- You can capture a simulation image directly from the controller connected to the PC.

↓

(3) Creating an image processing flowchart

Create a full image processing flowchart by combining capture, measurement, control, and input/output, etc.

Add necessary processing to the image processing flowchart in the units called "unit". When necessary setting is complete, now you can immediately run simulation on VisionEditor.

↓

(4) Creating a controller display screen

Place optional display parts and create a display screen (display template) for image processing results on the controller.

This display screen can display not only the latest measurement results and captured images of the image processing flowchart but also the past archived images and results recorded in the controller.

↓

(5) Creating a controller operation interface

Create the operation interface to be displayed on the controller operation screen.

You can create a menu-format dialog by combining optional dialog parts for the parts that must be modified and set on-site where the controller is used.

↓

(6) Setting the basic functions of the controller

Change the settings of the basic functions installed on the controller as required.

This change enables you to use the statistics function that can check measurement result data and the archive function that stores images and result data under specific conditions on the controller.

↓

(7) Setting external input/output, etc., in global settings

Make settings related to connection with external devices as required.

Besides basic settings of each communication port, set external terminal assignment, PCL link, and CC-Link addressing, etc.

2. Uploading Files to a Controller

Performing trial run by the controller

Upload program data (inspection settings, global settings, etc.) to the controller connected to the PC via Ethernet or USB. Switching to the uploaded inspection setting No. starts inspection of the created image processing inspection.

3. Debugging and modifying program data

(1) Checking the processing contents

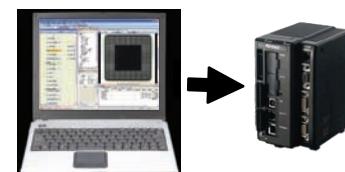
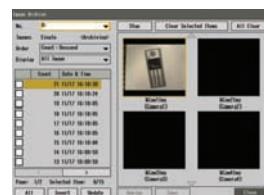
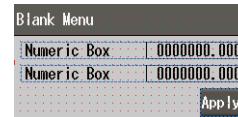
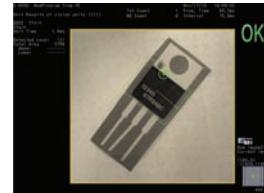
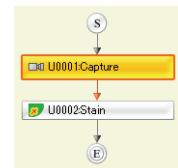
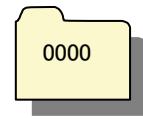
Use XG VisionEditor and the basic functions of the controller to check inspection program data (whether the results of the trial run differ from the initial purpose of creation). You can check not only simulation, actual measured data, and image data but also the operation conditions of various inputs and outputs and the operation results of the image processing flowchart.

↓

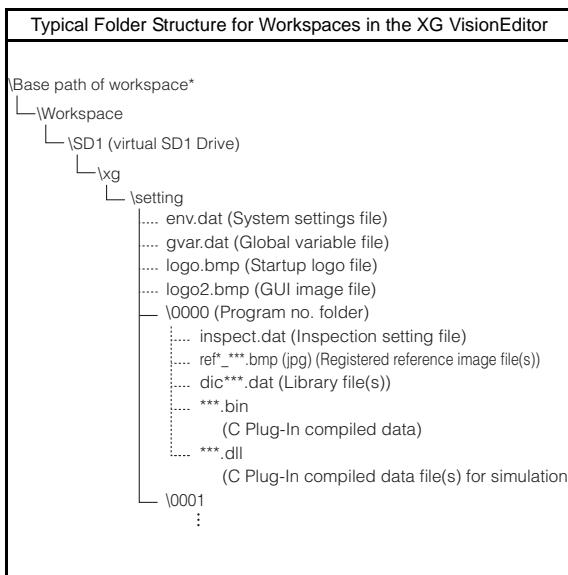
(2) Editing the flowchart with the controller

You can edit all the units in the image processing flowchart (except for the C language unit) on the controller via console operation. The controller can flexibly cope with on-site changes such as judgment tolerance (upper and lower limits) and inspection areas.

Also, VisionEditor can add and delete new settings. Even if the kinds of inspection targets increase, VisionEditor can cope with the increase with a single controller.



■ Terms you must memorize in program file management



(1) Base path

Place where two or more "workspaces" that are virtual controllers in the PC are put. Folder that serves as the base for the program data created by VisionEditor.

(2) Workspace

Virtual controller area that is created in the PC, has the same structure as the controller, and contains folders "SD1" and "SD2". Folder where setting files are placed.

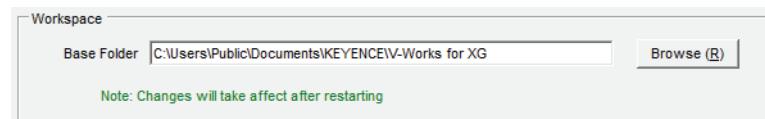
(3) Virtual SD drive

Folder that exists in the workspace and where files such as "inspect.dat" (setting file) and "env.dat" (global settings file) are placed. This drive is named SD1 or SD2 tailored to the controller structure.

■ Creating a New Program with VisionEditor

Changing the base path

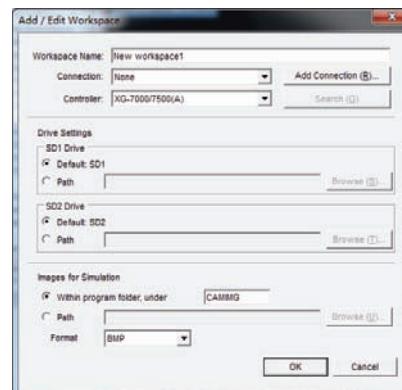
You can change the base path to any place by selecting [Options] from the [Tools] menu.



Creating a workspace

Click [Add] to the right of [System View]-[Workspace List].

When the [Add/Edit Workspace] window opens, initialize [Workspace Name] and [Connection] (registered controller associated with this workspace), etc.



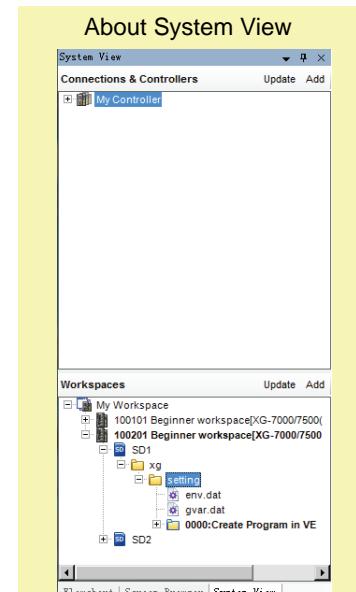
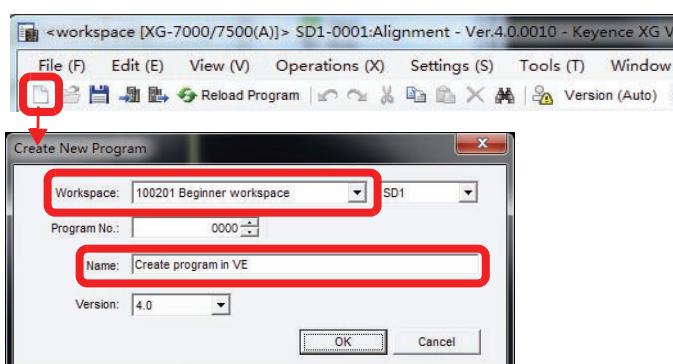
↑Workspace setting

Creating a new program/inspection

Click the [Create New Program] icon on top of the window.

Enter any workspace (previously created workspace) in [Workspace], enter an inspection name (free), and click [OK].

You can check that [0000: Any Name] was created in workspace (specified in the destination)-[SD1]-[xg]-[setting] of [System View]-[Workspaces].

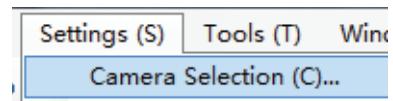


In the upper pane of the System View, you can register and check the controller connected to the PC. In the lower pane, you can add, update, and check workspaces in the PC.

System View exists in the place where "Flowchart View" that can create and check image processing flowcharts exists. It is used to add and manage the settings as in this example.

■ Specify the camera to be used.

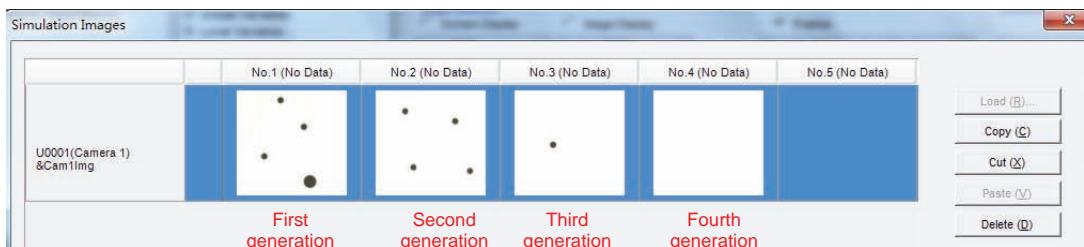
The camera model to be used depends on the image size. From the menu bar, select [Settings]-[Camera Selection]. Determine the model of the camera to be used.



■ About capture file setting

You can use the [Simulation Images] menu (capture file setting function) to register the archived result data and image files used by the capture unit when executing a simulation (except online simulation mode). Only the links to image files and archived result data are registered.

Select [Setting]-[Simulation Images].



The capture file setting function is used to register the information of links to the image data of image variables used by a capture unit for each "generation" (from the start unit within a program to the final end unit).

For the XG Series, a single flowchart execution may use several capture units and repeats one capture unit, so expressions such as "one sheet" or "once" cannot be used. For this reason, the units are called first generation/ second generation.

In each simulation mode, the necessary data is referenced based on the data registered to each capture setting file, and the simulation is executed.

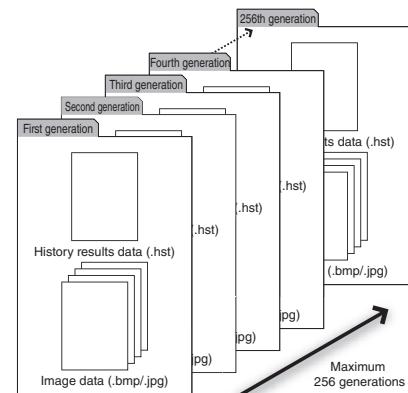


Image expansion direction

Select an expansion direction when expanding several images.

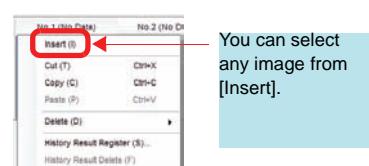
- Vertical: Registers to an image variable that differs from the same generation. (Registers downward with the image variable field of the selected generation as the starting point.)
- Horizontal: Registers as a generation that differs from the same image variable. (Registers to the right with the image variable field of the selected generation as the starting point.)



■ Several methods for capturing image data into the capture file

1. Capturing drive image data in the PC

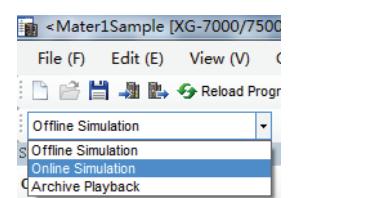
You can capture [BMP] and [JPEG] data in HDDs such as the C/D drive and removal media into the capture file. You can also use the image data inspected by our CV Series and other image processors and the images from the digital camera.



2. Capturing the images captured by the XG camera (online simulation)

Change the controller to remote capture mode and execute simulations using the image data captured with a camera connected to the controller.

You can also use the recording function to save captured image data to the simulation image storage directory automatically and register the image data to the capture file setting.



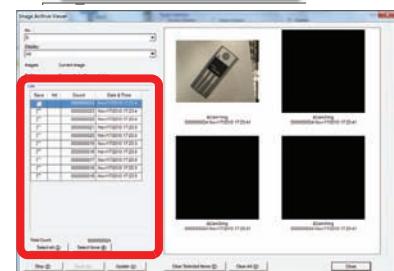
3. Capturing the archived images stored in the XG controller (image archive viewer)

You can use [Image Archive Settings] to save the NG judgment images stored in the controller in the PC.

Also selecting the [Add Saved Archive to Capture Image] function at this time adds archived data to the capture file setting in order starting from the generation at the specified location when archived data is saved.

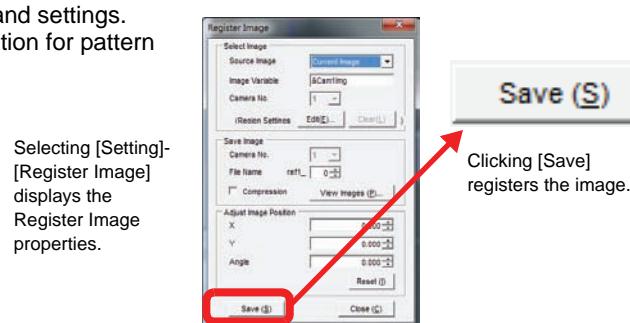
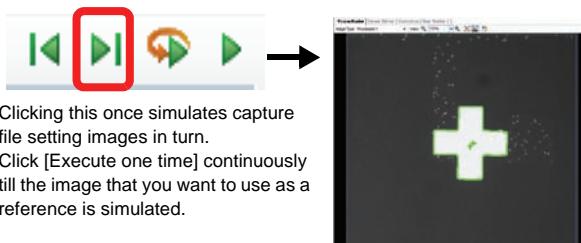
It is convenient that this function can collectively register the images used by simulation.

This function can also be used in replay mode.

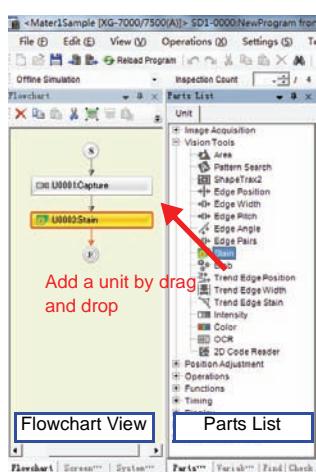


■ Registering the image used as a template

Register an image used as a template for measurement and settings. The registered image is used as reference image information for pattern search, ShapeTrax2, and a subtraction filter.



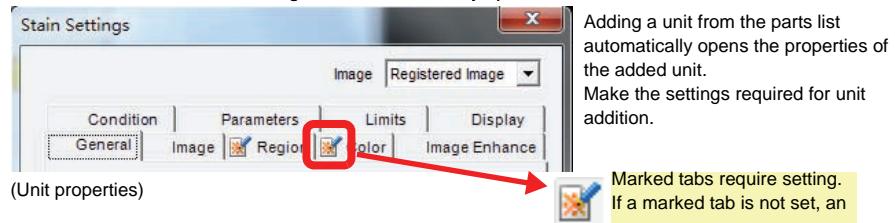
■ Adding a Unit to Flowchart View



VisionEditor creates a full image processing flowchart by combining capture, measurement, control, and input/output, etc., in the flowchart format. Add necessary processing to the image processing flowchart in the units called "unit". When necessary setting is complete, now you can immediately run simulation on the VisionEditor.

When a new program is created the flowchart shows the start unit (Unit ID: U0000), capture unit (U0001) and end unit (U0999). From this point units can be added as desired to create the image processing flowchart.

When a unit is added, the following window automatically opens:



(Setting order: The setting order may be changed. The following shows a general setting order for reference.)

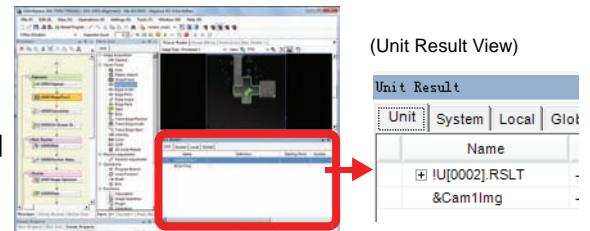
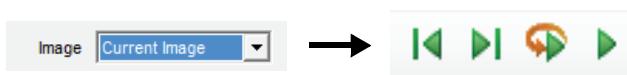
- Image** ↓ Change the image variables to be inspected as required.
- Color extraction setting** ↓ Convert the image to the one suitable for color camera limitation/inspection. (Color to binary/color to gray/fine color/RGB gray/gray)
- Inspection Region** ↓ Set the region matching the shape of the target. In addition to general rectangles and circles, an image region can be set.
- Image enhancement setting** ↓ Convert the image to the image that emphasizes the detection feature points according to the purpose of inspection.
- Detection condition** ↓ For a stain, set basic detection conditions such as whether to inspect the stain from which size and which depth.
- Settings** ↓ Set detailed detection conditions as required.
- Selected Item Limits** ↓ Set the threshold (upper and lower limits) for judging whether the measurement result is NG.
- Display Options** ↓ Set a detection point, whether to display regions, and color change as required.

* For setting of "Inspection Region" and "Color Extraction" by the measurement unit in stain mode, etc., see examples.

■ Checking the unit results in simulation execution

VisionEditor can perform simulation using the images in capture file setting when a unit is set. You can check the measurement results at that time in details from [Unit Result View]. Make the optimum setting while checking the results.

1. Change [Image] of the unit properties to [Current Image] and execute simulation once.



You can check the simulation results in details.

The above simulation results indicate that "Total Area" is "21".

■ About two simulators

Using the simulation function for two simulators allows users to check execution of inspection settings being edited on the XG VisionEditor.

This is useful for checking the simulation execution results and editing the flowchart structure and unit settings. You can also verify operations without having to upload the inspection settings to the controller following editing.

You can use two types of simulations with the VisionEditor: edit simulation, which uses the VisionEditor, and single simulation, which uses the XG Simulator. Edit simulation also has three simulation modes according to the application.

Edit simulation <ul style="list-style-type: none"> • Offline simulation mode • Online simulation mode • Replay mode 	 (Used by the run buttons on VisionEditor)	Single simulation <ul style="list-style-type: none"> • XG Simulator 	
---	--	---	---

■ Edit simulation

Offline simulation mode

The Offline simulation mode is the basic simulation operation mode of the VisionEditor and is the most versatile.

You can execute simulations without connecting to the controller by using image files registered to the capture file setting.



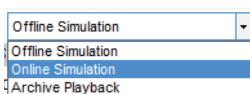
(Checking with the current image during unit setting)



(Checking with the current image after flowchart building)

Online simulation mode

You can remotely control the controller and execute simulations using the image captured with a camera connected to the controller as the current image.

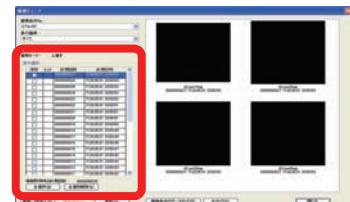


Selecting "Online Simulation" in VisionEditor causes the controller to change to "Remote capture mode" and trigger execution right to move to the PC. At this time, inspection is not performed even if a trigger is clicked on the console. Clicking the [Execute one time] button in VisionEditor runs the controller flowchart.

Replay mode

You can check the execution results on the controller by registering archived data stored in the controller together with images in capture file setting using [Image Archive Settings].

At this time, VisionEditor does not execute the flowchart.



■ Single simulation

XG Simulator

In addition to an edit simulation, you can also execute a single simulation, which virtually reproduces the operations of the controller on a computer.

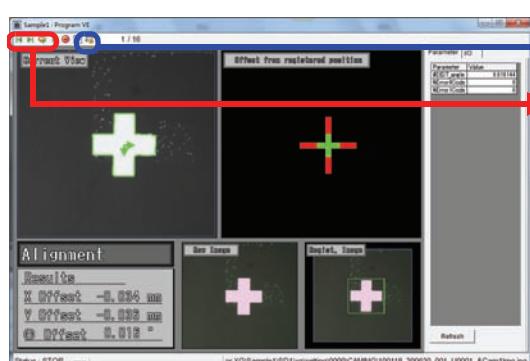
This is used for checking items that are not supported by an edit simulation, such as screen displays and dialog operations set with Screen Editor.

It also supports console operations, partial terminal inputs, and rewriting of variable values, so it is useful for checking program operations by using various external input factors without having to upload inspection settings to the controller.

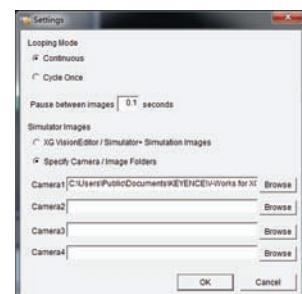
Select [XG Simulator] in the [Tools] menu. The active program is loaded and the simulation begins. You can also start the XG Simulator by clicking  from the toolbar.

(XG Simulator window)

(simulator setting icon)



Basic execution operations such as "Execute one time" are the same as edit simulation.



Clicking  on the toolbar displays the [Settings] menu, which can be used to change settings when continually executing a simulation for multiple images.

XG Simulator can simulate not only images in capture file setting but also up to 50,000 images in the specified folder.

Basic Tutorial_1_1: Creating settings with VisionEditor

Creating settings with VisionEditor

Create settings with VE (XG VisionEditor).

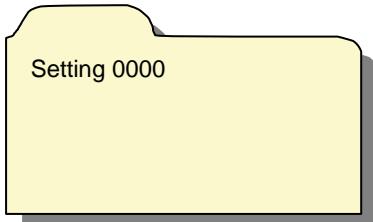
VE enables you to efficiently create inspection settings via convenient user interfaces of your PC.

In this subject, you will learn a basic flow of creating settings with VE.

■ Flow of creating inspection settings

- (1) Creating inspection settings
- (2) Preparing images (for simulation)
- (3) Creating a flowchart

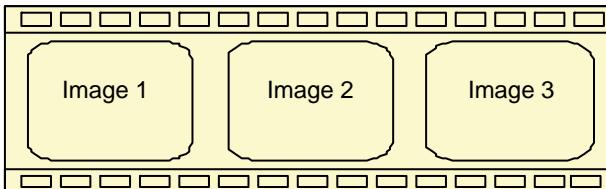
- (1) Creating inspection settings



Create an inspection setting.

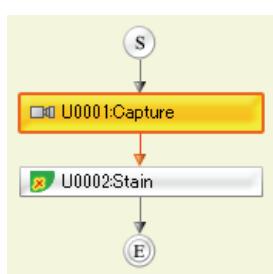
Adding an inspection setting creates one setting folder.

- (2) Preparing images (for simulation)



Register the image file required for simulation performed when creating an image processing flowchart.

- (3) Creating a flowchart

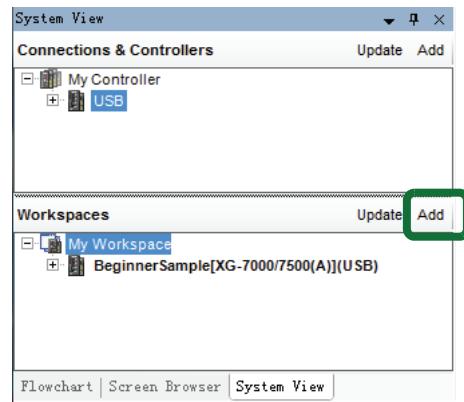


Create an image processing flowchart. Determine which inspection algorithm to use and which parameters to set.

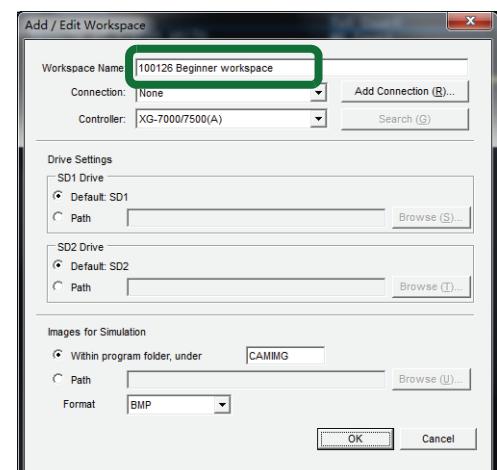
Creating an inspection setting

1. Create a workspace.

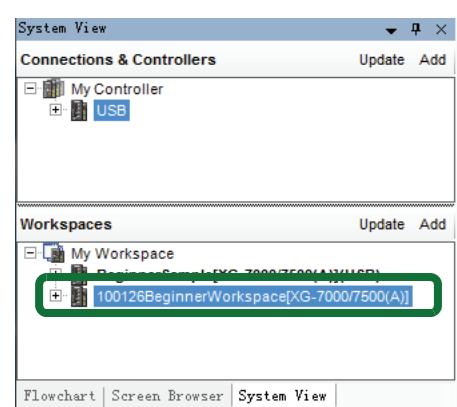
- (1) Click [Add] to the right of [System View]-[Workspaces].



- (2) In [Add/Edit Workspace]-[Workspace Name], set "(date of today) beginning workspace".
(Example: "100126 Beginner workspace")

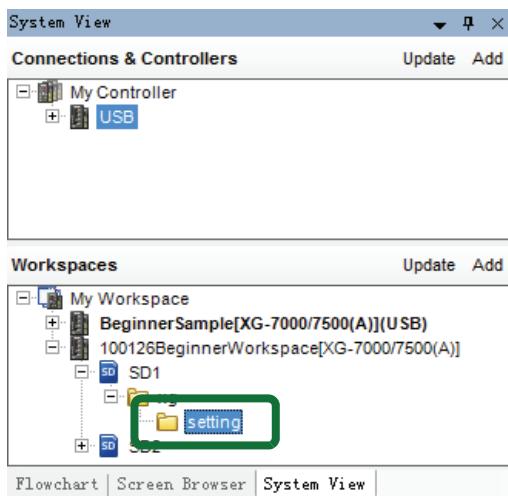


- (3) Check that "100126BeginnerWorkspace" has been added to [System View]-[Workspaces].

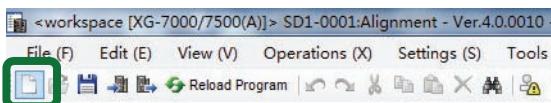


2. Create a new inspection setting.

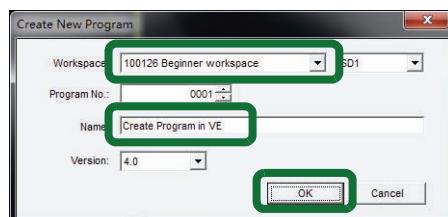
- (1) Check that the inspection setting folder does not exist in [100126BeginnerWorkspace]-[SD1]-[xg]-[setting] of [System View]-[Workspaces].



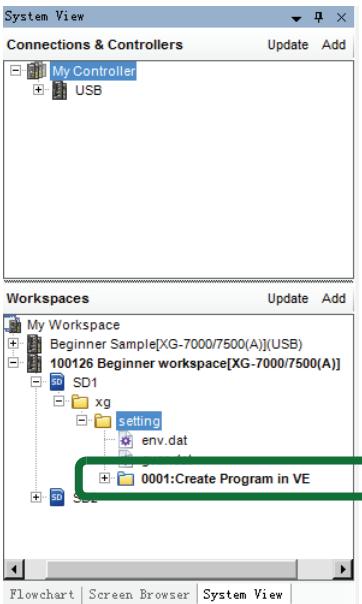
- (2) Click the [Create New Program] icon on top of the window.



- (3) Enter [100126 Beginner workspace] as [Workspace], enter [Create Program in VE], and click [OK].



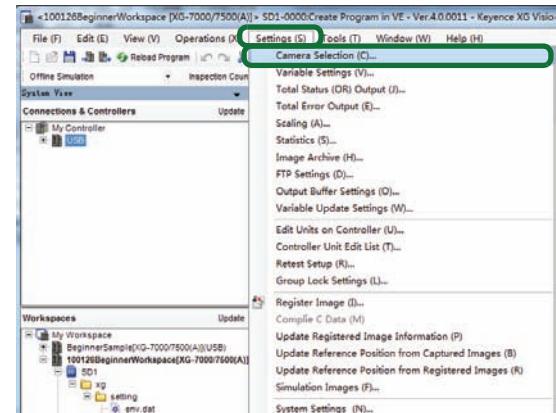
- (4) Check that [0001: Create Program in VE] has been created in [100126 Beginner workspace]-[SD1]-[xg]-[setting] of [System View]-[Workspaces].



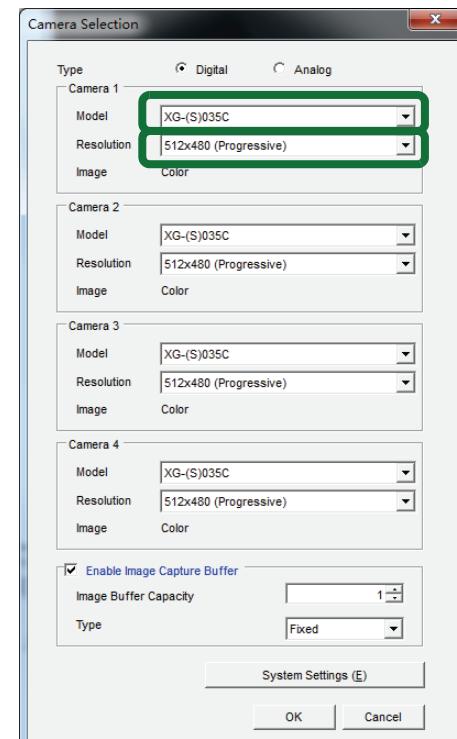
Preparing images (for simulation)

3. Specify the number of pixels of an image and select color/monochrome.

- (1) From the menu bar on top of the window, click [Settings]-[Camera Selection].



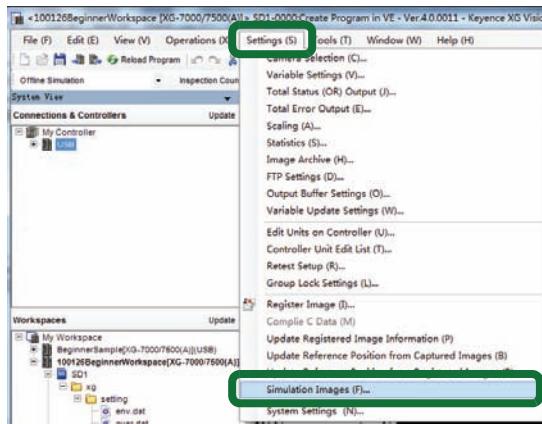
- (2) Check whether [XG-(S)035C] is specified as [Camera 1]-[Model] and [512x480 (Progressive)] specified as [Resolution].



- (3) Click [OK] to close the window.

4. Prepare images.

- (1) From the menu bar on top of the window, click [Settings]-[Simulation Images].



- (2) Double-click the square below [No. 1] to select the image in the PC.

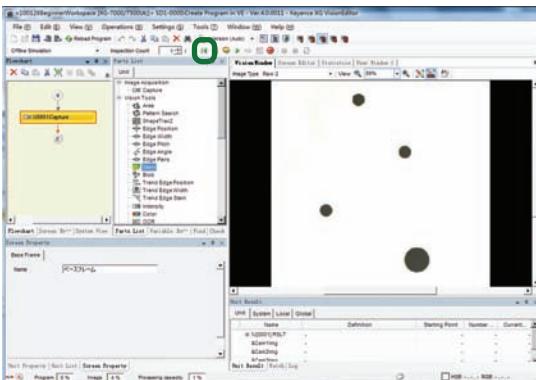
Image file location:

[Desktop]-[Lecture Data]-[Beginning Basepath]-[Image Data]



- (3) Click [OK] to close the window.

- (4) Click the [Execute one time] button to perform simulation using the images registered in capture file setting.

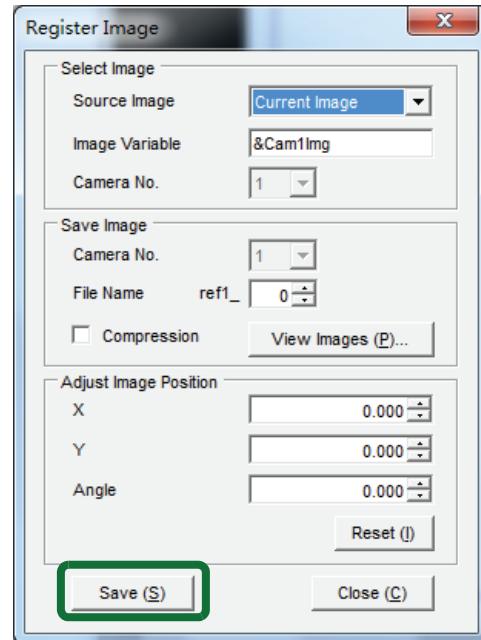


Creating a flowchart

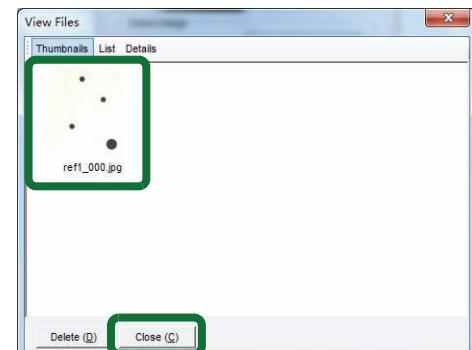
5. Register the flow creation reference image.

- (1) From the menu bar on top of the window, click [Settings]-[Register Image].

- (2) Click [Execute one time] to display the image you want to register and click [Save].



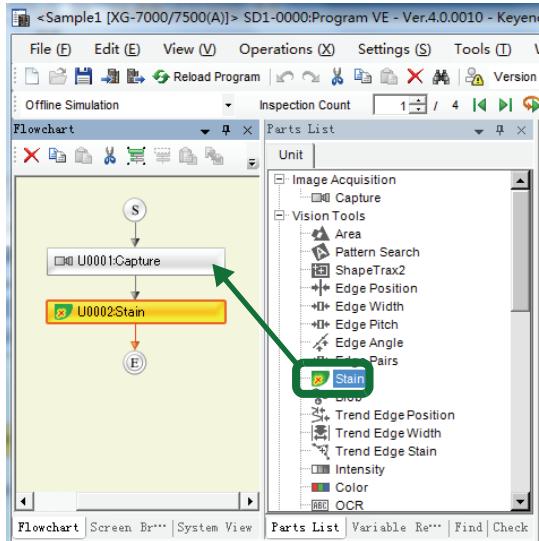
- (3) Click [View Images] to check the registered images and click [OK] to close the window.



- (4) Click [Close] to close [Register Image].

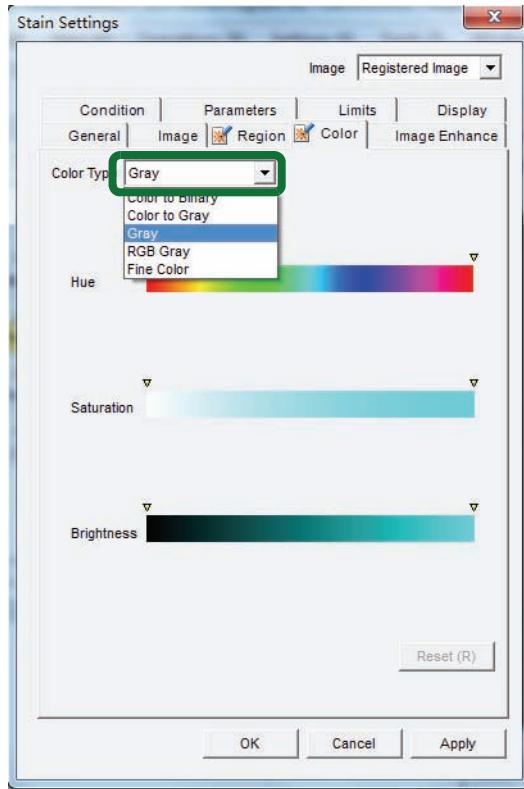
6. Add a unit.

- Select [Parts List]-[Vision Tools]-[Stain], drag and drop the stain so that it overlaps the [Capture] unit, and add the [Stain] unit.



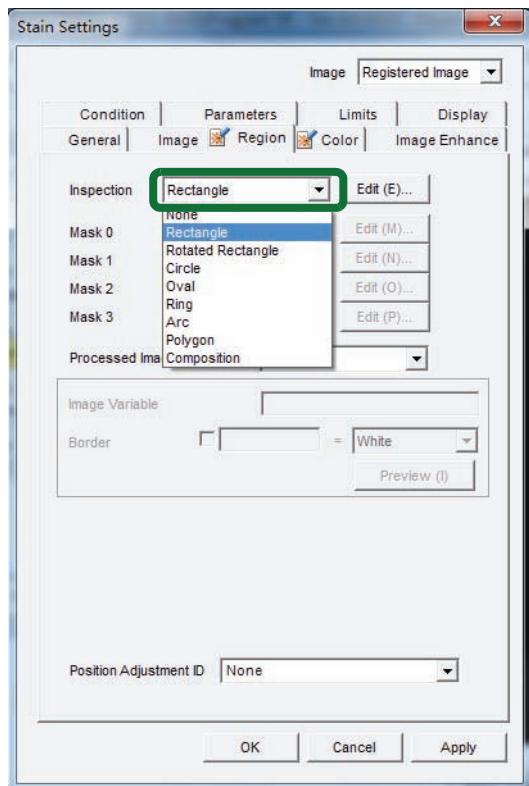
7. Set color extraction.

- Set [Color]-[Color Type] to [Gray].



8. Set a region.

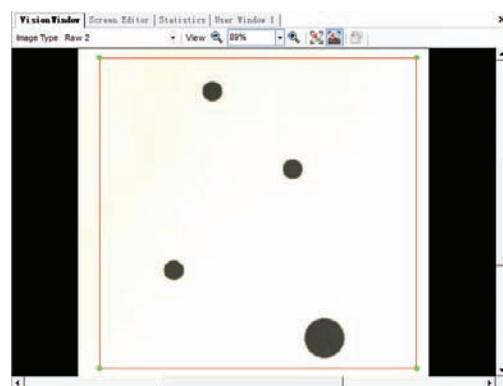
- Set [Region]- [Inspection] to [Rectangle].



- Specify a region in [Vision Window].

In the Vision Window, click the vertex in the upper left and click the vertex in the lower right. A region will be created.

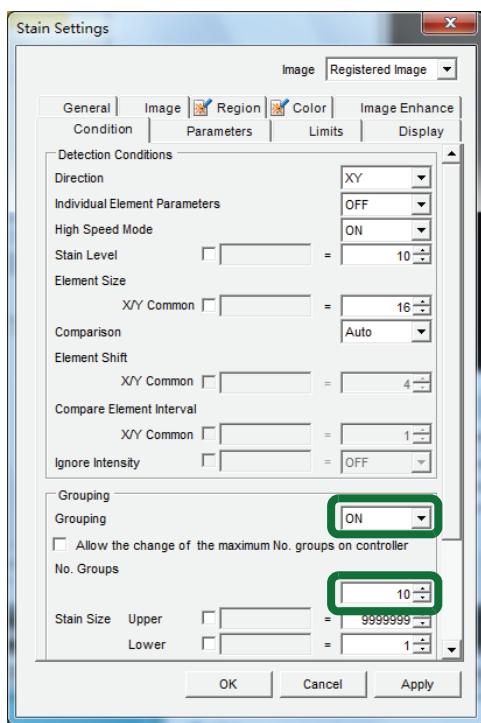
Move Vertex: The size changes.
Move Side: The location changes.



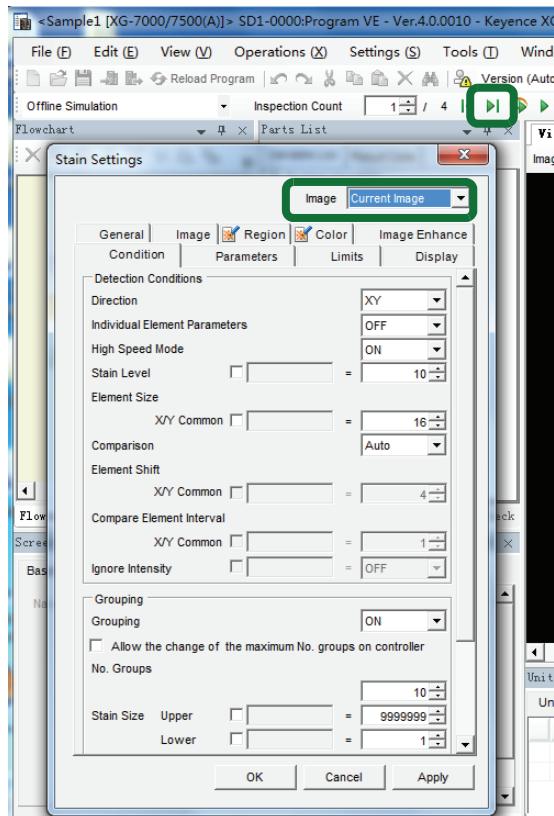
- Click [Apply] and check whether the region is correctly set.

9. Set detection conditions.

- (1) Select [Conditions] and set [Grouping] to [ON].
- (2) On the [Conditions] tab, set [No. Groups] to [10].

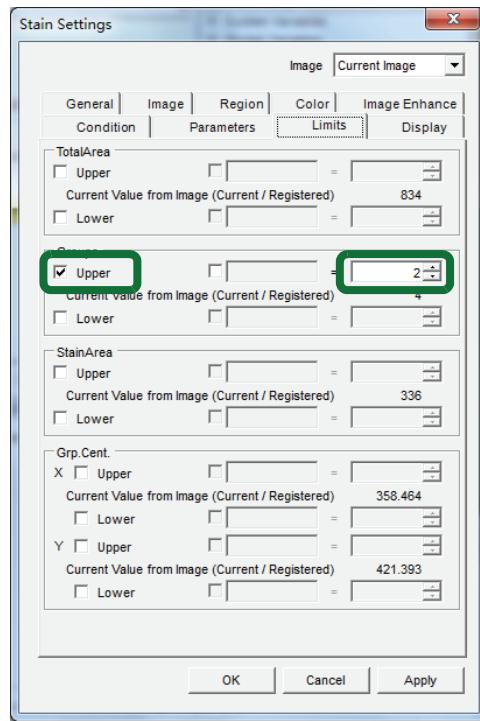


- (3) Set [Image] on top of the unit property to [Current Image] and click [Execute one time] to perform simulation with the image in capture file setting.



10. Set judgment conditions.

- (1) On the [Limits] tab, select the [Upper] check box in [Groups].
- (2) On the [Limits] tab, set [Upper] to [2].



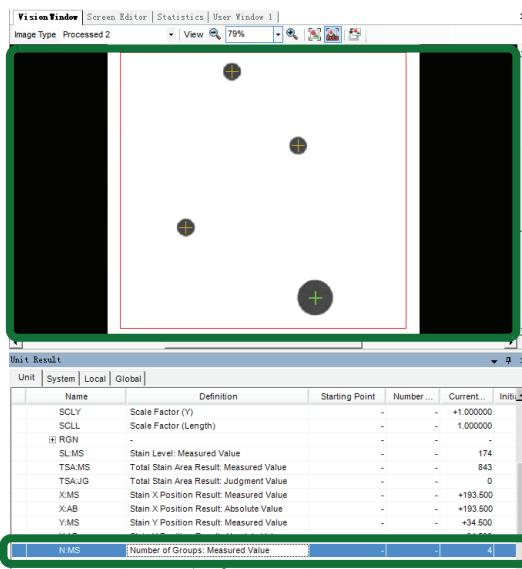
- (3) Click [OK] to close [Unit Property].

11. Check the following in simulation:

- (1) Click [Execute one time].
- (2) In [Vision Window], check the detection conditions with images.
Check whether crosshairs are visible in the stain locations.
- (3) In [Unit Results], check the detection conditions with numeric values.
Check the [OK/NG] result in [Unit Judgment Value]. When the unit judgment value is [OK], [0] is set. When [NG], [1] is set.
In [Number of Groups], check the [Number of Stains] result. Check whether the number of crosshairs in "Vision Window" matches the number of stains.

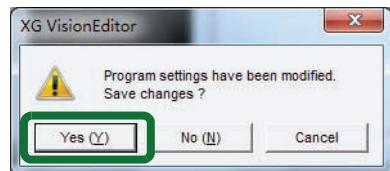


Clicking [Execute one time] performs simulation with the next image set in [Capture File Setting].



- (4) From the menu bar on top of the window, select [Tools]-[XG Simulator].

- (5) When the following confirmation message appears, asking whether you want to save inspection settings, select [Yes].



- (6) Click [Execute one time] to perform simulation.



The "XG Simulator" allows simulation using the same layout as the controller.

■ Registering a controller

The VisionEditor can only be used to control registered controllers. Controllers and subsequent connections need to be registered with the System View before establishing a connection. Click [Add] on the Controller List view. The [Add / Edit Connection] window appears.

Specify a controller in [Search] or [Search for Connections/Controllers] and click  to add the controller.



■ Associating a workspace with a controller

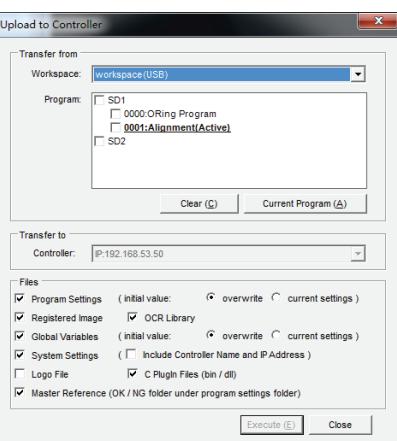
For upload/download, associate the added controller with the workspace that is a virtual controller in the PC. In [Connection] of [Add/Edit Workspace], specify the appropriate controller.



■ Uploading files from the PC to the controller

Upload the inspection settings, registered images, and global settings, etc., created with VisionEditor to the controller associated with the workspace.

Click [Upload Icon]. After checking the following items, start upload by clicking [Execute].



Workspace

Select the workspace from which to upload data.

Program

Select the programs to upload.

Selecting [SD1] or [SD2] will upload all program data within that drive.

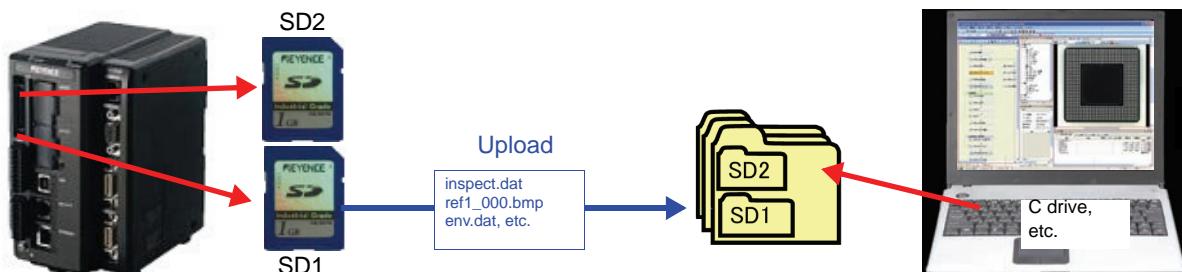
Transfer to

Select the controller to upload the files to.

Files

After specifying the options select the files to upload.

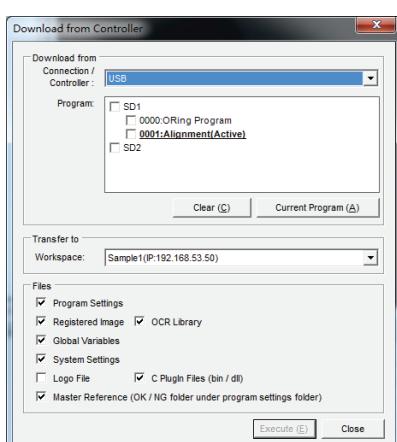
(Program Settings/Registered Image/OCR Library/Global Variables/System Settings/Logo File/C Plugin Files (bin/dll) (compiled data used by the C language unit),



■ Uploading files from the controller to the PC

Download the inspection settings, etc., edited by the controller to the PC workspace.

Click [Download Icon]. After checking the following items, start upload by clicking [Execute].



Controller

Select the connection and controller from which to download data.

Program

Select the programs to download.

Selecting [SD1] or [SD2] will download all program data within that drive.

Workspace (Transfer to)

Specify the workspace to download the data to.

Files

After specifying the options select the files to download.

(Program Settings/Registered Image/OCR Library/Global Variables/System Settings/Logo file/C Plugin Files (bin/dll) (compiled data used by the C language unit),

Basic Tutorial_1_2: Communication between VisionEditor and Controller

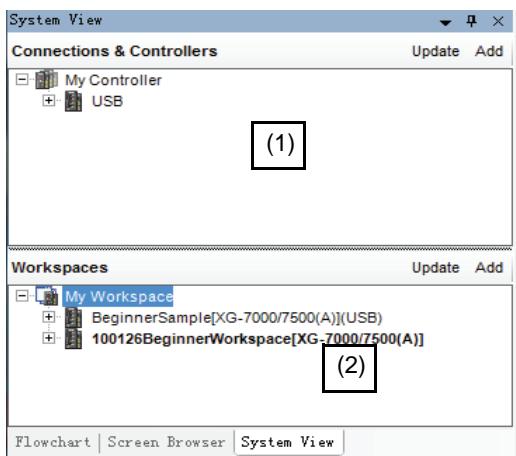
Exchanging data with the controller

Exchanging data with the controller on VE requires the following two preparations: (1) Registering a controller, (2) Setting a workspace connection destination

When the above two preparations are complete, you can send and receive data to and from the controller.

■ Preparation for communication between VE and controller

- (1) Registering a controller
- (2) Setting a workspace connection destination



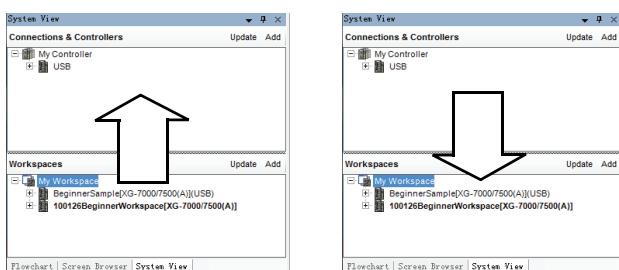
■ Upload and download

Upload

Sending workspace data to the controller

Download

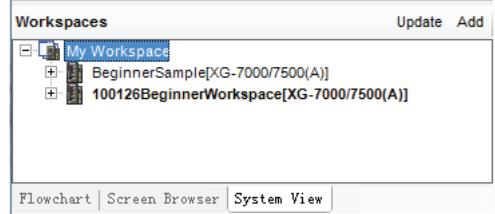
Sending controller data to the workspace



Registering a controller

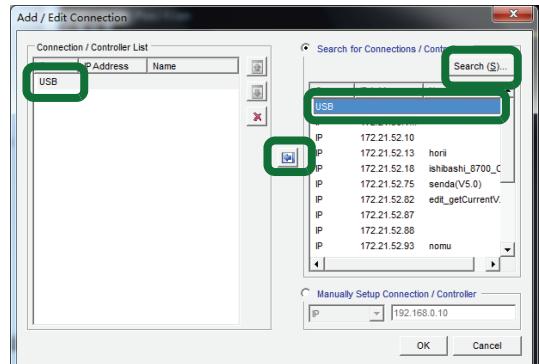
1. Register a controller.

- (1) Click [Add] to the right of [System View]-[Connections & Controllers].

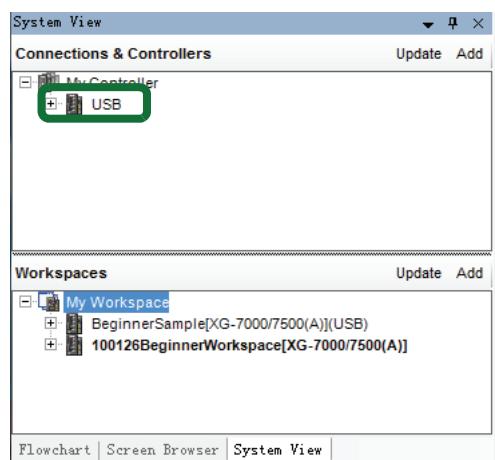


- (2) Select [Search for Connections /Controllers] and click [Search].

- (3) Select [USB], click [←] in the center, and check that [USB] has been added to [Connection/Controller List].



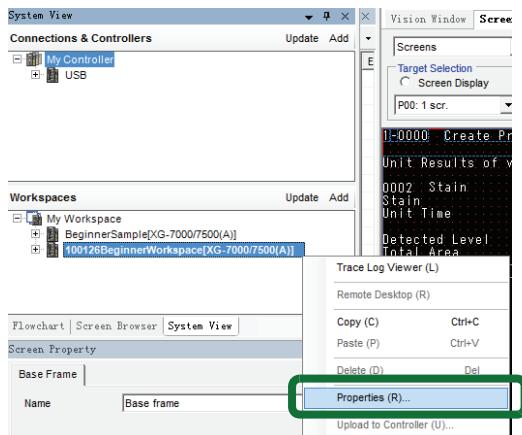
- (4) Check that [USB] has been added to [System View]-[Controller List].



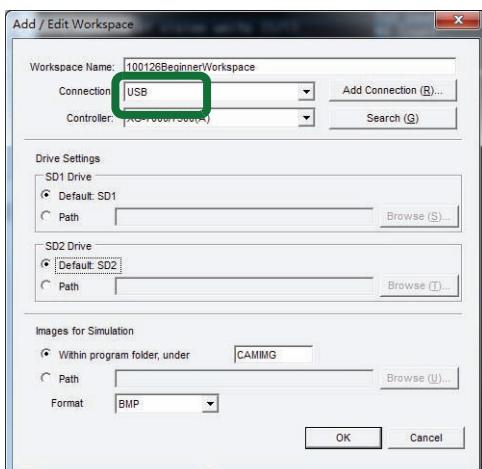
Setting a workspace connection destination

2. Set a workspace connection destination.

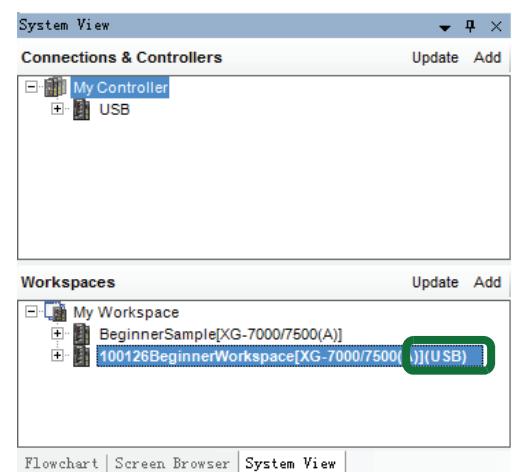
- Select [100126BeginnerWorkspace] from [System View]-[Workspaces] and right-click to open [Properties].



- Select [USB] as [Connection] and click [OK] to close the window.



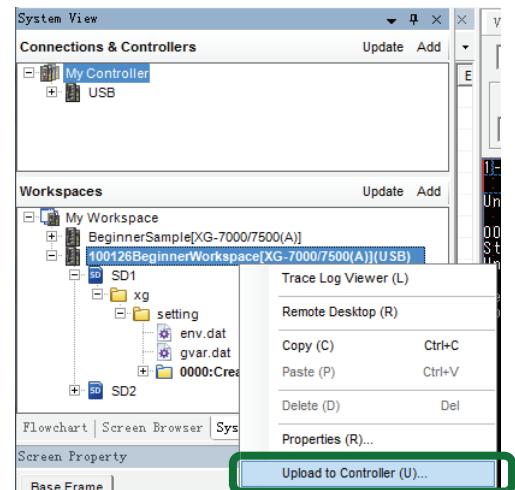
- Check that [(USB)] is displayed to the right of "workspace name".



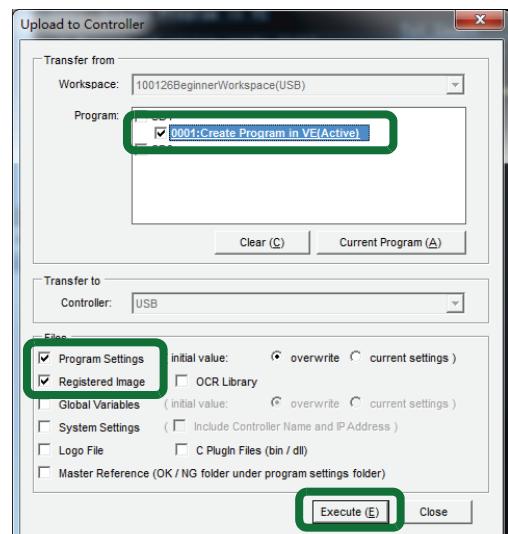
Uploading target data

3. Upload target data.

- Select [100126BeginnerWorkspace] from [System View]-[Workspaces], right-click on the selection, and select [Upload to Controller].



- Select [0001] in [Program], select [Program Settings] and [Registered Image] in [Files], and click [Execute].



■ Single flowchart editing function of controller

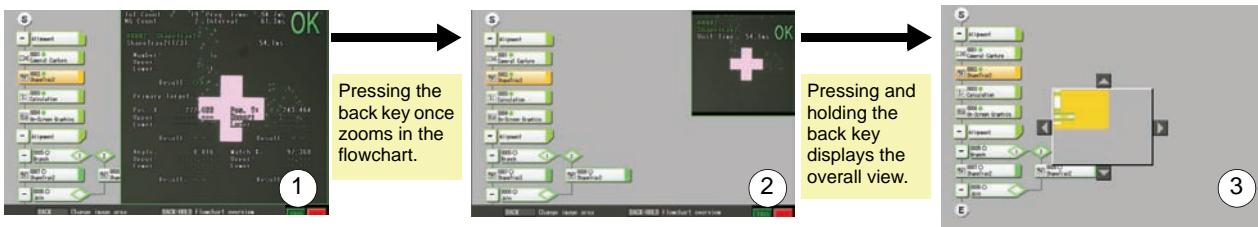
You can edit a flowchart using a controller. (Function from Ver3.0)

With Flowchart View, you can edit a flowchart while retrieving information necessary for inspection settings because Flowchart View visually displays not only the inspection setting structure but also the current image processing status. This achieves intuitive error-free inspection settings and adjustment.

* You can mainly perform the following two tasks using this editing function:

1. New setting and editing of inspection setting number and inspection flowchart (editable by all units other than the C language unit)
2. Setting of archive setting, statistical analysis, and terminal assignment, etc.

■ About flowchart display setting



You can check the flowchart during operation even if you do not edit data.

Selecting [Flowchart Display] from the function menu displays the flowchart as shown in Window (1). (Uneditable) If the flowchart expands horizontally because the branch unit was used, you can press the back (7) key on the console once to zoom in the flowchart. (Window (2))

If there are various flowcharts, you can display the overall view by pressing and holding the back (7) key. (Window (3)) Flowchart display does not affect processing time at all.

■ About flowchart editing and unit addition/editing

Operating the RUN/STOP slide switch on the console displays [Editing] in the upper right of the window. You can now edit the flowchart.

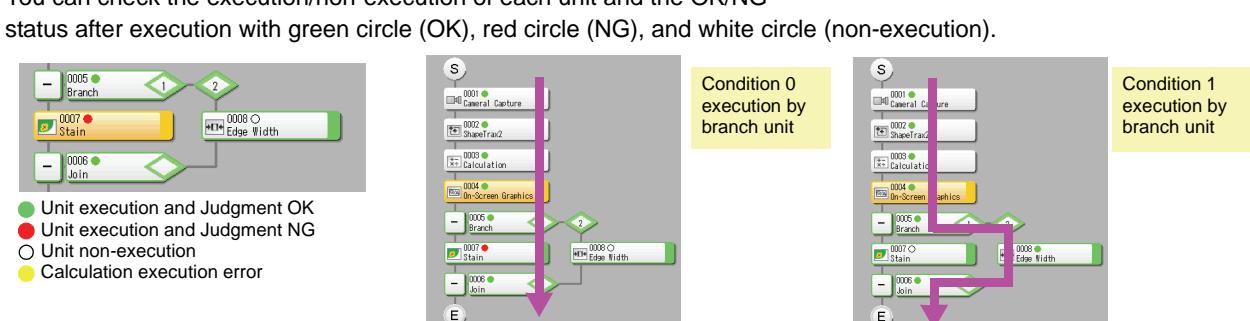
To add a unit to the flowchart, select [Add Unit]-[Vision Tools]-[Any Measurement Tool] from the [Function] key.

Besides the measurement unit, you can add and edit control units such as [Branch-Join] and [Loop Function] and timing units such as [Wait Terminal I/O]. Double-clicking the added unit displays the unit edit window where [Inspection Region] and [Detection Conditions] can be set. For details, check "Questions".



■ Unit execution/non-execution and OK/NG status display

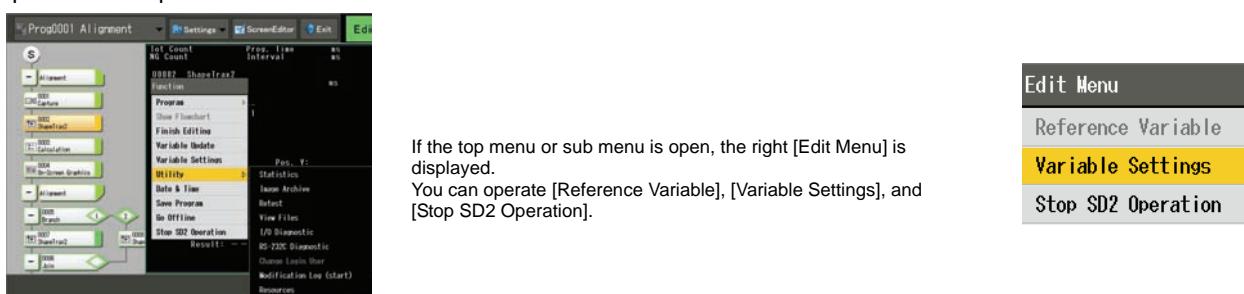
You can check the execution/non-execution of each unit and the OK/NG status after execution with green circle (OK), red circle (NG), and white circle (non-execution).



■ About differences between function menus

Opening the FNC menu when any unit is selected in the Flow Editor enables you to add a unit. (See the above flowchart editing.)

If anything other than a unit is focused upon, the function menu that is almost the same as the function menu used during operation will open.

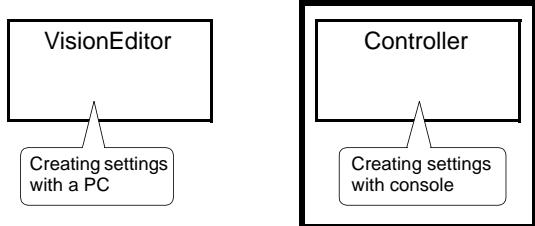


Basic Tutorial_1_3: Creating Settings on Controller

Creating settings on a controller

You can create settings not only on XG VisionEditor but also on the controller. This enables you to promptly cope with urgent on-site breed addition and inspection troubles. Settings on the controller do not require a PC. You can create settings only using the console connected to the controller.

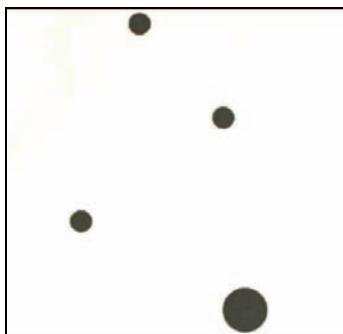
■ On-site setting adjustment



Use the controller to create settings.

Use the console to adjust on-site settings.

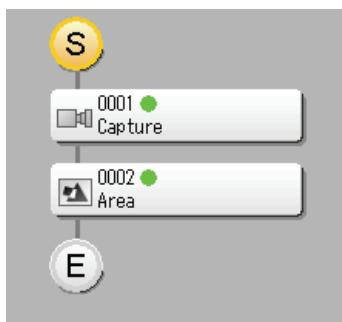
■ Example to be created



Perform a foreign matter inspection on a sheet.

Count the number of black pixels using a binary area and judge the inspection from the area of the foreign matter.

■ Flowchart image



Creating an area unit

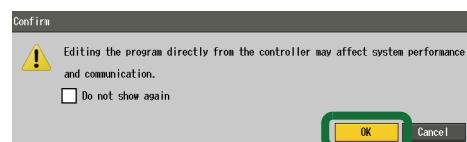
1. Switch the function to flowchart editing.

- (1) Open [Function]-[Edit Flowchart]. (You can also open flow editing by sliding the slide switch.)

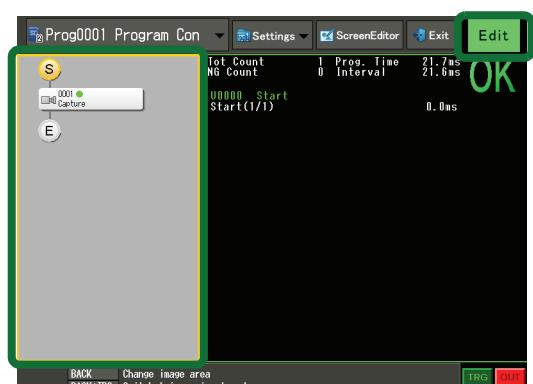


- (2) Click [OK] from the [Confirm] dialog to close it.

This dialog notifies you that edit operation affects image processing and input/output.



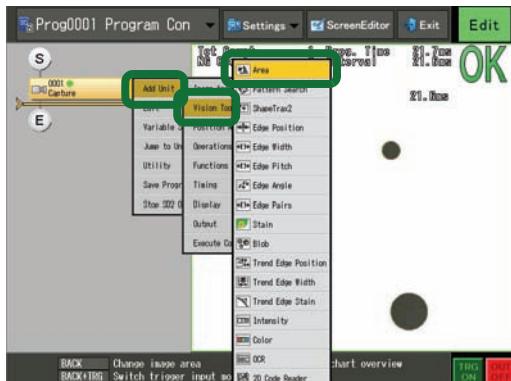
- (3) Check that [Flowchart Editing] is open.



- (4) Click [Enter] to enter the flowchart and move to the [Capture] unit.

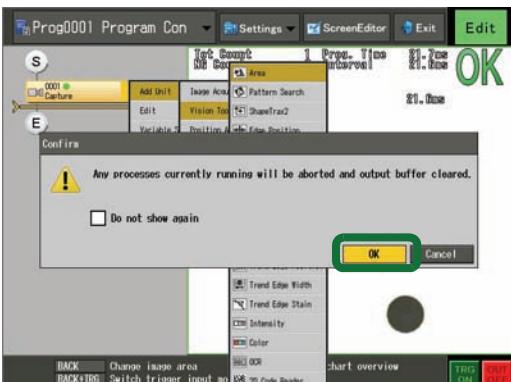
2. Add an area unit.

- (1) Select [Function Menu]-[Vision Tool]-[Area] to add the area unit.

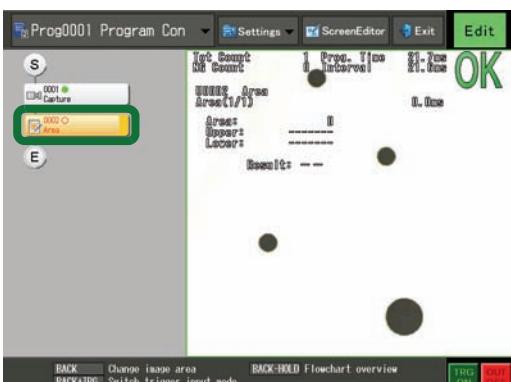


- (2) Click [OK] from the [Confirm] dialog, and close the dialog box.

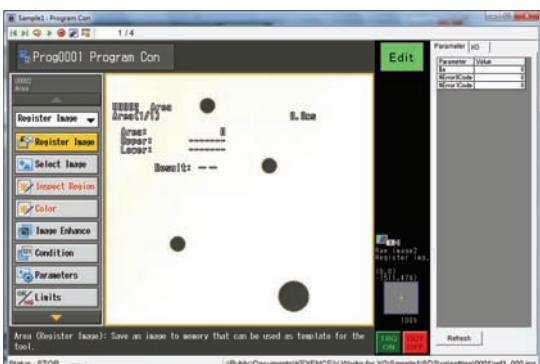
This dialog notifies you that operation has stopped and the output buffer is cleared to reflect the settings.



- (3) Check that the [Area] unit has been added.

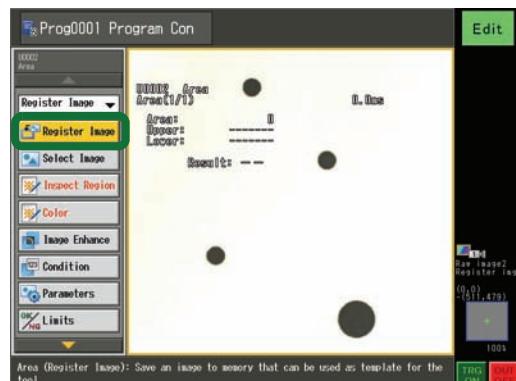


- (4) Focus the [Area] unit and press [Enter] to open the top menu.



3. Register an image.

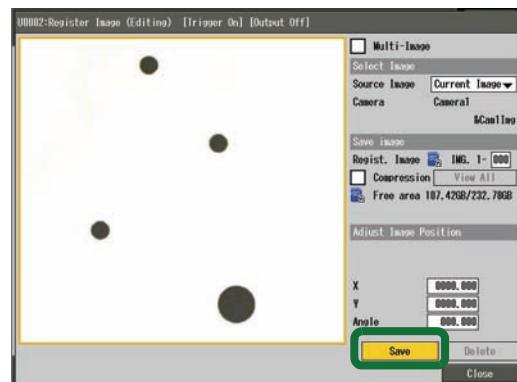
- (1) Select [Register Image].



- (2) Click [TRIGGER] to capture the image.

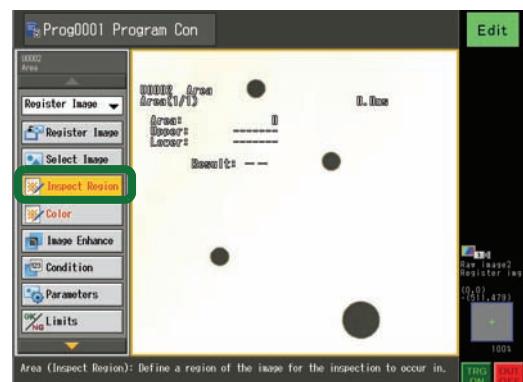
- (3) Click [Save] to register the image.

Thereafter, create settings based on this registered image.

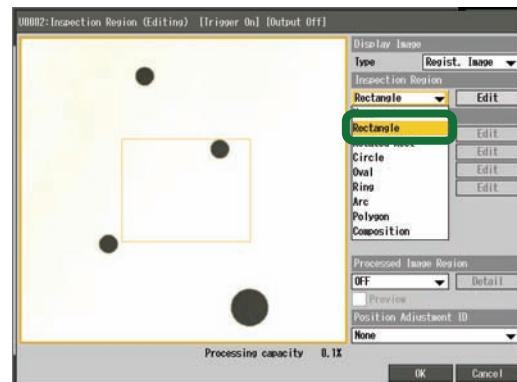


4. Set a region.

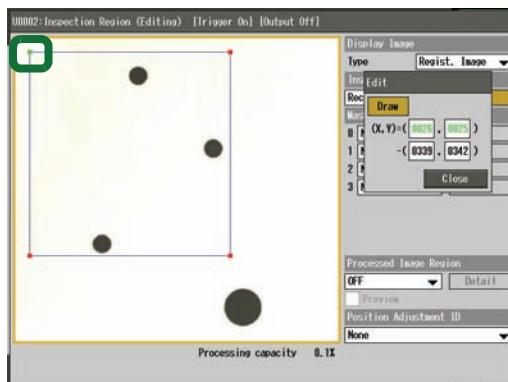
- (1) Select [Inspect Region].



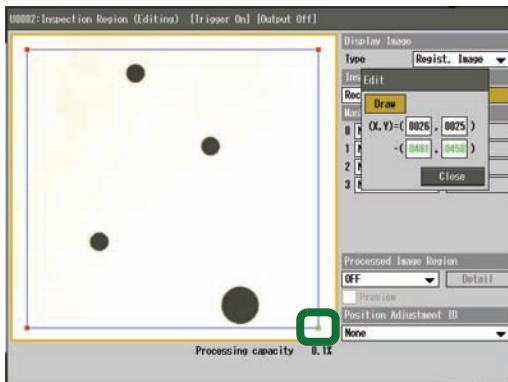
- (2) Select [Inspection Region]-[Rectangle].



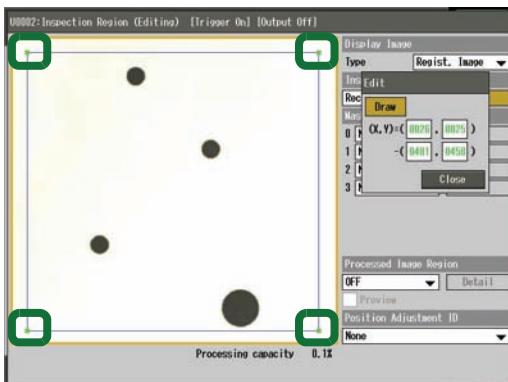
- (3) Move “Upper Left Vertex” to “Upper Left of Window” and press [Enter].



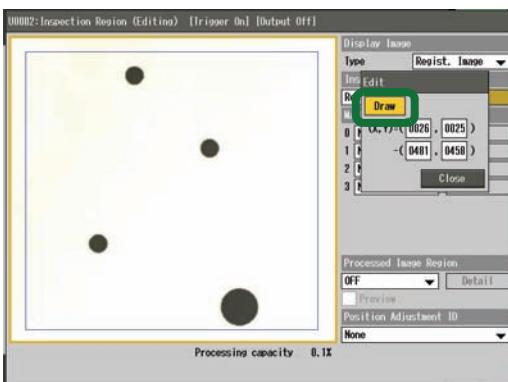
- (4) Move “Lower Right Vertex” to “Lower Right of Window” and press [Enter].



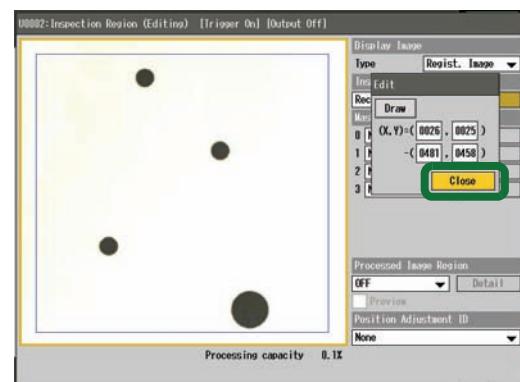
- (5) Fine-adjust “Four Vertices” to “Center of Window” and press [Enter].



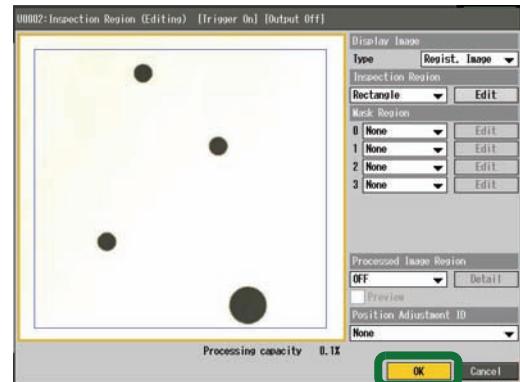
- (6) When you press [ESCAPE] after fine adjustment is complete, the cursor returns to [Editing].



- (7) Clicking [Close] closes the [Edit] dialog box.

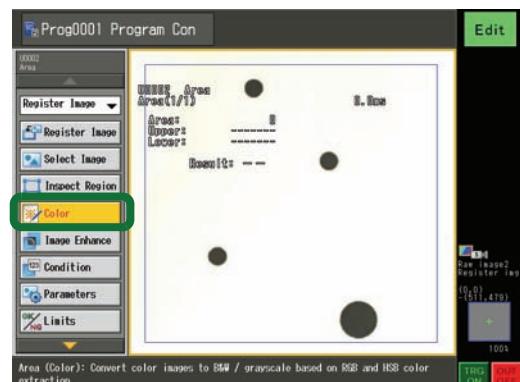


- (8) Clicking [OK] closes the [Inspection Region] sub menu.

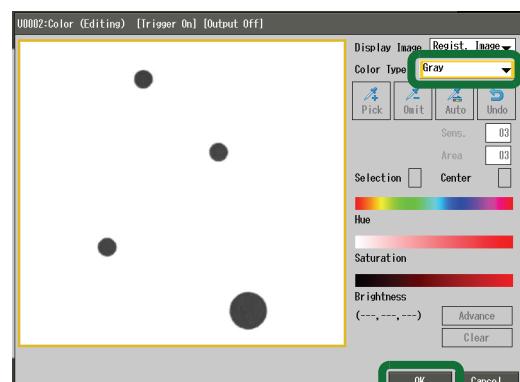


5. Set color extraction.

- (1) Select [Color].



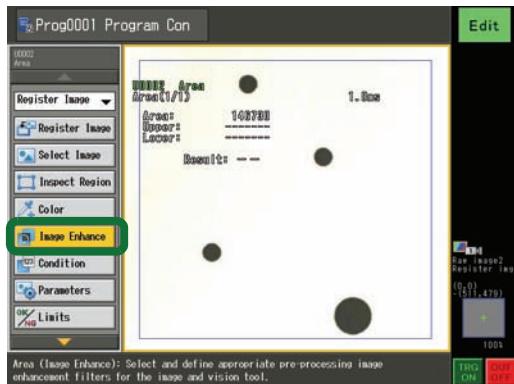
- (2) Select [Gray] as [Color Type].



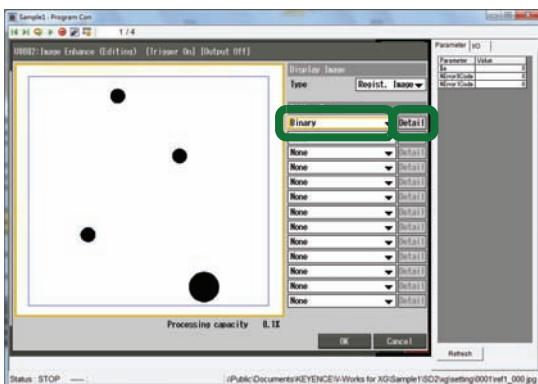
- (3) Click [OK] to close the [Color] sub menu.

6. Set image enhancement.

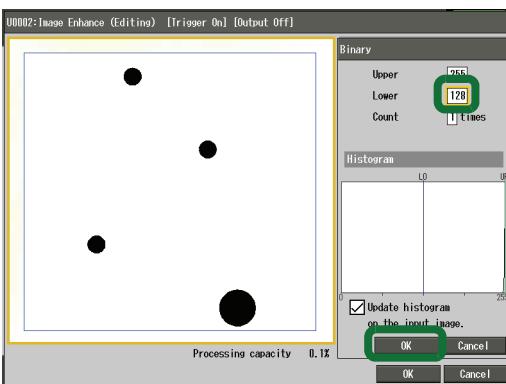
- Select [Image Enhance].



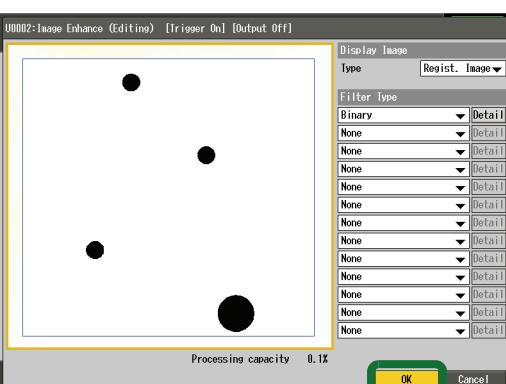
- Select [Filter Type]-[Binary] and select [Details] to the right of [Binary].



- Adjust [Binary]-[Lower], set the foreign matter to black and the background to white, and click [OK].

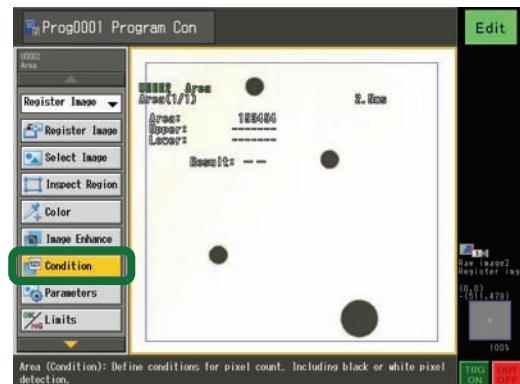


- Select [OK].

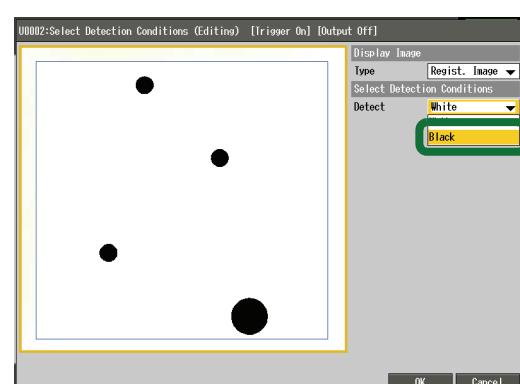


7. Set detection conditions.

- Select [Condition].

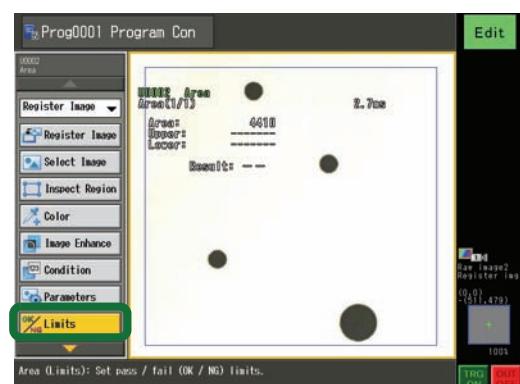


- Select [Select Detection Conditions], select [Black] as [Detect], and click [OK] to close the window.

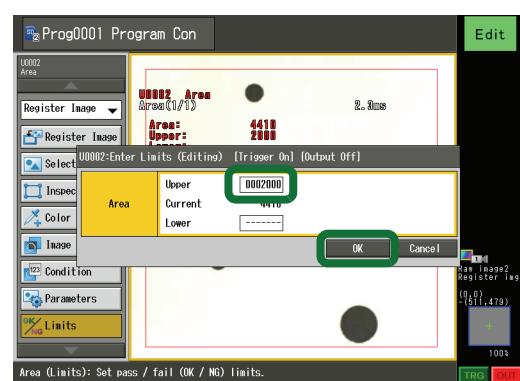


8. Set judgment conditions.

- Select [Limits].

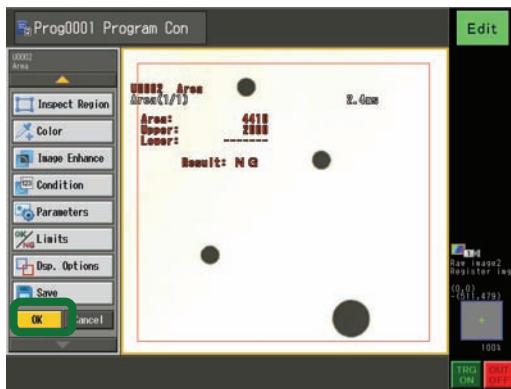


- Select [Area], directly enter [2000] as [Upper], and click [OK] to close the window.



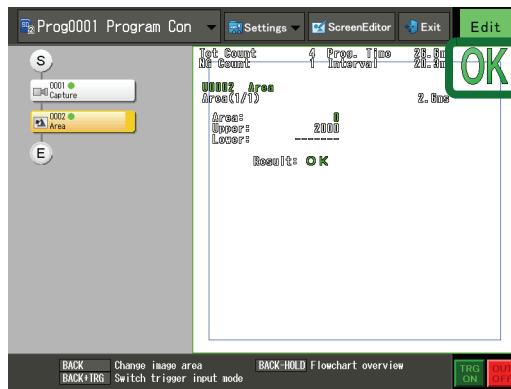
9. Close the top menu.

- Click [OK] to close the top menu.

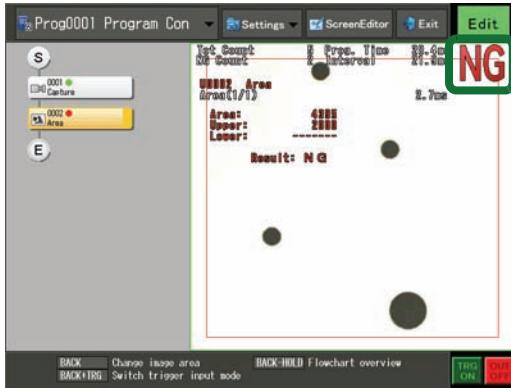


10. Check the settings.

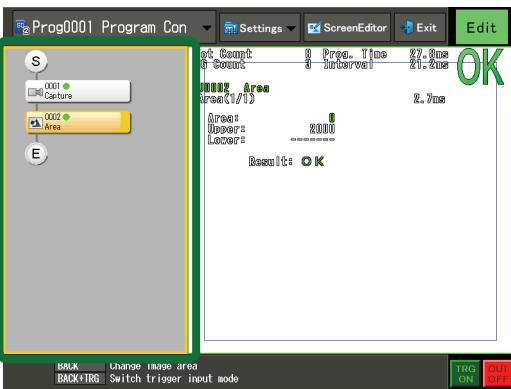
- Enter [TRIGGER] from an image without foreign matter, perform inspection, and check whether the total status result becomes [OK].



- Enter [TRIGGER] from an image with foreign matter and check whether the total status result becomes [NG].

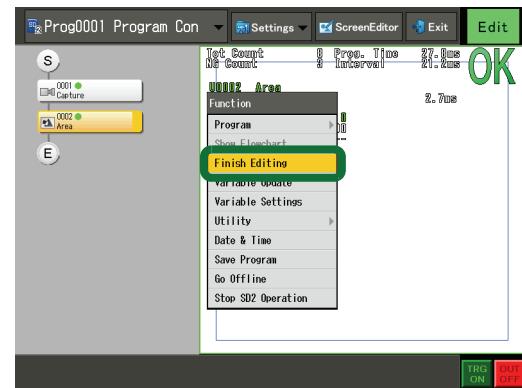


- Enter [ESCAPE] to get out of the flowchart.

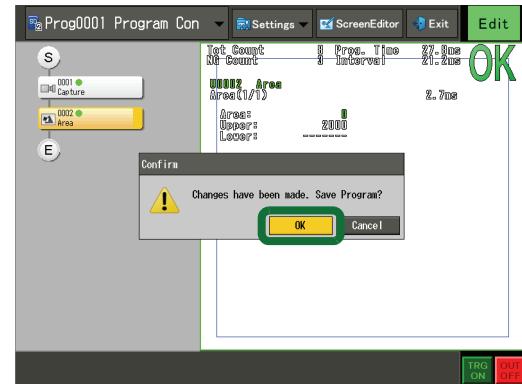


11. Check the settings.

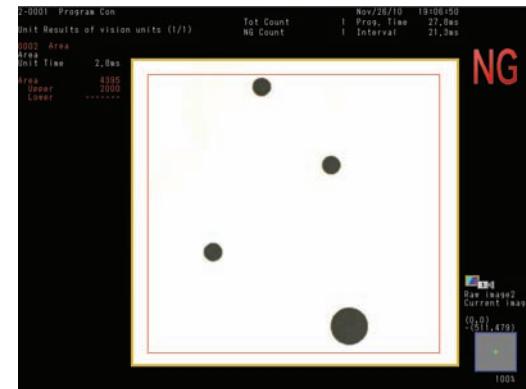
- Select [Function]-[Finish Editing] to end flowchart editing.



- Click [OK] from the [Confirm] dialog to save the settings.



- Check that [Edit Flowchart] has ended.



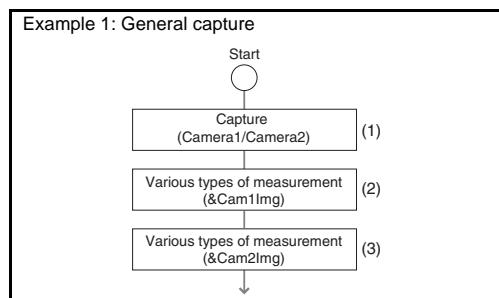
■ About capture unit

The capture unit is the unit used to capture with a camera an image for inspection or measurement and store the image data in image variables.

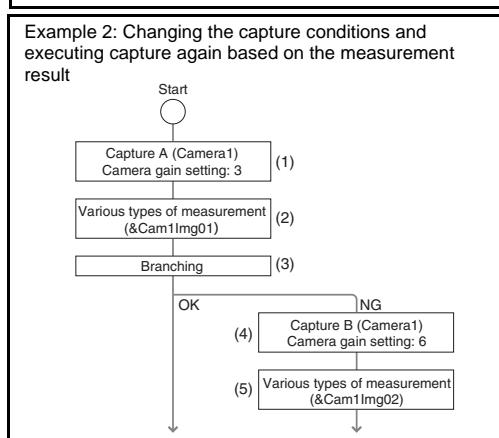
When the CA-DC20E illumination expansion unit is connected, you can control the unit (flash lighting, light intensity) using the FLASH (strobe) output.

The capture unit captures images of up to four cameras connected to the controller and stores the image data sent from the camera to the controller in a specified image variable.

- Preparations for capturing images with the set camera are performed when the capture unit is executed in the flowchart.
- You can choose to execute capture while waiting for a trigger signal or without waiting for a trigger signal.
- When the image capture buffer is enabled, images can be captured with the camera independent of the flowchart and the image data can be archived to the background buffer.



- (1) After waiting for and receiving trigger input, Camera1/Camera2 capture is executed.
When the trigger signal is received by 1Input, capture is executed for all cameras, and when the trigger signal is received by 4Input, capture is executed for individual cameras.
Image data is stored in the image variables (&Cam1Img/&Cam2Img).
- (2) Image processing to the image variable (&Cam1Img) of Camera1
- (3) Image processing to the image variable (&Cam2Img) of Camera2



- (1) After waiting for and receiving trigger input, capture of Camera1 is executed using Gain3.
Image data is stored in the image variable (&Cam1Img01).
- (2) Image processing to the image variable (&Cam1Img) for the initial capture by Camera1
- (3) If the result is NG, execution is retried using Capture B with a different gain setting.
- (4) Without waiting for trigger input, capture of Camera1 is executed immediately using Gain6.
Image data is stored in the image variable (&Cam1Img02).
- (5) Image processing to the image variable (&Cam1Img02) for the second capture by Camera1

■ About important parameters of capture unit

Shutter Speed

Enter or select a shutter speed suitable for the line speed and lighting conditions for each of Camera1 to 4. If you select a fast shutter speed to match a fast line, make sure there is enough light intensity to produce a quality image.

CCD Settings

To adjust the displayed image of the camera in high or low contrast regions (gain adjustment) for each of Camera1 to 4, click [Settings]. This option allows adjustment of offset (shift) and span. For color cameras, these can be set up for RGB individually.

Capture to image variable used for processing

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

White Balance

When a color camera is used, you can adjust the color balance to reproduce accurately the white color of captured images to match the lighting environment of the inspection site for each of Camera1 to 4.

Camera sensitivity

The camera sensitivity can be adjusted for each of Camera 1 to Camera 4. To adjust the brightness of an image, basically change conditions such as the lens aperture and shutter speed of the camera and lighting. However, if you can not improve image brightness by adjusting these features then change the camera sensitivity.

■ About image variables

What is an image variable?

The image variable is a variable for storing image data. You can define up to 512 user image variables (up to 512 elements per variable).

• System image variables (&Cam1Img to &Cam4Img):

Variables managed by the system. These variables are assigned to each camera of a capture unit in advance and are cleared (a black image is displayed) at the start of the flow for each inspection.

• User image variables:

The user image variables are the variables that can be defined by the user and they also support array specification. These variables differ from the system image variables in that a stored image is kept until either a separate image is stored or reset processing is performed.

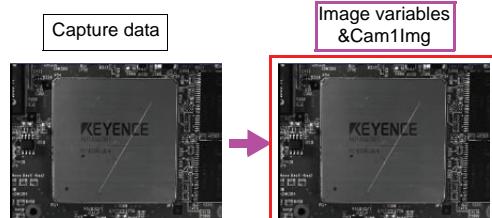
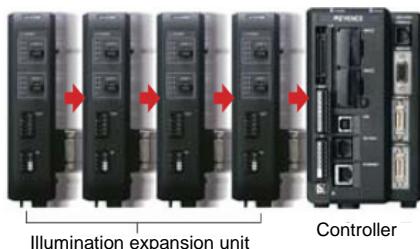


Image of storing capture data in a box (storage destination) called an image variable

■ About illumination expansion unit



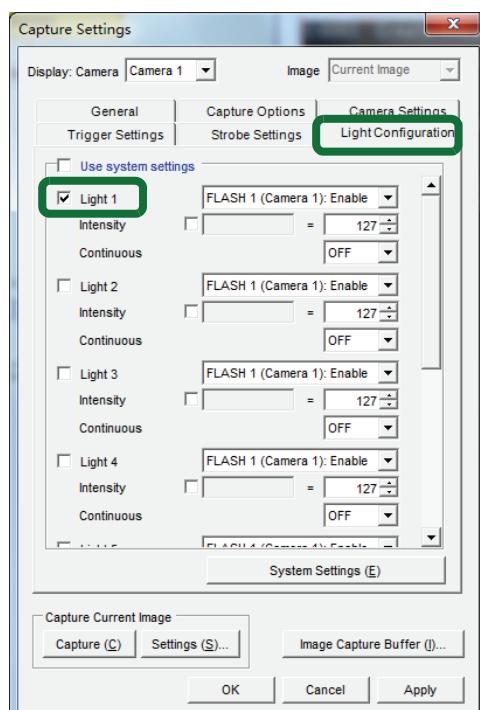
CA-DC20E is a buildup-type expansion unit and can be connected to a controller by wiring.

The capture unit of XGVisionEditor allows you to easily set combinations of up to eight illumination emission patterns connected to the illumination expansion unit.

FLASH setting enables you to perform illumination control in synchronization with trigger timing.

Up to four FLASH setting patterns can be set.

■ About light setting of the capture unit



If the CA-DC20E is connected, you can set [Intensity] and [Continuous], etc. of a light on the [Light Configuration] tab of the capture unit.

Light1 to 8

This section explains how to change settings and assignments for the FLASH signals. By changing this setting, you can control lighting without wiring the external terminals of FLASH signals.

Check the box of the light number to which to assign a FLASH signal, and then assign FLASH 1 to 4.

- The light will illuminate when the assigned FLASH signal is operated.
- Light signals are assigned by the controller in ascending order, with LIGHT1 of the unit on the controller of the connected illumination expansion unit as light 1 and LIGHT2 as light 2.

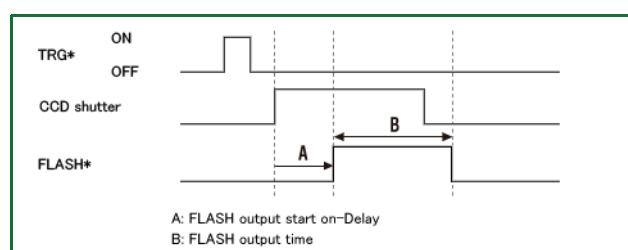
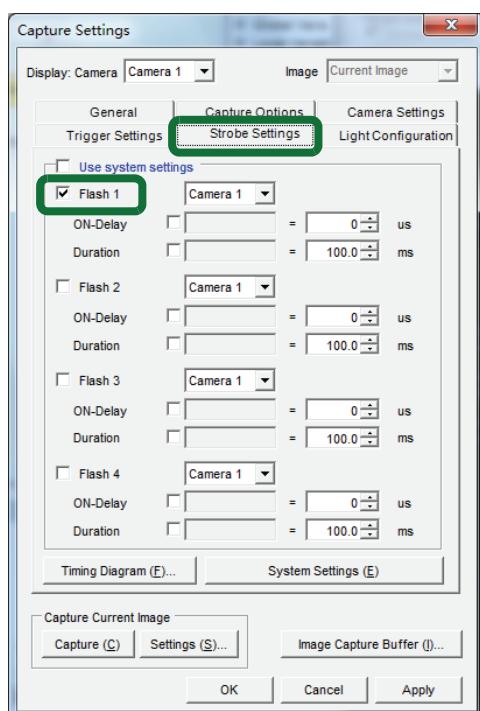
Intensity

Specify the brightness of the light from 0 to 255. (Default: 127)

Continuous

Select ON to keep the light illuminated regardless of FLASH signal output.

■ About FLASH setting of the capture unit



When the trigger signal is turned on and rises, the CCD shutter opens and the capture unit enters the exposure status.

The light illuminates on the leading edge of the FLASH signal during this time.

As a result, the capture unit can capture an image whose light illuminates in synchronization with the trigger.

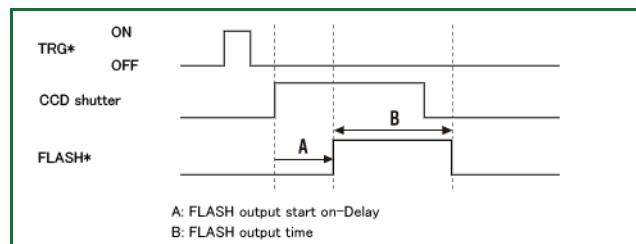
- ON-Delay: Specify the starting point for the FLASH1 signal output within the range -500 to 500 (μs), where 0 is the trigger output instance. (Default: 0 μs = Instance of the trigger output.) If a negative value is specified, output starts before the trigger output. If a positive value is specified, output starts after trigger output.
- Duration: Set the FLASH1 signal output time within the range 1 to 999.9 (ms) (Default: 100.0 ms).

Basic Tutorial_2_1: Illumination control

Method for controlling illumination by the controller

You can easily set combinations of up to eight illumination emission patterns connected to the illumination expansion unit on XG VisionEditor. FLASH setting enables you to perform illumination control in synchronization with trigger timing. Up to four FLASH setting patterns can be set.

■ FLASH setting



■ LED illumination expansion unit

Exclusive to the CV-5000/XG-7000 Series
World's first LED Illumination Expansion Unit



CA-DC20E is a buildup-type expansion unit and can be connected to a controller by wiring.

■ Examples of using lighting illumination switching

When performing printing inspection or dimension inspection with low angle illumination or when performing direction discrimination with coaxial epi-illumination, you can automatically switch illumination for every trigger input.



■ Illumination types



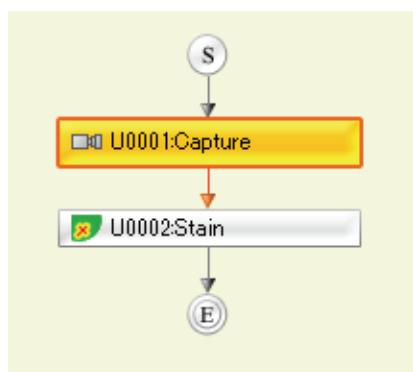
Various kinds of illumination is available as shown in the above figure. Combining LED lights and performing an inspection creates the image optimum for the inspection.

When the trigger signal is turned on and rises, the CCD shutter opens and the capture unit enters the exposure status. The light illuminates on the leading edge of the FLASH signal during this time. As a result, the capture unit can capture the image whose light illuminates in synchronization with the trigger.

Reference

- ON-Delay: Specify the starting point for the FLASH1 signal output within the range -500 to 500 (μs), where 0 is the trigger output instance. (Default: 0 μs = Instance of the trigger output.) If a negative value is specified, output starts before the trigger output. If a positive value is specified, output starts after trigger output.
- Duration: Set the FLASH1 signal output time within the range 1 to 999.9 (ms) (Default: 100.0 ms).

■ Flowchart image drawing

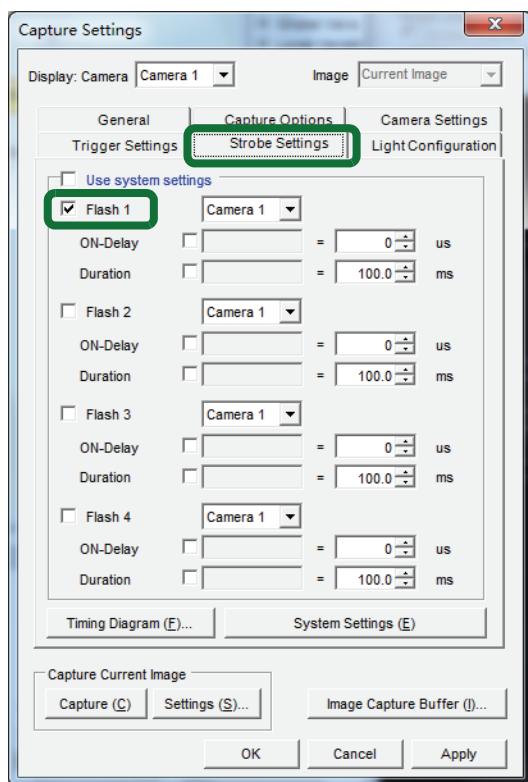


Select the lights used by the capture unit and make FLASH setting that serves as the emission pattern.

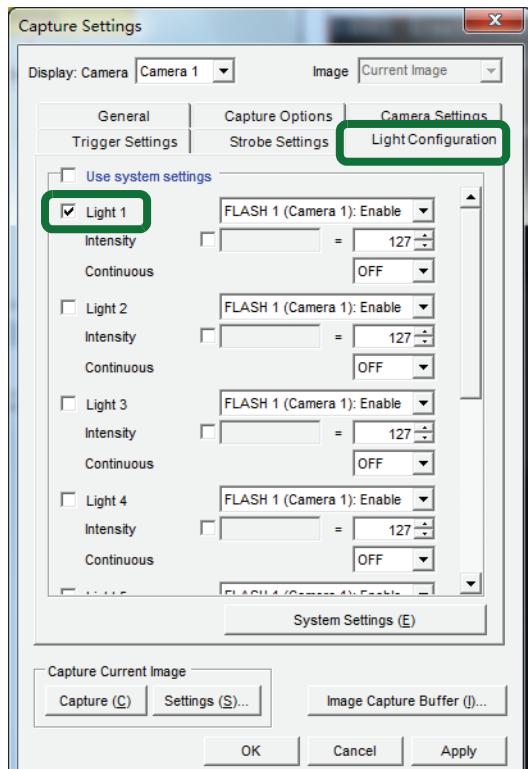
Editing the capture unit

1. Open the unit properties of the capture unit.

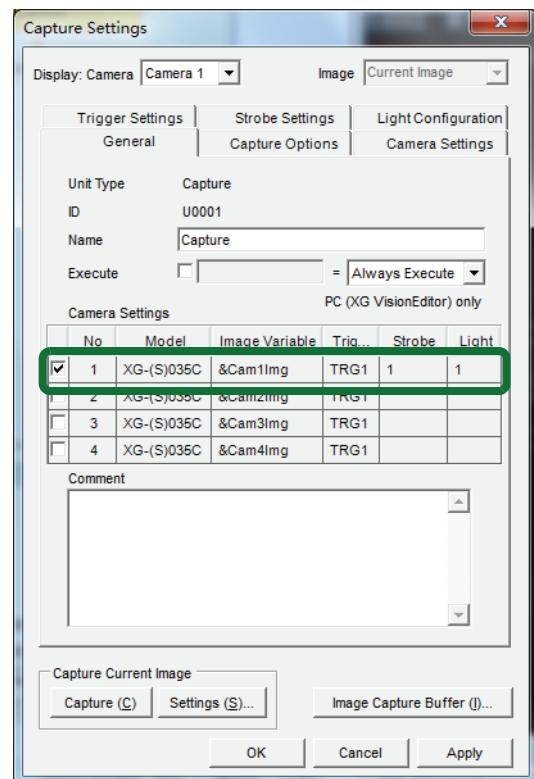
- (1) Select the [Strobe Setting] tab and check that the [Flash 1] check box is selected.



- (2) Select the [Light Configuration] tab and select the [Light 1] check box.



- (3) In [Camera Settings] of [General] tab, check that [1] is assigned to [Flash] and [Light] of [Camera 1].



■ What is an image enhancement filter?

The image enhancement filter is a function that converts an image to the image optimum for the purpose of image processing.

Various kinds of image enhancement filters are provided for each measurement unit so that they can be selected and combined per tab.

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

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 click [Edit] to apply more detailed filter settings.

■ Types and effects of image enhancement filters

XG supports 21 types of abundant image enhancement filters. XG also supports 13 free combinations of image enhancement filters, thereby improving image quality.

The following introduces [Expand], [Shrink], [Average], and [Sobel/Prewitt] as the typical effects of image enhancement filters.

(Total of 21 types)

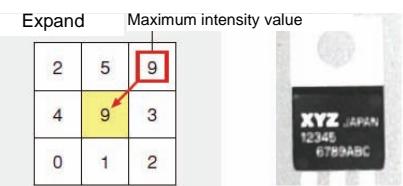
None
Binary
Expand
Shrink
Average
Median
Sharpen
Sobel X
Sobel Y
Sobel
Prewitt
Roberts
Laplacian
Subtract
Preserve Intensity
Contrast Conversion
Image Extraction
Shading Correction
Blur
Custom
Custom (Advance)
Blob

Expand filter

Processing that replaces the intensity of a 3x3 center pixel with the maximum intensity (brightest value) in nine pixels including the center.
This processing has effect on removal of a black noise component.

General		Image	Region	Color	Image Enhance
Filter Type	Setting				
0 None					
1 None					
2 None					

Filter Type	Setting	
0 Contrast Conv...	Shift -50	Span 3
1 Shrink	Size 3 x 3	Direction XY
2 Shading Corre...	Correct M...	Extract Size



Shrink filter

Processing that replaces the intensity of a 3x3 center pixel with the minimum intensity (darkest value) in nine pixels including the center.
This processing has effect on emphasizing black pixels and stabilizing check of stains such as a black point.

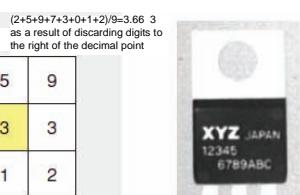
Expand	Maximum intensity value
2	5
4	9
0	1



Average filter

Processing that replaces the intensity of a 3x3 center pixel with the average intensity in nine pixels including the center.
This processing has effect on blurring pixels to reduce noise components and stabilizing a search.

Shrink	Minimum intensity value
2	5
4	0
0	1



Both Sobel and Prewitt are edge extraction processing that separately extracts edges in X and Y directions and composes the results of the both.

After applying the following coefficients to each of the nine 3x3 center pixels, replace them with the combined intensity value. Sobel has an effect on emphasizing edges with less contrast compared with Prewitt because [2] is applied to the center pixel.

Sobel

-1	-2	-1
0	0	0
1	2	1

-1	0	1
-2	0	2
-1	0	1



Prewitt

-1	-1	-1
0	0	0
1	1	1



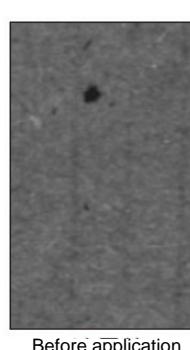
■ Effect on image enhancement combinations

In the appearance check, you can see the stains and foreign matter that you want to detect. However, in many cases, background noise hinders the detected stains and foreign matter.

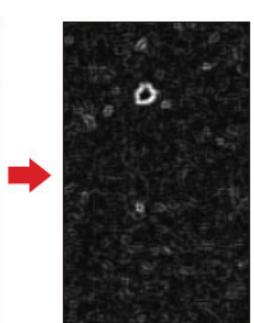
At this time, combining image enhancement filters improves image quality as follows:

Filter Type	Setting
0 Contrast Conv...	Shift -50
1 Sobel	Count 1 Times
2 Binary	Upper Limit 255
3 Expand	Size 3 x 3

Brightness adjustment → Edge extraction → Binary
→ Size sharpening



Before application



Sobel



Binary + Expand

Basic Tutorial_2_2: Image Enhancement Filter

What is an image enhancement filter?

Image enhancement is image processing treatment that is the previous step of this inspection.

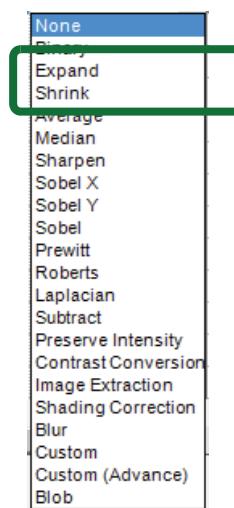
Especially in appearance inspection, the image enhancement filter is an indispensable tool for detecting flaws and stains. Applying the image enhancement filter to an image converts the image to the one optimum for inspection, improving detection accuracy.

Image enhancement filter list

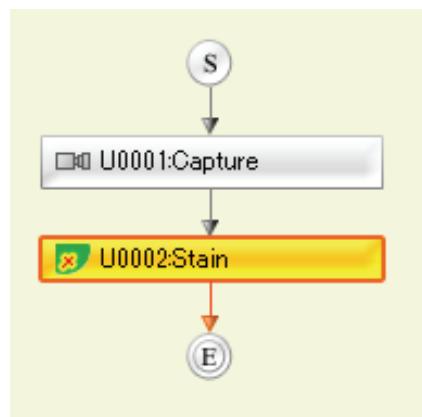
21 types of abundant image enhancement filters are installed on the XG.

Combining this image enhancement with other processing produces the image optimum for inspection.

Today we will introduce the [Expand] and [Shrink] filters most generally used among the image enhancement filters.

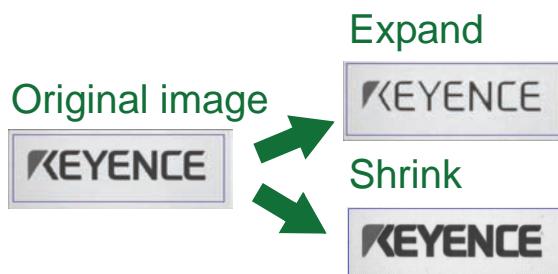


Flowchart image drawing



This inspection detects only large foreign matters. Create an optimum image by applying the expand and shrink filters.

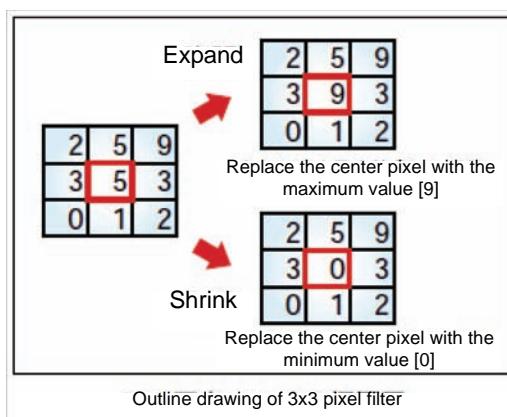
Expand and shrink filters



Sharpen a bright component by applying the expand filter to the original image.

Sharpen a dark component by applying the shrink filter to the original image.

You can cancel the noise, etc., resulting from this sharpening.



Outline drawing of 3x3 pixel filter

Original image

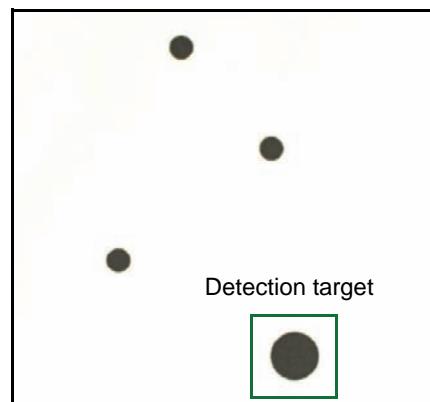
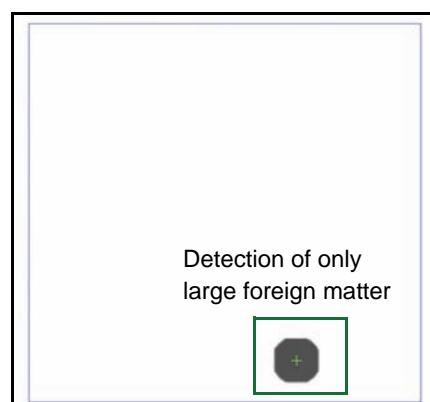


Image after processing

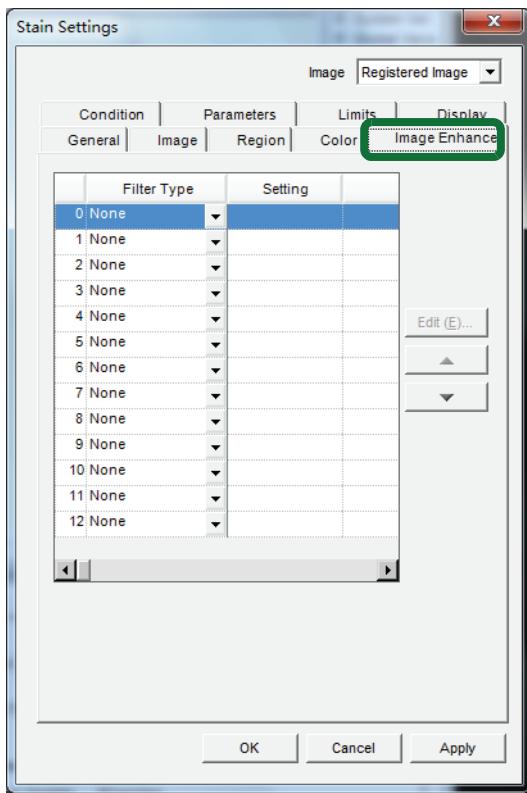


Use the expand and shrink filters to perform image processing, so that small foreign matters disappear.

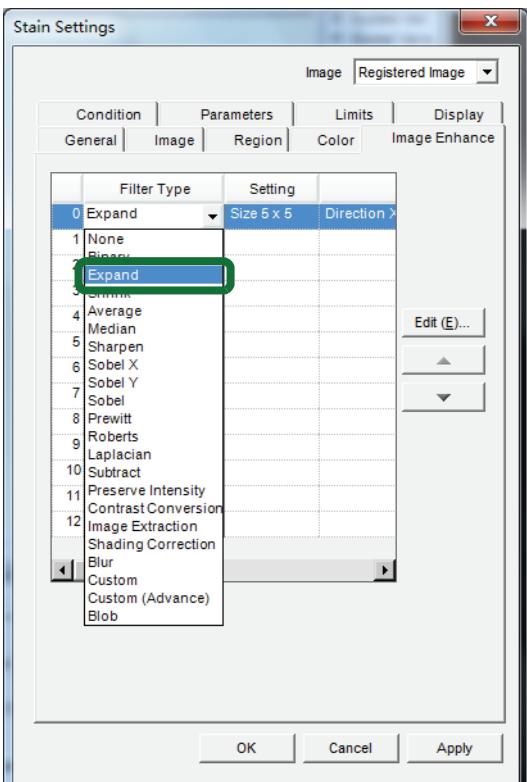
Editing a stain unit

1. Open the unit properties of the stain unit.

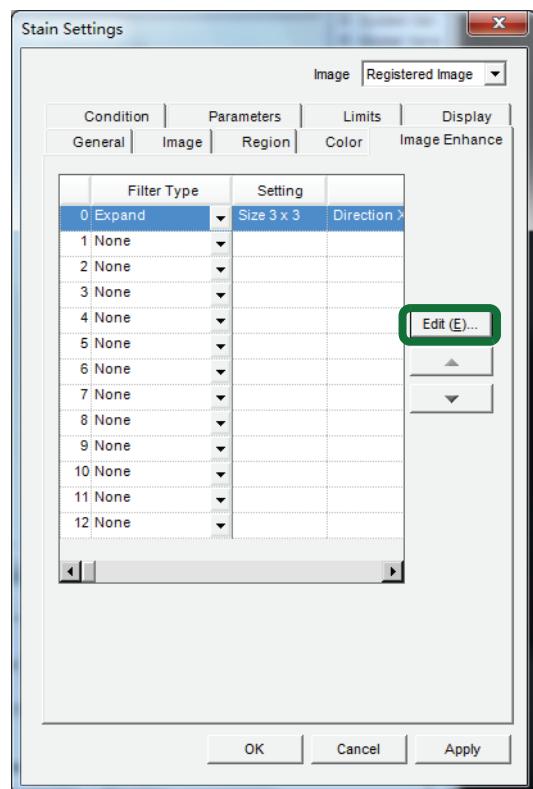
(1) Open [Flowchart]-[Stain Unit]-[Image Enhance] tab.



(2) Click [0]-[Filter Type]-[Expand].



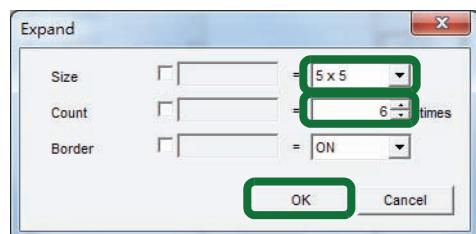
(3) Click the [Edit] button.



(4) Select [5x5] as [Size].

Select [6] as [Count].

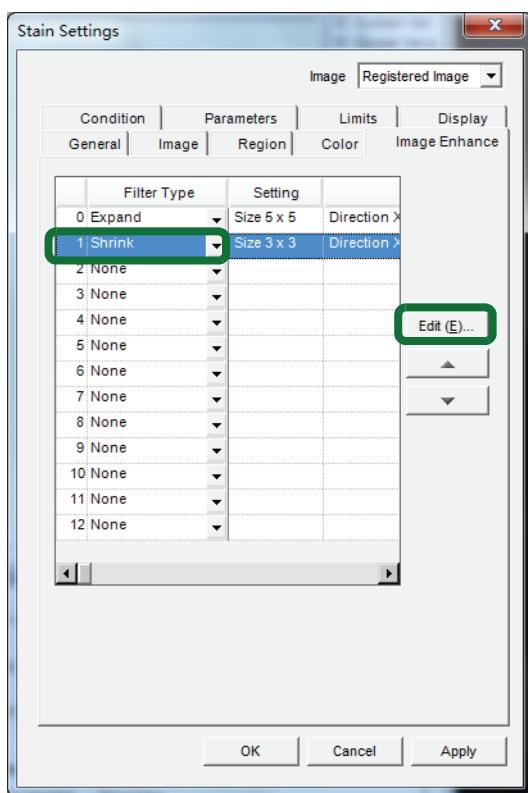
When input is complete, click the [OK] button.



► Note

Set [Size] and [Count] while seeing Vision Window.

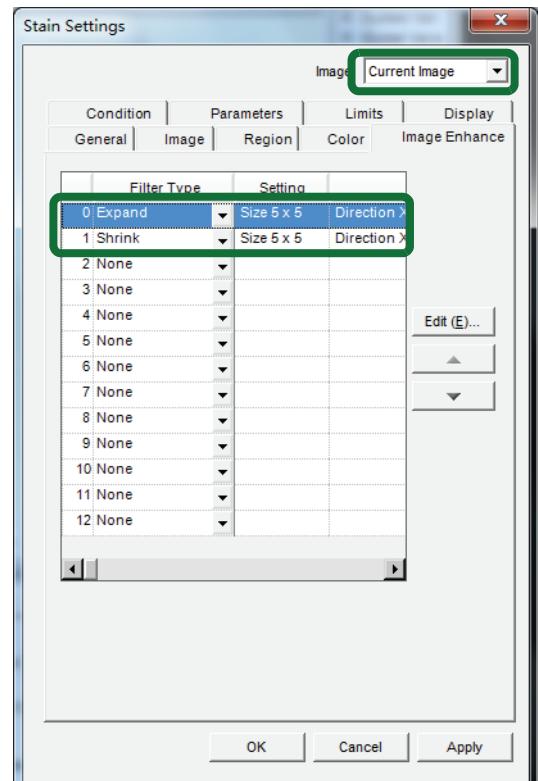
(5) Click [1]-[Filter Type]-[Shrink]-[Edit] button.



(7) Check that [5x5] is set as [Size] of [Expand] and

[Shrink], and [6] is set as [Count].

For confirmation, select [Image] as [Display Image].



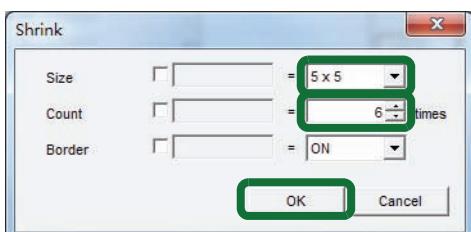
Reference

XG Series can combine 13 types of image enhancement filters as shown above.

(6) Select [5x5] as [Size].

Select [6] as [Count].

When input is complete, click the [OK] button.



Note

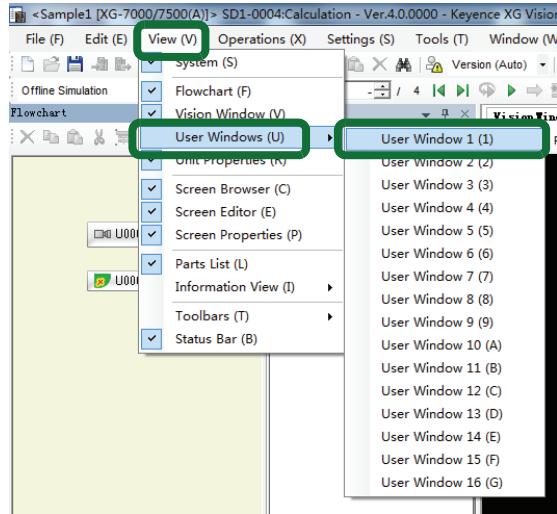
Set [Size] and [Count] while looking at the Vision Window.

Adding a user window

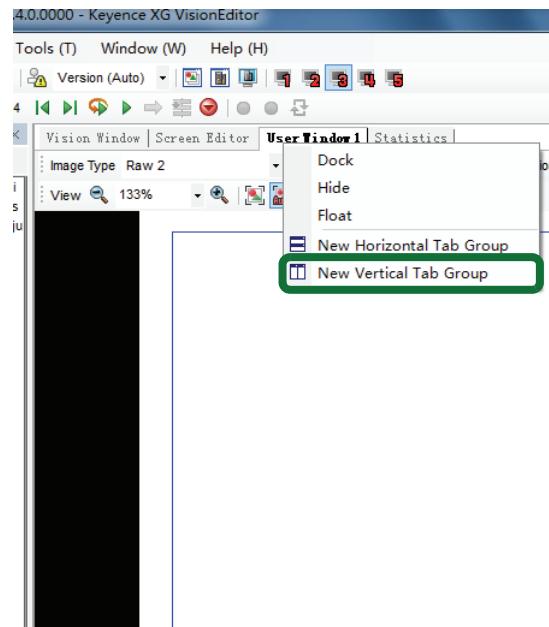
2. Add a user window.

The purpose of this processing is to compare the original image with the image after processing.

- (1) From the top of the XGVisionEditor window, select [View]-[User Window]-[User Window (1)].

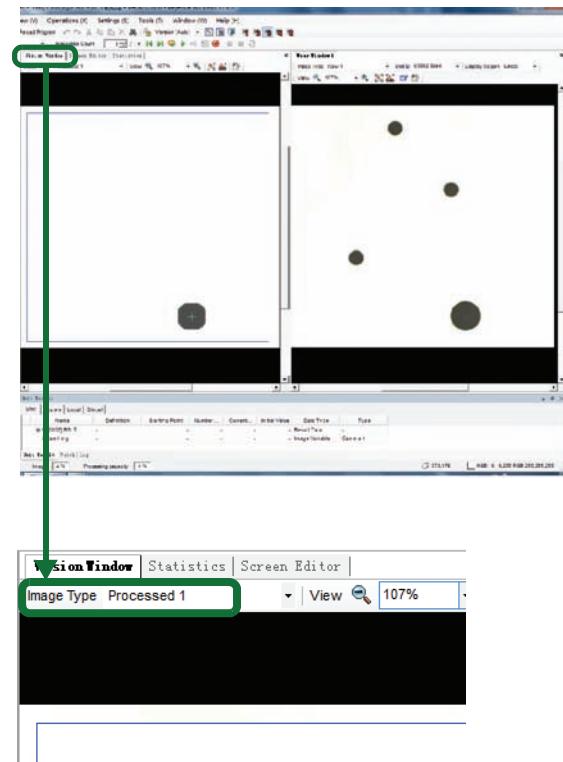


- (2) Right-click on [Vision Window]-[User Window 1] and select [New Vertical Tab Group].



- (3) Select [Vision Window]-[Image Type]-[Processed 1].

Compare the image after image enhancement with the through image and click [Execute one time] to confirm the comparison results.



■ Outline of variables

In this system, variables are used to reference result data and setting parameters with units.

- Variables can also be used to reference data between units and programs and to store calculation results.
- Use variables to make various settings for system input and output and also images captured with cameras.

■ Categories of Variables

The system supports the following four variable categories.

System variables: Prefix (%)

Variables managed by the system. These are all defined and are basically read-only; however, some variables can change the values using commands.

User variables

These are variables that can be defined by the user. There are two types of user variables with different usage ranges.

Local variables: Prefix (#)

Variables that are valid only within a defined program. Up to 10,000 local variables can be defined.

Global variables: Prefix (\$)

Variables that are valid between programs within the same controller. Up to 1024 global variables can be defined.

Image variables: (&)

The image variables are variables for storing image data. Up to 512 user image variables can be defined.

The usage range is the same as that of local variables in that it is valid only within a defined program.

System image variables (&Cam1Img to &Cam4Img): These are variables managed by the system.

These variables are assigned to each camera of a capture unit in advance and are cleared (a black image is displayed) at the start of the flow for each inspection.

User image variables: These are variables that can be defined by the user and they also support array specification. As opposed to system image variables, the user image variables stored once are stored as another image or retained until reset processing is performed.

Also, specifying a user image variable in Variable Setting enables you to use it as the resultant image variable for checking the processed image of the image operation unit, C language unit, or calibration unit.

Temporary variables: (@)

These variables can only be used during arithmetic expressions of calculation units and do not require definition with variable settings.

■ Types of Variables

[Local Variables] and [Global Variables] that are user variables are divided into the following eight types:

You can specify [Scalar Type] that serves as one numeric value such as [Area] and [Stain Area] and [Position Type] indicating [Coordinate] according to the contents of the measurement value.

Scalar type : Variable that retains one numeric value such as stain area storage

Scalar array type : Variable that retains one of several numeric values such as storage of areas of several blobs

Position type : Variable that retains the two numeric values of X and Y such as pattern search detection points

Position array type : Variable that retains several coordinate data such as the four points (rectangle) of an inspection region

Line type : Variable that retains the line data required when the distance between a point and a line is calculated (calculation)

Line array type : Variable that retains multiple line data

Circle type : Variable that retains the circle data used in calculation

Circle array type : Variable that retains multiple circle data

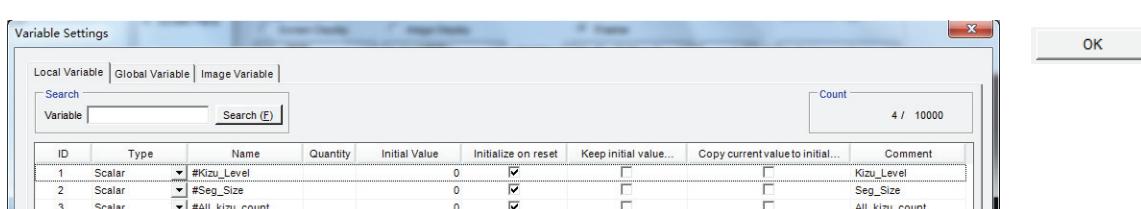
■ Save Location of Variables

Local variable : Program files (inspect.dat) under each program folder

Global variable : Global variable files (gvar.dat) under SD1 drive

■ About new definition of variables

Select [Settings]-[Variable Setting]. Enter the following required information and click the [OK] button to confirm the entry:



Click the [Add] button to add a variable and determine [Type], [Name (Free)], and [Initial Value].

If the added variable is an array variable, also enter [Quantity].

You can freely enter a comment.

■ What is the calculation unit?

The calculation unit is used to store the calculation result of a specific result data in a user-specified variable or to make the upper/lower limit judgment for a calculation result.

Since multiple calculation results can be applied to other arithmetic expressions, you can use this unit to make complex evaluations based on various judgment results or measurement values.

■ Arithmetic expression patterns

```

Script
@b=#X/(Dist(#cam1K[0],#cam1K[1]))
@c=#X/(Dist(#cam2K[0],#cam2K[1]))
@d=#X/(Dist(#cam3K[0],#cam3K[1]))
@e=#X/(Dist(#cam4K[0],#cam4K[1]))

@f=(@b+@d)/2 'camera1:1pixel=fmm'
@g=(@c+@e)/2 'camera2:1pixel=gmm'

@h=Angle((#cam1K[0],#cam1K[1])
@i=Angle((#cam2K[0],#cam2K[1])
@j=90-Angle((#cam1K[1],#cam1K[2])
@k=90-Angle((#cam2K[1],#cam2K[2]))

@l=((@h+@j)/2) 'camera1 and stage offsetangle

```

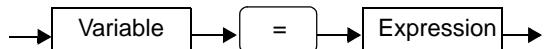
18 Line 12 Column

Error No error.

The basic pattern of an arithmetic expression is an assignment that takes the form of "variable=expression (in the above example, the distance between two points (Dist) is assigned to the temporary variable)".

One calculation unit can create several arithmetic expressions.

If <conditional expression> THEN - statements - [ELSE IF] - statements - [ELSE] - statements - END IF	FOR <variable> = <initial value> TO <final value> [STEP <increment>] - statements - NEXT
---	--



Besides the basic assignment expression, [IF statement (assumed arithmetic expression)] and [FOR statement (repetitive arithmetic expression)] , etc., are created. Even in these cases, the basic operation is assignment to a variable.

(Calculation and variables)

As shown above, the basic pattern of XG calculation is numeric value assignment to a variable and the use of variables is important.

For example, XG Series can handle coordinate data as a position variable, so it is not necessary to calculate X and Y coordinates separately even if the center of gravity position of a blob is assigned to a position variable. For this reason, we have expressions like "position variable = position-type unit measurement value (center of gravity position of blob, detection position, etc.) .

■ Arithmetic expression comments

```

#RU=ISect(Line(!U[0005].RSLT.DLXY1:AB,!U[0005].F
#LD=ISect(Line(!U[0006].RSLT.DLXY1:AB,!U[0006].F
#RD=ISect(Line(!U[0006].RSLT.DLXY1:AB,!U[0006].F

|
'Intersection of intersection
#PKGXY=ISect(Line(#LU,#RD),Line(#LD,#RD))
#[PKGXY before position adjustment PKG center]

'PKG dimension,0 is vertical,1 is horizontal
#PKGsize[0]=(Dist(#LU,#LD)+Dist(#RU,#RD))/2
#PKGsize[1]=(Dist(#LU,#RU)+Dist(#LD,#RD))/2

```

Several arithmetic expressions (assignment expressions to variables) can be created in a calculation unit.

A calculation unit is convenient in that many arithmetic expressions can be created in the unit. On the negative side, if 10 or more arithmetic expressions exist in the same frame, it is difficult to instantly understand what they do.

At this time, adding an apostrophe (') before an arithmetic expression allows it to be used as a comment.

In the left example, "intersection of intersection" and "PKG dimension, 0 is vertical, 1 is horizontal) are written as a comment.

■ Arithmetic expression errors

A setting error easily occurs in calculation units that include many arithmetic expressions and use many variables and computing functions.

It is said that debugging a description program in the PC type, etc., is hard work. However, for XG, it can find the arithmetic expression error as shown below.

1 Line 4 Column

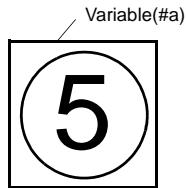
Error (1 row 4 column) The local variable is invalid.

Basic Tutorial_2_3: Calculation

About calculation and variables

Calculation units make necessary calculations at the time of measurement. XG VisionEditor can calculate the measurement values and variables of several units. Variables are the places where data (numeric data, image data) is stored. The variables are not direct numeric values, so you can modify the values of these variables by changing the values to be stored in the variables.

■ What is a variable?



The variable is the place where data is stored. If the contents of a variable are changed, the variable changes to another value.

Categories of Variables

System variables: Variables managed by the system

Example) %JgAll, %OutDataB, %InDataAsyncA

User variables: Variables that the user can freely define

Local variables: Variables that are valid only within a defined program.

Example) #stainLevel

Global variables: Variables that are valid between programs within the same controller.

Example) \$stainLevel

Image variables: Variables for storing image data.

Example) &Cam1Img, &test1, &Out1

■ What is a calculation?

$$\#a = \#a + 1$$

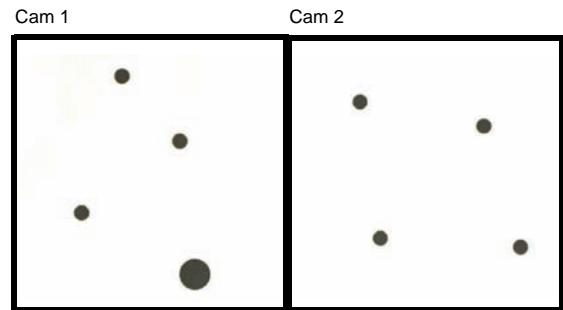
Assigns the right part ($\#a+1$) to the left part ($\#a$).

- Calculation enables you to calculate the value you want to obtain via computation.
- You can make a judgment using the calculated value.

■ Calculating the total number of stains

Add the number of stains of the image captured by camera 1 and the number of stains of the image captured by camera 2 to variable "#total".

Example) If a stain is detected by cameras 1 and 2

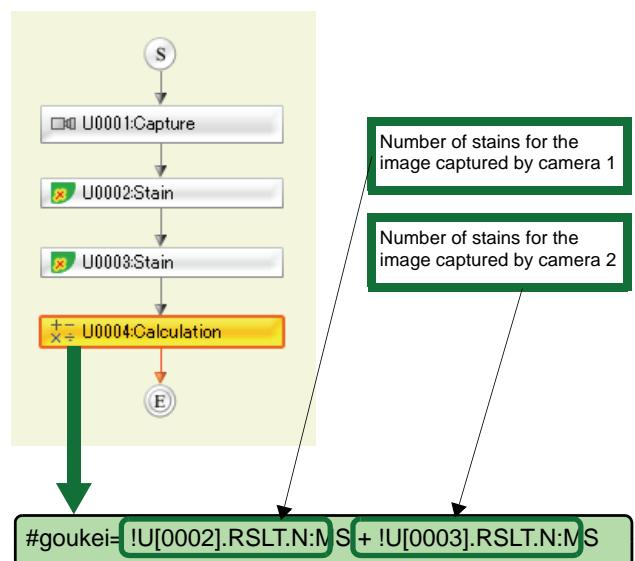


Before #total is 0

#total = !U[0002].RSLT.N:MS + !U[0003].RSLT.N:MS
Assigns the sum of the number (number of groups: Measurement value) of stains detected by units 2 and 3 to #total.

After #total is 8

■ Flowchart image drawing

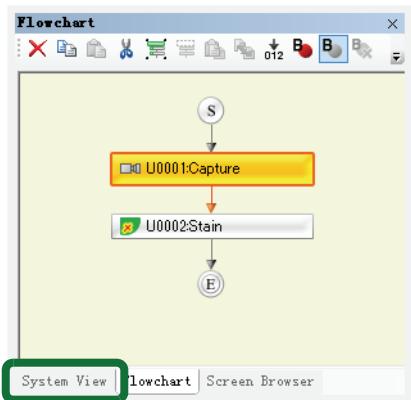


Copying program data

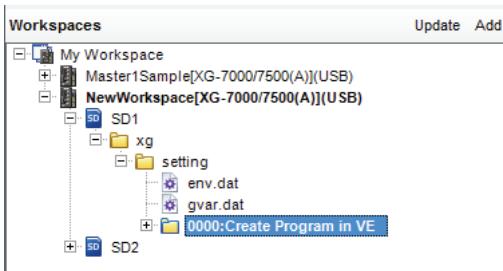
Copy the inspection settings of the full version and check the results.

1. Check inspection items in the current [Workspace].

- (1) Select [System View] behind [Flowchart].



- (2) Check that [Workspace]-[SD1]-[xg]-[setting]-[0000:Create Program in VE] exists.



Add the inspection settings of the full version here.

2. Copy program data.

- (1) From the top of the window, open [Files]-[Copy and Paste File].

In [Copy From], select [Master 1 Sample] as [Workspace].

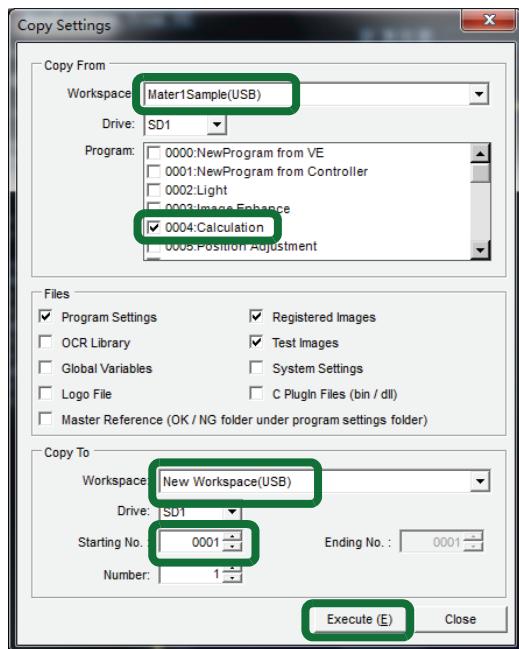
In [Program], select the check mark of [0004:Calculation].

In [Files], select the check boxes of [Inspection Setting], [Registered Image], and [Simulation Image].

In [Copy To], select [New Workspace] as [Workspace].

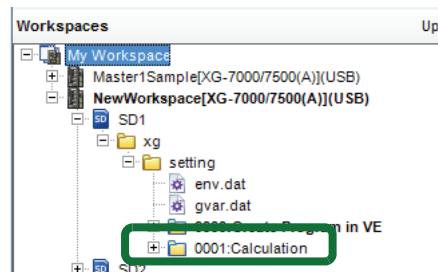
Select [0001] as [Starting No.].

After checking the above settings, click the [Execute] button.

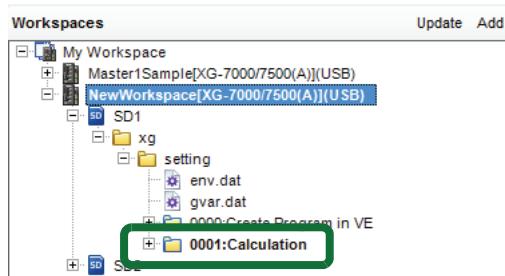


3. Switch the window to the window for the copied inspection settings.

- (1) Check that [Workspace]-[SD1]-[xg]-[setting]-[0001:Calculation] exists.



- (2) Switch the window to the window for [0002:Alignment] inspection settings.
 Right-click and select [Active Program].
 After checking the above settings, open [Flowchart].



Checking each unit

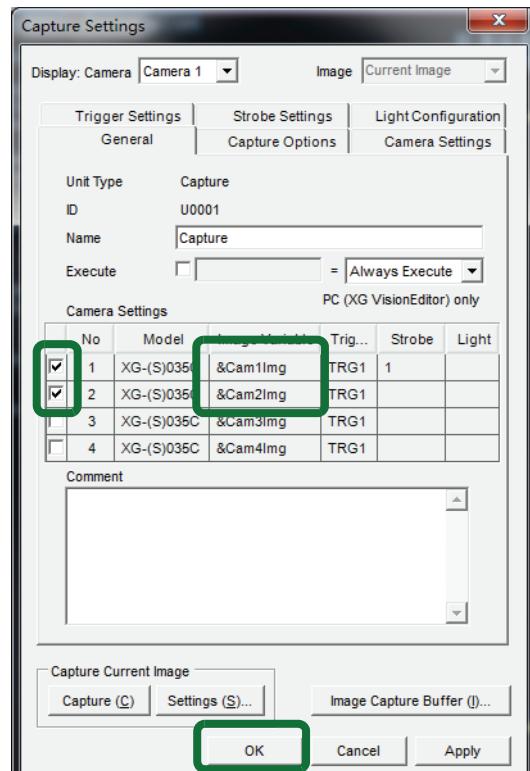
3. Check the capture unit.

- (1) Double-click [U0001:Capture].

Check that [Camera 1] and [Camera 2] are selected.

Check that [Image Variable] of [Camera 1] is [&Cam1Img] and [Image Variable] of [Camera 2] is [&Cam2Img].

After checking the above settings, click [OK].

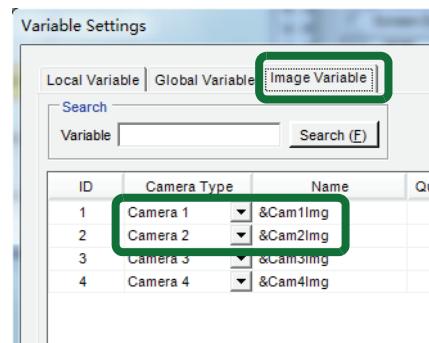


(2) Check the image variables.

From the top of the window, select [Settings]-[Variable Settings]-[Image Variables].

Check the cameras corresponding to each image variable.

After checking the above settings, click [OK].



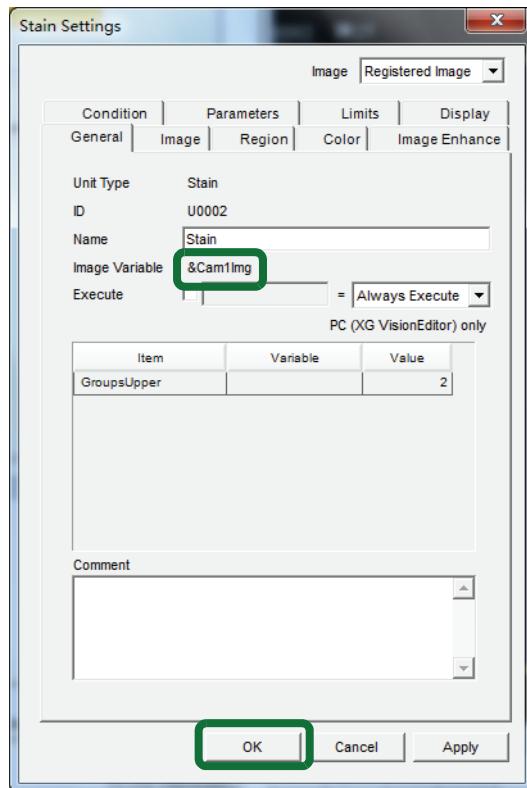
Reference

An image variable is like a box that stores the image captured by each camera.

4. Check the stain unit.

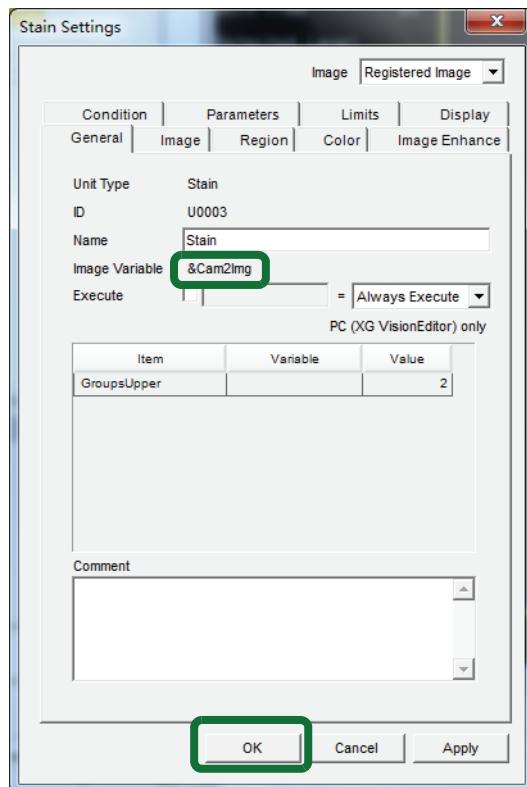
- (1) Double-click [U0002:Stain].

Check that [&Cam1Img] is set as [Image Variable].



- (2) Double-click [U0003:Stain].

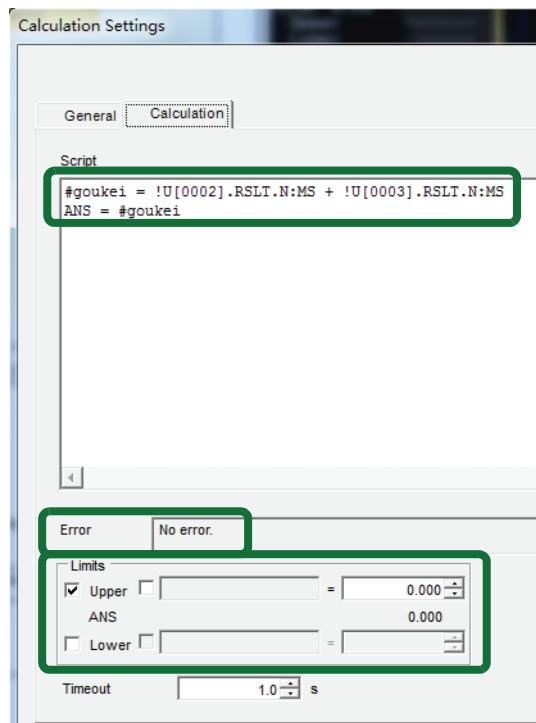
Check that [&Cam2Img] is set as [Image Variable] and click [OK] to close the window.



5. Check the calculation unit.

- (1) Double-click [U0004:Calculation].

Check [Script] and [Limits].

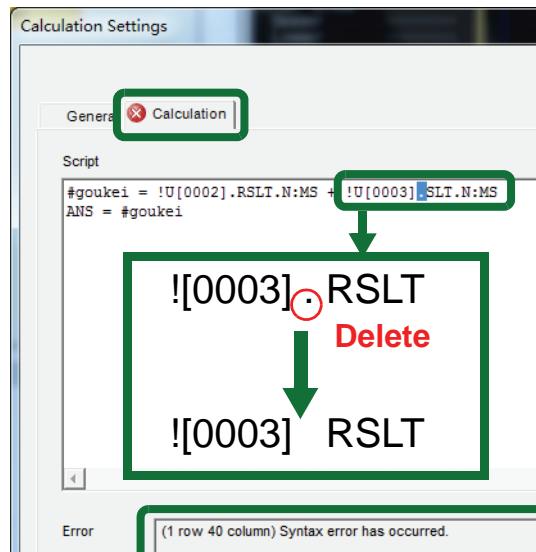


Limits

To perform tolerance judgment in the calculation unit, specify the judgment limits for the calculation result ANS.

- (2) Delete [.] from [!U0003.RSLT].

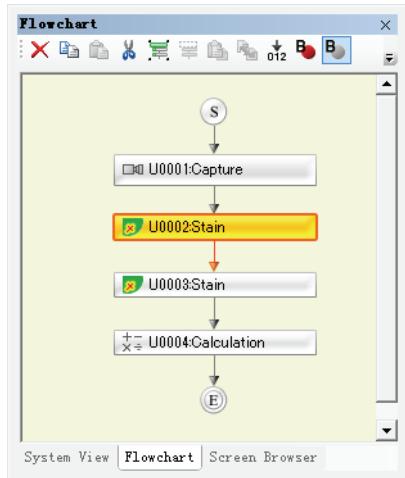
Check [Error] by clicking the [Apply] button.



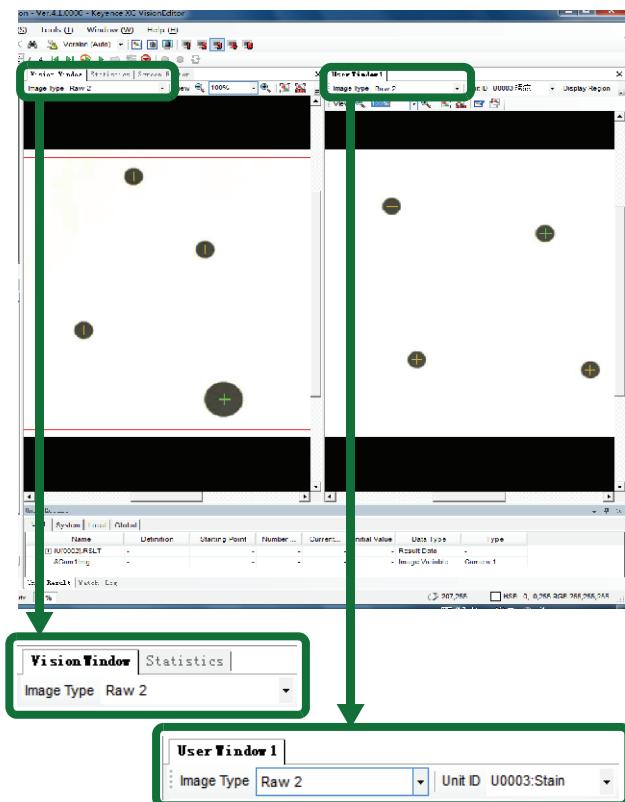
Check the measurement result

6. Check [Vision Window] and [User Window].

- (1) Click [Flowchart View]-[U0002:Stain].



- (2) In [Vision Window], check that [Raw 2] is selected as [Image Type]. In [User Window 1], check that [Raw 2] is selected as [Image Type] and [U0003:Stain] is selected as [Unit ID].



- (3) Click [Execute one time] for the confirmation.

The image captured by Camera 1 is displayed in [Vision Window]. The image captured by Camera 2 is displayed in [User Window 1].



- (4) Select [Unit Result]-[Local Variable] and check [#goukei]-[Current Value].

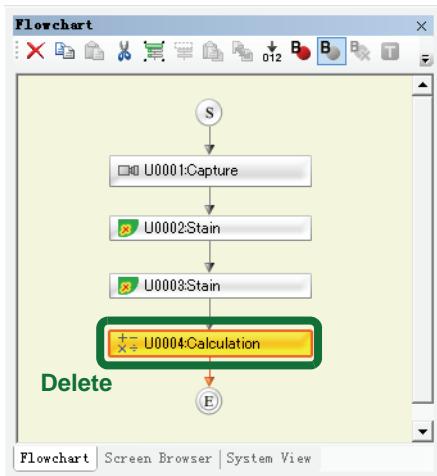
Compare the total number of stains in [Vision Window] with that in [User Window 1].

Name	Starting Point	Number ...	Current...
#goukei	-	-	8

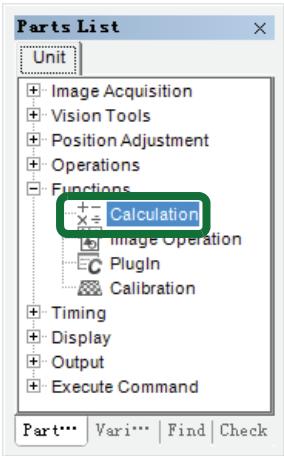
Creating a calculation unit

7. Create a new calculation unit.

- (1) Delete [U0004:Calculation] by right-clicking.



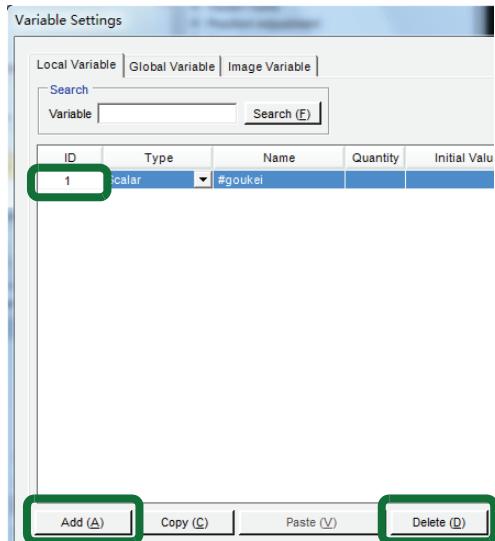
- (2) Drag and drop [Parts List]-[Functions]-[Calculation] into [U0003:Stain].



8. Define the variables to be used.

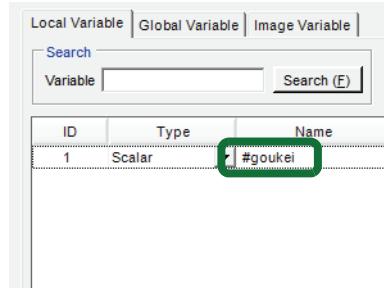
- (1) From the top of the window, select [Settings]-[Variable Settings].

- (2) Delete the variable by clicking [ID]-[1]-[Delete] button. Click the [Add] button.



- (3) Enter [goukei] as [Name].

After checking the above settings, press [Enter].



You can now check that the defined "Variable" has been added.

After checking the above settings, click [OK] to close the window.

9. Create a [Calculation] unit.

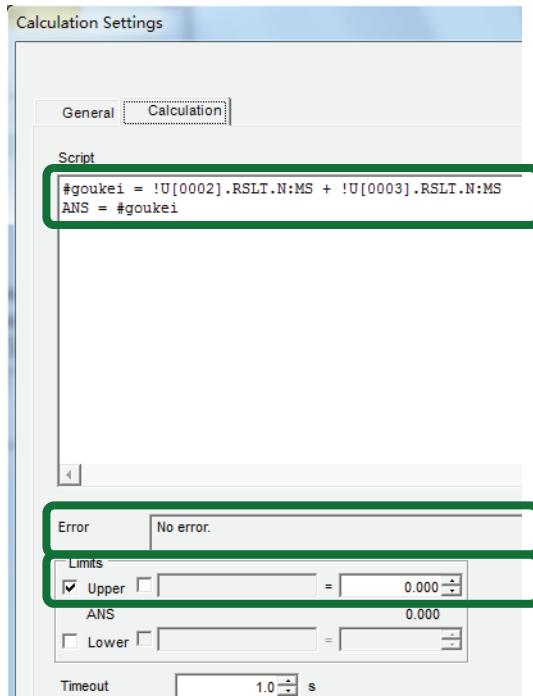
- (1) Enter [Calculation] Unit-[Script].

In [Limits], select the check box of [Upper].

Enter [0] from the Numerical Box.

After checking that [0] has been entered, click the [Apply] button to check [Error].

Check that [No error.] is displayed and click [OK] to close the window.



10. Check the measurement result.

- (1) Check the measurement result by selecting [Vision Window]-[User Window]-[Unit Result].

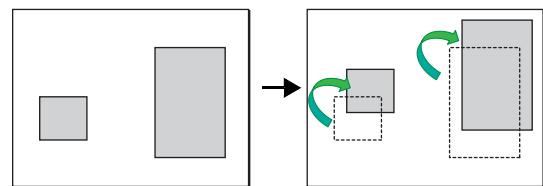
Click [Flowchart View]-[U0002:Stain] to display [Vision Window].

Click [Execute one time] to check the measurement result.

■ What is a position adjustment unit?

The position adjustment specifies a reference and automatically applies misalignment information to other measurement units so that correct measurements are ensured even when the position of the workpiece to be inspected has shifted.

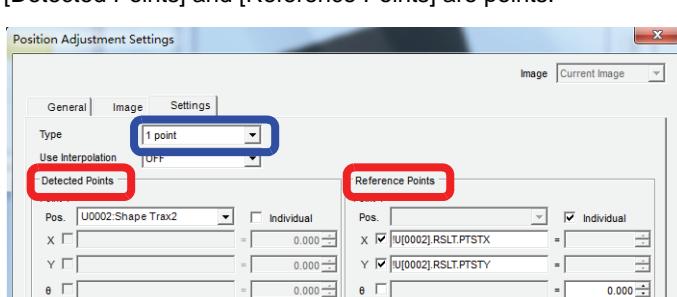
In addition to adjusting the position of other units based on the measurement unit, the position adjustment unit has various uses, such as directly referencing and adjusting variables. Multiple position adjustment units can also be collectively adjusted.



■ Basic settings of position adjustment unit

In position adjustment, "Position Adjustment Source (Pattern Search/ShapeTrax2, etc.)" and "Position Adjustment Destination (Stain/Area, etc.)" are important. "Position Adjustment Source (Pattern Search/ShapeTrax2, etc.)" gives the adjustment value of the current image to other units based on the reference (registered image). "Position Adjustment Destination (Stain/Area, etc.)" checks the correct position according to the adjustment value.

In unit setting, [Detected Points] and [Reference Points] are points.



If [Pattern Search] or [ShapeTrax2] frequently used as the position adjustment source is used as the reference destination, the image is automatically registered in the reference position by specifying the unit in [Detected Points]-[Position] as shown above.

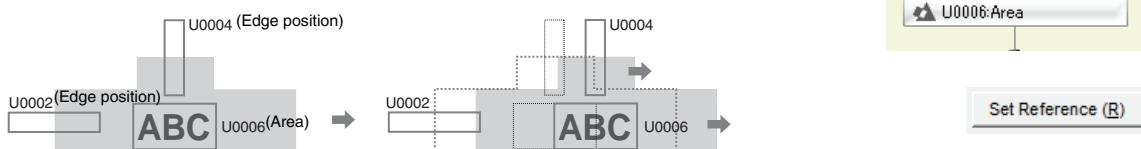
Then, selecting the position adjustment unit in [Position Adjustment ID] of [Region Setting] of the position adjustment destination as shown below will complete the settings.



■ Multi-step position adjustment and reference position registration

This example is for those instances where a workpiece, as shown in the following figure, is to be measured with the position adjustment for the measurement unit of U0006 performed using different measurement units for the X and Y directions. Firstly, the adjustment is made for displacement in the X direction using the result data of U0002, according to the shape of the workpiece, and then for the Y direction using U0004. In such instances, the following adjustment procedures become necessary:

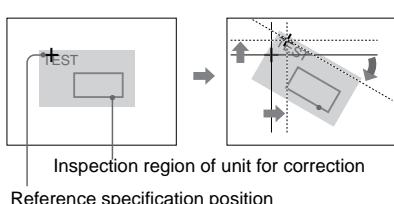
- (1) Firstly, the adjustment is made for displacement in the X-axis direction of U0004 using the position adjustment unit (A) of U0003 where the X direction edge position of U0002 is the location for adjustment.
- (2) Next, the adjustment is made for displacement in the XY-axis direction of U0006 using the position adjustment unit (B) of U0005 where the Y direction edge position of U0004 is the location for adjustment.



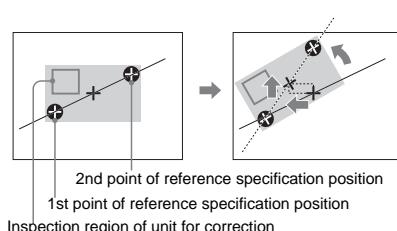
It is important to register the correct position data using [Set Reference] when setting a multi-step position adjustment with related multiple position adjustments.

■ 1-point position adjustment and 2-point position adjustment

1-point position adjustment is used the most. This function performs a position adjustment based on the detection points (1 point) of Pattern Search and ShapeTrax2.



2-point position adjustment uses the two points of an opposing corner. 2-point position adjustment is not especially superior to 1-point position adjustment. You can also use 1-point position adjustment if you are familiar with it.



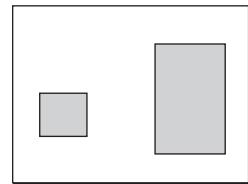
Basic Tutorial_2_4: Position Adjustment

What is position adjustment?

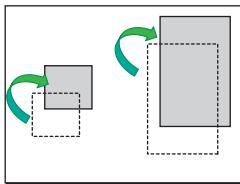
Position adjustment allows the position adjustment unit to automatically track the region you want to measure when the workpiece to be measured shifts. Workpieces that flow on an on-site production line are not always fixed at the same position when they are captured by a camera. If the Measurement Window is fixed when the position or angle of the workpiece to be measured shifts slightly, correct inspection is not assured.

Shift amount from reference position

ΔX : Shift amount of X coordinate
 ΔY : Shift amount of Y coordinate
 $\Delta\theta$: Shift amount of angle

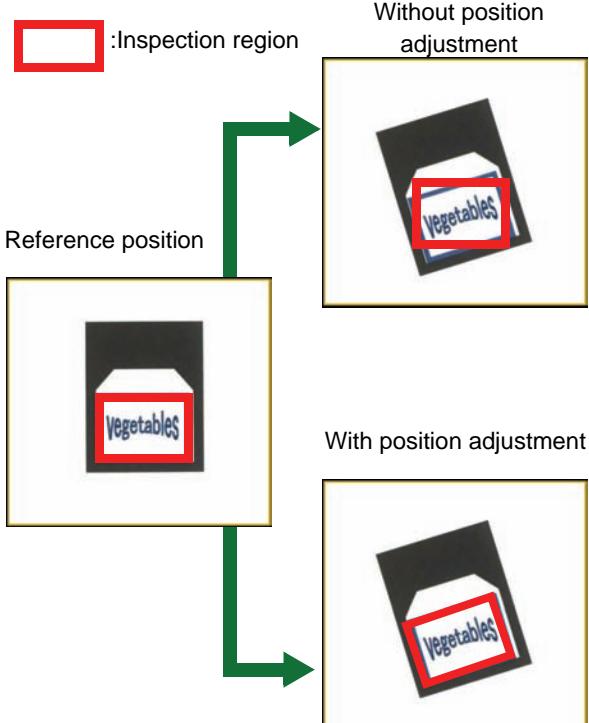


Example of reference position



Example of image with deviated position

Position adjustment image



The position adjustment unit tracks the inspection region position that has shifted.

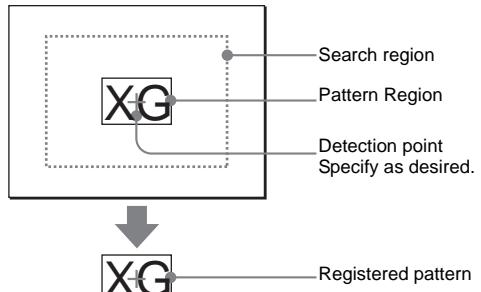
This time [Pattern Search] is used to search for the position of a workpiece.

Pattern Search

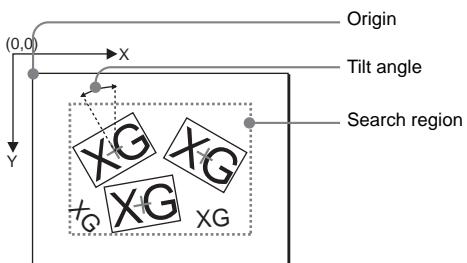
Pattern Search registers the characteristic pattern of a registered image.

It detects the part most resembling to the registered pattern among the current images and calculates a detection position, an angle, and match % which is the degree of resemblance.

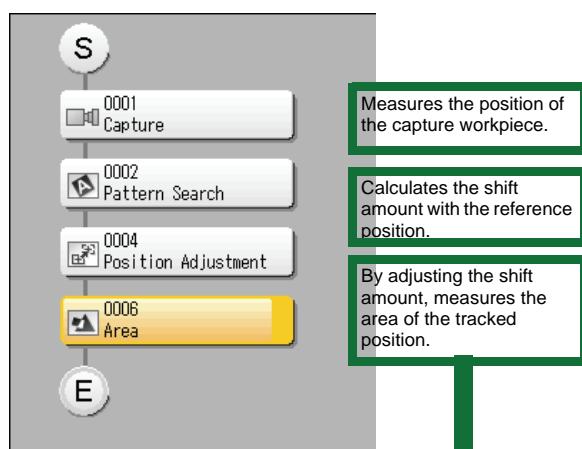
When a pattern is registered



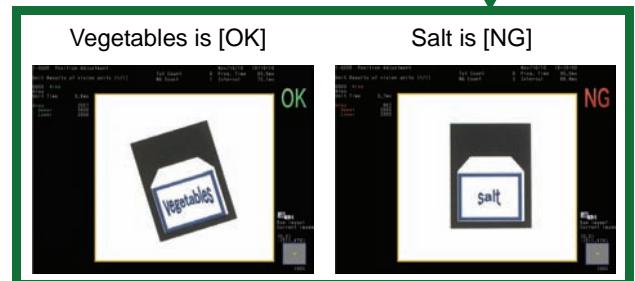
While the system is in operation



Flowchart image



Inspection contents
(breed discrimination inspection)



Uploading inspection settings to a controller

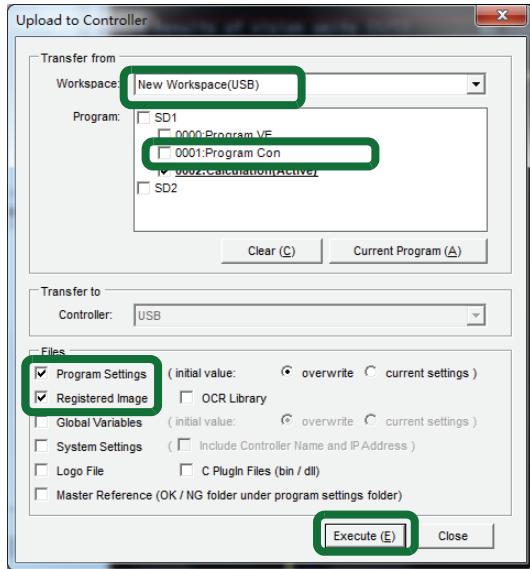
1. Upload the current inspection settings to the controller as review.

(1) Select [Files]-[Upload].

In [Transfer from], select [New Workspace] as [Workspace]. In [Program], select the check box of [0001:Program Con].

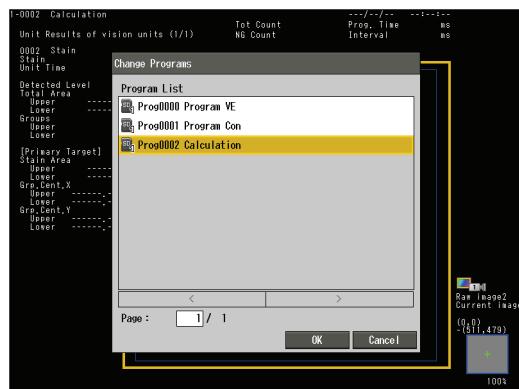
In [Files], select the check boxes of [Program Settings] and [Registered Image].

After checking the above settings, click [Execute].



(2) Check that the inspection settings have been uploaded to the controller.

Press the [FUNCTION] button on the console, select [Inspection Settings]-[Change Programs], and press [Enter].



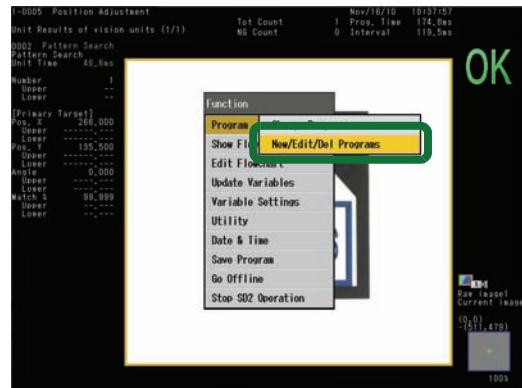
Check that [Setting0002:Calculation] has been added.

Creating new inspection settings

Create new inspection settings on the controller.

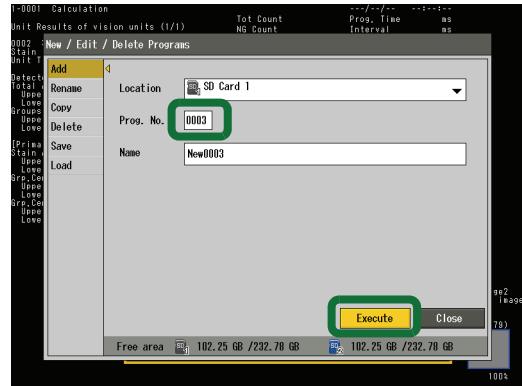
2. Add new inspection settings.

(1) Open [Function]-[Program]-[New/Edit/Del Programs].

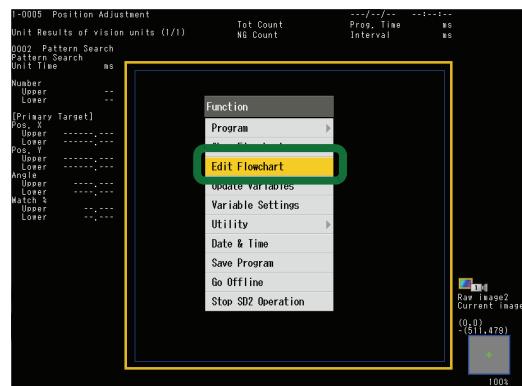


(2) Click [Add]-[Execute].

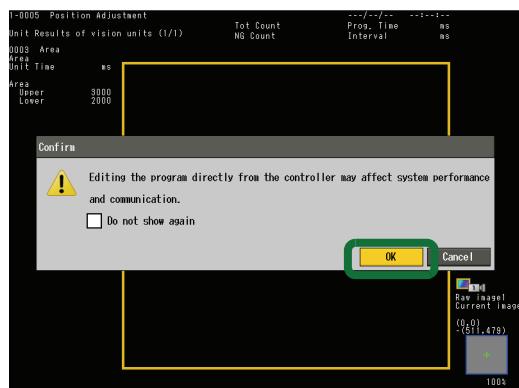
At this time, check that [Program No.] is [0003].



(3) Check that the inspection setting number is [0003]. Open [Function]-[Edit Flowchart].



The following caution appears:
Click [OK].



Creating inspection settings

3. Register an image.

First register an image that serves as the reference image when inspection settings are created.

(1) Make settings so that the [Vegetables] workpiece moves to the center of the window.

Click [TRIGGER] continuously.

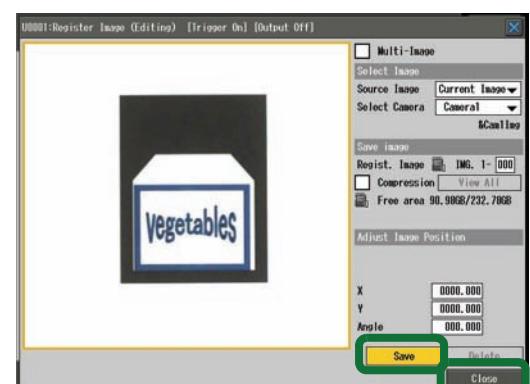
Clicking [TRIGGER] button continuously updates the window continuously.



(2) Press [Enter] to open [Register Image].



(3) Click the [Save]-[Close].
[Register Image] is now complete.

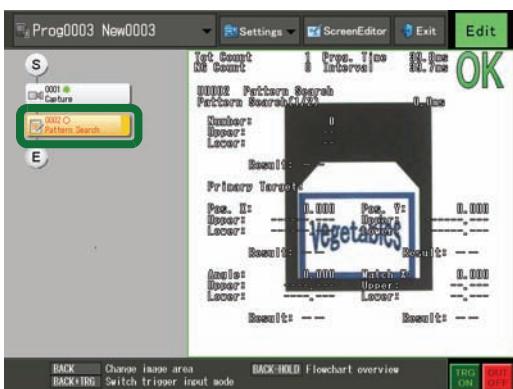


4. Add and set a [Pattern Search] unit.

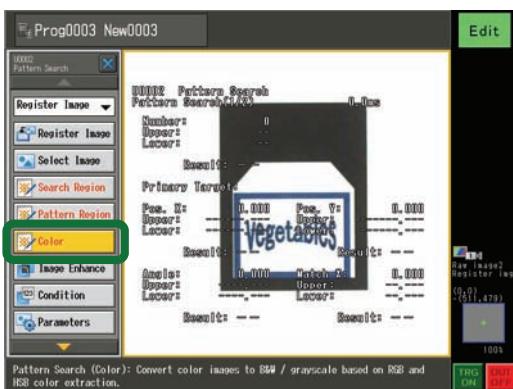
- Use the [FUNCTION] button to add the [Pattern Search] unit.
- Select [Add Unit]-[Vision Tools]-[Pattern Search].



- Click the [Enter] button.

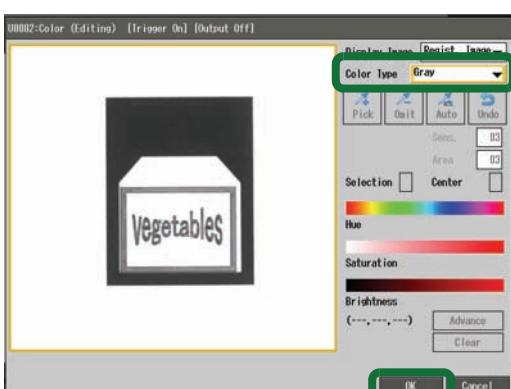


- Select [Color].

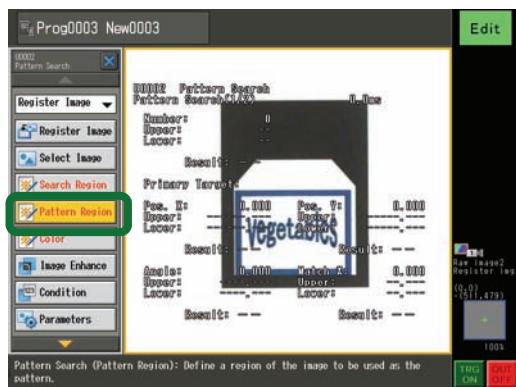


- Select [Gray] as [Color Type].

Click [OK] to close the window.



5. Select [Pattern Region].



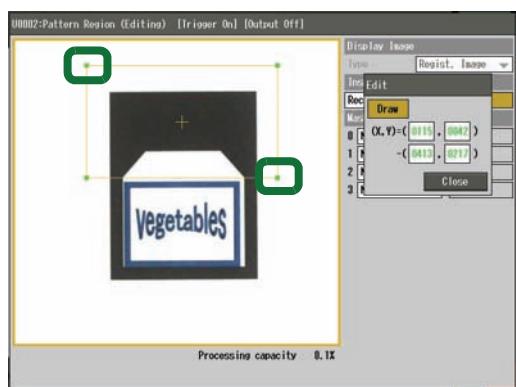
6. Select [Inspection Region]-[Rectangle].



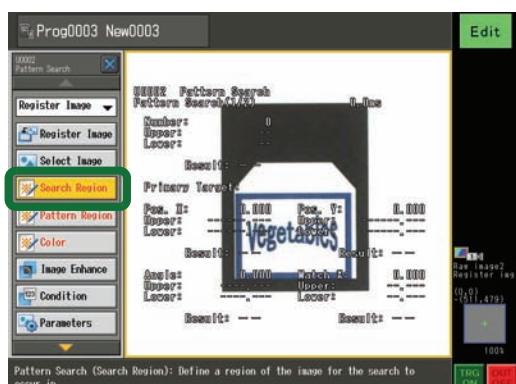
- Move [Upper Left Vertex] to the upper left of the workpiece and [Lower Right Vertex] to the middle right of the workpiece.

Press [Enter].

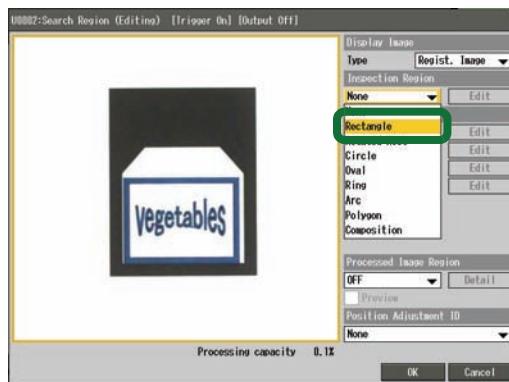
Press [ESCAPE] twice and click [OK].



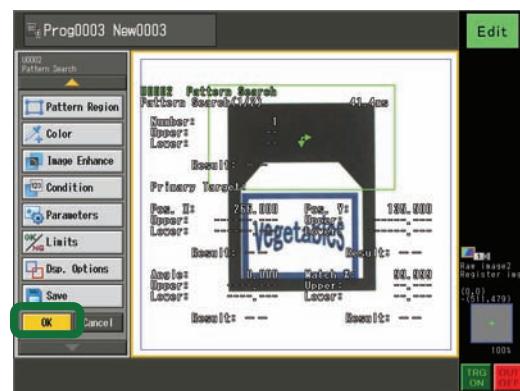
8. Select [Search Region].



(9) Select [Inspection Region]-[Rectangle].



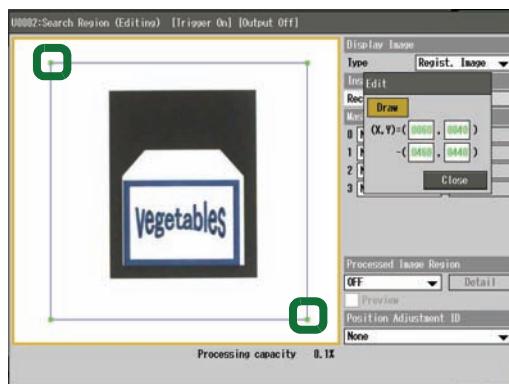
(13) Click [OK] to close the window.



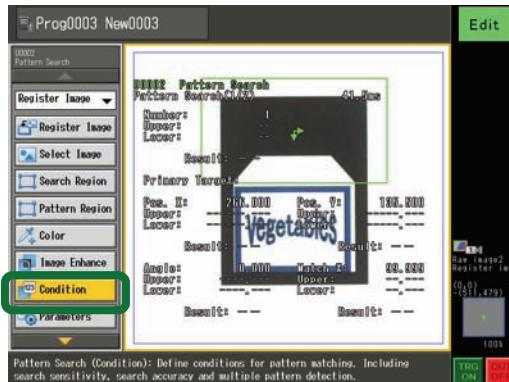
(10) Move [Upper Left Vertex] to the upper left of the workpiece and [Lower Right Vertex] to the middle right of the workpiece.

Press [Enter].

Press [ESCAPE] twice and click [OK].

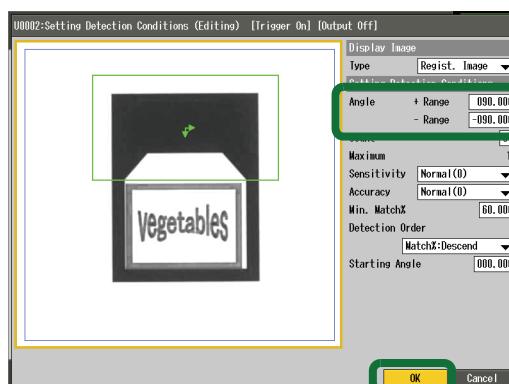


(11) Select [Conditions].



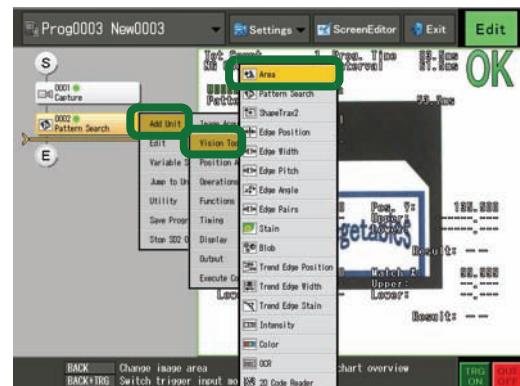
(12) In [Detection Condition Setting]-[Angle], enter [90] as [+ Range] and [-90] as [- Range].

After entering the above conditions, click [OK] to close the window.

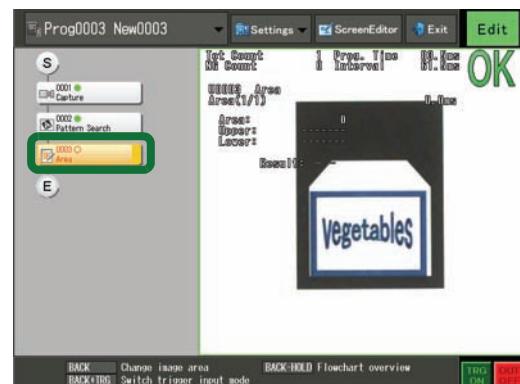


5. Add and set a [Area] unit.

(1) Use the [FUNCTION] button to add the [Area] unit. Select [Add Unit]-[Vision Tools]-[Area].



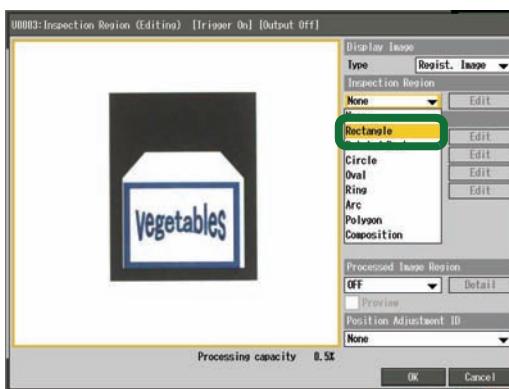
(2) Press [Enter].



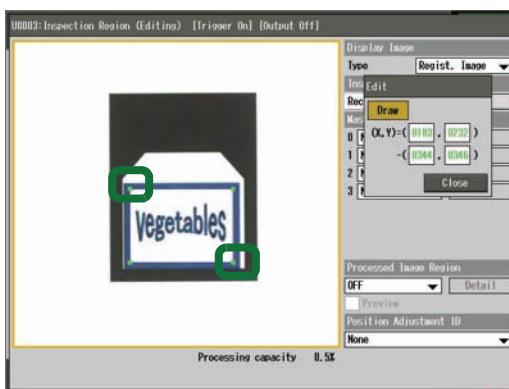
(3) Select [Inspect Region].



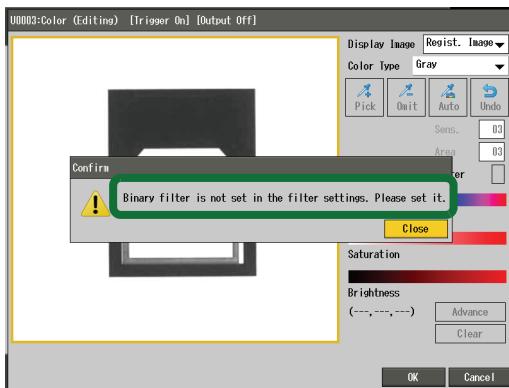
(4) Select [Inspection Region]-[Rectangle].



(5) Move [Upper Left Vertex] to the upper left of character string [Vegetables] and [Lower Right Vertex] to the lower right of character string [Vegetables].
Press [Enter].
Press [ESCAPE] twice and click [OK].

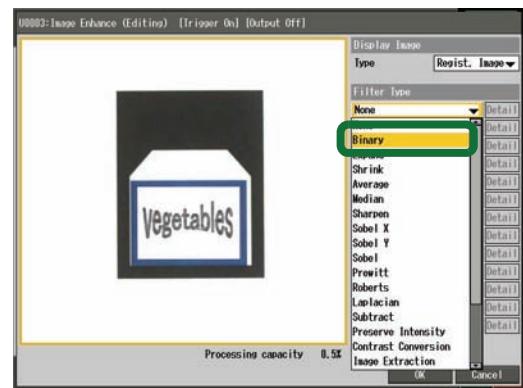


(6) Open [Color Extraction].
Select [Gray] as [Color Type].
Click [OK] to close the window.



A note appears, asking you to set image enhancement.
In [Image Enhancement], set [Binary].

(7) Select [Image Enhancement].
Select [Filter Processing]-[Binary].



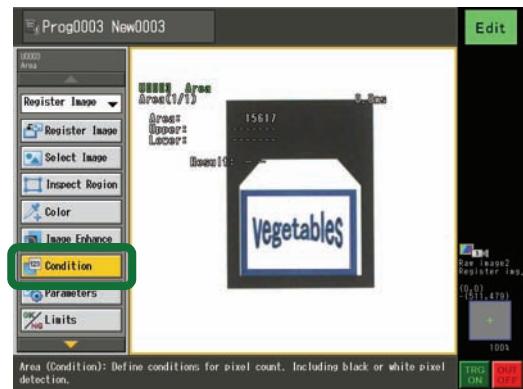
(8) In [Binary], change [Lower].
Set a lower value that enables you to clearly recognize the characters.
You can also set [Lower] in [Histogram] using the cursor.
Click [OK] to close the window.



(9) Click [OK] to close the window.



(10) Select [Condition].



- (11) Select [Select Detection Conditions]-[Detect]-[Black].

To judge the area, select a black or white. Click [OK] to close the window.



- (12) Click [OK] to close the window.



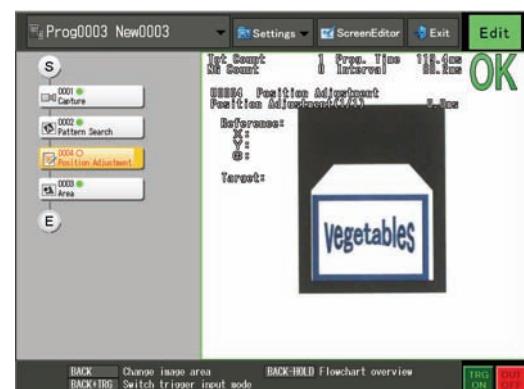
[Area] detection setting is now complete but [Inspection Region] is [Fixed]. Add [Position Adjustment] so that the workpiece can be tracked even if the position of the workpiece shifts.

6. Add and set a [Position Adjustment] unit.

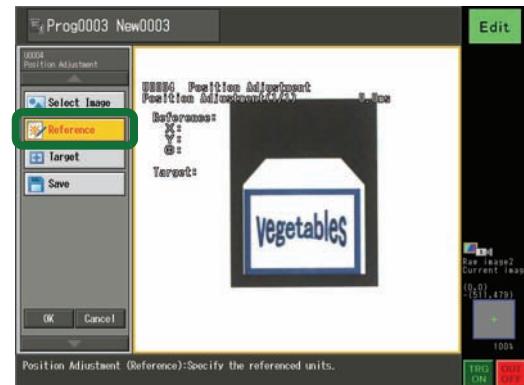
- (1) Use the [FUNCTION] button to add the [Position Adjustment] unit. Select [Add Unit]-[Position Adjustment]-[Position Adjustment].



- (2) Press [Enter].



- (3) Select [Reference].

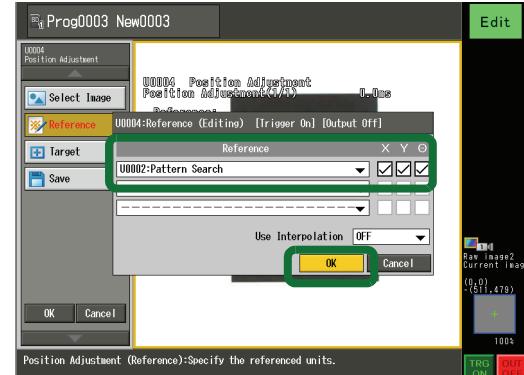


- (4) Select [Reference]-[U0002:Pattern Search].

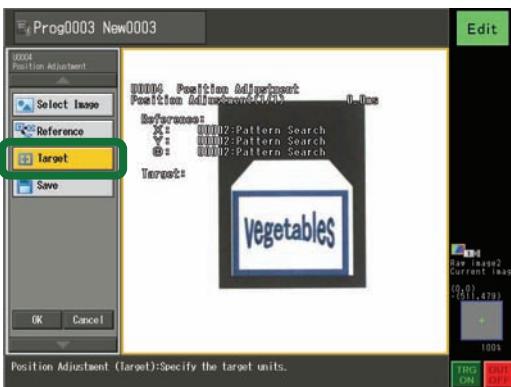
Next select an adjustment value.

Select the check boxes of [X] [Y] [0].

After checking the above settings, click [OK] to close the window.

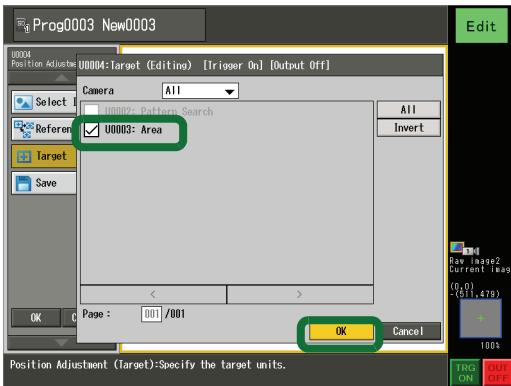


(5) Select [Target].

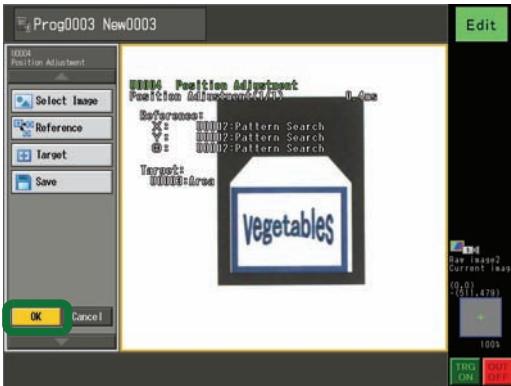


(6) Select [U0003:Area].

After checking the above settings, click [OK] to close the window.



(7) Click [OK] to close the window.



(8) Position the cursor at the [Area] unit and click the [TRIGGER] button.

Check that [Inspection Region] is being tracked.



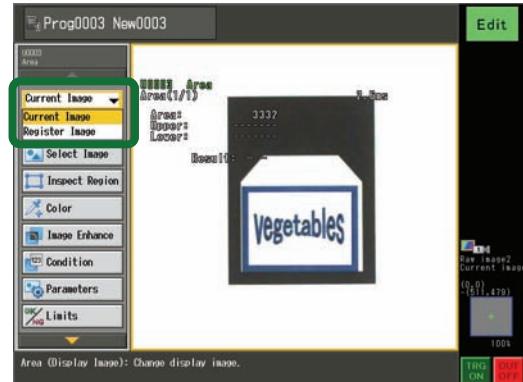
7. Set the judgment conditions of the [Area] unit.

At this point of time, [OK] is judged to have been set for both workpieces.

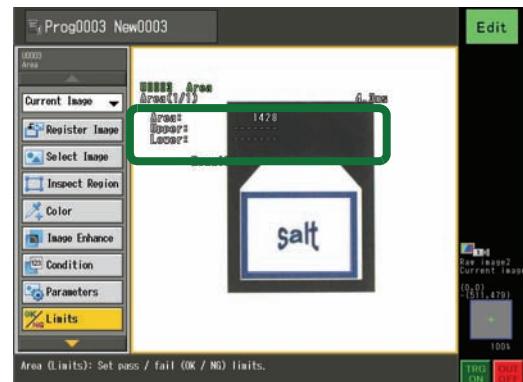
Set conditions for setting [Vegetables] to [OK] and [Salt] to [NG].

(1) Select an [Area] unit.

Select [Regist.Image] as [Current Image].



(2) Click [TRIGGER] to compare the area values of both workpieces.

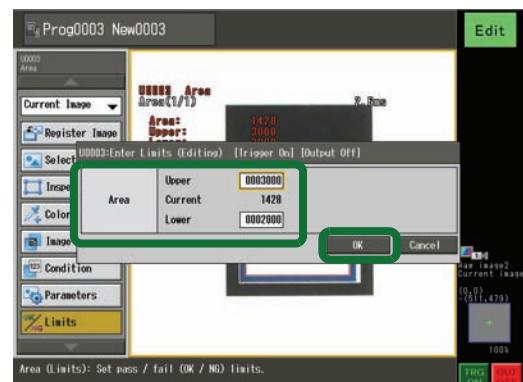


(3) Select [Limits].

Set [Upper] and [Lower] of [Area].

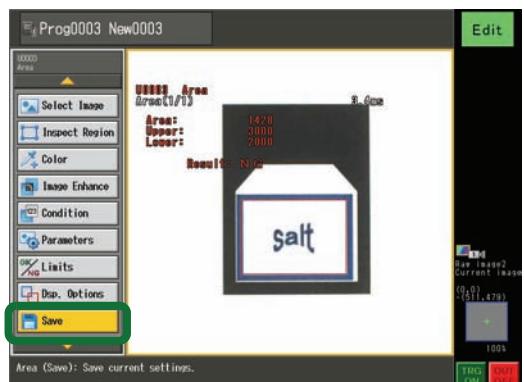
Make settings so that [OK] is set only for [Vegetables].

Click [OK] to close the window.



(4) Save all settings.

Click [Save].



(5) Slide the slide switch on the console and check the results according to the run mode status.

■ What are branch and join units?

You can branch the flowchart based on a specified condition into separate processing flows, and then join them again into a single flow.

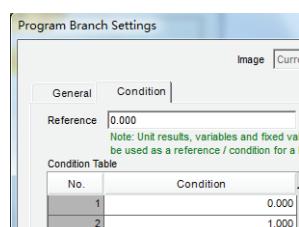
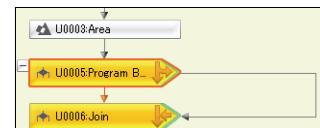
This is useful when switching the processing flow according to the result of a specific vision unit, calculation unit, or external I/O.

Up to 64 branches can be set.

■ Example of setting branch and join units?

Adding branch and join units /Example: Drag and drop [Control]-[Branch-Join] unit from the parts list, which is used to add branch-join to a flowchart of only capture-blob, into [Blob] of Flowchart View.

The branch and join units are added under the blob.



Reference

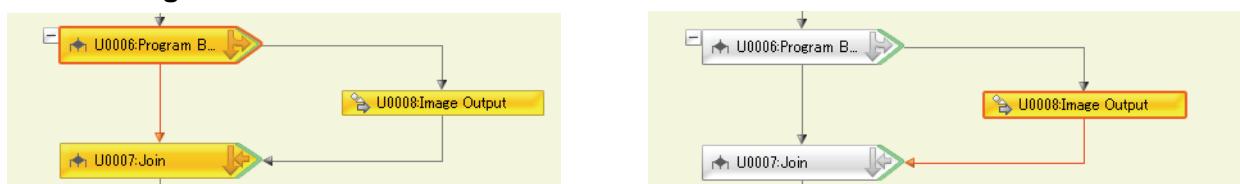
Enter the value used for evaluation of the branch condition. A variable, result data, or numerical value can be used.

Condition

Enter the value to be compared with the reference value.

A variable, result data, or numerical value can be used. In addition, [ELSE] can be used as a condition value representing instances where no condition values are satisfied.

■ Determining branch conditions



Determine the branch conditions from the condition value (condition).

Enter [0] of judgment OK from branch No1 (left most and right below in the flowchart). Enter [1] of judgment NG from branch No2 (to the right by 1).

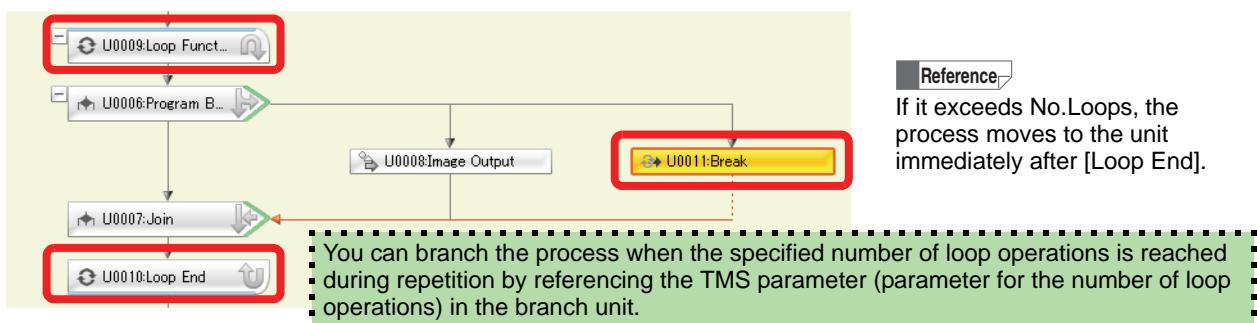
■ What is a loop function unit?

The combination of the loop function and loop end units repeat a set section in the flowchart a specified number of times.

When the loop function unit is added to the flowchart, the loop end unit is automatically added.

If the specified value is within No. of loops, the process moves to the immediately following unit.

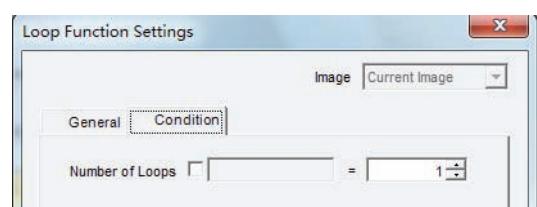
You can know "how many times" of the number of loop operations (No. of loops) by referencing the "TMS" parameter (parameter for the number of loop operations) of this unit.



In the loop function unit, specify the number of loop operations.

Besides direct numerical input, the loop function unit supports variable reference.

The loop function unit can also repeat another processing from the blob by the specified count.

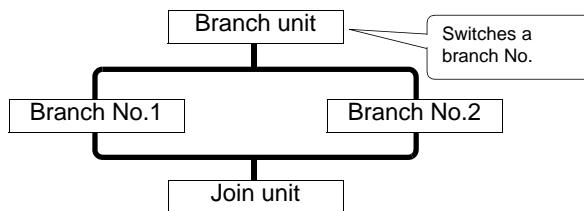


Basic Tutorial_2_5: Branch

Branch unit

In the flowchart that uses the branch unit, the branch unit branches the flow according to the conditions specified in advance and performs separate processing. Then, the branch unit joins to one flowchart. This is useful when switching the processing flow according to the result of a specific vision unit, calculation unit, or external I/O.

■ Overview of branch unit

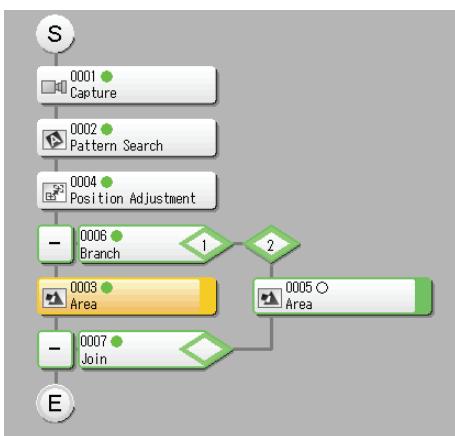


■ Recipe switching inspection with branch and join units



Measure the areas of “vegetable” and “salt” characters.

■ Flowchart image drawing



Switch the flowchart of inspection with [Branch and Join] units. Switch the flowchart so that one of the [Area] units whose [Judgment Tolerances] differ is executed.

- (1) In U0003, OK when the character area is 2000 to 3000
- (2) In U0005, OK when the character area is 0000 to 1000

Creating an [Area] unit for [Vegetable] inspection

1. Copy the “U0003 Area” unit.

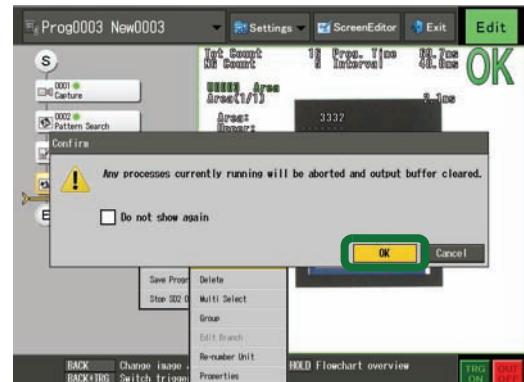
- (1) Select [Area], press [FUNCTION] on the console, and press [Enter] on the console with [Edit]-[Copy] selected.



- (2) Select [Area], press [FUNCTION] on the console, and press [Enter] on the console with [Edit]-[Paste] selected.



- (3) The following confirmation message appears. Click the [OK] button.

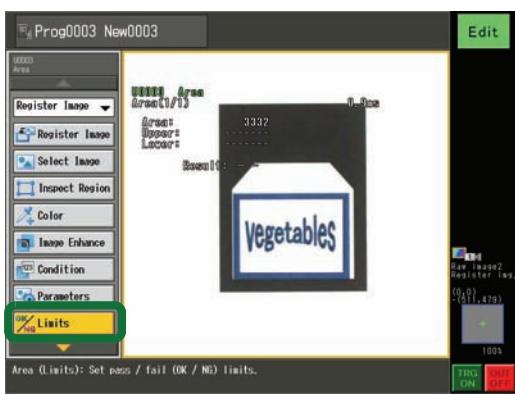


2. Check the judgment conditions of the “U0003 Area unit”.

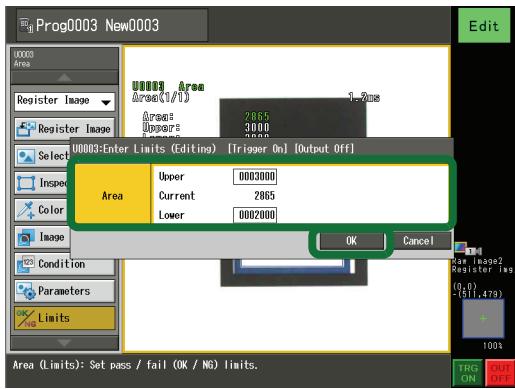
(1) Select the “U0003 Area unit” on the flowchart.



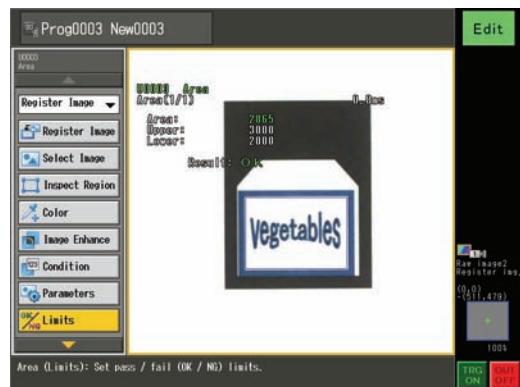
(2) Select [Limits] and press the [Enter] button on the console.



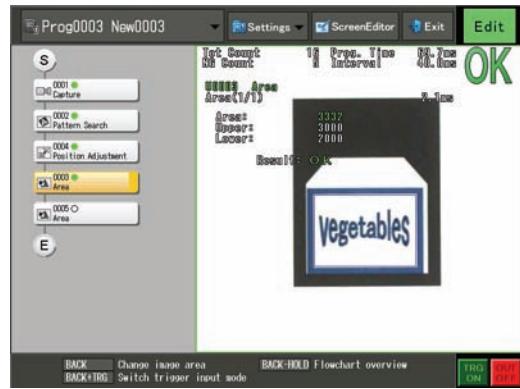
(3) Check that [Upper] of the area is [3000] and [Lower] of the area is [2000]. With the [OK] button selected, press the [Enter] button on the console.



(4) Press the [ESCAPE] button on the console.



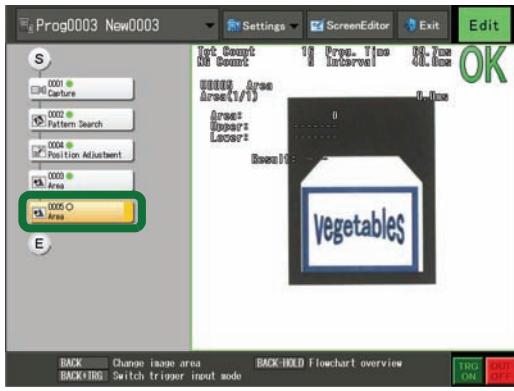
(5) Check that the flowchart creation window has been redisplayed.



Creating an [Area] unit for [salt] inspection

3. Change the judgment conditions of the U0005 [Area] unit.

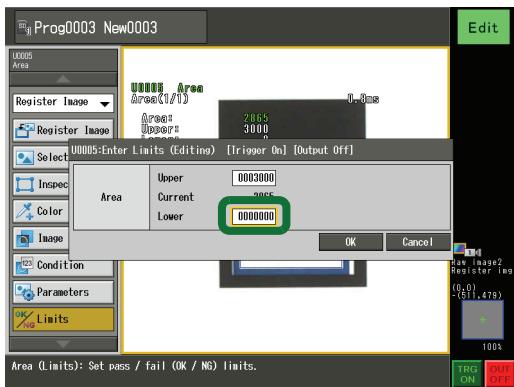
(1) Change the “U0005 Area unit” on the flowchart.



(2) With [Limits] selected, press the [Enter] button on the console.

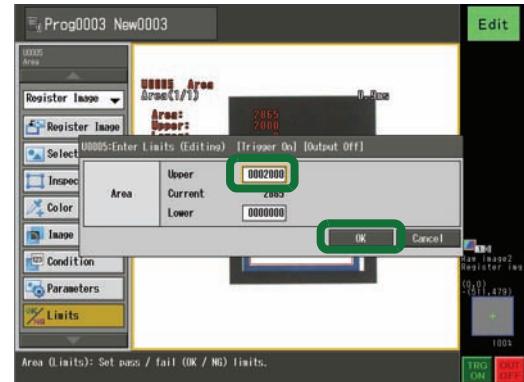


(3) Press the [Enter] button on the console, select [Direct Input], change [Lower] of the area from [1000] to [0], and press the [ESCAPE] button on the console.



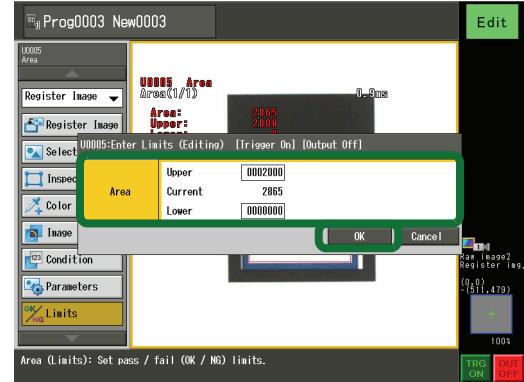
(4) Change [Upper] of the area from [2000] to [1000]. Select [Direct Input]. Set [1000] using the crosshair key on the console and press the [ESCAPE] key on the console.

(5) Click the [OK] button.



(6) Close the [Enter Limits] dialog. With the [OK] button selected, press the [Enter] button on the console. Press the [ESCAPE] button on the console.

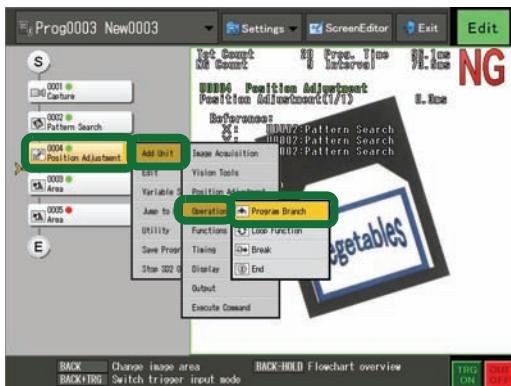
(7) With [OK] selected, press the [Enter] button on the console.



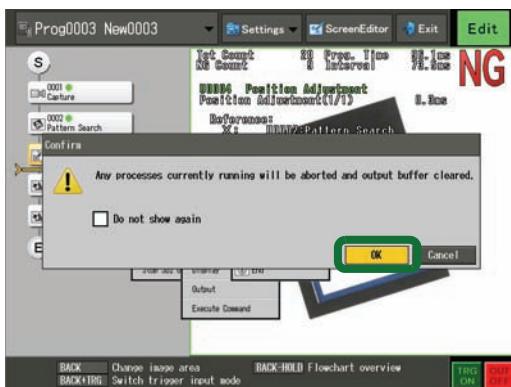
Switching Recipe Using [Branch and Join] Units

4. Add [Branch and Join] units.

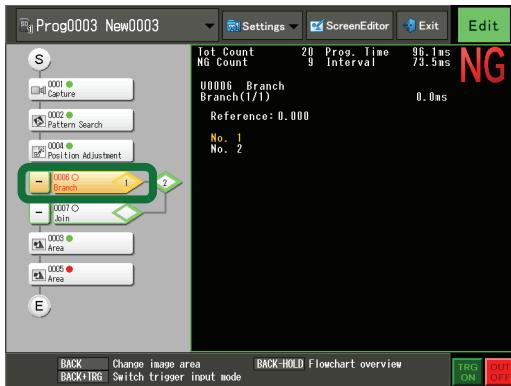
- (1) Press [FUNCTION] on the console, select [Add]-[Control]-[Branch and Join], and press [Enter].
- (2) From the [Confirm] menu, click [OK].
- (3) Check that the [Branch and Join] units have been added.



- (4) A [Confirm] message appears. With [OK] selected, press the [Enter] button on the console.



- (5) The [Branch and Join] units have been added.

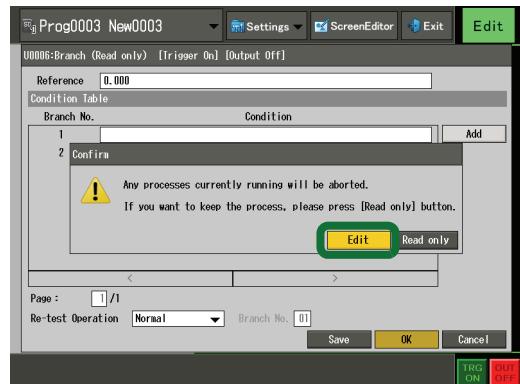


5. Enter the branch conditions of the [Branch and Join] units.

- (1) With the [Branch and Join] units selected, press the [Enter] button on the console.

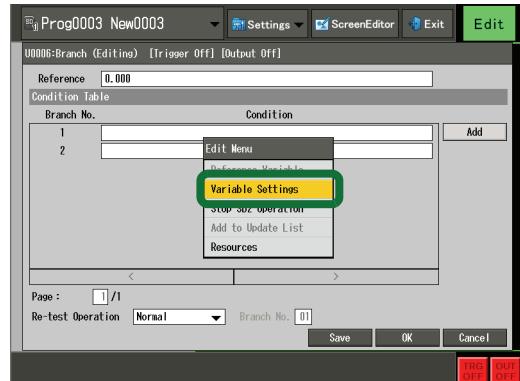


- (2) A message appears. With [Edit] selected, press the [Enter] button on the console.

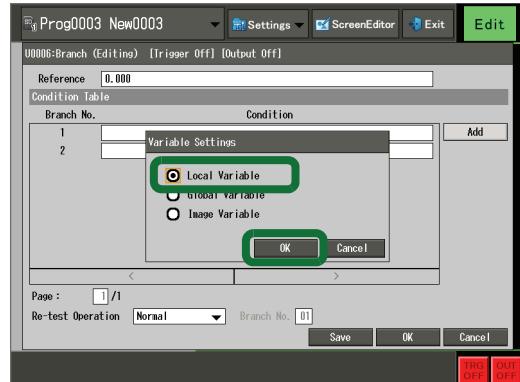


6. Set the variable used as [Reference].

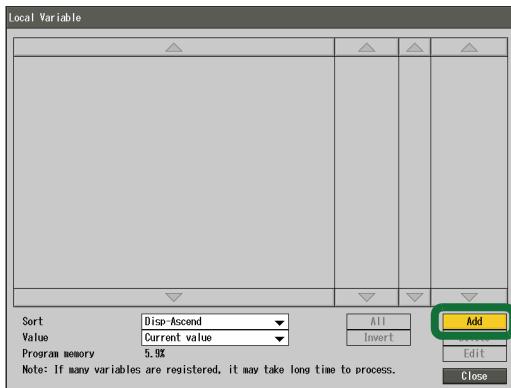
- (1) Press the [FUNCTION] button on the console. With [Variable Setting] selected, press the [Enter] button on the console.



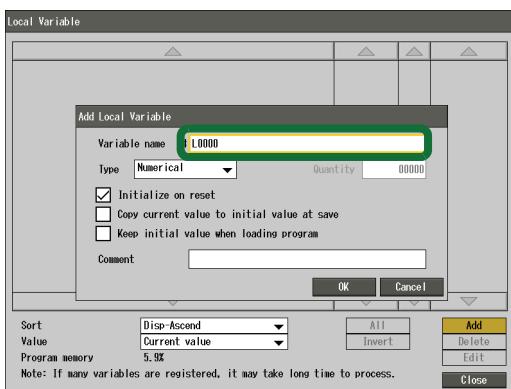
- (2) Select [Local Variable]. With [OK] selected, press the [Enter] button on the console.



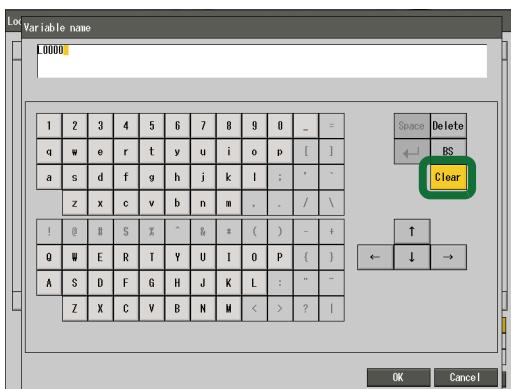
- (3) With [Add] selected, press the [Enter] button on the console.



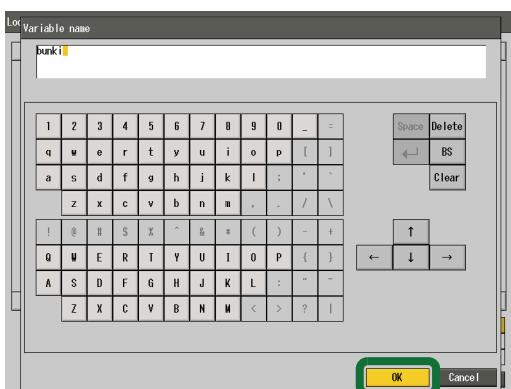
- (4) Change [Variable name]. With [Variable name] selected, press the [Enter] button on the console.



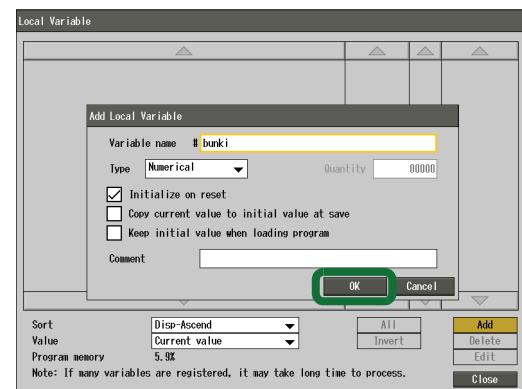
- (5) Click [Clear] to delete the variable name once.



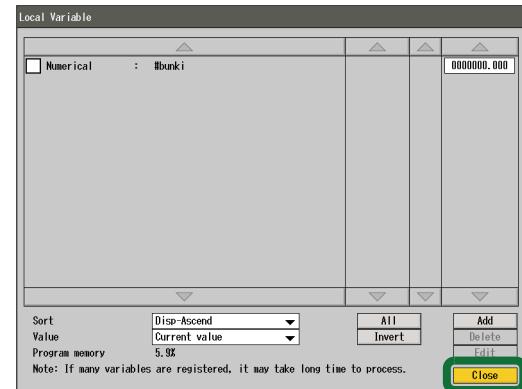
- (6) Enter [bunki]. Click the [OK] button.



- (7) Click [OK].



- (8) Click [Close]. The variable [#bunki] has now been created.

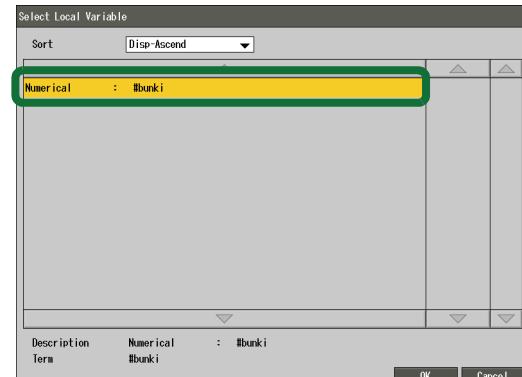


- (9) With [Reference] selected, press [Enter] on the console, select [Local Variable], and click the [OK] button.



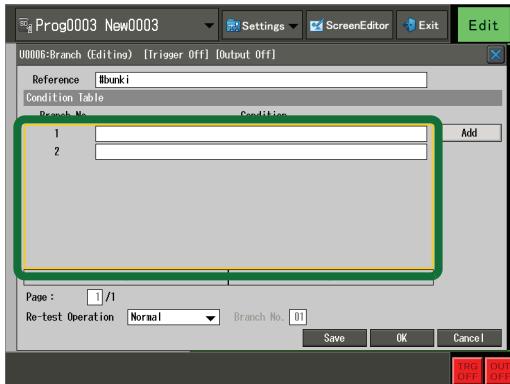
- (10) With [#bunki] selected, press the [Enter] button on the console.

With the [OK] button selected, press the [Enter] button on the console.

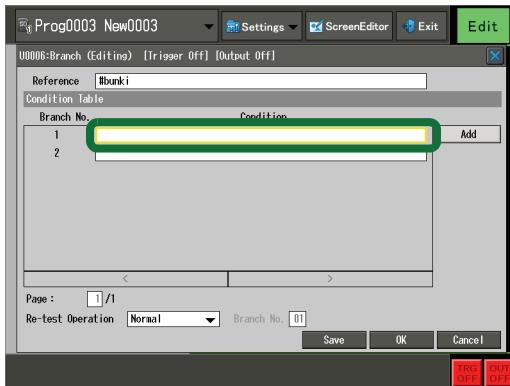


7. Make settings so that the process proceeds to branch No.1 and branch No.2 according to the [Reference] value.

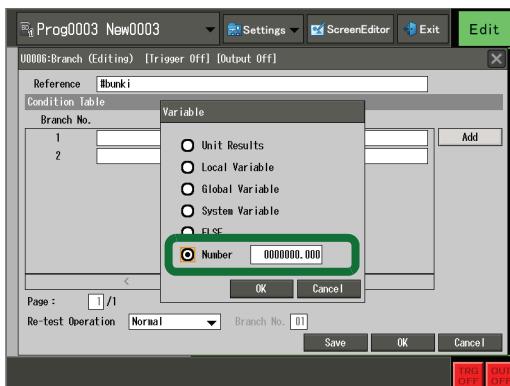
(1) Perform branch setting. In the selection status as shown in the figure below, press the [Enter] button on the console.



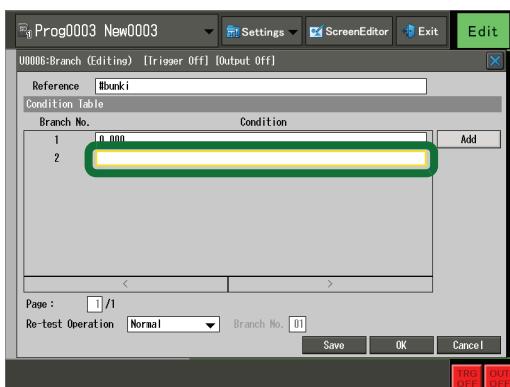
(2) With [Branch No.1] selected, press the [Enter] button on the console.



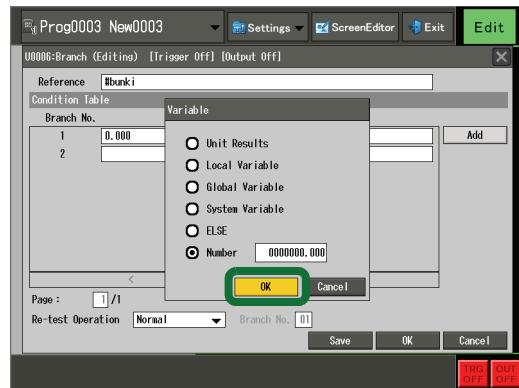
(3) Select [Number] and enter [0000]. Click [OK] to close the window.



(4) With [Branch No.2] selected, press the [Enter] button on the console.

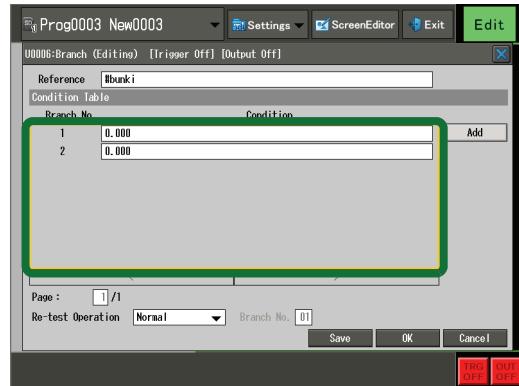


(5) Select [Number], enter [0001], and click [OK] to close the window..



8. Click [OK] to close the [Branch] unit sub menu.

(1) Press the [ESCAPE] button on the console.



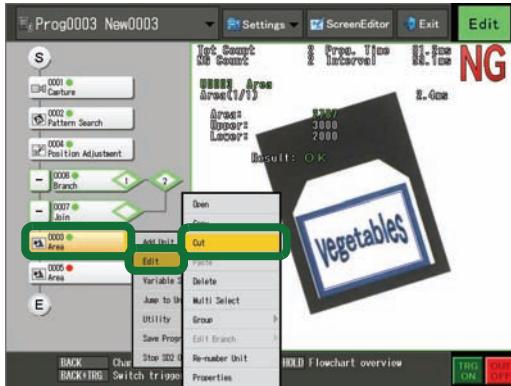
(2) Press the [ESCAPE] button on the console.



Moving the [Area] unit to the respective destinations

9. Place two types of [Area] units in the [Branch and Join] units.

- With the [Area] units selected, select [FUNCTION]-[Edit]-[Cut] on the console.



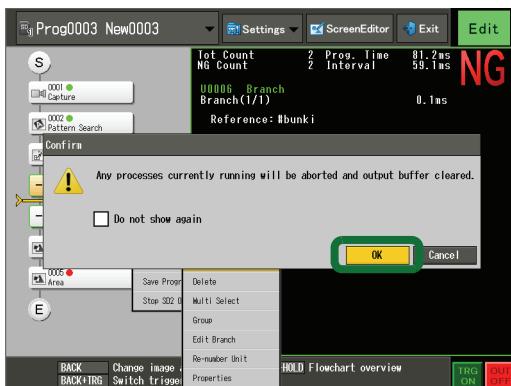
- Select [1] of the [Branch] unit.



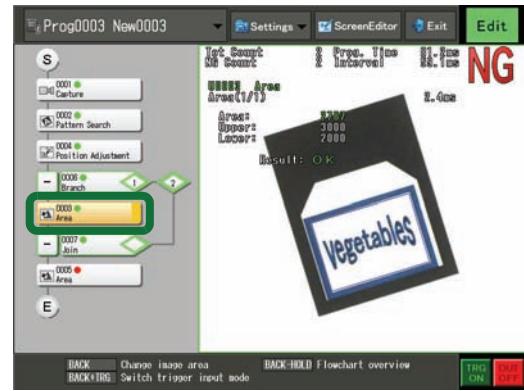
- Select [FUNCTION]-[Edit]-[Paste] on the console.



- From the [Confirm] menu, click [OK].



- Check that "U0003 Area" has moved to branch No.1.



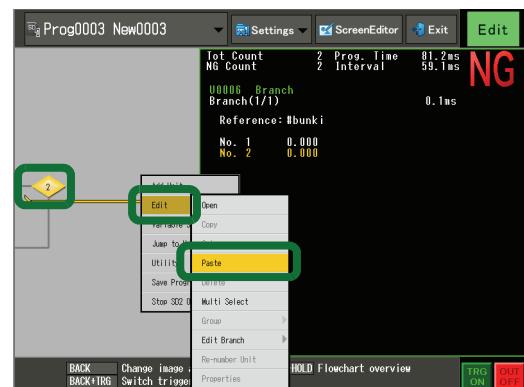
- With the "U0005 Area unit" selected, select [FUNCTION]-[Edit]-[Cut] on the console.



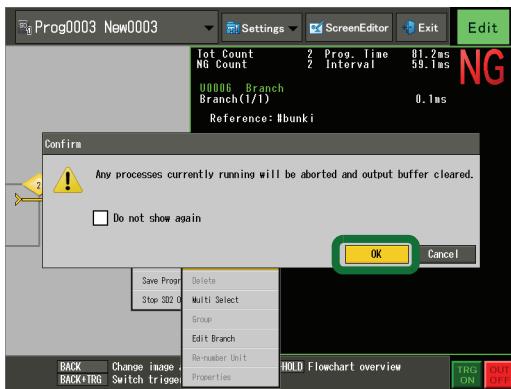
- Select [2] of the [Branch] unit.



- Select [FUNCTION]-[Edit]-[Paste] on the console.



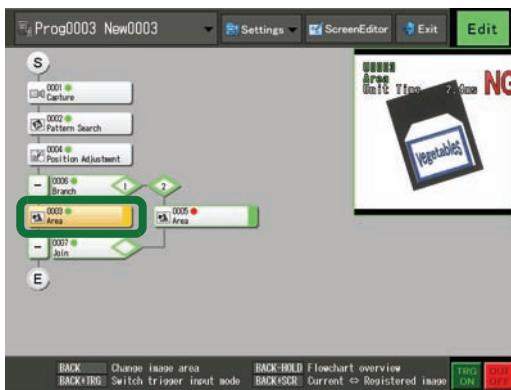
(9) From the [Confirm] menu, click [OK].



(10) Check that “U0005 Area” has been added to branch No.2.



10. Check the entire image of the flowchart by pressing the [Back] key on the console.

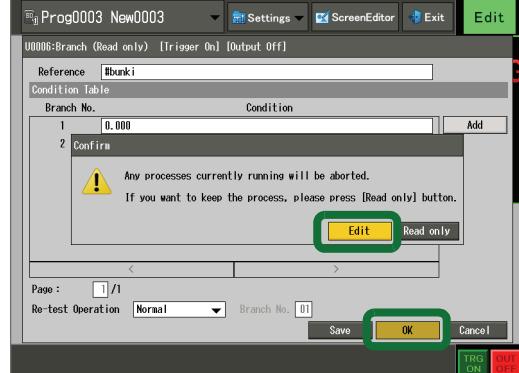


Switching the destination and changing the inspection contents

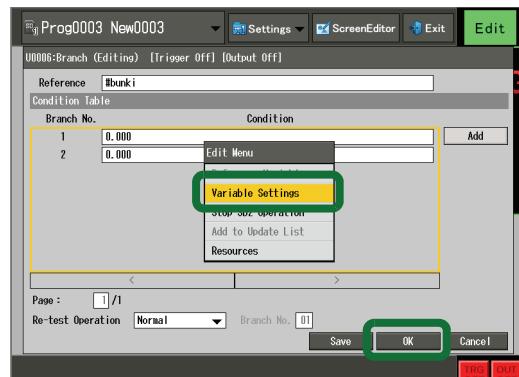
11. Change the [#bunki] value from [0] to [1].

(1) With [Branch] unit selected, press the [Enter] button on the console.

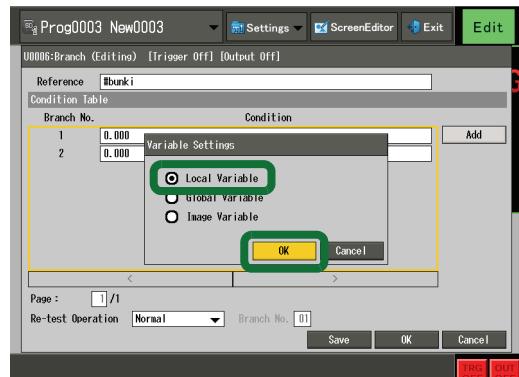
(2) From the [Confirm] menu, click [OK].



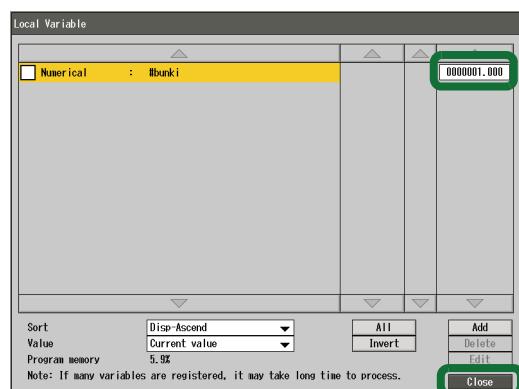
(3) Press the [FUNCTION] button on the console and select [Variable Setting].



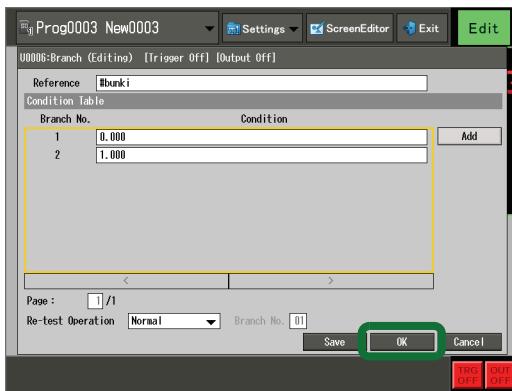
(4) Select the check box of [Local Variable] and click [OK].



(5) Change the [#bunki] value to [1.000] and click the [Close] button.

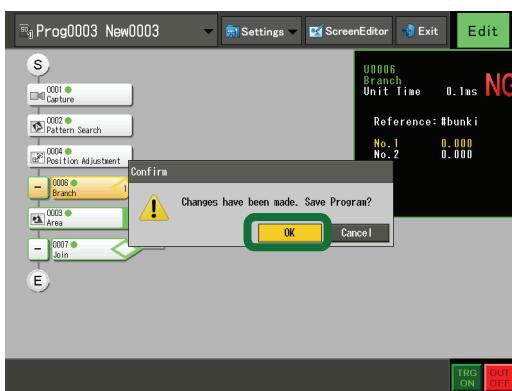


(6) Click the [OK] button.



12. Switch the destination during operation and check the inspection contents.

(1) Lower the [RUN/STOP] slide switch on the console. Click the [OK] button.



(2) Check that "U0003 Area" is not executed.



(3) Press [Up/Down] on the console and check that "U0005 Area" is being executed.



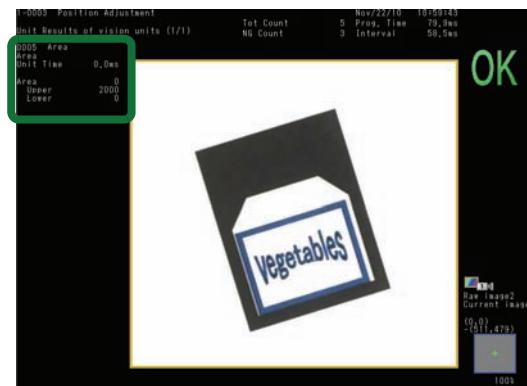
(4) Press [Up/Down] on the console and check that "U0005 Area" is being executed.

(5) Change the inspection contents to [FUNCTION]-[Flow Edit] on the console, change the [#bunki] value from [1] to [0], and get out of [Flow Edit].

(6) Check that "U0003 Area" unit is being executed.



(7) Press [Up/Down] on the console and check that "U0005 Area" is not being executed.



■ What is a parallel terminal output unit?

The parallel terminal output unit sets details for the numerical data output to the parallel I/O connector or terminal block. This unit can also output any numerical value from the terminal to which "%OutDataA to H" is assigned in global settings.

■ Parallel output terminal setting in global settings

Selecting [Setting]-[System]-[Parallel Port]-[Outputs] enables you to check the initial assignment status of output terminals.

The parallel output terminal unit can use only the terminals to which system variables (%OutDataA to H) for any data output are assigned in system settings. In initial values, 16 points are assigned as %OutDataA. %OutDataB can also be assigned to other parallel output terminals.

However, it's often the case that "%Ack (command completion signal)" and "%CmdReady (command acceptance status signal)" assigned as their initial values are required in control. For this reason, note when reassigning these signals.

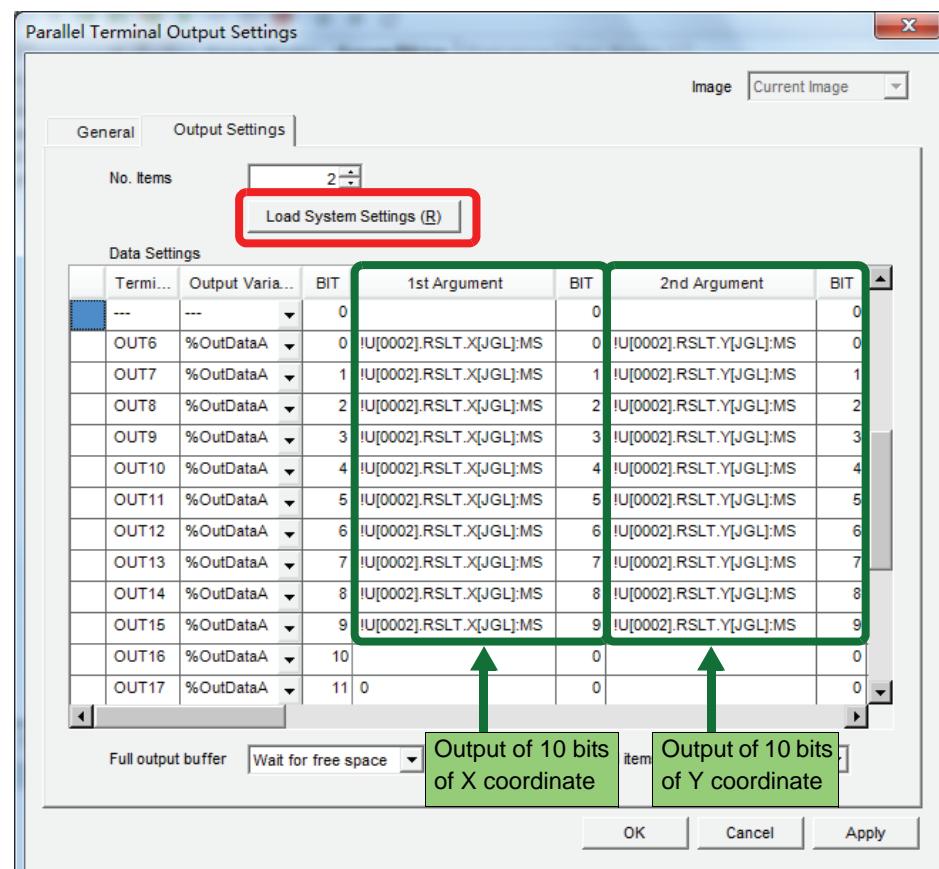
Terminal	Output Function	BIT
F_OUT0	%Flash1	0
F_OUT1	%Flash2	0
F_OUT2	%Error0	0
F_OUT3	%Run	0
OUT0	%Ack	0
OUT1	%Nack	0
OUT2	%Busy	0
OUT3	%CmdReady	0
OUT4	%Trg1Ready	0
OUT5	%Trg2Ready	0
OUT6	%OutDataA	0
OUT7	%OutDataA	1

■ Parallel output terminal setting in system settings

Add a parallel terminal output unit to the image processing flowchart.

Opening the [Output Settings] tab and clicking [Load System Settings] reads "%OutDataA to H" specified in global settings. Next, set the number of data that you want to output [No. Items (up to eight times)].

Lastly, assign the data that you want to output to [1st Argument] and [2nd Argument], etc., and specify bits.



In the above example, the X and Y coordinates in the ShapeTrax2 detection position are output from the IO terminals. The X coordinate and Y coordinate each use 10 bits. 20 bits cannot be assigned at a time, so they are output over two times.

If 1 data is 8 bits or less, two results can be output simultaneously using the first 16 bits of OutDataA.

Basic Tutorial_2_6: Parallel Terminal Output

Parallel terminal output

The total status is output from a parallel port. Parallel terminal output is convenient for high-speed data output because high-speed (1 ms or less) data output in the binary format can be started from a terminal block.

Flow of setting

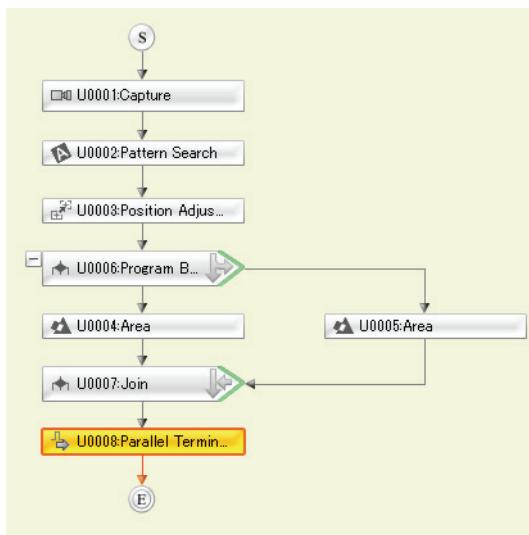
To enable data output from parallel ports, use the following procedure:

- (1) Add a [Parallel Terminal Output] unit.
Data output from the parallel port is started when data passes the parallel terminal output unit.
- (2) In [Global Settings], set [Output Type] to [Sync with STO].
The total status is output in synchronization with STO.

<Output Type>

- Latching: Latch the output of an NG result for the next inspection and beyond. (To unlatch, either reset the controller, change the program, or turn the outputs off.)
- Synchronize with STO output (default): Turn the output on and off for parallel terminal output units in synchronization with the %Sto state.
- One shot: Turn the output on for the time specified in [One shot time (ms)] and turn off immediately after.

Flowchart image drawing

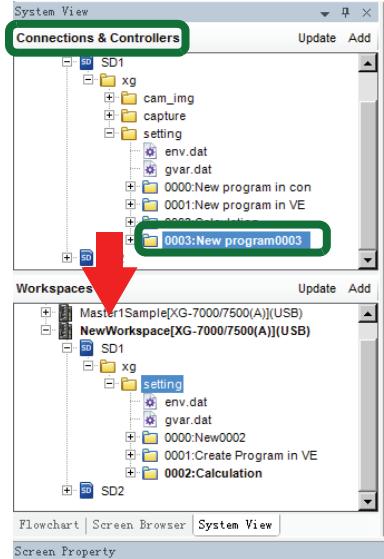


Preliminary preparation

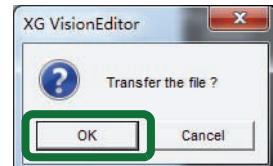
1. Download [0003:New 0003].

- (1) Select [System View]-[Connections & Controllers]-[0003:New program0003].

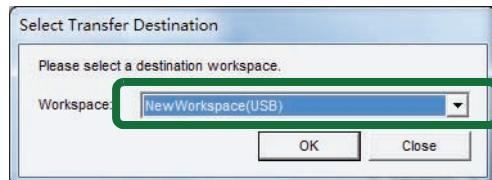
- (2) Right-click to [0003:New program0003].



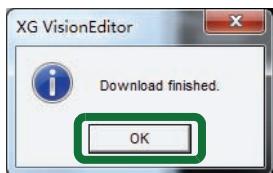
- (3) The following confirmation menu appears. Click [OK].



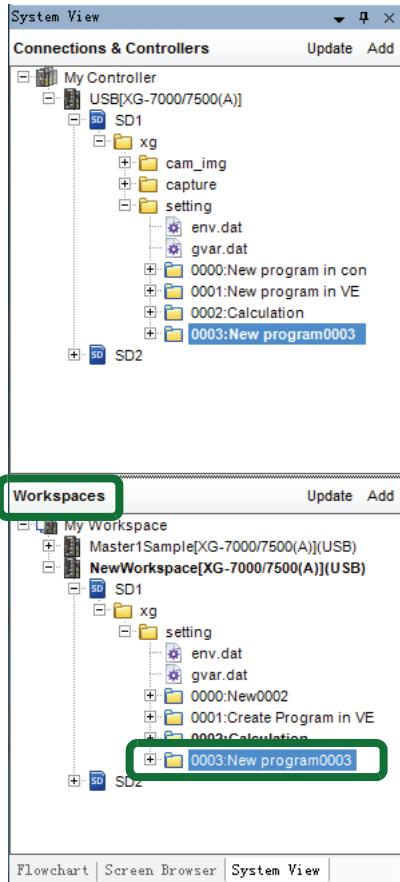
- (4) The following [Select Transfer Destination] dialog box appears.
Select [New Workspace (USB)].



- (5) The following confirmation menu appears. Select [OK].

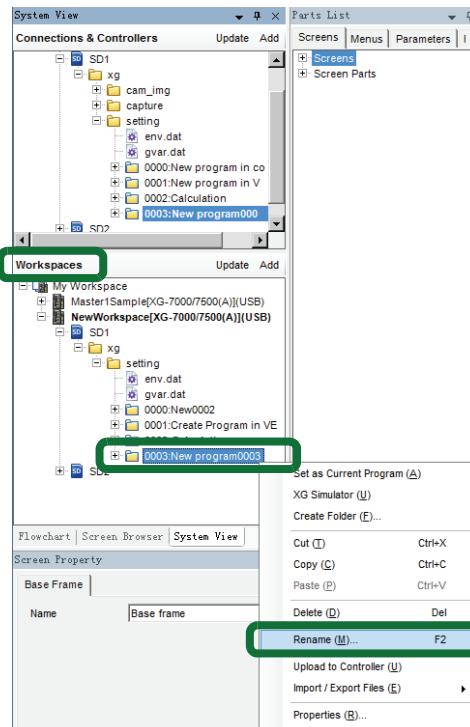


- (6) Check that [0003: New program0003] has been added to [Workspaces] in [System View].

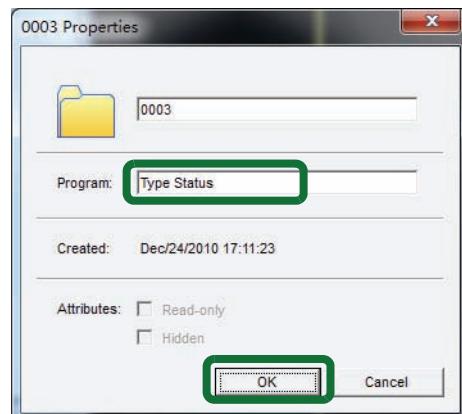


- 2. Change the name of [0003: New program0003] to [Type Status].**

- (1) In [Workspaces], right-click on [0003: New program0003], and click [Rename].

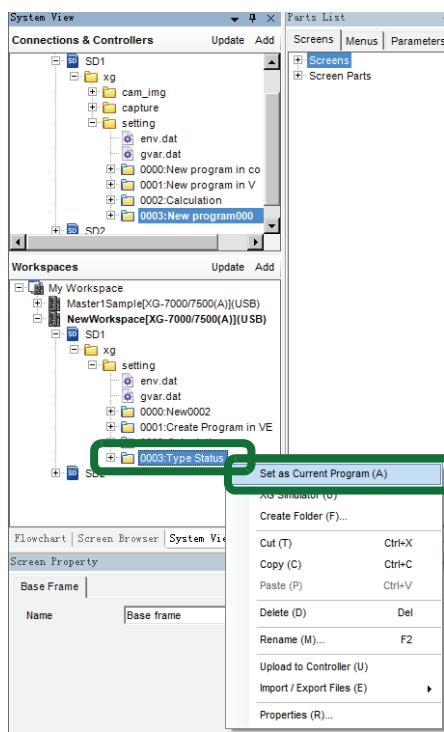


- (2) Enter [Type Status] from the [Program] input field. After entering [Type Status], click the [OK] button.

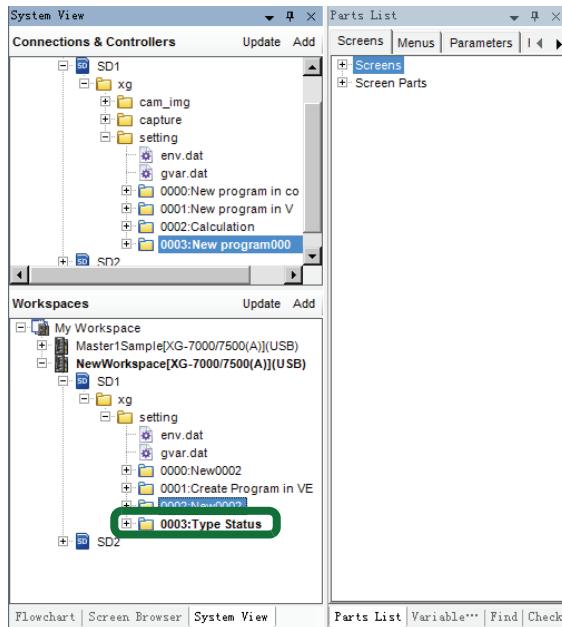


3. Select [Set as Current Program] as [0003:Type Status].

- (1) Right-click on [0003:Type Status].
Click [Set as Current Program].



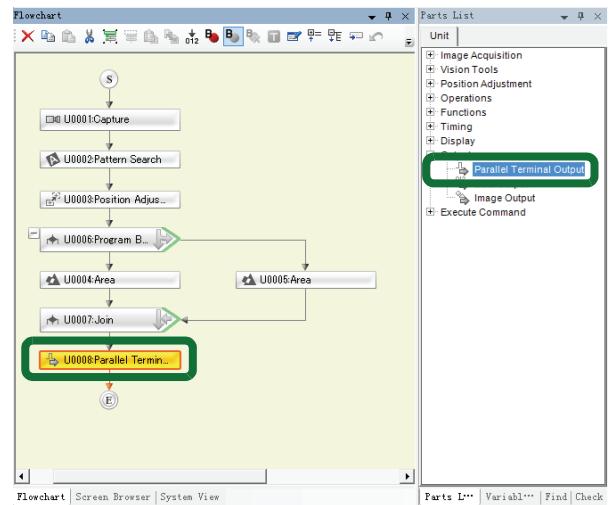
- (2) Check that [0003:Type Status] is displayed in boldface. The part displayed in boldface is [Active Program].



Adding a [Parallel Terminal Output] unit

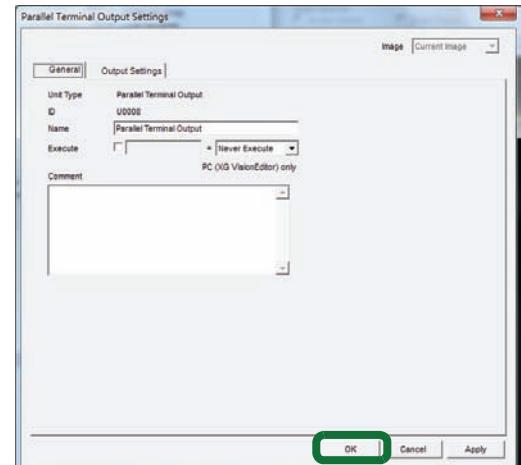
4. Add a [Parallel Terminal Output] unit.

- (1) Drag and drop [Parts List]-[Output]-[Parallel Terminal Output] (the last end unit in the flowchart).



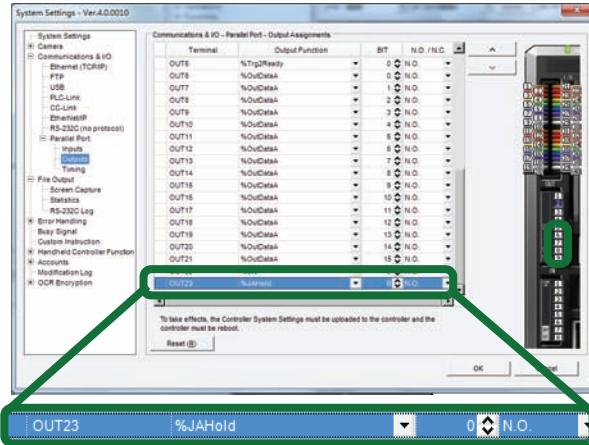
- (2) [Unit Properties] of the [Parallel Terminal Output] unit opens.

Click the [OK] button to close the window.



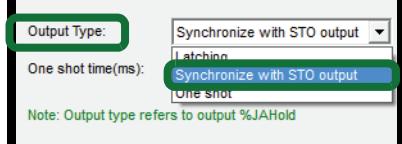
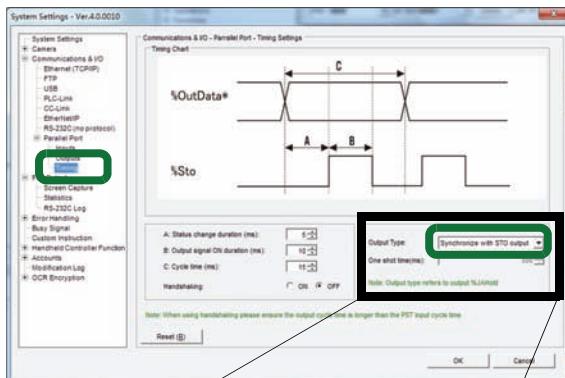
Setting output type to Sync with STO

5. From the menu bar on the top of the window, select [Settings]-[Global]-[I/O]-[Parallel Port]-[Outputs]. Check that the system variable [%JAHold] is assigned to the [OUT23] system.

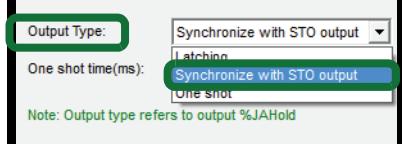
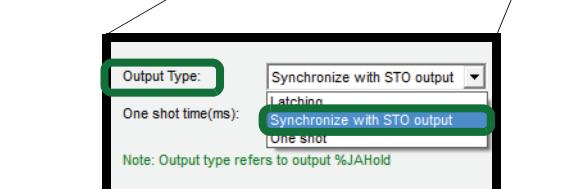
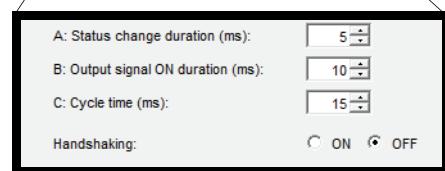
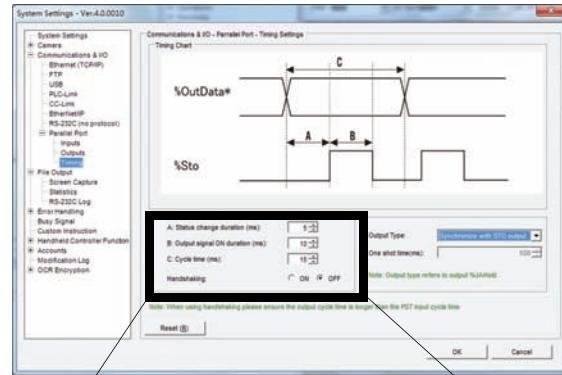


You can immediately find which terminal is the terminal of which position of the real controller. When you click a terminal name, the appropriate terminal of the controller on the right becomes blue.

6. From the menu bar on the top of the window, select [Settings]-[Global]-[I/O]-[Parallel Port]-[Outputs]. Check that [Output Type] is set to [Synchronize with STO output].



7. To change output timing, from the menu bar, select [Settings]-[Global]-[Communication & I/O]-[Parallel Port]-[Timing].



Check whether data has been output.

8. Check whether the data set in parallel terminal output has been output.

- Check the offline simulation result from the Unit Result View by clicking the [Execute one time] button from the toolbar.

When the total status is OK, [%JAHold] is [0].

Unit Result				
Unit	System	Local	Global	
Name	Starting Point	Number ...	Current...	
%InDataAsyncG	-	-	0	
%InDataAsyncH	-	-	0	
%InDataFieldbus	0	100		
%JAHold	-	-	0	

When the total status is NG, [%JAHold] is [1].

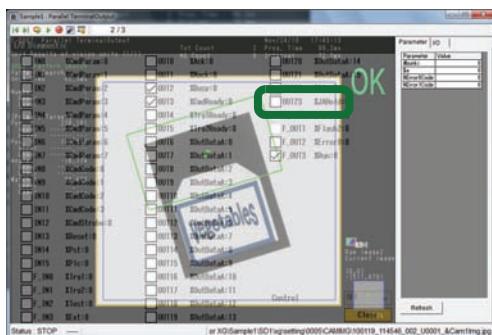
Unit Result				
Unit	System	Local	Global	
Name	Starting Point	Number ...	Current...	
%InDataAsyncG	-	-	0	
%InDataAsyncH	-	-	0	
%InDataFieldbus	0	100		
%JAHold	-	-	1	

- From the menu bar, click [Tools]-[XG Simulator] and check the offline simulation result with single simulation.

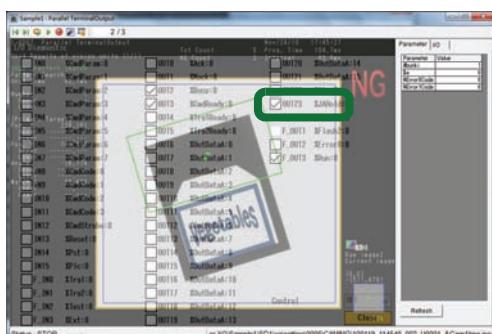
Performing the following operation from the keyboard displays [FUNCTION]-[I/O Diagnostic] from which you can check the terminal I/O status. Check the terminal I/O status from [FUNCTION]-[I/O Diagnostic].

Clicking the [MENU] button displays the Monitor window behind the current window.

When the total status is OK, the OUT23 check box is [Not Checked (Cleared)].



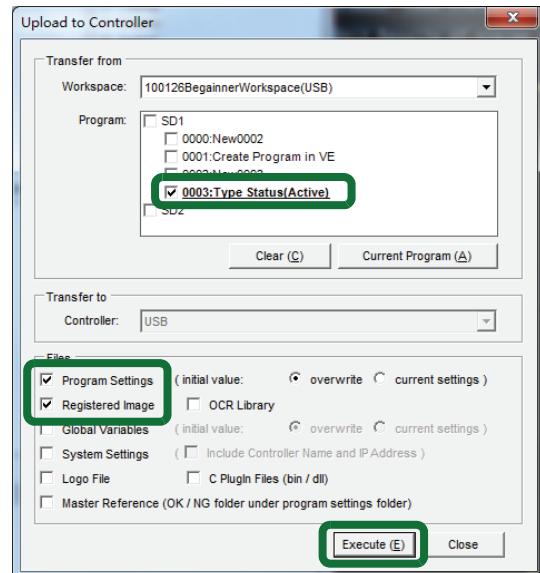
When the total status is NG, OUT23 is [Checked (Selected)].



The settings are now complete.

Check the status on the controller.

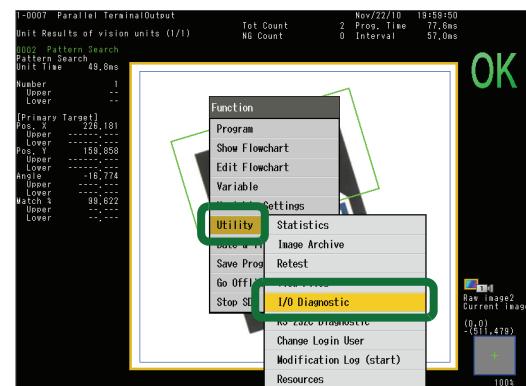
9. Upload [0003:Type Status].



10. Check the I/O diagnostic.

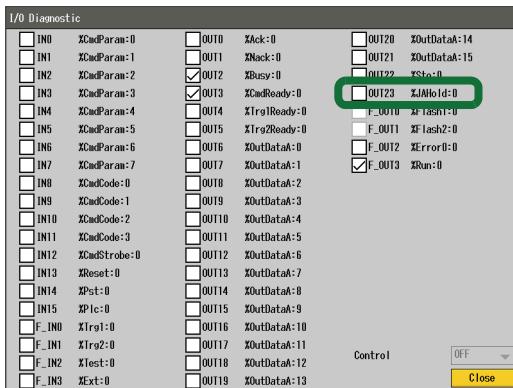
11. Press a back key on the console.

With [Utility]-[I/O Diagnostic] selected, press the [Enter] button on the console.

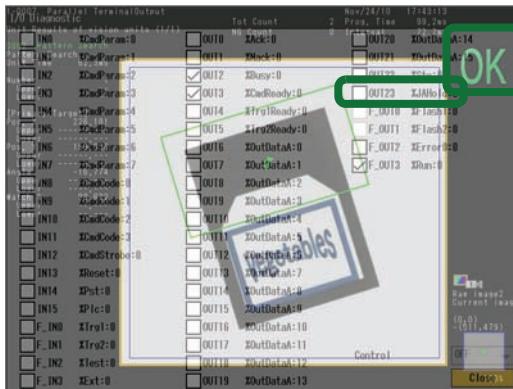


12. Capture OK images and check the I/O diagnostic status.

- (1) When the total status is OK, the OUT23 check box is cleared.

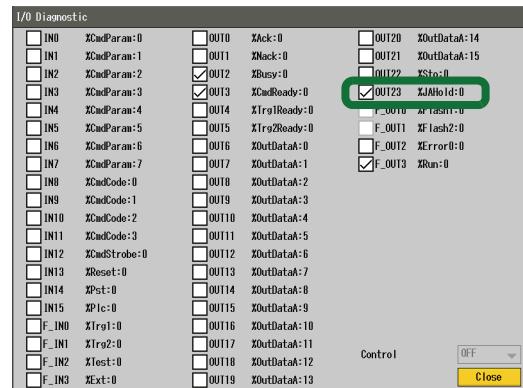


- (2) When you press the [MENU] button on the console, the monitor window becomes transparent.

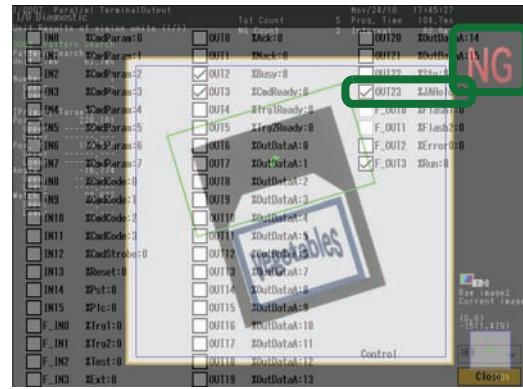


13. Capture NG images and check the I/O diagnostic status.

- (1) When the total status is NG, the OUT23 check box is selected.

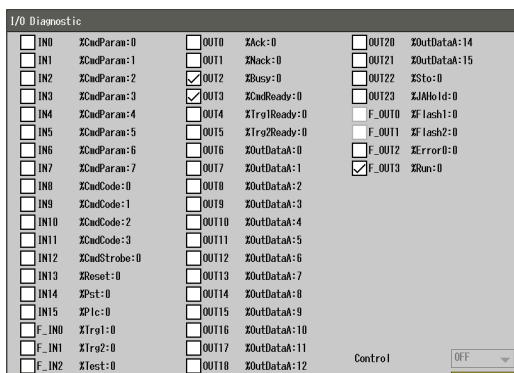


- (2) When you press the [MENU] button on the console, the monitor window becomes transparent.



■ What is an I/O diagnostic?

You can check the connection status of I/O signals from parallel ports (parallel I/O interface and terminal block interface) of this system via an I/O diagnostic. An I/O diagnostic is convenient in that you can check the connection status of terminals of this system connected to an external device in such cases as when data cannot be appropriately exchanged between connected devices. From the function menu on the console, select [Utility]-[I/O Diagnostic].



- The status display of each terminal is rewritten in real time tailored to signal input/output and the check boxes of shorted (ON) terminals are selected.
- To force on a specific output terminal, select [ON] in [Control] and then select the check box of the terminal that you want to short (ON) (valid only in offline mode).

■ What is a trace log?

You can use the timing chart format display on the [Trace Log Viewer] menu to view changes in the status (ON/OFF) of the controller terminals and to view the execution status of the various units and commands from connected devices. By viewing the trace logs actually logged during the production line, you can efficiently identify the locations of timing offset during flowchart execution and external control and the locations that create bottlenecks in terms of processing time. You can also set the criteria to control logging. This is useful for analyzing phenomena that occur at times that cannot be identified during operation.

Information recorded in trace logs

Trace logs record the execution status of the connected controller as an "event" immediately after logging is started. An event indicates the point at which the logging target changed as follows. *Up to 7,000 events of data can be left in the trace log.

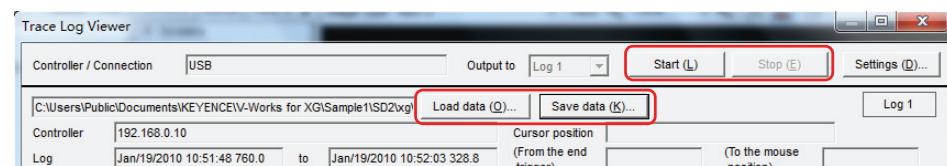
- Terminal turned ON or OFF (counted as one event when turned ON or OFF)
- Start or end program, flowchart, or unit (counted as one event when starting or ending)
- Receive or end command (counted as one event when receiving or ending)

■ How to use the trace log

Selecting [Tools]-[Trace Log Viewer] opens the following window:

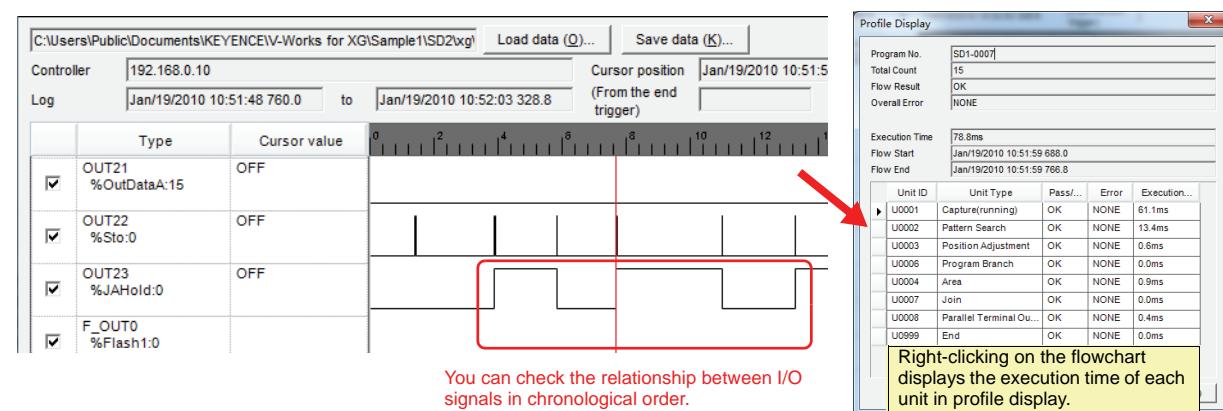
Check that the trace log is connected to the controller and start log collection.

Until the [End Logging] button is clicked, the unit execution status is saved as the trace log.



The trace log can also be saved (data save). In addition, the saved data can be read (data read).

■ Trace log results



Basic Tutorial_2_7: Using I/O Diagnostic and Trace Log

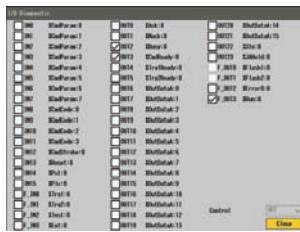
I/O diagnostic and trace log

I/O diagnostic enables you to check the connection status of I/O signals from the I/O connectors (parallel I/O interface and terminal block interface) of this system during operation or setting.

The trace log enables you to use the timing chart format display on the [Trace Log Viewer] menu to view changes in the status (ON/OFF) of the controller terminals and to view the execution status of the various units and commands from connected devices.

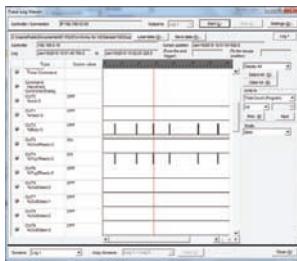
■ Differences between I/O diagnostic and trace log

I/O Diagnostic



You can know the current ON/OFF status of each parallel port from the I/O diagnostic.

Trace Log Settings



The trace log enables you to leave the ON/OFF status of each parallel port in the timing chart format.

■ Types of data that can be collected by the trace log

- (1) Status change of each terminal
- (2) Execution status of each unit

You can know not only the status change of each terminal but also the execution status (what unit required how many milliseconds) of each unit from the trace log.

■ Example of using the data collected in the trace log

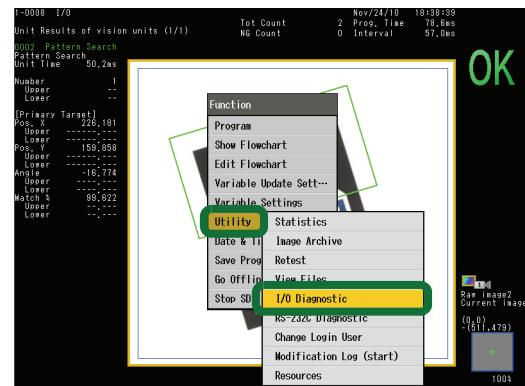
- (1) You can trace the causes of I/O errors because you can know the status change of each terminal in chronological order from the data collected in the trace log.
- (2) You can understand which unit is a bottleneck when you want to delete measurement time because you can know the execution status and time of each unit from the data collected in the trace log.

I/O Diagnostic

I/O diagnostic enables you to check the connection status of I/O signals from the I/O connectors (parallel I/O interface and terminal block interface) of this system during operation or setting. I/O diagnostic is convenient in that you can check the connection status of terminals of this system connected to an external device in such cases when data cannot be appropriately exchanged between connected devices.

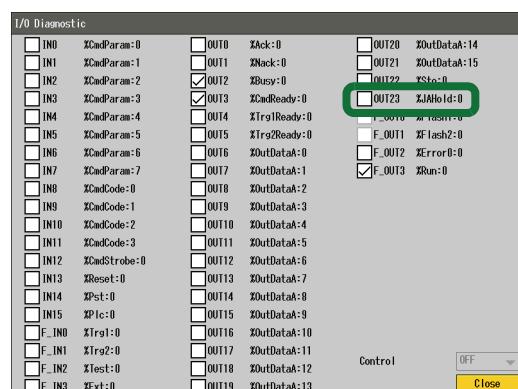
1. Press the back key on the console.

With [Utility]-[I/O Diagnostic] selected, press the [Enter] button on the console.

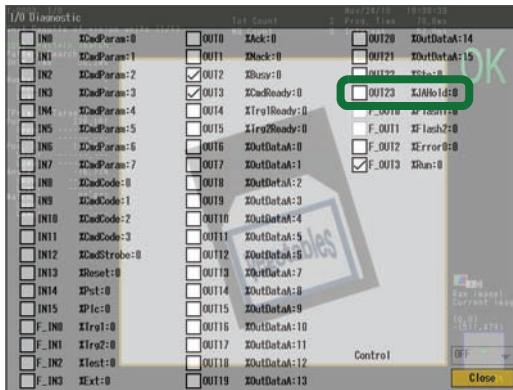


2. Capture OK images and check the I/O diagnostic status.

- (1) When the total status is OK, the OUT23 check box is cleared.

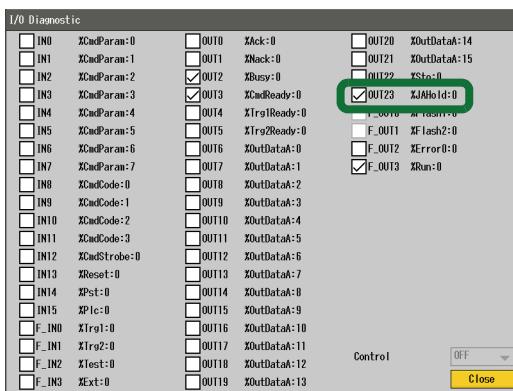


- (2) When you press the [MENU] button on the console, the monitor window becomes transparent.

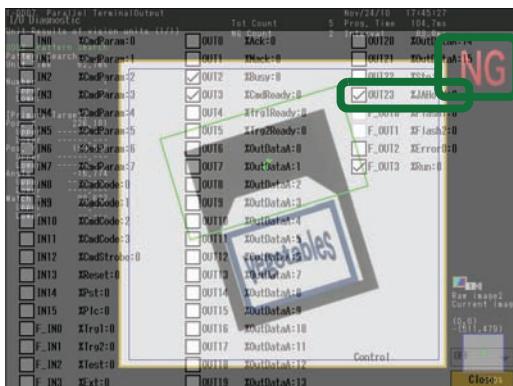


3. Capture NG images and check the I/O board status.

- (1) When the total status is NG, the OUT23 check box is selected.



- (2) When you press the [MENU] button on the console, the monitor window becomes transparent.



Trace Log

You can use the timing chart format display on the [Trace Log Viewer] menu to view changes in the status (ON/OFF) of the controller terminals and to view the execution status of the various units and commands from connected devices.

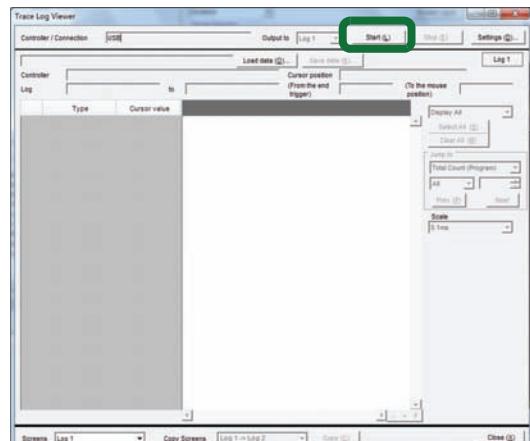
By viewing the trace logs actually logged during the production line, you can efficiently identify the locations of timing offset during flowchart execution and external control and the locations that create bottlenecks in terms of processing time. You can also set the criteria to control logging. This is useful for analyzing phenomena that occur at times that cannot be identified during operation.

4. Collect [Trace Log] with XG VisionEditor.

- (1) From the menu bar on the top of the window, click [Tools]-[Trace Log Viewer].



- (2) Click the [Start] button.



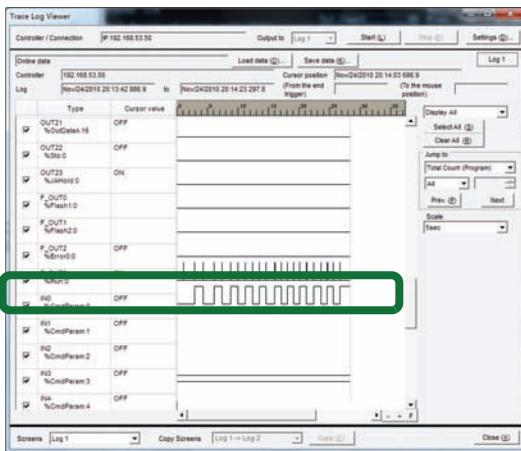
- (3) Trigger OK images and NG images alternately.

- (4) Click the [Stop] button.

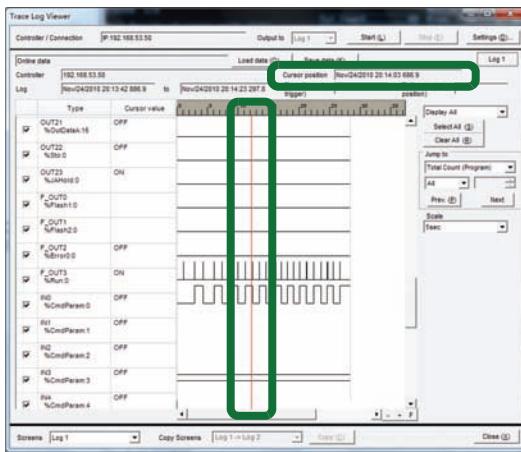


5. Check the status change (ON/OFF status) of each terminal.

- (1) You can check that ON and OFF are alternately arranged from [OUT23].



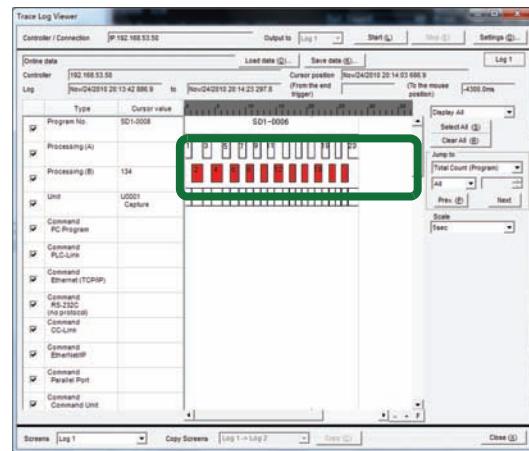
- (2) Clicking here displays [Red Vertical Line]. The time appears in [Cursor Position].



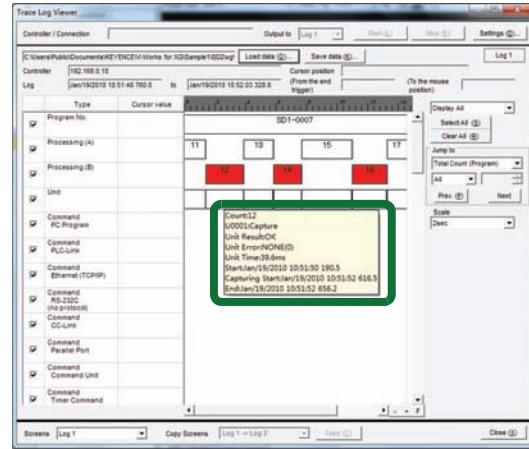
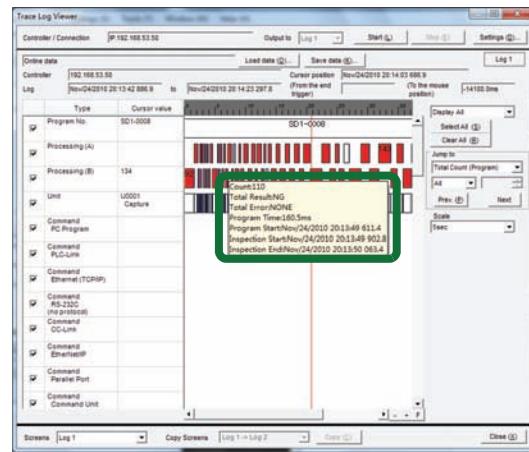
6. Check the execution status of each unit.

- (1) When the judgment is NG, a measurement count is displayed in red.

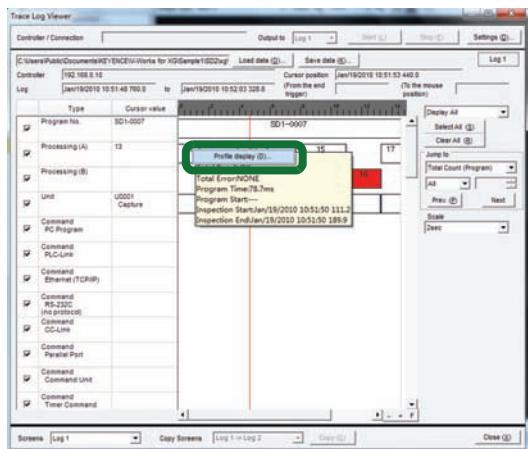
[OK] and [NG] are alternately arranged.



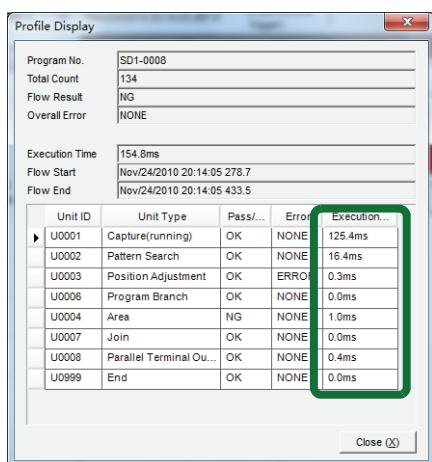
- (2) Data for the measurement count over which the mouse pointer is positioned is displayed.



(3) Right-click and click [Profile display].



(4) You can understand the execution time of each unit from [Profile Display].



Basic Tutorial_2_8: Image Capture Buffer

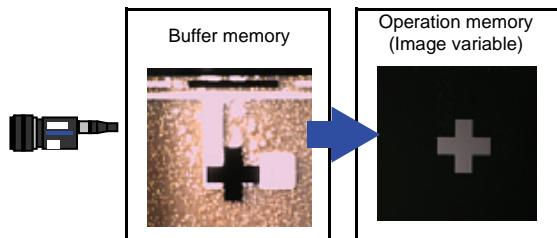
What is the image capture buffer function?

The image capture buffer function can capture images asynchronously with the execution status of a flowchart. The image capture buffer function can buffer capture data to image memory as history logging can. For this reason, this function enables applications that could not be achieved by only the conventional double buffers.

Upgrading the version of the controller to 3.0 enables you to use the image capture buffer function.

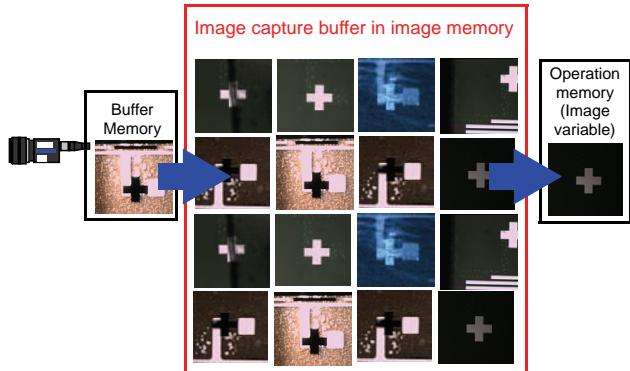
■ Principle of image capture buffer function

i) Capture function of general image processor



Only one image can be captured and accumulated during image processing.

ii) Image capture buffer function (XG-7000 Series)



The image capture buffer function can capture images in parallel with processing during image processing.

This function can also retain up to 1,013 image capture buffers in image memory.

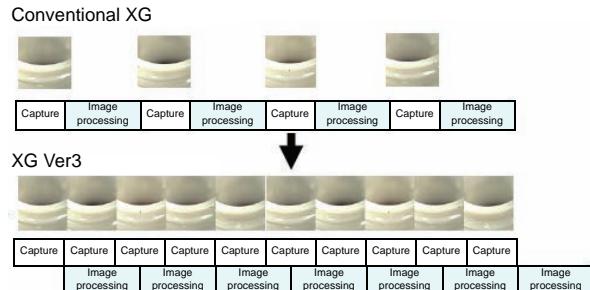
(For XG-035M*1: The number of image capture buffers that can be retained depends on the camera to be used and its settings.)

The function can accumulate image capture buffers by the number of buffers that can be retained without being affected by image processing.

■ Examples of using the image capture buffer function

Application (1): Advance capture

Example) Appearance inspection of workpieces that rotate at a high speed

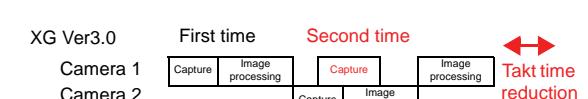
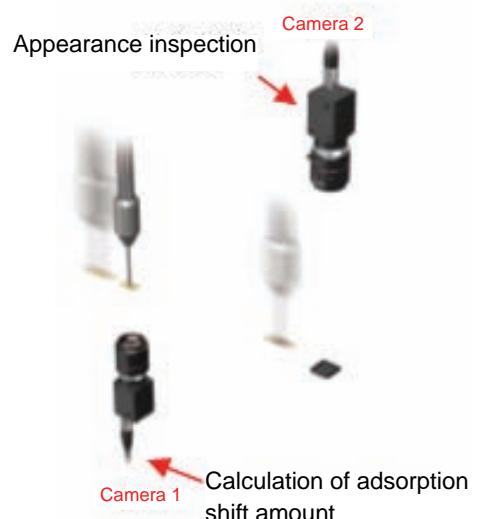


The conventional XG checks foreign matters in the bottle opening. The conventional XG rotates the bottle but could capture images only after the processing of the image take two images back was completed. Even if the double buffer was used.

XGVer3.0 can capture images at the maximum speed without regard for completion of image processing.

Application (2): Multiple inspections in one line

Example) two-camera shift adjustment by chip mounter
→ appearance inspection

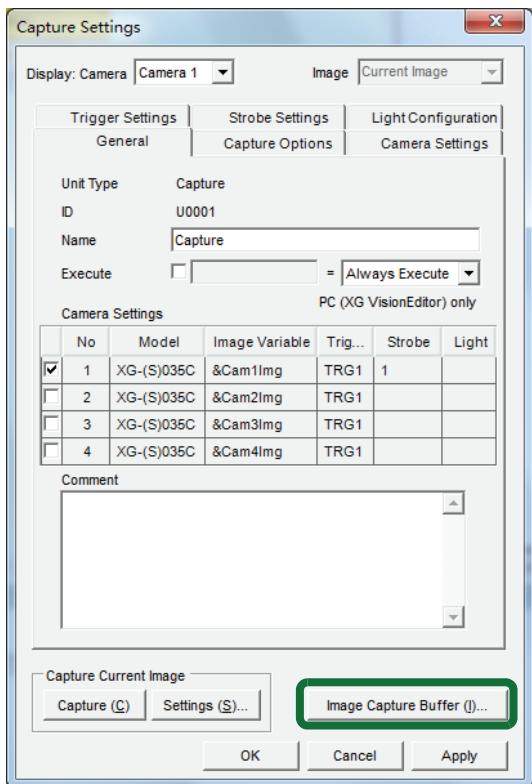


If multiple inspections are performed in one line (when two processes are inspected this time), the post-process trigger input can be performed without waiting for completion of the previous process. An image can be captured even when a capture unit is not being executed.

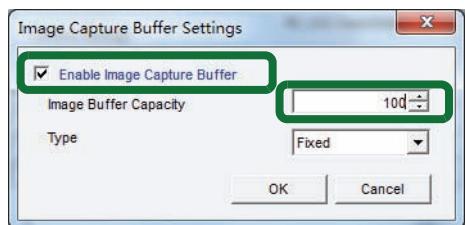
Setting the image capture buffer

1. Set the image capture buffer.

- (1) Open the unit properties of [Capture Unit] and click [Image Capture Buffer Setting] at the bottom.



- (2) Select the check box of [Enable Image Capture Buffer] and set [Image Buffer Capacity] to [100].



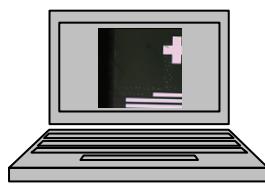
Basic Tutorial_2_9: Capturing On-Site Images to PC

Online simulation mode

Online simulation is to perform simulation using the images captured by the camera connected to the controller. You can check whether settings on your PC are created as intended under the on-site installation conditions on your PC. You can check the processing results of on-site images from images and result data in Vision Window and Unit Result View as you perform simulation using images in your PC.

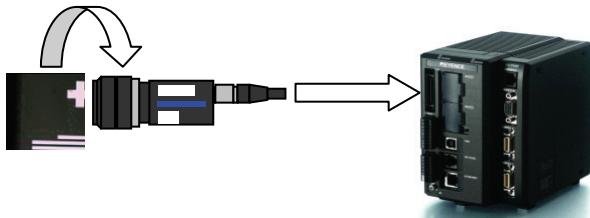
■ Offline simulation and online simulation

Offline simulation



Offline simulation is to perform simulation using images in your PC (images registered in the capture file setting)

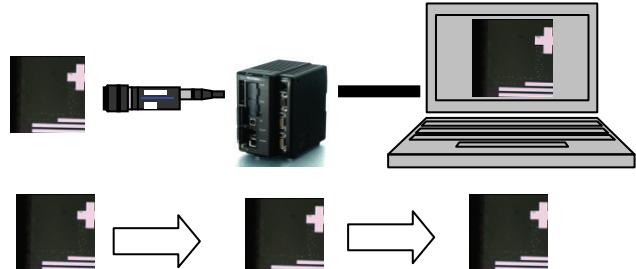
Online simulation



Online simulation is to perform simulation using the images captured by the camera connected to the controller.

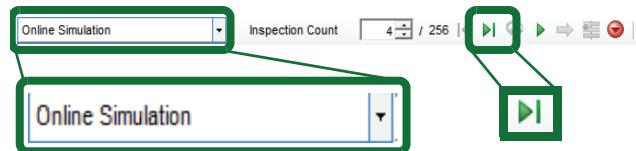
■ Registering on-site images in the capture file setting using online simulation

Register on-site images in the capture file setting using online simulation. Registering on-site images in the capture file setting in advance allows you to perform simulation on your PC even if your PC is not connected to the controller.



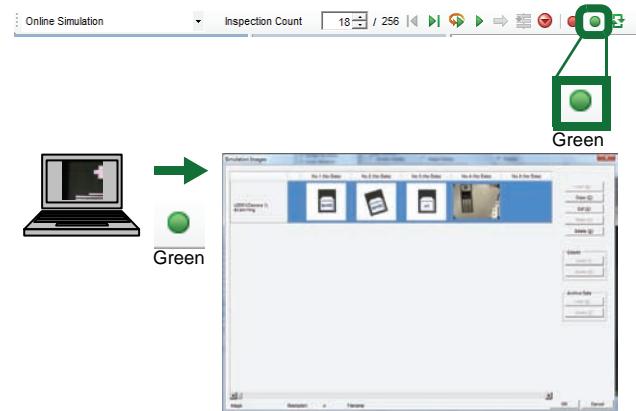
■ Procedure for registering on-site images in the capture file setting

(1) Register the captured images in the capture file setting.



Perform simulation using on-site images.

(2) Capture images with online simulation.

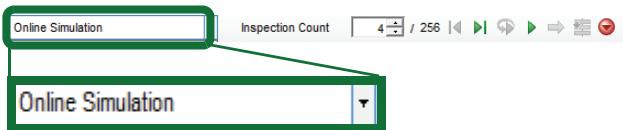


Clicking the green circle registers the latest captured image in the capture file setting.

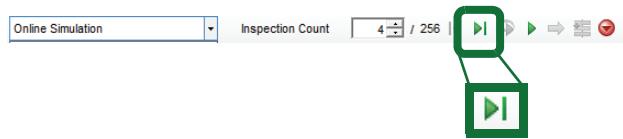
Registering on-site images in the capture file setting

1. Register on-site images in the capture file setting.

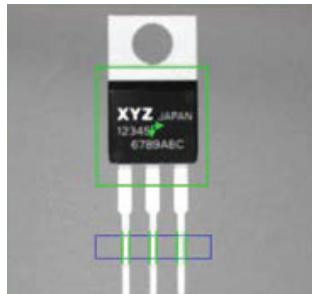
- (1) Change [Offline Simulation] in the upper left of the window to [Online Simulation].



- (2) Click [Excute one time] to perform simulation.

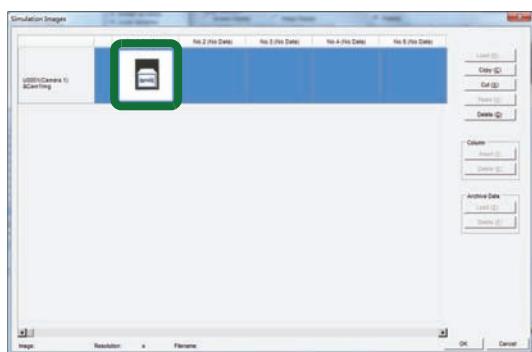


- (3) Capture the following workpiece in the upright status by clicking [Excute one time] or [Run Continuously].

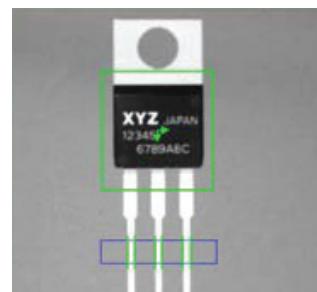


- (4) Click the green circle button (captured image addition) to register the workpiece in the capture file setting.

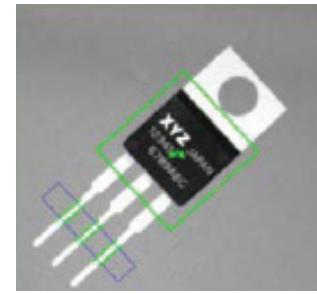
- (5) Check [Settings]-[Simulation Image] in the menu bar on the top of the window.



- (6) Repeat (2) to (5) to also register the following two images in [Simulation Images].

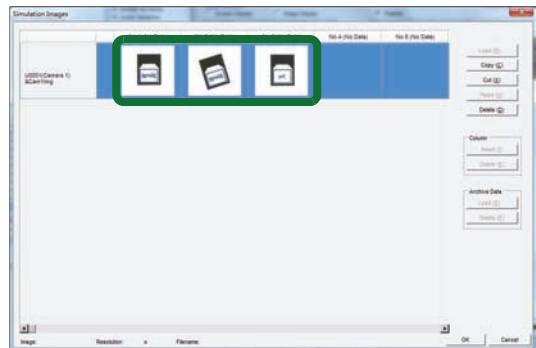


Upright workpiece



Tilted workpiece

- (7) Check [Settings]-[Simulation Images] in the menu bar on the top of the window.



■ Screen configuration parts available with the VisionEditor

Screen display (P00 to P99)

Controller display screens.

Image display (maximum 5 screens)

This is an area part that displays the image captured with the camera.

Base frame (BF, only 1)

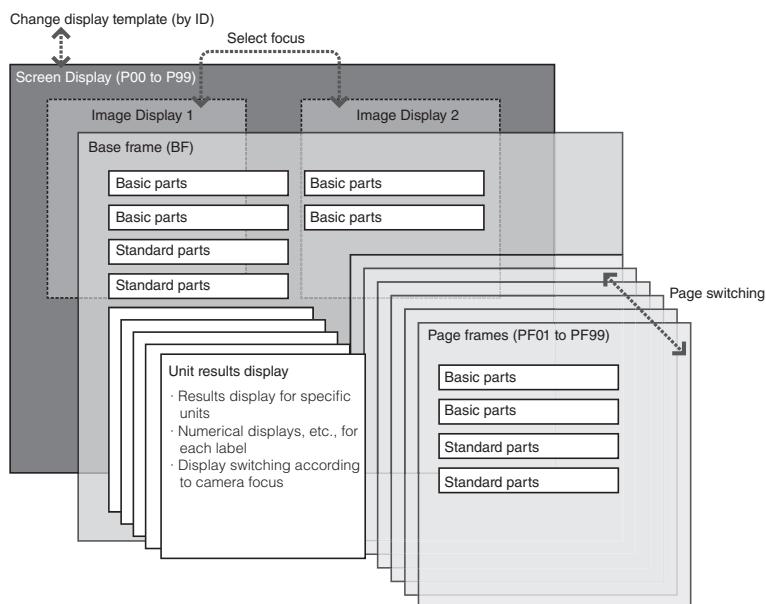
This is an 800x600-pixel area part. All screen parts can be placed on the base frame.

- 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)

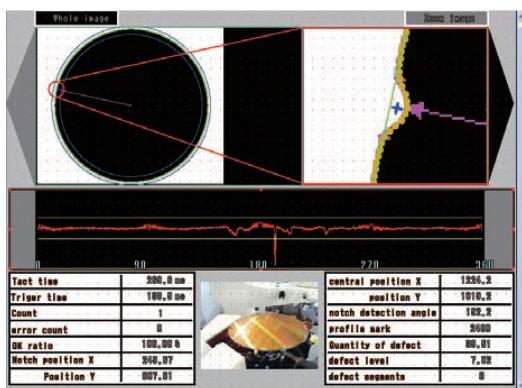
This is an 800x600-pixel area part with page switching support.

Like the base frame, it can be laid out with basic parts and most standard parts.



■ Screen display basics

(Screen display example)



The following three views of the VisionEditor are mainly used for setting a screen display:

- (1) Screen Browser: Used to set/confirm a displayed flowchart.
- (2) Screen Editor: Used to set/confirm a displayed screen.
- (3) Screen Property: Used to set/confirm the setting of a displayed part.

Refer to "1-5" for details of each view.

The parts on the currently selected page frame appear visible on top of the base frame display.

The maximum number of parts that can be placed on a single screen display is 4000, including area parts.

Parts you want to be visible at all times for the current screen display should be placed directly on the base frame, whereas parts that need only be visible in certain situations should be placed on a page frame that is called into use when needed. This allows flexible display possibilities with a single screen display.

■ Screen display styles and screen parts

Screen display styles

(19 types)

- Blank
- Single Display (reduced screen)
- Single Display (full screen)
- 2 Equal Displays (reduced screen)
- 2 Equal Displays (full screen)
- Vertical Split Display (reduced screen)
- Vertical Split Display (full screen)
- Horizontal Split Display (reduced screen)
- Horizontal Split Display (full screen)
- 4-way Equal Split Display (reduced screen)
- 4-way Equal Split Display (full screen)
- Main +3 Smaller Right Displays (reduced screen)
- Main +3 Smaller Right Displays (full screen)
- Main +3 Smaller Bottom Displays (reduced screen)
- Main +3 Smaller Bottom Displays (full screen)
- Main +4 Smaller Right Displays (reduced screen)
- Main +4 Smaller Right Displays (full screen)
- Main +4 Smaller Bottom Displays (reduced screen)
- Main +4 Smaller Bottom Displays (full screen)

Parts that can be placed directly on a screen display

- Image display
- Base frame
- Page frame

Parts that can be placed on a base frame or page frame

- | | |
|------------------|-------------------------------------|
| • Basic parts | • Standard parts |
| -Value | -Program Name |
| -Text | -Inspection Date |
| -Active Text | -Inspection Time |
| -Horizontal Line | -Display Camera & Image Information |
| -Vertical Line | -Display Area & Magnification |
| -Point | -Total Status Pass / Fail |
| -Rectangle | -Logo Image (BMP) |
| -Circle | -Unit Details (vision tools) |
| -Polygon | -Unit Details (non-vision tools) |
| -Table | -Variable List |
| | -Unit Pass / Fail Graphic |
| | -Unit Result Summary List |

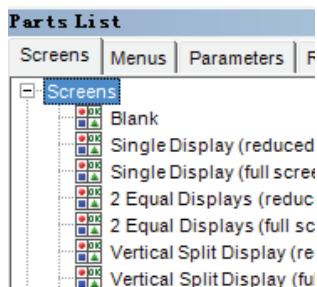
■ Setting a screen display

The Screen Browser/Screen Editor/Screen Property and Parts List are mainly used for setting a screen display. The basic procedure to create a screen display is as follows: Drag and drop a desired item from [Screens] or [Screen Parts] in the Parts List onto a desired position on the Screen Editor and define details.

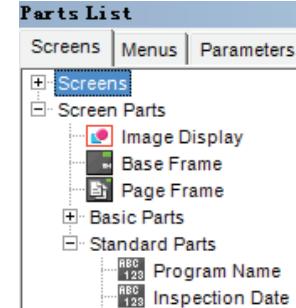
Step (1): Select [Screens] in the Screen Editor.



Step (2): From [Parts List] - [Screens], select a desired screen display style and add it to the Screen Editor.



Step (3): From [Parts List] - [Screen Parts], select a desired part and add it to the Screen Editor.



Step (4): Set the details of the part in the Screen Property.



Step (5): After adding necessary part(s) in step (3), check the result in the Screen Editor.

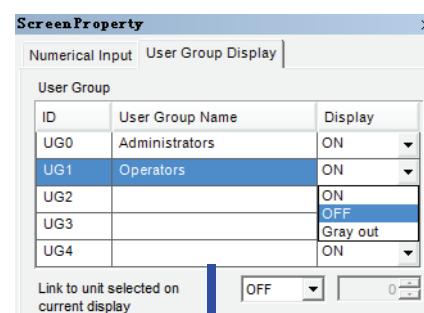
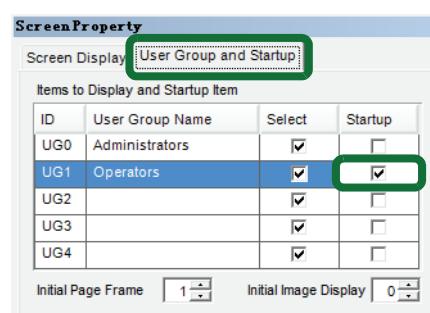


■ User group UI

The XG Series offers a security function necessary for field operation, allowing different user interfaces (UIs) to be assigned to each user.

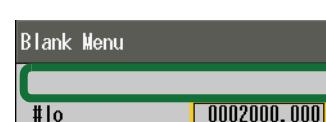
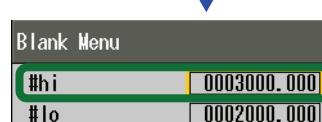
Specify a user group (UG0 to UG4) to each user account (100 accounts max.) to which he/she belongs.

User interfaces (screen displays and menus) can be customized differently for each user group.



Whether to show or hide a specific part can be selected differently for each user group. A setting menu which can be used only by administrators can be created.

The screen display shown at startup can be specified differently for each user group.



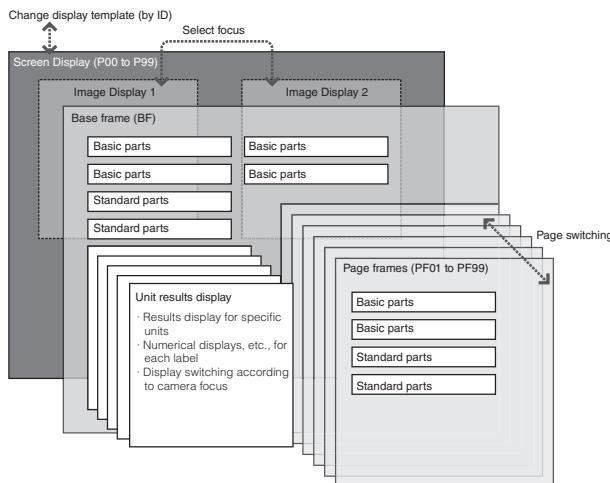
Basic Tutorial_3_1: Screen Display

Screen display

The user interface of the XG Series consists of a screen which displays various information including current images and image processing results (screen display), and of operating elements used to change setting parameters or judgment limits (menus).

This exercise introduces a "screen display".

■ What is a screen display?

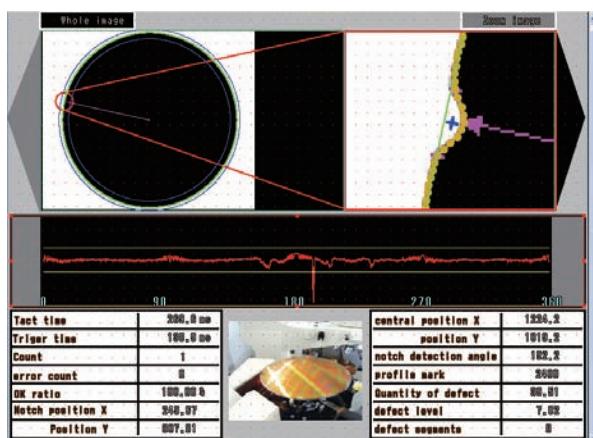


A "screen display" has a structure as shown above. One or more "image displays" are placed on the underlying "screen display".

Each inspection result data and text is regarded as a part and is placed on a frame called a "base frame".

A screen display basically consists of these "image display(s)" and "base frame".

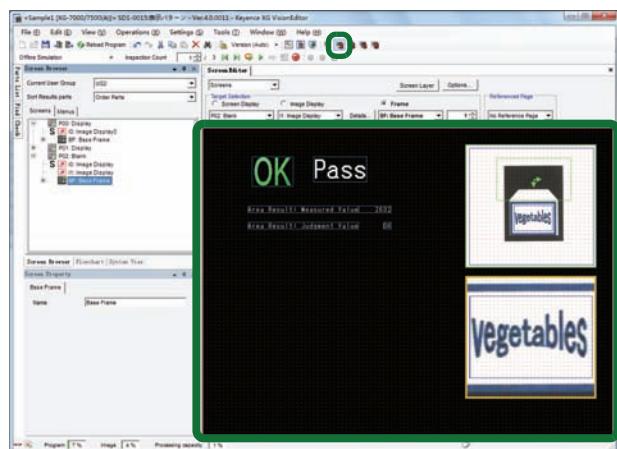
■ Screen display sample



You create a "screen display" on the "Screen Editor".

■ What is the Screen Editor?

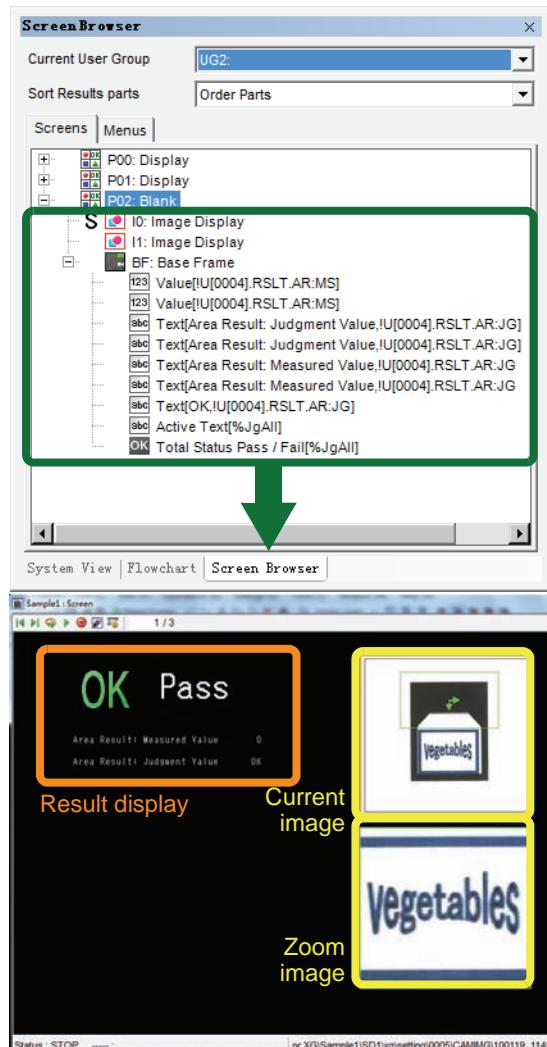
Layout 2



The "Screen Editor" allows customization according to the field operation of each user.

Parts such as "image displays", "text" and "values" are laid out on the "Screen Editor".

■ Example of the screen display to be created



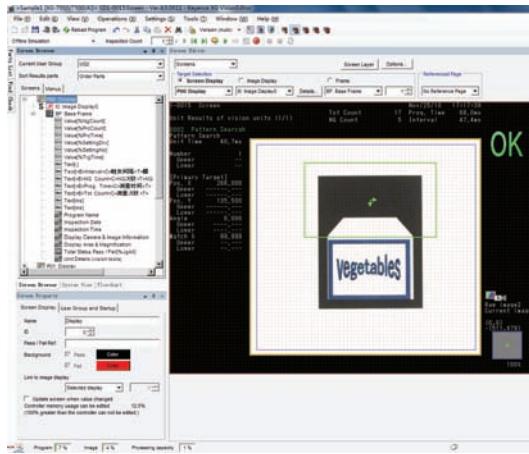
Creating a new screen display

1. Change the "layout".

- (1) Change the "layout" to "2".



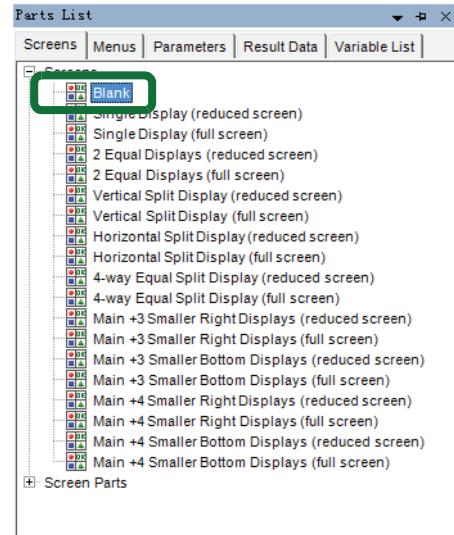
- (2) Check that "Screen display: P00", which is set by default, is displayed.



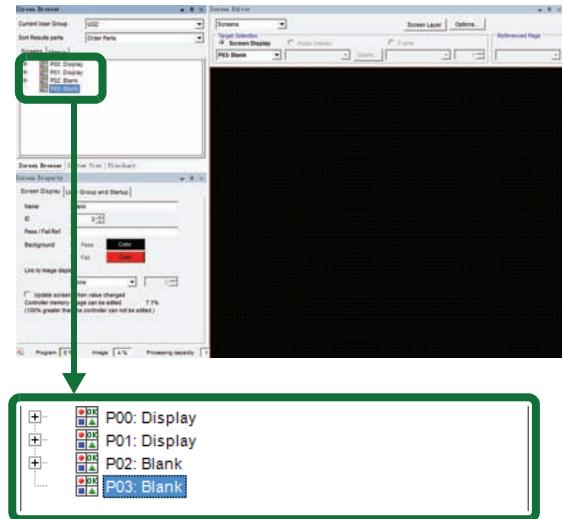
If you do not set a "screen display" in particular, "P00" is displayed as a screen on the monitor.

2. Create a new "screen display".

- (1) Select [Parts List] - [Screens] - [Screens] - [Blank], and drag and drop it onto [Screen Editor].



- (2) Check that [P03: Blank] has been added.

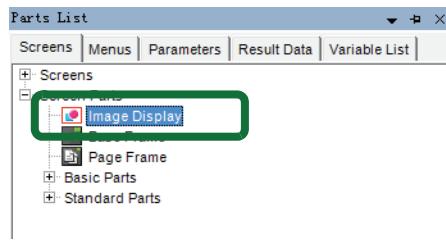


Today, we will configure "Screen display P02". Right now, you can see that there is no part in this screen display.

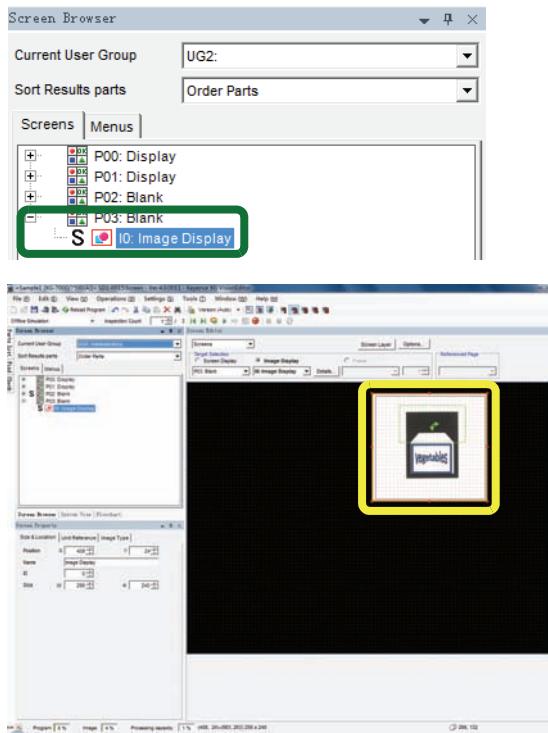
3. Place an "image display".

By placing an "image display" in "P02", you will be able to view an image.

- (1) Select [Parts List] - [Screens] - [Screen Parts] - [Image Display], and drag and drop it onto [Screen Editor].

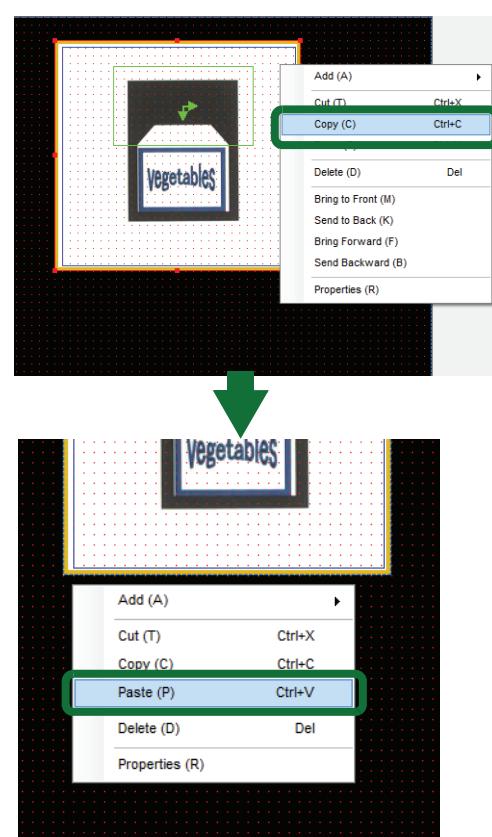


- (2) Check that [I0: Image Display] is added to [Screen Browser] - [Screens] - [P03: Blank].
Also, confirm that an "image" is displayed in [Screen Editor].



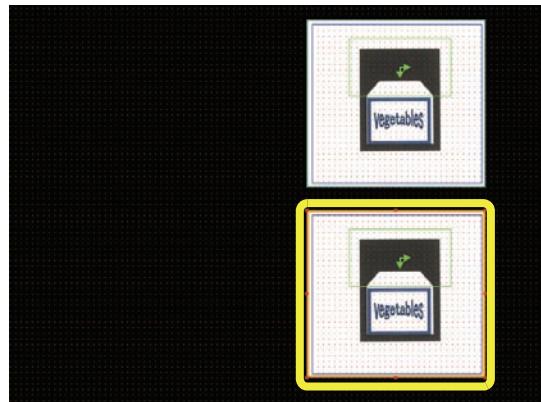
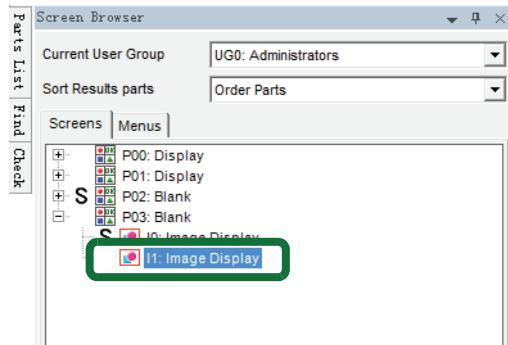
- (3) Right-click on the "image display" in [Screen Editor] and select [Copy].

Right-click again and select [Paste].



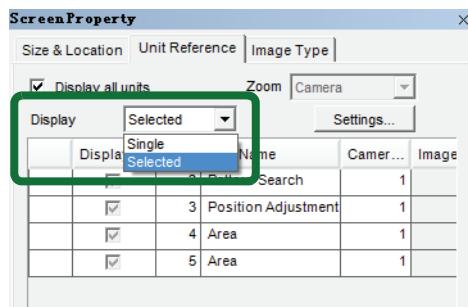
- (4) Check that [I1: Image Display] is added to [Screen Browser] - [Screens] - [P03: Blank].

Also, confirm that an "image" is displayed in [Screen Editor].

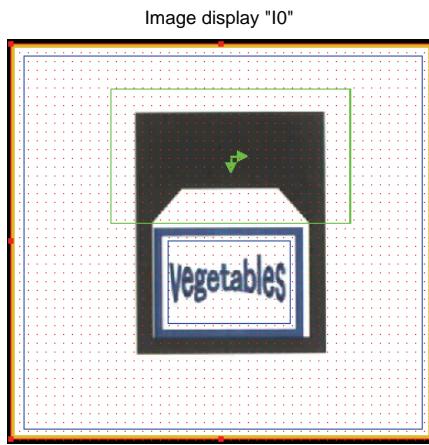


(5) Click [I0: Image Display].

Select [Screen Property] - [Unit Reference] - [Display] - [Selected].



Check that more than one "region" is displayed on "I0".



(6) For "I1", set a "zoom display" to its "area" inspection region.

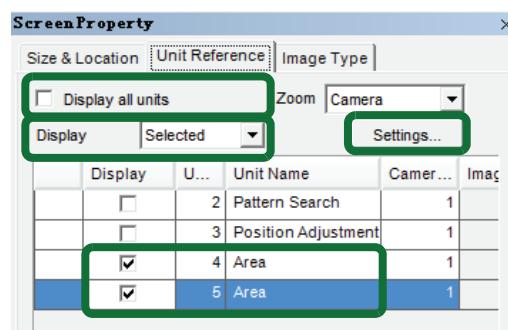
Remove the check mark for "Display all units".

Click "I1" on [Screen Editor].

Select [Screen Property] - [Unit Reference] - [Display] - [Selected].

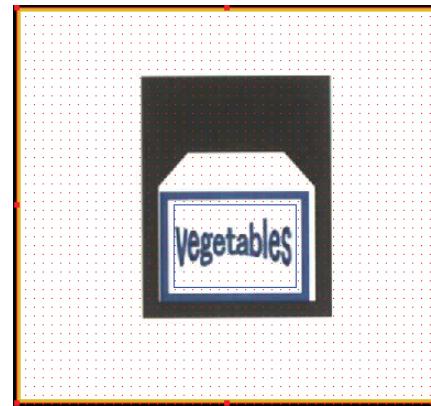
Check the check boxes for [Area] (ID4, ID5).

Click the [Settings] button.

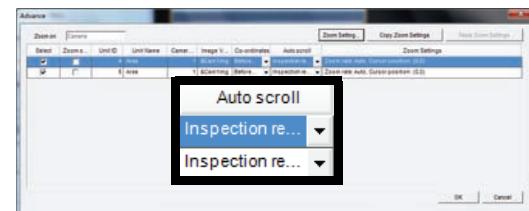


Check that more than one "area region" is displayed on "I1".

Image display "I1"



(7) Select [Auto scroll] - [Inspection region].



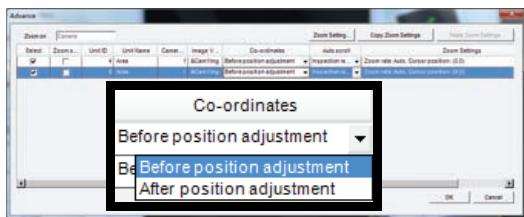
View [Screen Editor].

Execute simulation one time and check the images.



You can see that the image was "zoomed" in accordance with the "area" inspection region.

- (8) Adjust the position of the "auto scroll" region.
Check that [Co-ordinates] is set to [Before position adjustment].

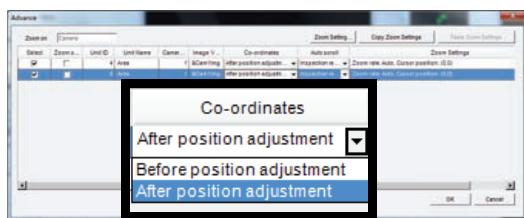


With this setting, the "area" region of the second image is tilted.

<Second image>



Change [Co-ordinates] to [After position adjustment] and click the [OK] button to close the window.
Execute simulation one time and check the second image.



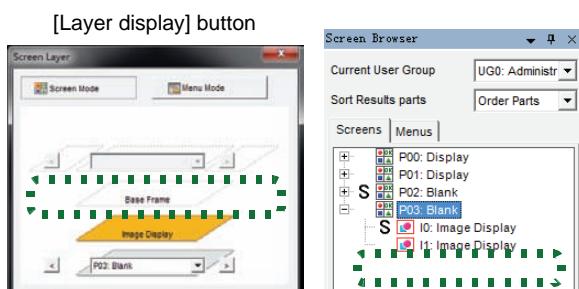
<Second image>



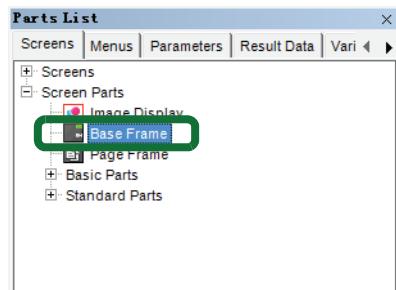
Selecting [After position adjustment] makes the position of the image adjusted when the target is tilted. This ensures that the image is always displayed at a proper angle.

4. Make the setting to display inspection result and text.

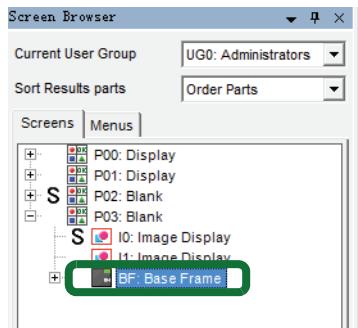
To display inspection result and text, you need to place a "base path".



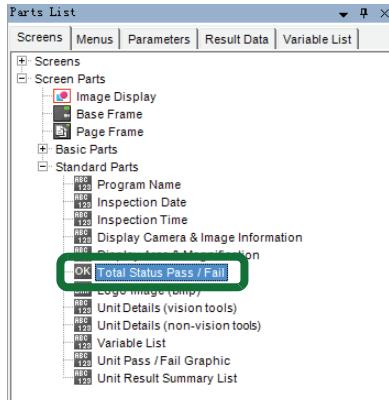
- (1) Place a "base path".
Select [Parts List] - [Screens] - [Screen Parts] - [Base Frame], and drag and drop it onto [Screen Editor].



Check that [Base Frame] is placed on [Screen Browser].



- (2) Select [Parts List] - [Screens] - [Screen Parts] - [Standard Parts] - [Total Status Pass / Fail], and drag and drop it onto [Screen Editor].

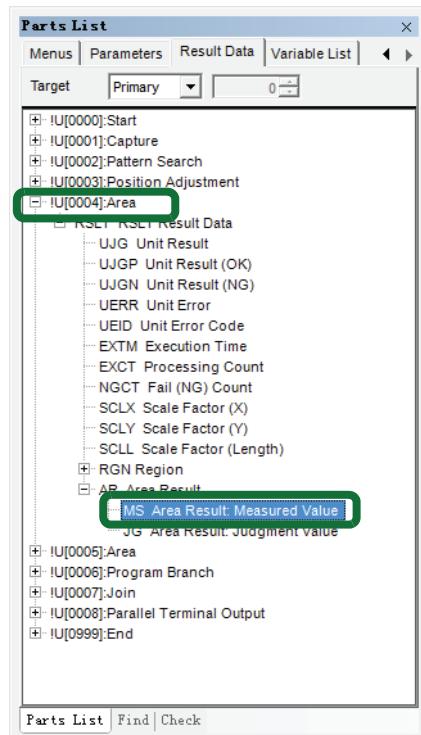


- (3) Execute simulation one time and view [Screen Editor].



- (4) Set the "area value" of the "area" unit to be displayed.

Select [Parts List] - [Result Data] - [!U[0005]:Area] - [AR Area Result] - [MS Area Result: Measured Value], and drag and drop it onto [Screen Editor].

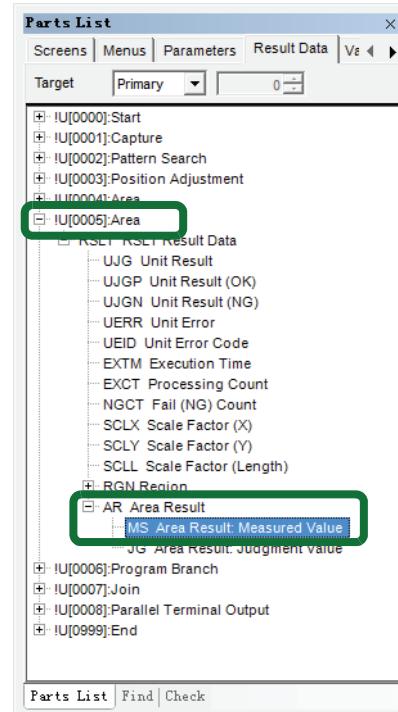


View [Screen Editor].



- (5) Set the "area value" of the "area" unit to be displayed.

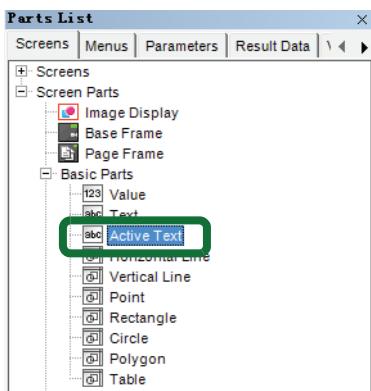
Select [Parts List] - [Result Data] - [!U[0005]:Area] - [AR Area Result] - [MS Area Result: Measured Value], and drag and drop it onto [Screen Editor].



View [Screen Editor].



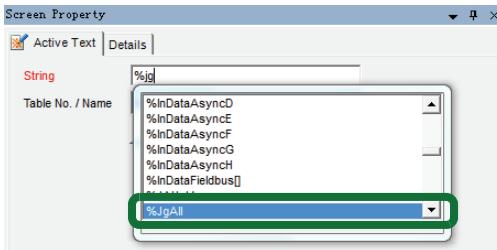
- (6) Make the setting to display text "Pass" when the result is "OK", and "Fail" when the result is "NG". Select [Parts List] - [Screens] - [Screen Parts] - [Basic Parts] - [Active Text], and drag and drop it onto [Screen Editor].



- (7) View [Screen Property].

Enter "%JgAll" in the [String] field.

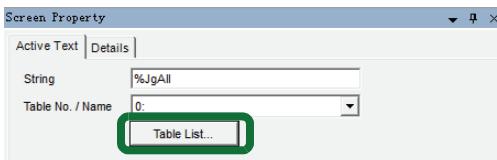
This is a "system variable" representing the total status value.



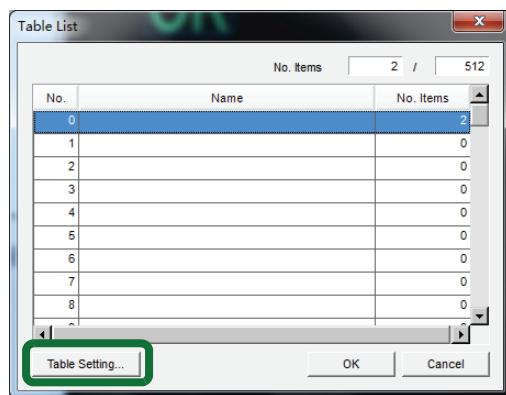
Variable "%JgAll" contains value "0" when the result is "OK", and value "1" when the result is "NG".

- (8) Set the options in detail.

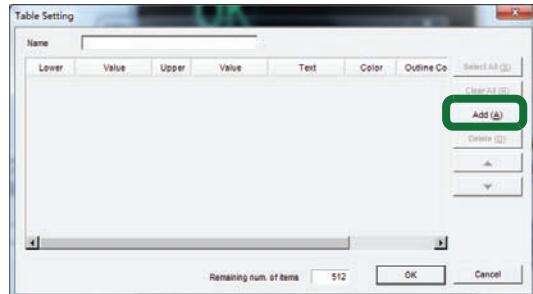
Click the [Table List] button.



- (9) Click the [Table Setting] button.

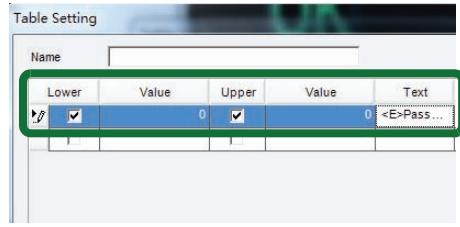


- (10) Click the [Add] button.



- (11) Check the check boxes for [Lower] and [Upper]. Enter "Pass" in the [Text] column.

Confirm the entry and then click the [Add] button.

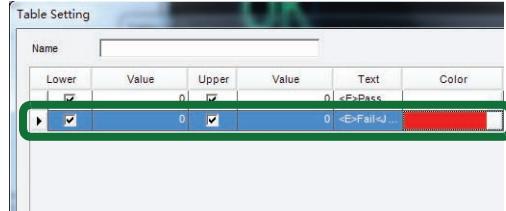


- (12) Check the check boxes for [Lower] and [Upper]. Enter "1" as the value for [Lower]. Enter "1" as the value for [Upper].

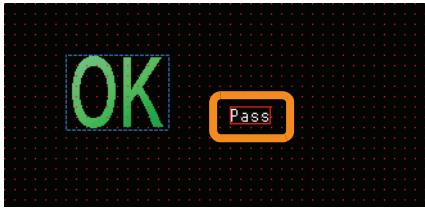
Enter "Fail" in the [Text] column.

Select the [Color] column and select "red".

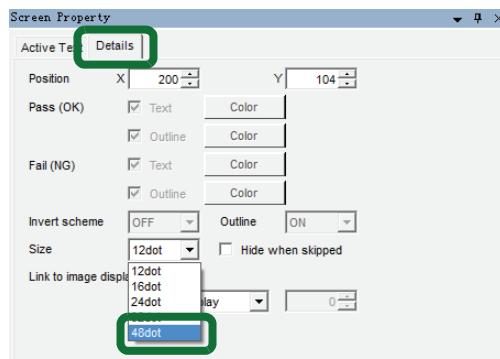
Confirm that the settings are correct, and then click the [OK] button.



View [Screen Editor].
Execute simulation one time and check the result.



(13) Change the "Size" of the text characters.
Select [Screen Property] - [Details] tab - [Size] and change the setting to [48dot].



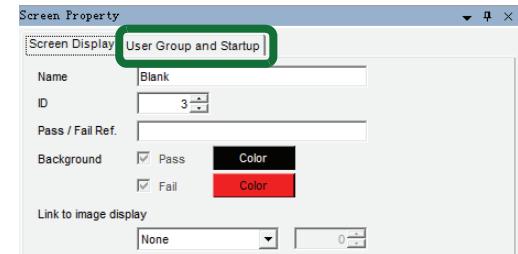
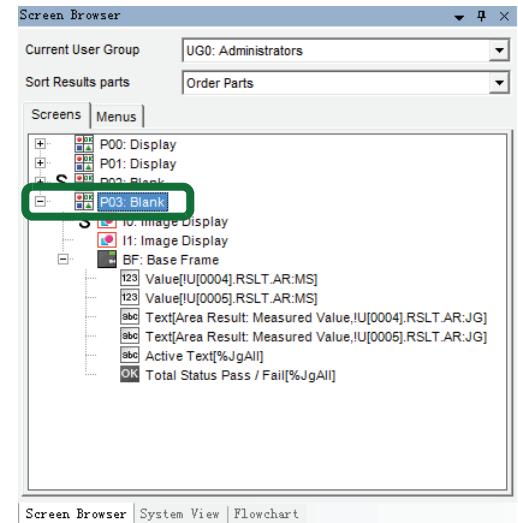
View [Screen Editor].
Execute simulation one time and check the result.



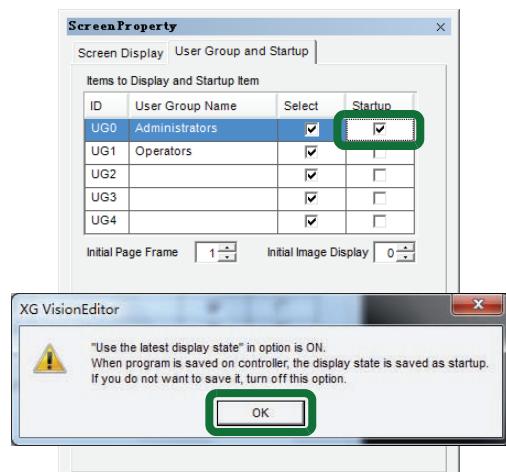
5. Set this "Screen display: P02" to be displayed when the controller is started.

(1) Click [Screen Browser] - [Screens] - [P02].

In [Screen Property] in the lower section of the screen, open the [User Group and Startup] tab.



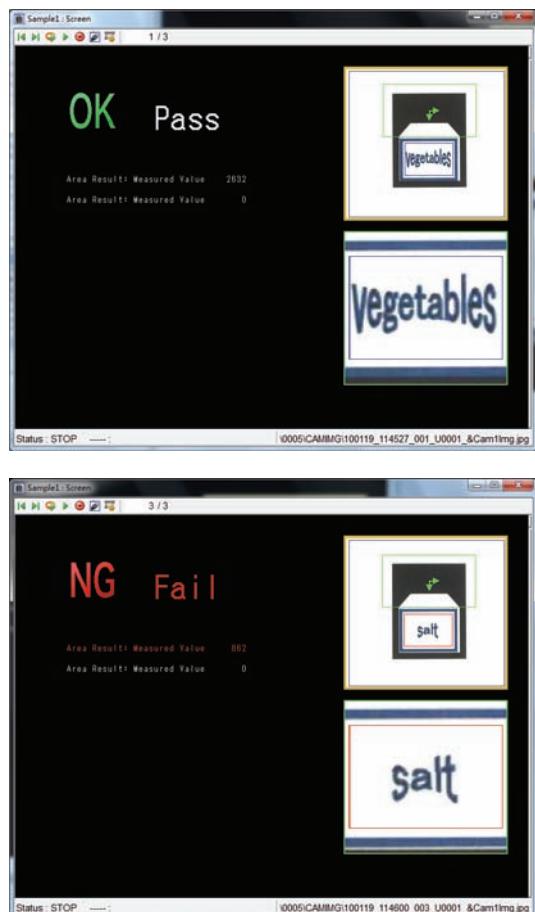
(2) Check the check box for [UG0] - [Startup].
An alert message appears. Click [OK].



- (3) Check the result with the "XG Simulator".
Click the [Start Simulator] button at the top of the screen.



Execute simulation one time and check the result.



6. Check the inspection result.

- (1) Check the result on [Vision Window], [User Window], and [Unit Result].
Click [Flowchart] - [U0002:Stain] to display [Vision Window].

Execute simulation one time and check the result.

■ What is a menu?

A menu is a special operation menu created for a screen display and can be operated from the controller or XG Simulator with a handheld controller/keyboard.

You can use "buttons" and "drop down menus" with desired names to execute various commands. It is effective to avoid confusion or misunderstanding among operators in the field.

In addition, there are various "standard menus" available with the VisionEditor by default, such as [Unit Properties], allowing sophisticated menus to be created in short time.

■ Menu types

There are four templates available for the menu.

- Blank Menu
- New Menu
- Call (Statistics/History) Menu
- Numerical Input

The following five basic elements are provided.

- Text
- Numerical Input
- Drop Down Menu
- Option Button
- Confirmation Button

The following six menus can be modified on the Screen Editor (standard menus).

- Inspection Region Menu
- Register Image Menu
- Color Extraction Menu
- Statistics Menu
- Image Archive Menu
- Library Menu

■ Setting a menu

The Screen Browser/Screen Editor/Screen Property/Parts List are mainly used for setting a menu.

The basic procedure to create a menu is as follows: Drag and drop a desired item from [Templates] or [Basic Elements] in the Parts List onto a desired position on the Screen Editor and define details.

Step (1): Select [Menus] on the Screen Editor.



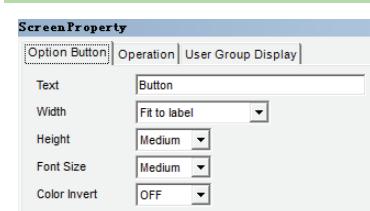
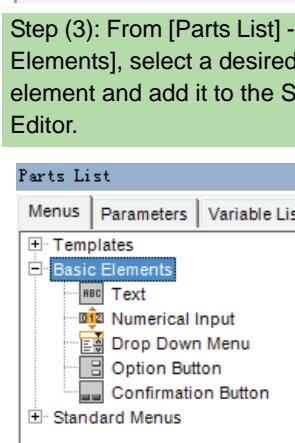
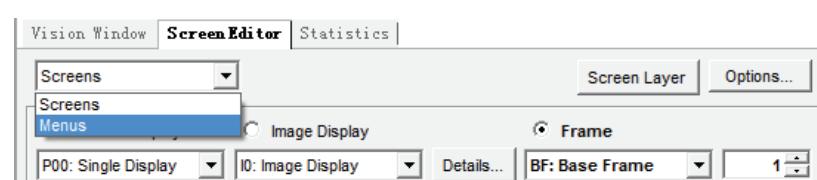
Step (2): From [Parts List] - [Templates], select a desired template and add it to the Screen Editor.



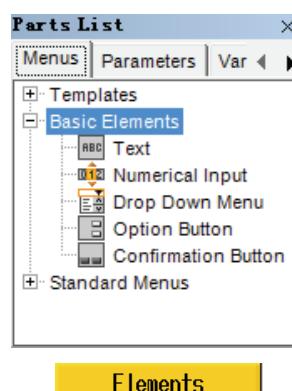
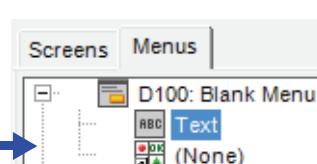
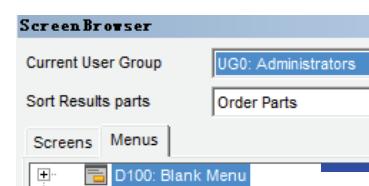
Step (3): From [Parts List] - [Basic Elements], select a desired element and add it to the Screen Editor.



Step (4): Set the details of the element in the Screen Property.



Finally, confirm the menu flow on the Screen Browser and then check the operation with the XG Simulator.



Basic Tutorial_3_2: Menu

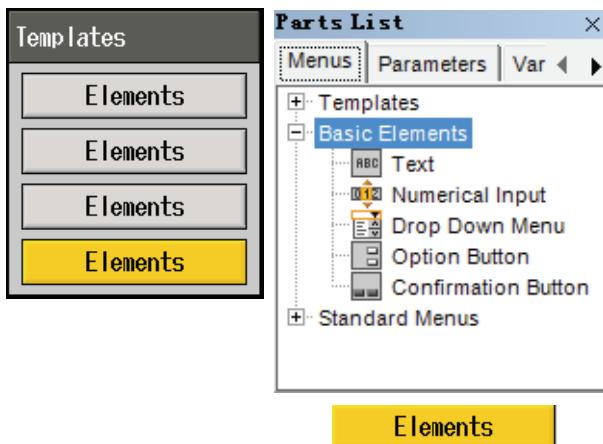
What is a menu?

A menu is a display element used to modify parameters in the field with a handheld controller.

Many operators in the field may want to change just some parameters.

In such a case, it is useful to create a menu that can be used to modify a certain parameter only.

■ Menu



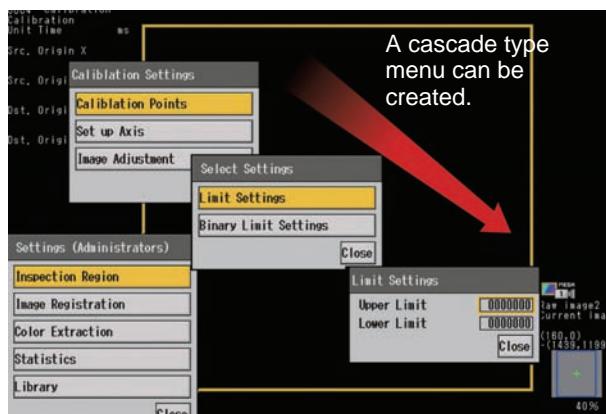
Elements

A menu can be used to change the value of a variable or to execute a command.

Element types

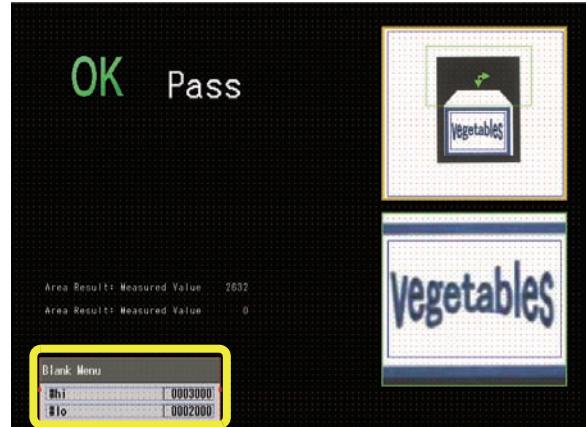
- | | |
|---------------------|--|
| Text | : Used to display characters. |
| Numerical Input | : Used to change the value of a variable (no candidate displayed). |
| Drop Down Menu | : Used to change the value of a variable (candidates displayed). |
| Option Button | : Used to assign a function. |
| Confirmation Button | : Used to assign a function (always displayed at the bottom). |

■ Example of the creation of a cascade type menu

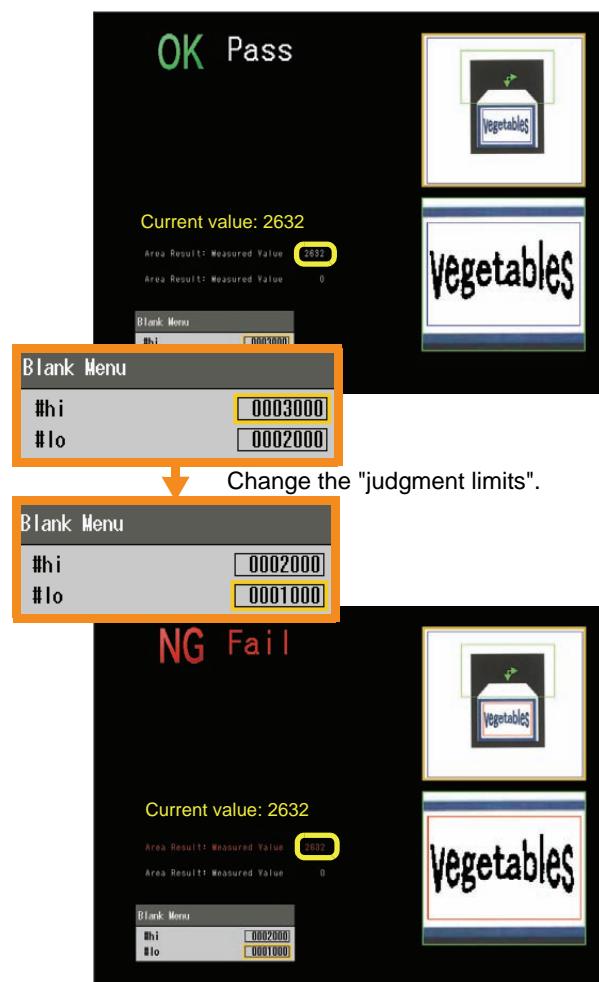


By using a "menu", you can change "unit parameters" or "judgment limits" even during Run mode.

■ Menu operation example



Enter a value in the [Numerical Input] element to change the judgment limits.



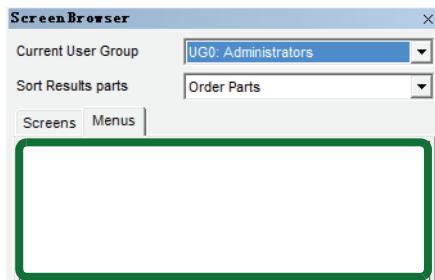
The "judgment limits" are changed and the "judgment result" for the same target changes accordingly.

As you can see, the settings can be modified easily in the field. Today, we will create this "custom menu".

Creating a new "menu"

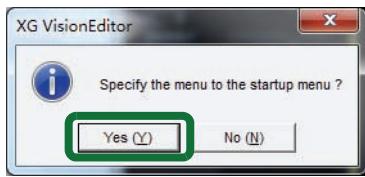
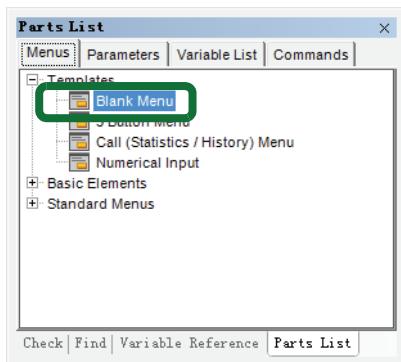
1. Create a "new menu".

- (1) Open [Screen Browser] - [Menus].



By default, there is no "menu" being created.
Create a "new menu" here.

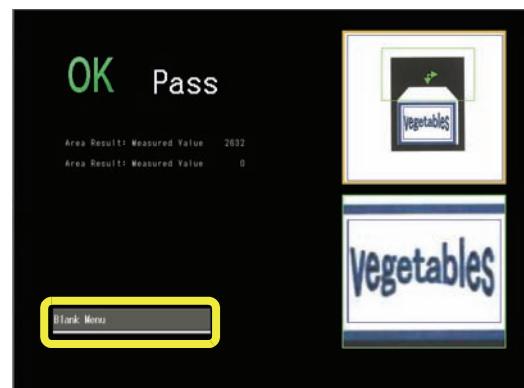
- (2) Select [Parts List] - [Menus] - [Templates] - [Blank Menu], and drag and drop it onto [Screen Editor].



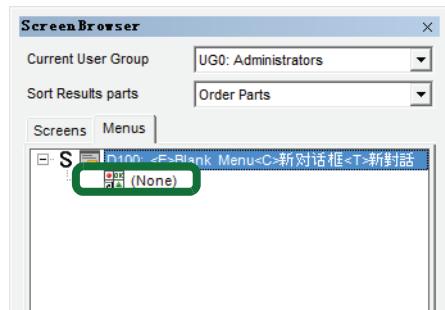
Select [Yes].

Now this "menu" will be displayed at startup.

- (3) View [Screen Editor].



A new "menu" has been added.
View [Screen Browser].

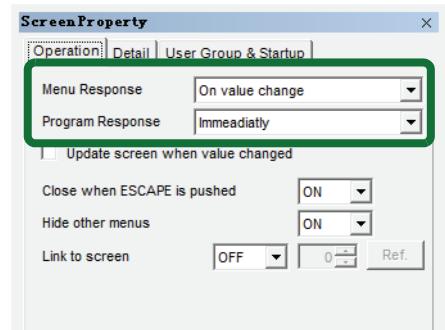


A "new menu" has been added.
There is no "element" being contained yet to compose the "menu".

- (4) Specify the timing to apply the change to the "menu" and to apply the change to the "program" when setting is changed with this "menu".

Open [Screen Property] - [Operation] and set [Menu Response] to [On value change] and [Program Response] to [Immediately].

Now when you "change" the value of the "judgment limits", the change is applied to the controller "immediately".



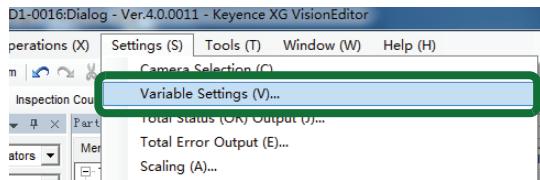
Assigning "variables" to the judgment limits for the "area" unit

To use a "menu" to change the "judgment limits" for an "area" unit, you need to assign "variables".

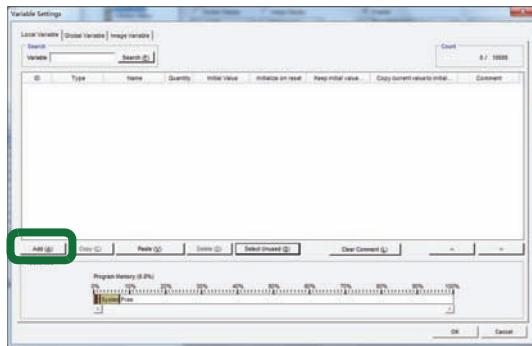
The value you will "change" in the "menu" is a value assigned to the "variable".

2. Define "variables".

- (1) Open [Settings] - [Variable Settings] at the top of the screen.



- (2) Click the [Add] button.



- (3) Define a "variable" used for the "upper value" of the "judgment limits".

Enter "hi" in the [Name] column of the added "variable" and press [Enter].

* The "#" sign shown below is displayed automatically.

ID	Type	Name
1	Scalar	#bunki
2	Scalar	#hi

- (4) Enter "3000" in the [Initial Value] column of "#hi".

Check [Copy current value to initial value at save].

Remove the check mark from [Keep initial value].

ID	Type	Name	Quantity	Initial Value	Initialize on reset	Keep initial value...
1	Scalar	#bunki				<input checked="" type="checkbox"/>
2	Scalar	#hi		3000	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Enter the current upper limit value for "Unit 4:Area" as the initial value of "#hi".

When [Keep initial value] is selected, the changed value will be set as the "initial value" in the controller after reset.

- (5) Click the [Add] button.

Define a "variable" used for the "lower value" of the "judgment limits".

Enter "lo" in the [Name] column of the added "variable".

* The "#" sign shown below is displayed automatically.

ID	Type	Name
1	Scalar	#bunki
2	Scalar	#hi
3	Scalar	#lo

- (6) Enter "2000" in the [Initial Value] column of "#lo".

Check [Keep initial value].

Remove the check mark from [Initialize on reset].

ID	Type	Name	Quantity	Initial Value	Initialize on reset	Keep initial value...
1	Scalar	#bunki		0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Scalar	#hi				<input type="checkbox"/>
3	Scalar	#lo		2000	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Assign these variables to the "judgment limits" of the "area" unit

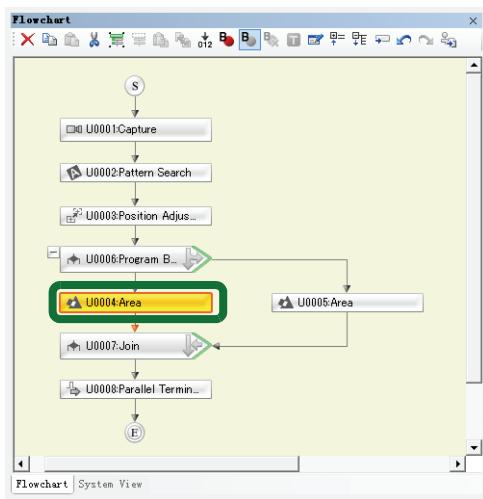
- (7) Click [OK] to close the window.

Change the "layout" from "2" to "1".

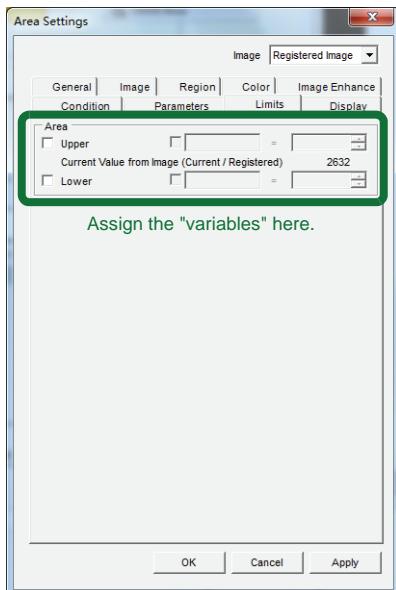


3. Assign the "variables".

(1) Open [Flowchart] - [U0004:Area].



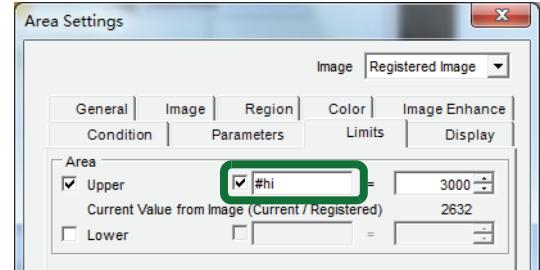
(2) Open the [Limits] tab.



(3) Set the [Upper] limit value.

Check the check box in the middle. (This check box determines whether to use a "fixed value" or to "reference a variable".)

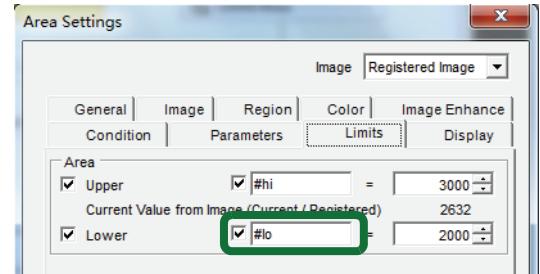
Enter "#hi" in the input field.



(4) Set the [Lower] limit value.

Check the check box in the middle. (This check box determines whether to use a "fixed value" or to "reference a variable".)

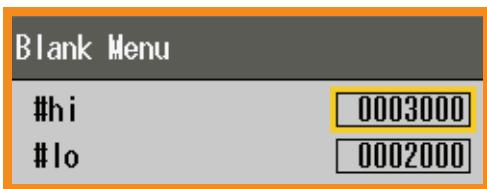
Enter "#lo" in the input field.



This completes the "variable" assignment to the "judgment limits".

Next, we will create a [Numerical Input] element to change the "judgment limits" in the "menu".

Creating a [Numerical Input] element.

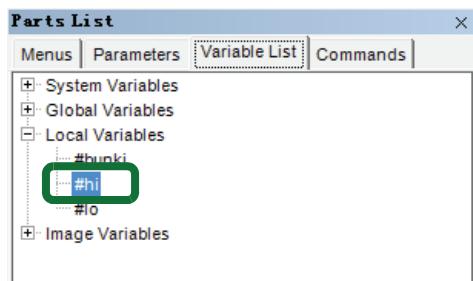


We will create a [Numerical Input] element like this.

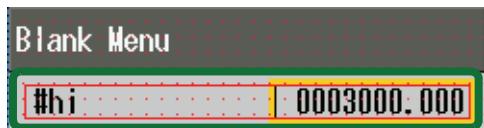
Change the "layout" from "1" to "2".

4. Add a [Numerical Input] element.

- 1) Select [Parts List] - [Variable List] - [Local Variables]
- [#hi], and drag and drop it onto [Screen Editor].



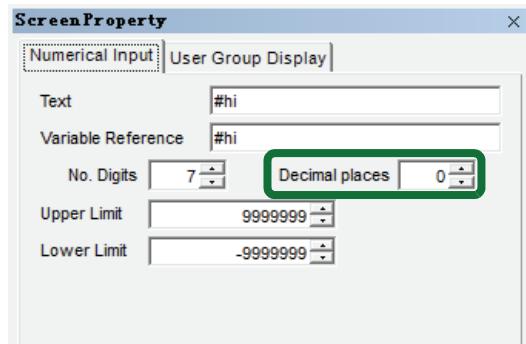
View [Screen Editor].



A [Numerical Input] element to "change" the [Limits: Upper] has been created.

- 2) Open [Screen Property] - [Numerical Input].

Set [Decimal places] to "0".



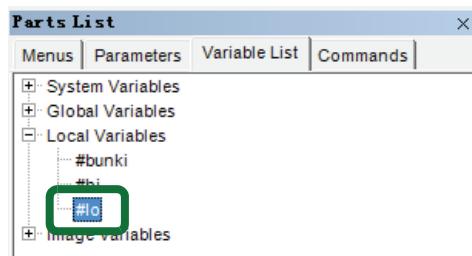
View [Screen Editor].



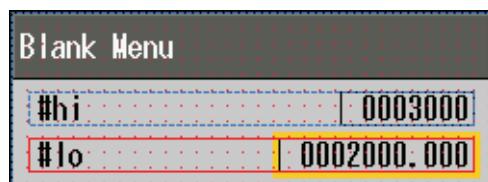
- 3) Select [Parts List] - [Variable List] - [Local Variables]

- 3) Select [Parts List] - [Variable List] - [Local Variables]
- [#lo], and drag and drop it onto [Screen Editor].

* Drop [#lo] below [#hi] on [Screen Editor].



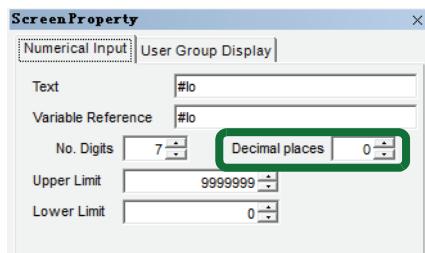
View [Screen Editor].



A [Numerical Input] element to "change" the [Limits: Lower] has been created.

(4) Open [Screen Property] - [Numerical Input].

Set [Decimal places] to "0".



View [Screen Editor].



This completes the settings of the "menu".

Now you have created a numerical input element for changing the "judgment limits" for the "area" unit.

Check the result.

Checking the result with the "XG Simulator".

Start the "XG Simulator".

Change the "judgment limits" and check the behavior.

Before the change "Upper limit: 3000 Lower limit: 2000"



After the change "Upper limit: 2500 Lower limit: 2000"

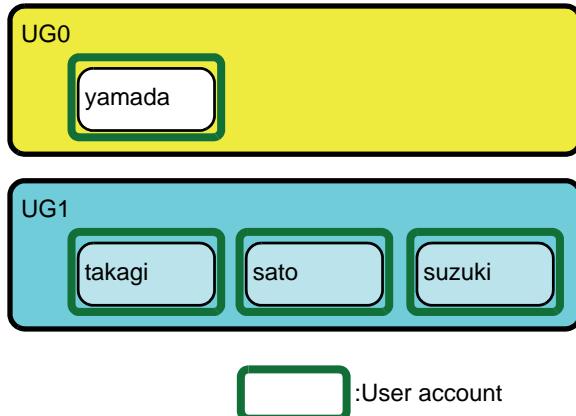


Basic Tutorial_3_3: UG-specific User Interface

UG-specific user interface

The XG Series offers a security function necessary for field operation. This allows different user interfaces to be assigned to each user.

User group



Specify a user group (UG0 to UG4) to each user account (100 accounts max.) to which he/she belongs.

User interfaces (screen displays and menus) can be customized differently for each user group.

For example, you can change items which can be set according to the authority of the operators who use the system in the field.

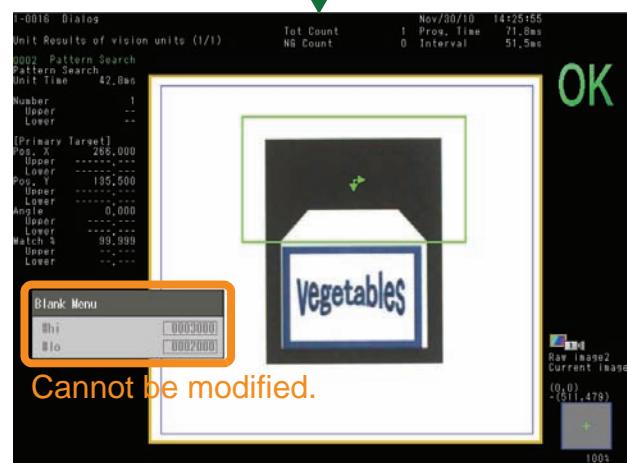
■ Operation menu

Change the "screen display" and "menu" according to each user.

UG0



UG1



You can set a different "screen display" to be displayed when a user account is changed and the account belongs to group "UG1".

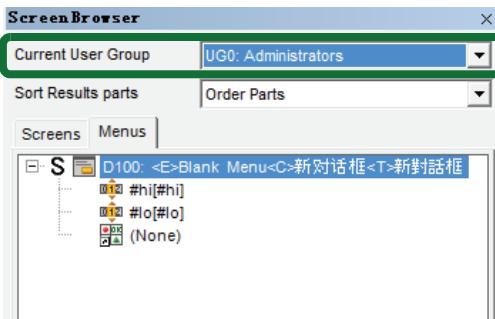
You can also set the "menu" to be grayed out to prevent modification.

Today, we will create a "UI" shown above.

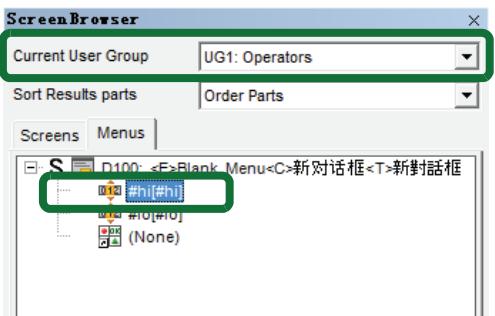
Creating a "menu" for "UG1"

1. Disable the modification of the current "menu".

- (1) Select [Screen Browser] - [Current User Group] and check the setting.
You can see that the currently displayed "menu" is a menu for "UG0".

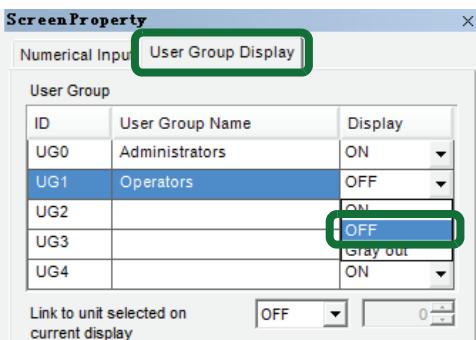


- (2) Select [Screen Browser] - [Current User Group] - [UG1: Operators].
Click [D100:Blank Menu] - [#hi].

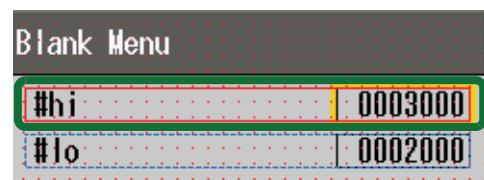


Change the "modification options" for [#hi].

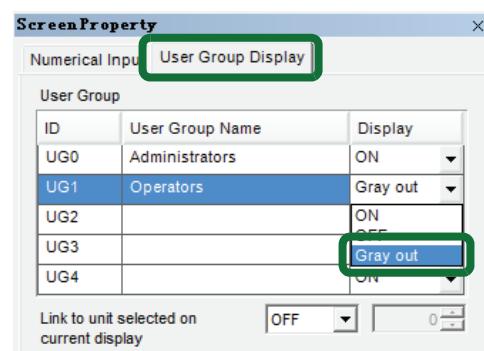
- (3) Select [Screen Property] - [User Group Display] - [UG1: Operators] - [OFF].



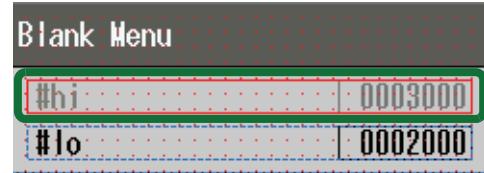
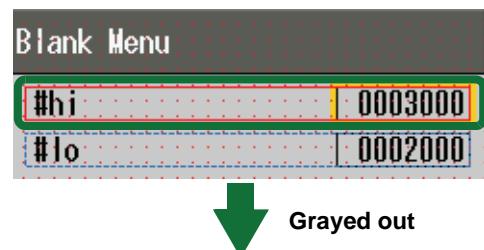
View [Screen Editor].



- (4) Select [Screen Property] - [User Group Display] - [UG1: Operators] - [Gray out].



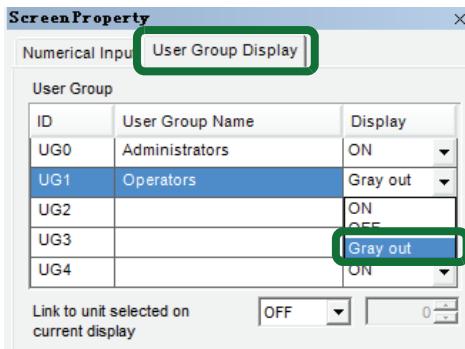
View [Screen Editor].



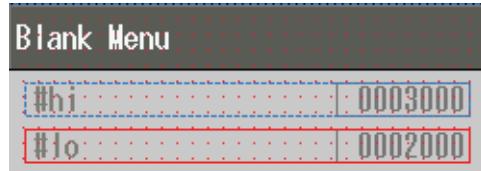
- (5) Click [Screen Browser] - [Menus] - [D100:Blank Menu] - [#lo].



- (6) Select [Screen Property] - [User Group Display] - [UG1: Operators] - [Gray out].



View [Screen Editor].



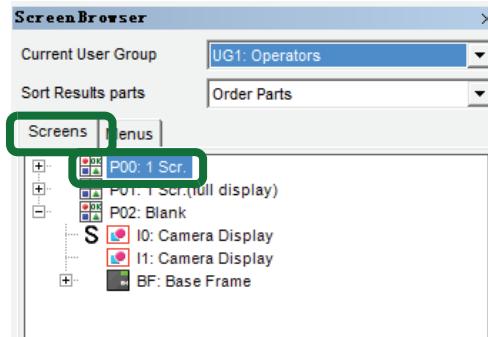
Now both "Numerical Input" elements in the menu are grayed out.
This prevents users with the "UG1" privilege from modifying these items.

Setting the "screen display" for "UG1"

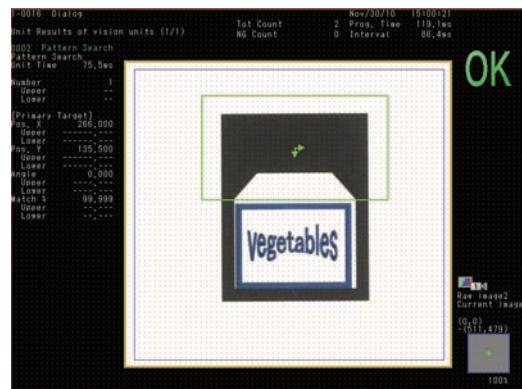
Set the "screen display" to be switched between user groups.

2. Change the "screen display".

- (1) Click [Screen Browser] - [Screens] - [P00].



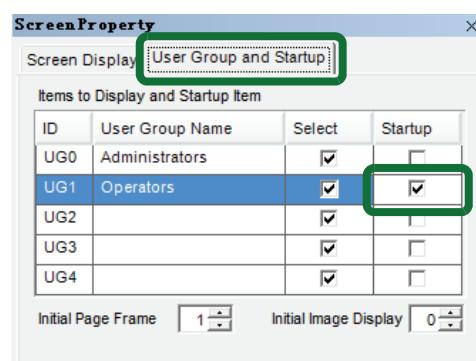
View [Screen Editor].



Set this "screen display" to be shown to users with the "UG1" privilege.

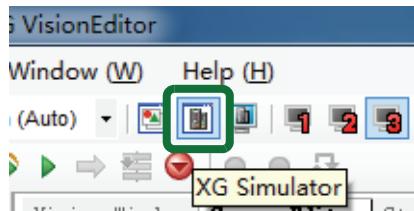
- (2) Select [Screen Property] - [User Group and Startup] - [UG1: Operators] - [Startup] and check the check box.

This makes "P00" be displayed as initial screen for "UG1" users.



Checking the result

To check the result, open the "XG Simulator".



3. Check the result.

(1) Execute simulation one time and check the result.



(2) Press [F] on the keyboard and open [Function] - [Utility] - [Change Login User].



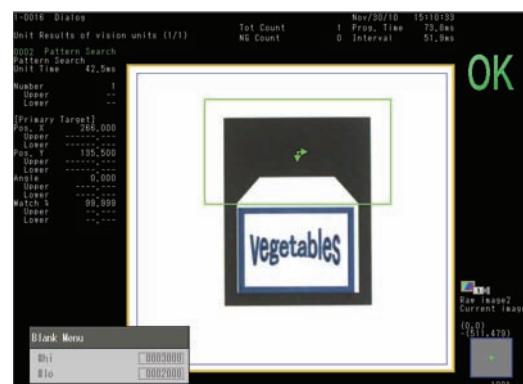
(3) Select [Select User] - [Operator].



(4) Click [OK].



(5) You can see that when the "user account" is changed to [Operator] who belongs to "UG1", the conditions for displaying the "screen display" and "menu" were changed.



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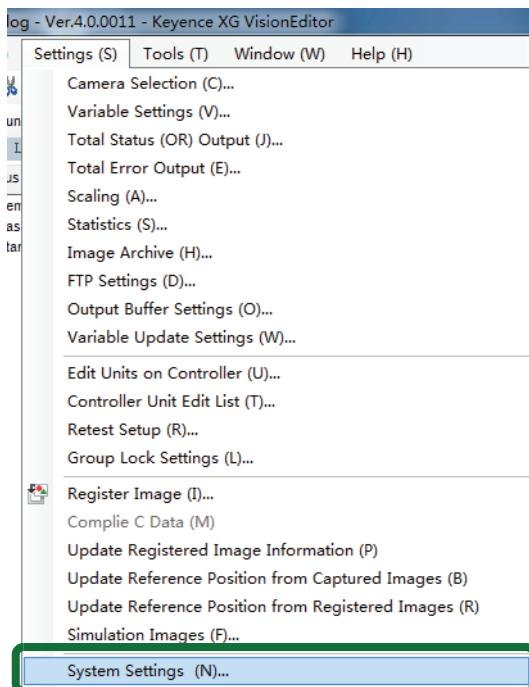
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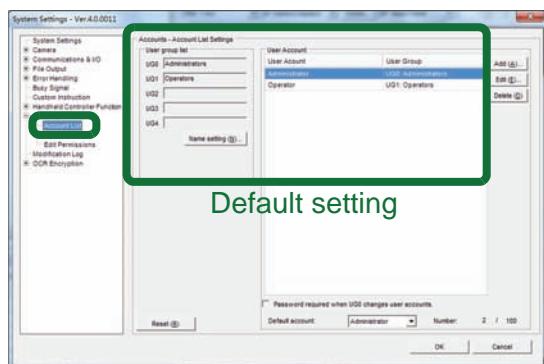
"User group" and "User account" setting window

You can set the "user group" and "user account" with the XG VisionEditor.

- (1) Open [XG VisionEditor] - [Settings] - [System Settings].



- (2) Open [Accounts] - [Account List Settings].



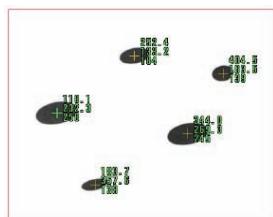
UG0: Administrators

UG1: Operators

These "user accounts" are set by default.

■ What is an on-screen graphics setting?

You can combine 8 types of graphics and 4 types of text to define up to 32 graphics or text blocks for one unit and to draw them during measurement. Since this function supports referencing the result data or variable (including array type for both), you can also use it to display all detection results of a vision unit or all numerical data contained in an array variable at a specified position on the screen.



■ Advantages of the on-screen graphics setting

(Conventional display)



Since values are shown in a different area away from the targets in the image display, you cannot easily identify which target relates which value.

Although the screen display setting allows measured values to be displayed at desired positions, there were limitations on the display at fixed positions because sometimes targets change their positions.



(XG display)



The measured value display is tied to the position where each target is detected in the image display.

This allows easy-to-see display regardless of target movement or the number of targets. The on-screen graphics setting offers a useful display which is completely different from the conventional display.

■ Element types

Specify up to 32 graphics or text blocks to be displayed. You can select graphics and text from the following:

- None : No on-screen graphics is displayed.
- Rectangle : Display a rectangle. Click [Edit] to specify conditions such as display position and size.
- Rotated Rectangle : Display a rotated rectangle. Click [Edit] to specify conditions such as display position, size, and angle.
- Circle : Display a circle. Click [Edit] to specify conditions such as display position and size.
- Oval : Display an oval. Click [Edit] to specify conditions such as display position, size, and angle.
- Ring : Display a ring. Click [Edit] to specify conditions such as display position and size.
- Arc : Display an arc. Click [Edit] to specify conditions such as display position, size, and start/end angles.
- Point : Display a point (or a rotating crosshair by changing the settings). Click [Edit] to specify conditions such as display position, size, and angle.
- Line : Display a line. Click [Edit] to specify conditions such as display position and tilt angle.
- Text : Display specified text. Click [Edit] to specify conditions such as display position and contents.
- Value : Display a numerical value. Click [Edit] to specify conditions such as display position and contents.
- Active Text : Display text from those predefined in the table which satisfies conditions. Click [Edit] to specify conditions such as display position and contents.
- Decimal to ASCII : Display a character string converted from ASCII codes (decimal). Click [Edit] to specify conditions such as display position and contents.

Basic Tutorial_3_4: On-Screen Graphics

What is an on-screen graphics display?

The on-screen graphics display is a screen display which allows anyone to understand the inspection result visually. By using an on-screen graphics unit, you can show information necessary for a production line (text, judgment, inspection result) on the "image display".

■ Advantages of the on-screen graphics display

In the conventional system, the style of the inspection result display depended on the unit being used.

Consequently, with the "stain" unit shown below, for example, "+" marks were displayed over the detected stains, preventing the observation of the stains.



It is impossible to identify the "inspection result" of each target on the display screen.

When an on-screen graphics unit is used, the shape and size of each "stain" can easily be observed with the inspection result display being tied to each target for an easy visual check.

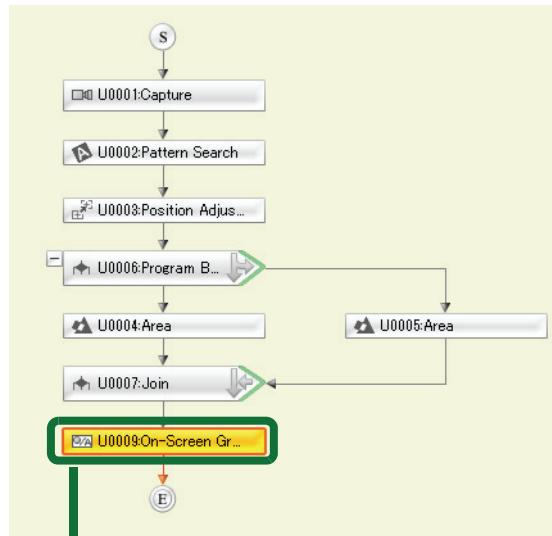


■ What is an on-screen graphics unit?

The on-screen graphics unit allows you to combine 8 types of graphics and 4 types of text to define up to 32 graphics or text blocks for one unit and to draw them during measurement.

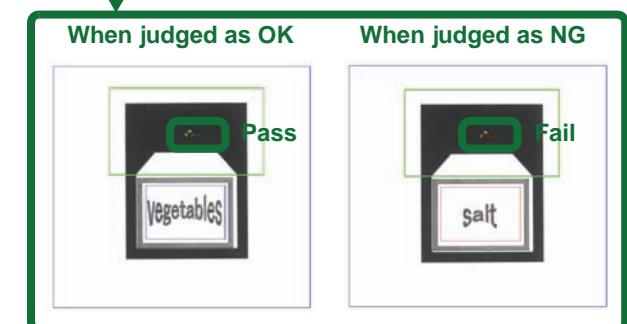
None
Rectangle
Rotated Rectangle
Circle
Oval
Ring
Arc
Point
Line
Text
Value
Active Text
OCR

■ Sample flowchart



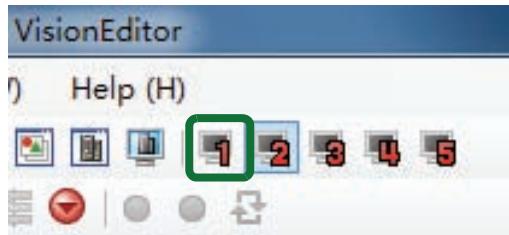
"Pass" for judgment result "OK"
"Fail" for judgment result "NG"

By setting the results to be displayed at the detection positions of a "pattern search" unit, you can make the display positions adjusted according to the target movement.



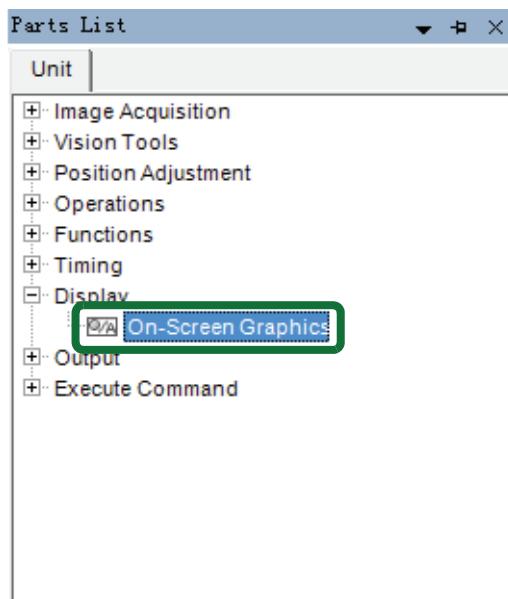
Adding an on-screen graphics unit

First, change the "layout" from "2" to "1".

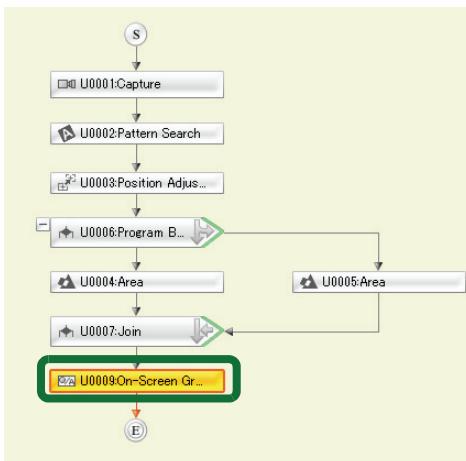


1. Add an "on-screen graphics" unit.

- 1) Select [Parts List] - [Display] - [On-Screen Graphics].
Add this unit below the [U0008:Parallel Terminal Output] unit.



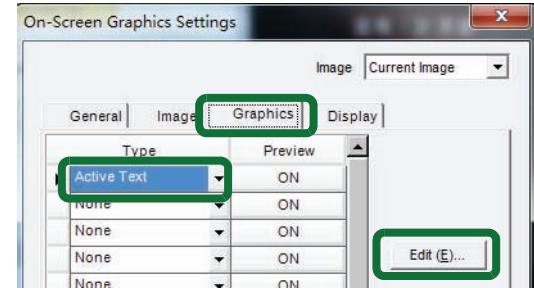
Confirm the result in the [Flowchart] view.



(2) Open the [Graphics] tab.

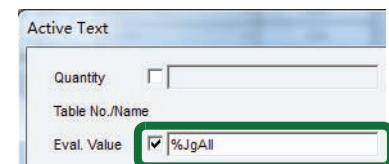
Select [Type] - [Active Text].

Click the [Edit] button.



(3) Check the check box for [Eval. Value].

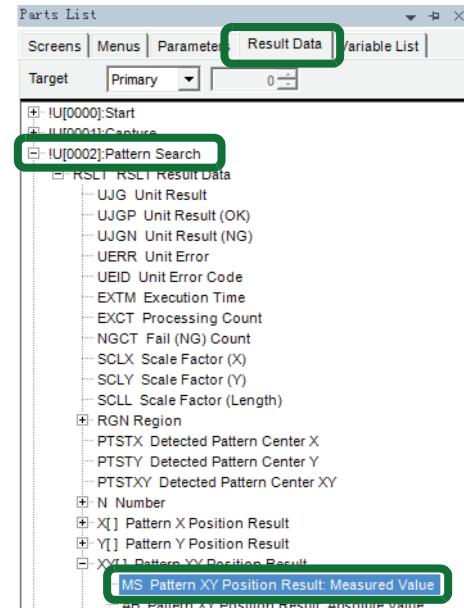
Enter "%JgAll" in the input field.



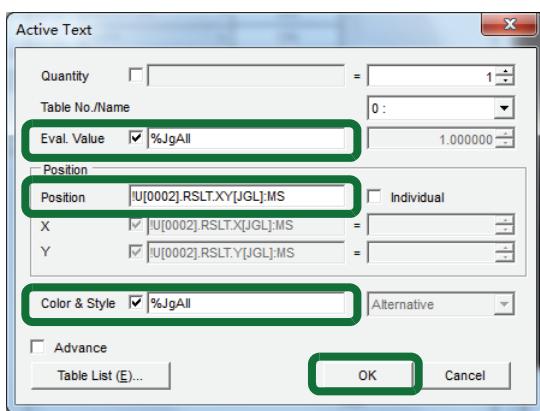
The "active text" will be switched in accordance with the value of the total status variable "%JgAll".

- 4) Remove the check mark for [Pos. XY] - [Individual].
In the [Position] input field, enter the detection position of the "pattern search" unit.

Select [Parts List] - [Result Data] - [Pattern Search] - [XY[]] - [MS Pattern XY Position Result: Measured Value], and drag and drop it onto [Screen Editor].



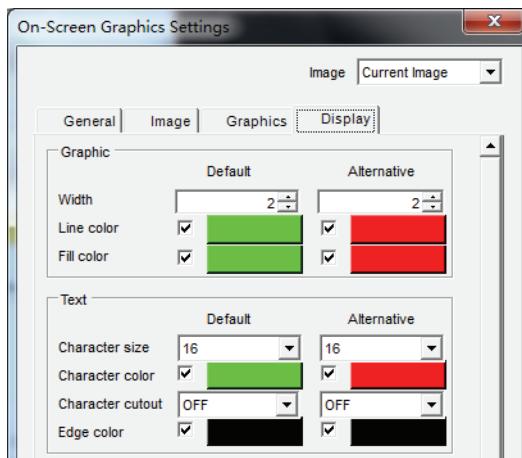
- (5) Check the check box for [Color & Style].
 Enter "%JgAll" in the input field.
 When you complete the input, click the [OK] button to close the window.



Let me explain some more about the [Color & Style].

When you open the [Display] tab, you will see [Default] and [Alternative].

The display color of "text" and "graphics" will change in accordance with the value specified for these [Default] and [Alternative].

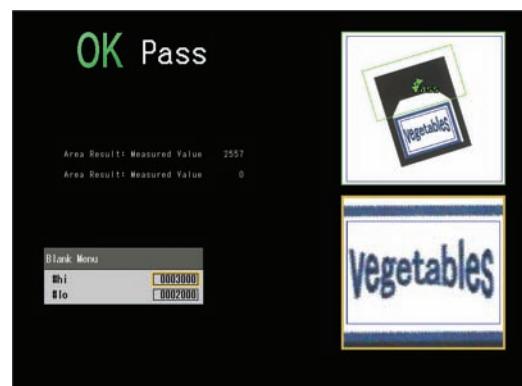
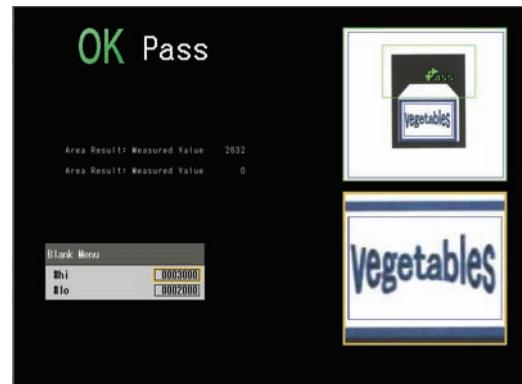


This completes the setting.
 Click [OK] to close the window.

Checking the result

To check the result, open the "XG Simulator".

2. Check the result.



■ What is the statistics function?

On the PC (VisionEditor)

This function allows you to view specified measurement results as statistics during an edit simulation.

By recording data in the program memory within the controller, you can view the actual measurement results on the controller in the same way.

While viewing the graphs, you can change the upper and lower limits or directly reference the NG images from NG data. For edit simulations, trend graphs can display measurement results for up to four items simultaneously, which is useful for checking the correlation of simulation results.

On the controller

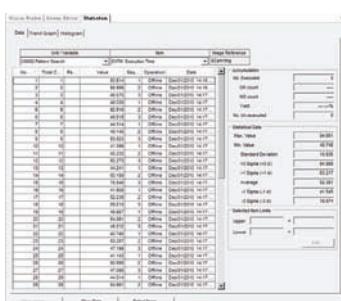
Any of the data used or generated from the running of a program and inspection of parts can be recorded for later viewing and analysis through the [Statistics] option in the XG Vision Editor or Edit mode on the XG-7000 controller. In Run mode the items identified for collection can be viewed in real-time, 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 with the VisionEditor

First, select [Settings] - [Statistics] and select the items used for statistical processing.

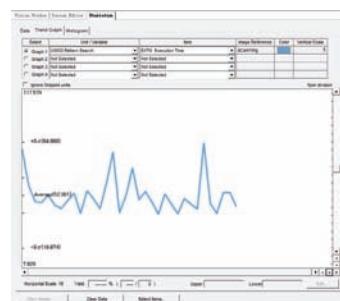
Upload the setting to the controller and perform inspection. When the inspection is complete, the result data is saved in the resource memory. You can view the result data in three types of display: "List", "Trend graph", and "Histogram".

(List display)



Displays the statistical 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 2.

(Trend graph display)



Displays values along a time axis (trend graph). This function is useful for checking how the values change over the course of time during Run mode.

The upper and lower limits can also be changed during Run mode while viewing changes in the graph and yield rate is updated in real time.

(Histogram display)



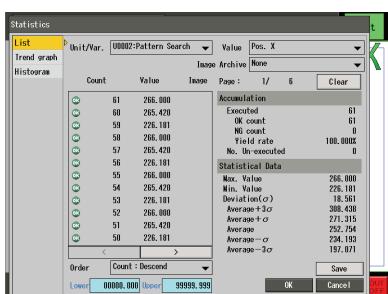
Displays a distribution of values as a histogram. This function allows the user to grasp the overall dispersion of values, so it is useful when adjusting measurement limits. The threshold can also be changed while viewing changes in the graph and yield rate.

■ Statistics with the controller

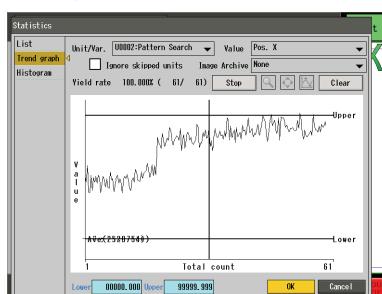
As is the case with the VisionEditor, you can view the result data in three types of display with the controller.

To do this, make the setting with the VisionEditor and upload it to the controller. You can also use [Options] - [Statistics] on the Flow Editor.

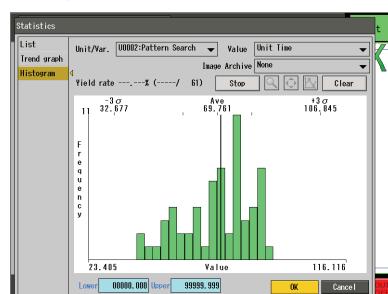
(List display)



(Trend graph display)



(Histogram display)



From XG Ver. 3.0, the statistics function is also available with the simulator alone.

You can use the statistics function after performing continuous simulation with the simulator.



Basic Tutorial_4_1: Statistics

Statistics

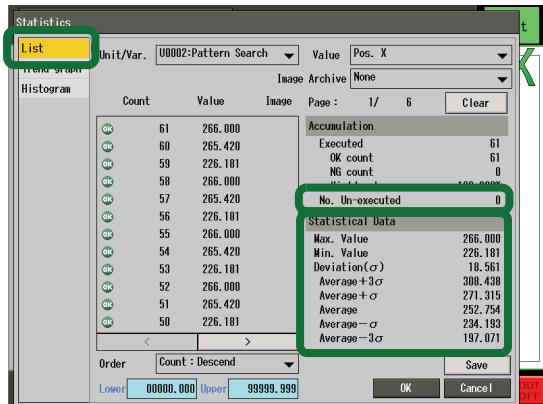
Any of the data used or generated from the running of a program and inspection of parts can be recorded for later viewing and analysis through the [Statistics] option in the XG Vision Editor or Edit mode on the XG-7000 controller. In Run mode the items identified for collection can be viewed in real-time, 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.

■ Structure of the statistics view

The Statistics view has the following tabs.

(1) List

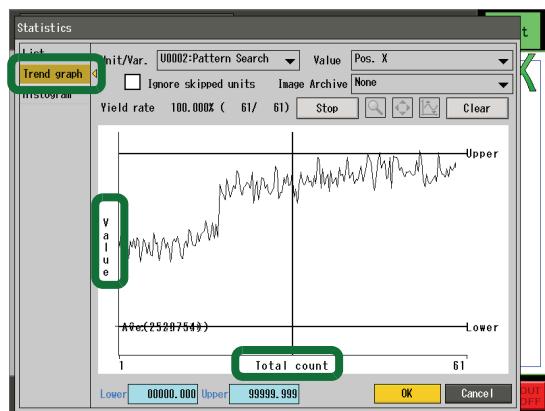
Displays the statistical results of items that have been selected for statistical processing. Here statistical summary data such as OK/NG counts, standard deviation of each item can be seen and saved to an SD card 2. You can also analyze the cause of NG results by cross-checking the image data stored in the image archive.



(2) Trend graph

Displays values along a time axis (trend graph).

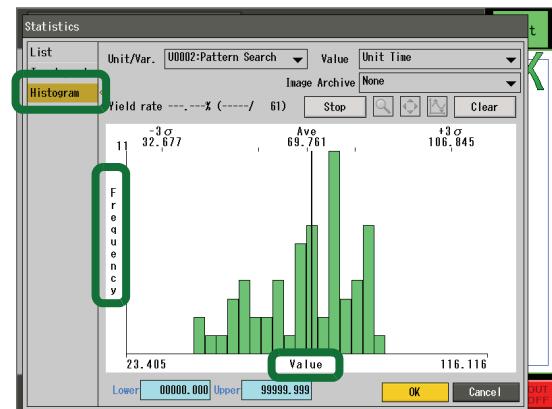
This function is useful for checking how the values change over the course of time during Run mode. The upper and lower limits can also be changed during Run mode while viewing changes in the graph and yield rate updated in real time. The graph also displays whether image data was recorded with the image archive and allows images to be viewed directly.



(3) Histogram

Displays a distribution of values as a histogram.

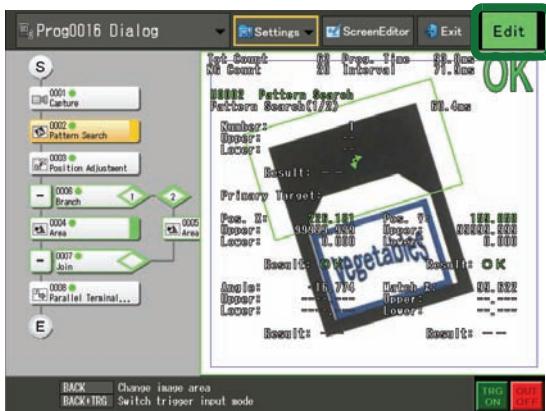
This function allows the user to grasp the overall dispersion of values, so it is useful when adjusting measurement limits. The threshold can be changed while viewing changes in the graph and yield rate. It also displays whether or not the graph contains image data, and allows the image to be directly viewed when values are measured.



Setting the "statistics" options

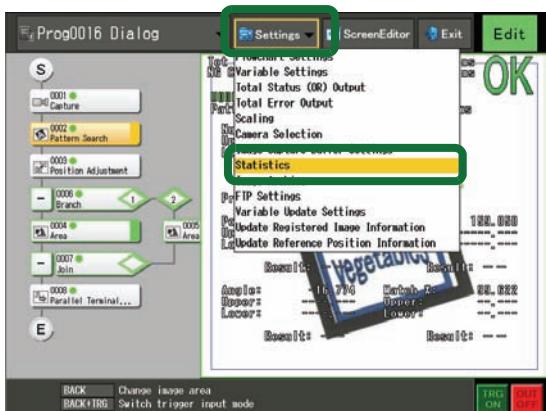
1. Switch to edit mode.

- Move [RUN/STOP] (slide switch) of the handheld controller downward.

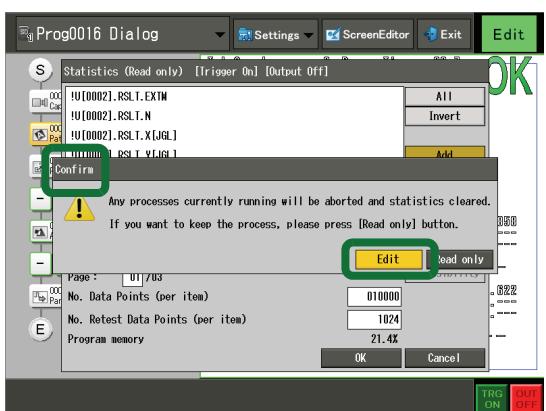


2. Go to the [Statistics] dialog.

- Select [Settings] and press [Enter] on the handheld controller. Select [Statistics] and press [Enter] on the handheld controller.

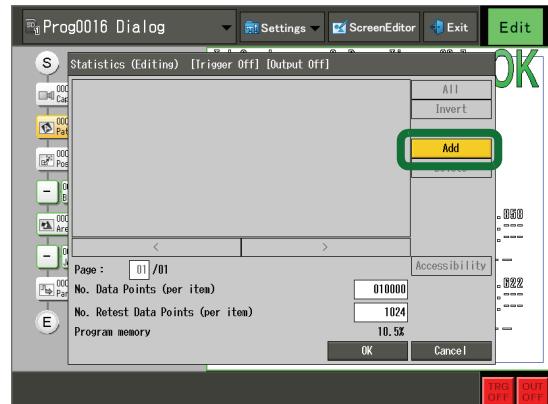


- A confirmation dialog appears. Select [Edit] and press [Enter] on the handheld controller.

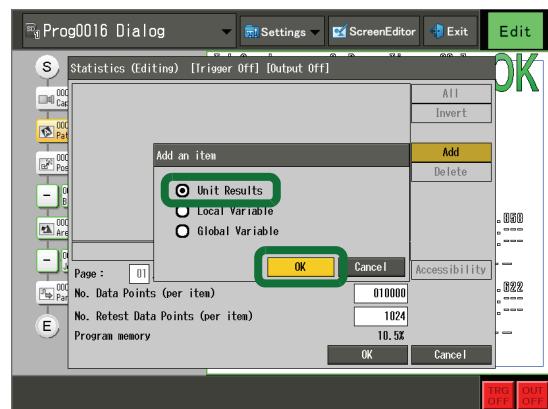


3. Select data to be collected for statistics processing.

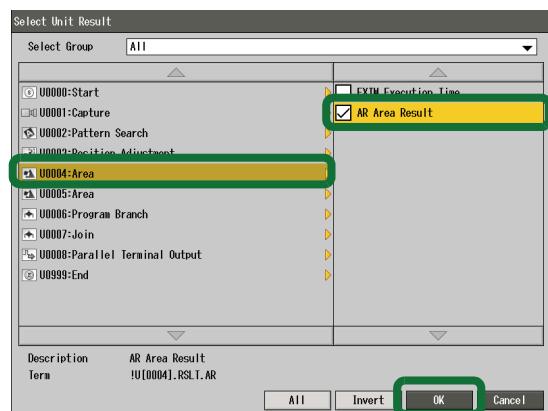
- Select [Add] and press [Enter] on the handheld controller.



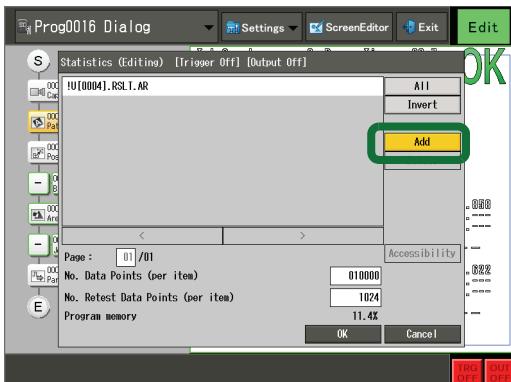
- Confirm that [Result Data] is selected. Select [OK] and press [Enter] on the handheld controller.



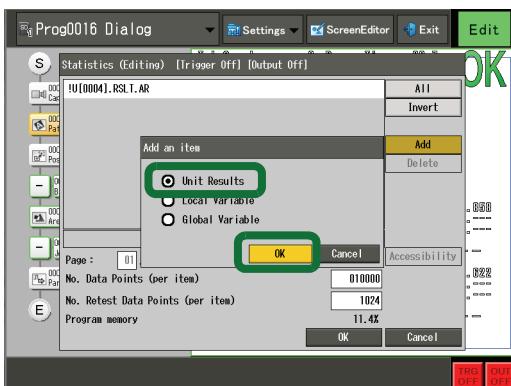
- Check the check box for [U0004:Area] - [AR Area Result]. Select the item and press [Enter] on the handheld controller, and a check mark appears. Select [OK] and press [Enter] on the handheld controller.



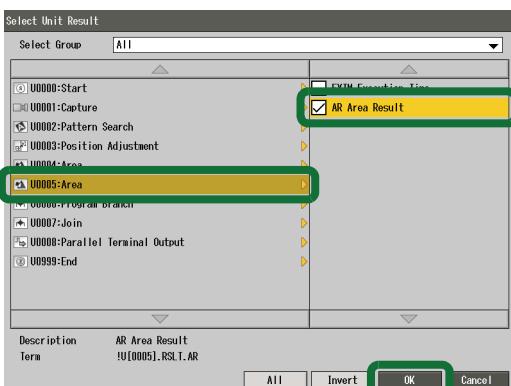
- (4) Select [Add] and press [Enter] on the handheld controller.



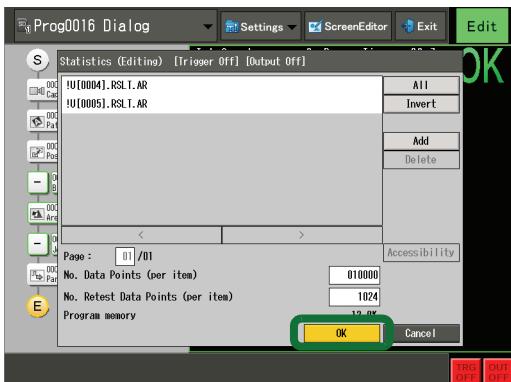
- (5) Confirm that [Result data] is selected. Select [OK] and press [Enter] on the handheld controller.



- (6) Check the check box for [U0005:Area] - [AR Area Result]. Select the item and press [Enter] on the handheld controller, and a check mark appears. Select [OK] and press [Enter] on the handheld controller.



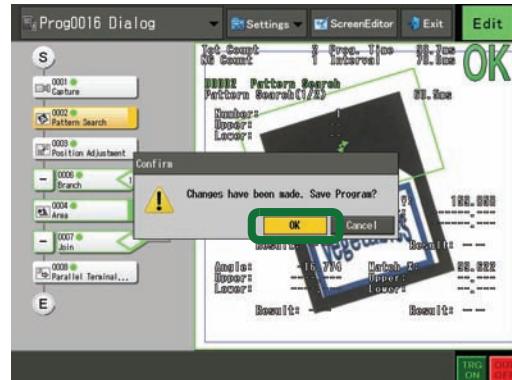
- (7) Confirm that [U0004] and [U0005] are selected.



4. Go to the [Statistics] dialog.

- (1) Switch to "Run" mode. Move [RUN/STOP] (slide switch) of the handheld controller downward.

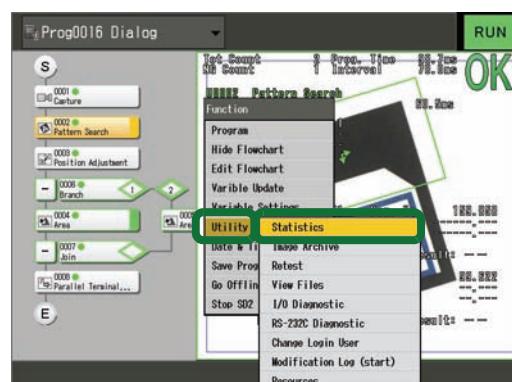
- (2) A confirmation dialog appears. Select [OK] and press [Enter] on the handheld controller.



- (3) Confirm that the controller has been switched to [Run].

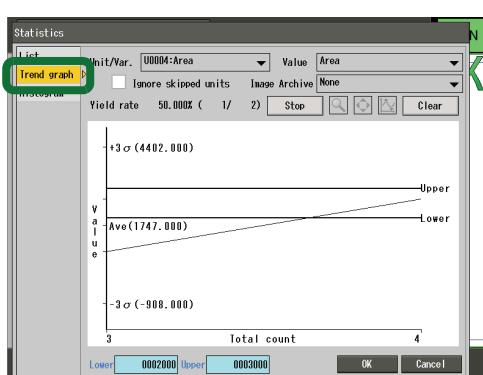
Press [FUNCTION] on the handheld controller.

Select [Utility] - [Statistics] and press [Enter] on the handheld controller.

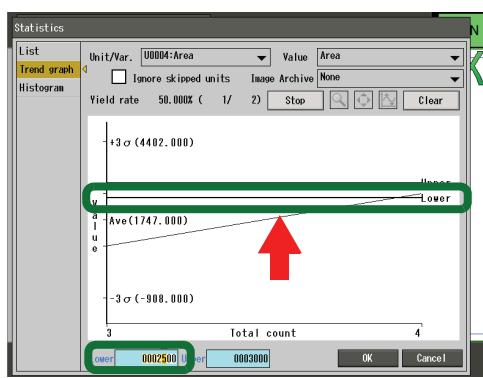


5. Change the [Upper] and [Lower] values for [U0004:Area] while viewing a trend graph.

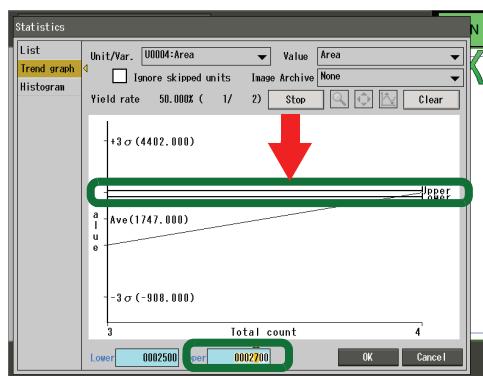
(1) Select [Trend graph].



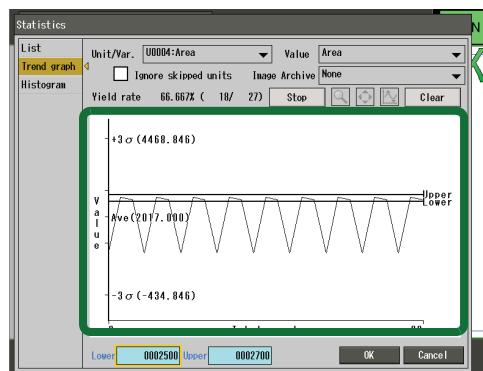
(2) Change the [Lower] value from "2000" to "2500". Confirm that the bar on the graph moves up accordingly. (The value varies depending on the customer.)



(3) Change the [Upper] value from "3000" to "2700". Confirm that the bar on the graph moves down accordingly. (The value varies depending on the customer.)

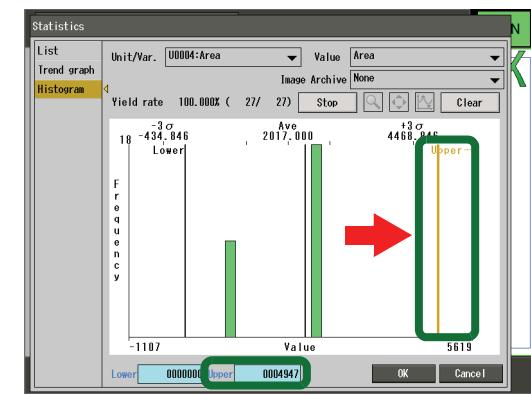
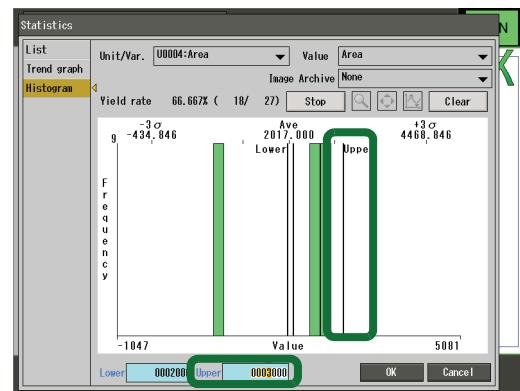


(4) Check the result on the graph.



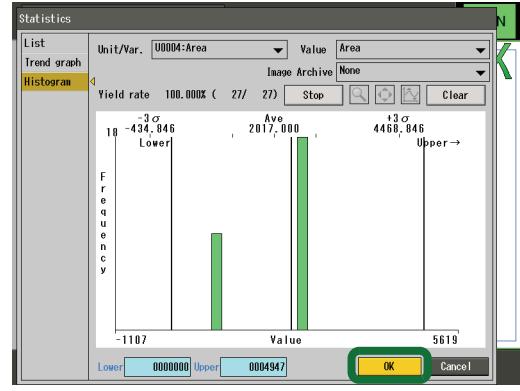
6. Change the [Upper] and [Lower] values for [U0004:Area] while viewing a histogram.

(1) Change the [Upper] and [Lower] values. Confirm that the vertical bars on the graph moves right or left accordingly.



(2) Close the [Statistics] dialog.

Select [OK] and press [Enter] on the handheld controller.



■ What is the image archive function?

On the PC (VisionEditor)

You can archive images used in inspections and result data in the controller's image and program memory. You can set the criteria for archive operations as desired.

You can check the archived data without stopping operations on the controller.

By registering archived data as simulation images, you can use it in offline simulation mode, replay mode, and the XG Simulator.

On the controller

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 controller's internal memory for review at a later time.

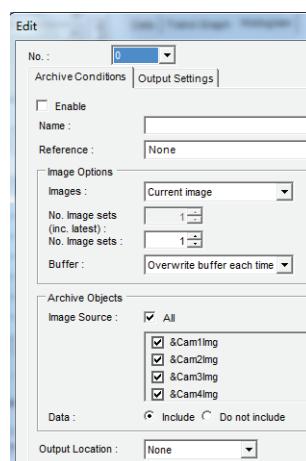
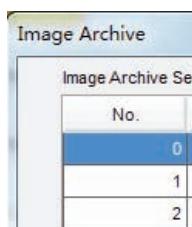
■ Image archive criteria setting

Up to eight criteria settings can be set.

Each criteria setting produces a separate image archive in the controller.

Even if the same criteria is specified in multiple settings, the data will be handled separately for each setting.

Select [Settings] - [Image Archive Settings] to set the criteria. Assign the archive No. first, and then set the image archive criteria.



Selecting the reference: Set the criteria for the image archive activation such as when the total status is NG.

Set the number of image sets and whether to overwrite old data.

Specify image variables to be saved such as the specified camera No.

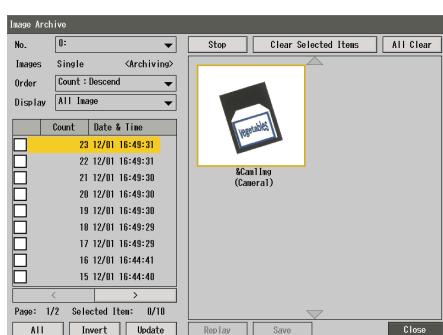
■ Image Archive viewer (controller and PC)

Controller: You can view image data by selecting [Function Menu] - [Image Archive].

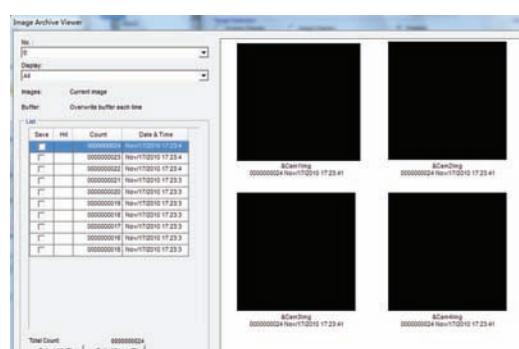
VisionEditor: You can view image data by selecting [Tools] - [Image Archive Viewer].

* By archiving result data together, you can view image data also in replay mode.

(Image Archive viewer of the controller)



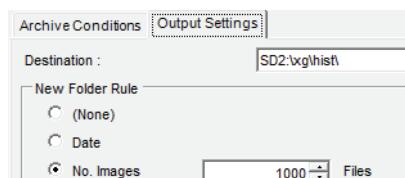
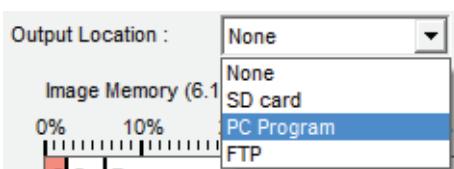
(Image Archive viewer of the VisionEditor)



■ Image archive output

The [Output Location] option of the controller's image archive function saves image data in a PC application or SD card. Unlike an image output unit, which prohibits the next image output during a previous image output, buffering is available to store the next images in the image memory even during image output. This allows image data to be saved continuously in an SD card as much as the specified number of image sets.

This is useful when you need to save continuous image data temporarily.



Basic Tutorial_4_2: Image Archive

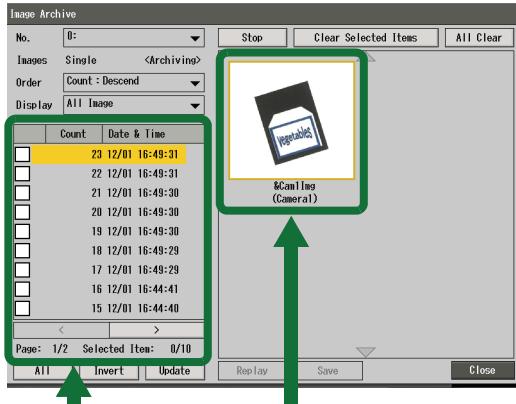
Overview of the image archive function

You can archive images used in inspections and result data in the controller's image and program memory.

This function has the following advantages:

- (1) You can set the criteria for archive operations as desired.
- (2) You can check the archived data without stopping operations on the controller.
- (3) Archived data can be registered as simulation images. These registered images can be used in offline simulation mode, replay mode, and the XG Simulator.

An archived image can be viewed in the Image Archive viewer.



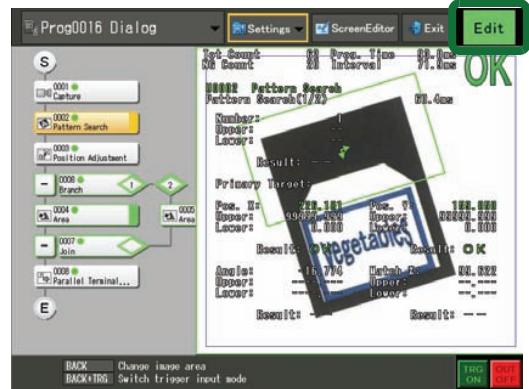
Inspection count for which archive data is saved

Image of the selected inspection count

Setting the "image archive" options

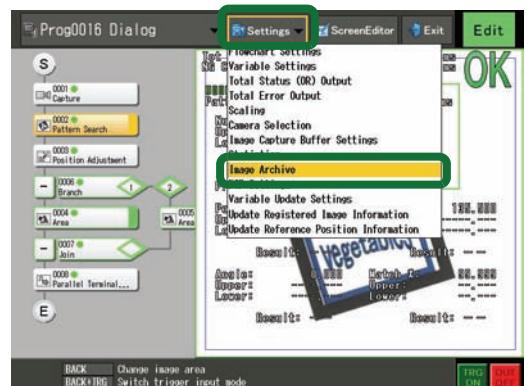
1. Switch to edit mode.

- (1) Move [RUN/STOP] (slide switch) of the handheld controller downward.

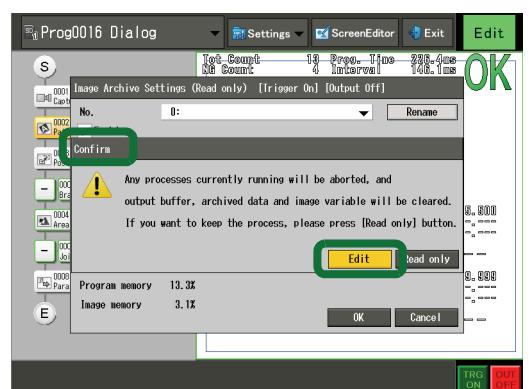


2. Go to the [Image Archive] dialog.

- (1) Select [Options] and press [Enter] on the handheld controller. Select [Image Archive] and press [Enter] on the handheld controller.

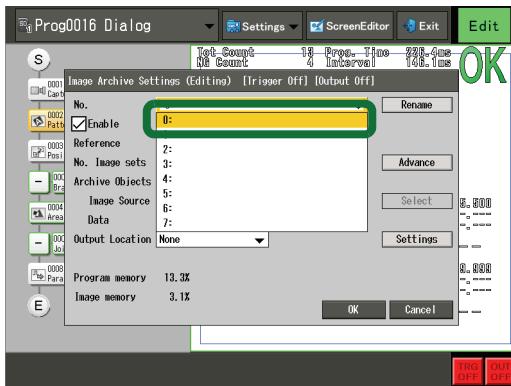


- (2) A confirmation dialog appears. Select [Edit] and press [Enter] on the handheld controller.

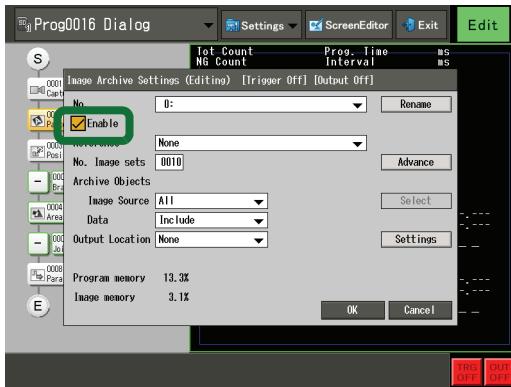


3. Set the options in the [Image Archive] dialog.

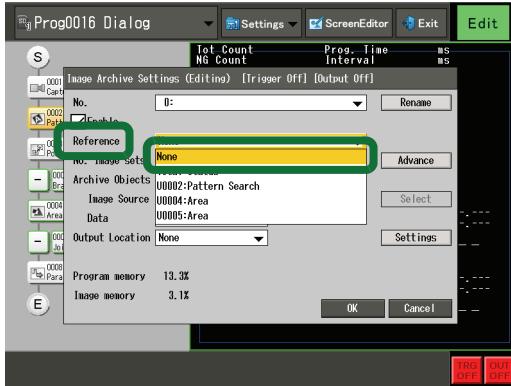
(1) Select [0] for [No.].



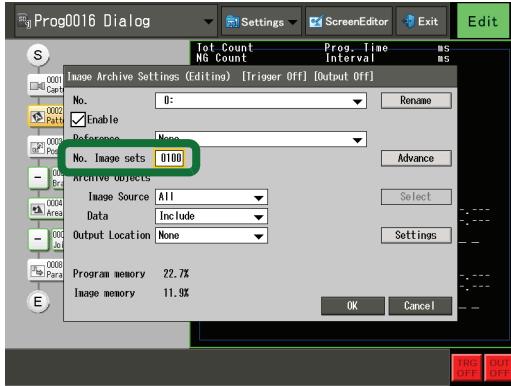
(2) Check the [Enable] check box.



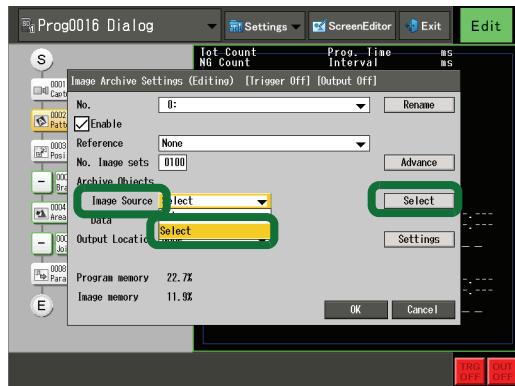
(3) Select [None] for [Reference].



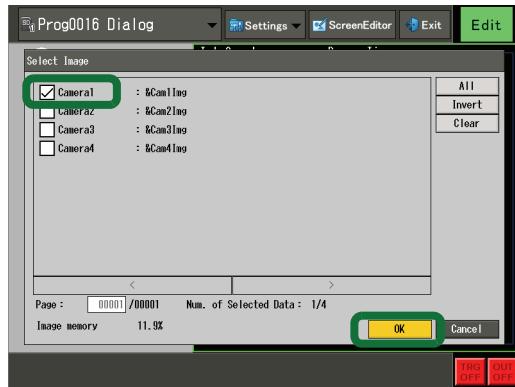
(4) Enter "100" for [No. Image sets].



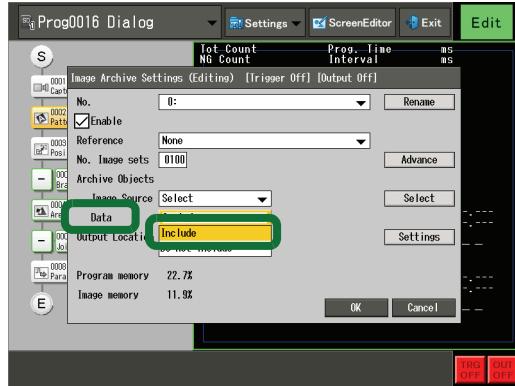
(5) Select [Select] for [Image Source] and select the [Select] button.



(6) Check the [Camera 1] check box only. Select [OK].

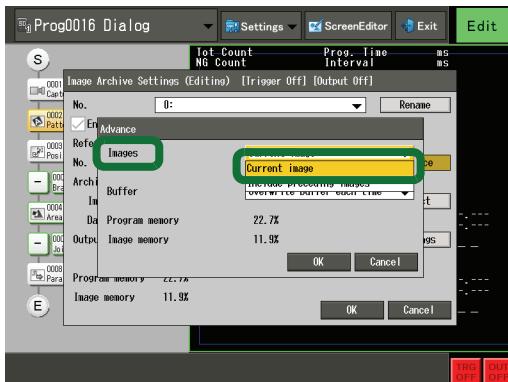


(7) Select [Include] for [Data].



4. Confirm the settings of the other options.

- (1) Confirm that [Current image] is selected for [Images].

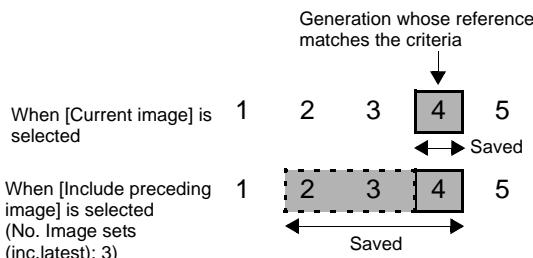


○ Images

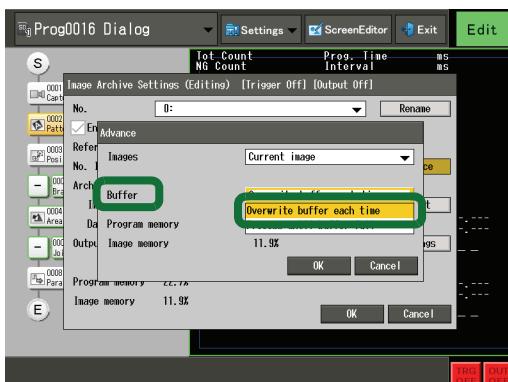
Specify the units of images to be archived.

- Current image: Saves the generation whose reference matches the criteria.
- Include preceding images: Saves the generation whose reference matches the criteria and the number of past generations specified in [No. Image sets (inc.latest)] as one unit. This is useful when you want to save the state just before an NG instance.

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



- (2) Confirm that [Overwrite buffer each time] is selected for [Buffer].

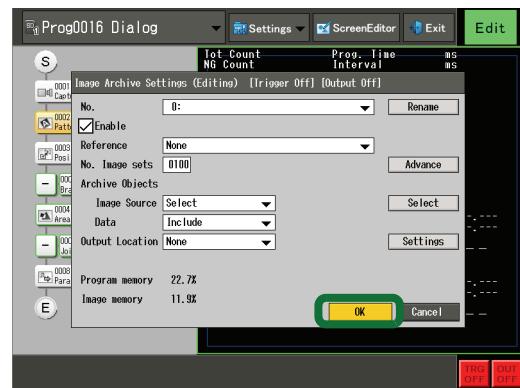


○ Buffer

Specify the behavior when the number of image sets is reached.

- Overwrite buffer each time: Continues storage by overwriting data from the oldest generation.
- Process until buffer full: Pauses archiving until the controller is reset, or the data in the archive criteria is cleared.

- (3) Select [OK] and press [Enter] on the handheld controller.

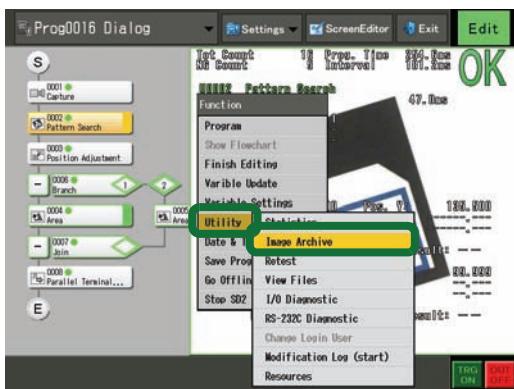


5. Press the [TRIGGER] button on the handheld controller to capture both OK and NG images so that you will be able to check that only a NG image will remain as an archived image.

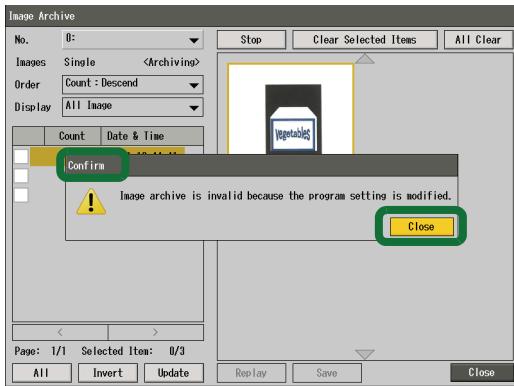
Checking the [Image Archive] viewer

6. Go to the [Image Archive] viewer.

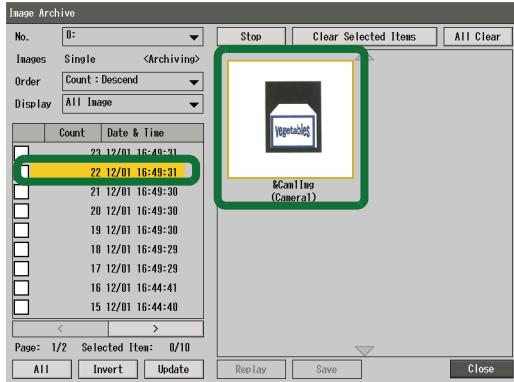
- Press [FUNCTION] on the handheld controller.
Select [Utility] - [Image Archive] and press [Enter] on the handheld controller.



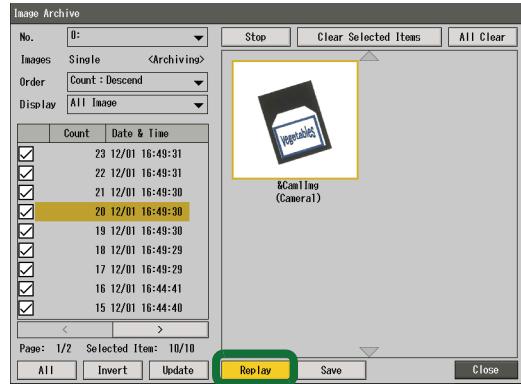
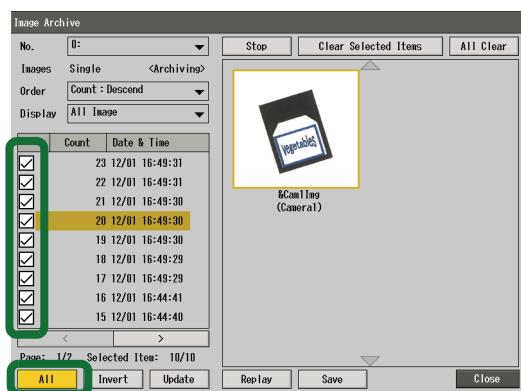
- A [Confirm] dialog appears. Select [Edit] and press [Enter] on the handheld controller.



7. Check the archived images in the [Image Archive] viewer.



8. Go to the [Replay] screen.



9. View the [Replay] data.

- (1) Hold down the [FUNCTION] button on the handheld controller and press the 8-way key right or left.
The inspection is replayed using the archived images.



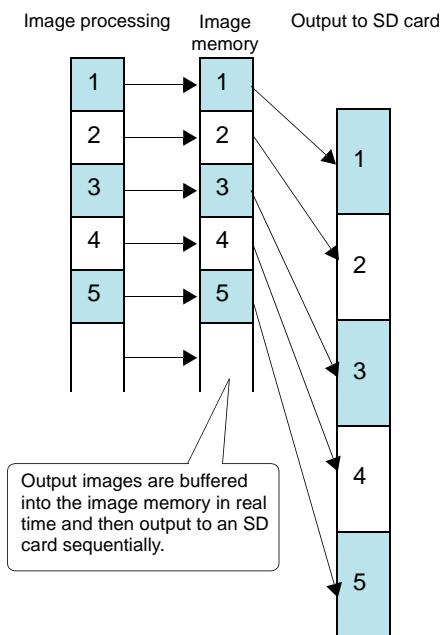
Basic Tutorial_4_3: Image Archive Output

Continuous image output

The [Output Location] option of the controller's image archive function saves image data in an SD card. Unlike an image output unit, which prohibits the next image output during a previous image output, buffering is available to store the next images in the image memory even during image output. This allows image data to be saved continuously in an SD card as much as the specified number of image sets.

This is useful when you need to save continuous image data temporarily.

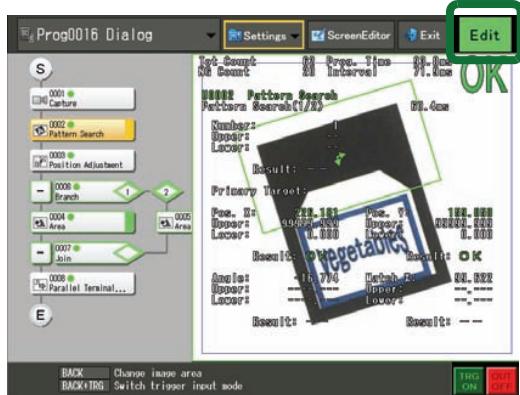
■ Conceptual drawing of the image archive output



Setting the advanced "image archive" options

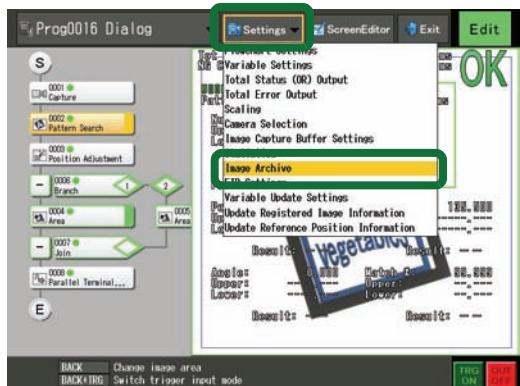
1. Switch to Edit mode.

- (1) Move [RUN/STOP] (slide switch) of the handheld controller downward.

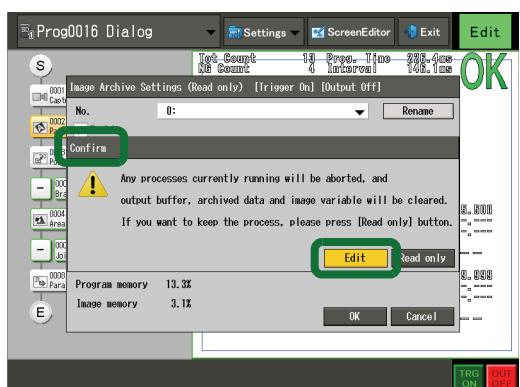


2. Go to the [Image Archive] dialog.

- (1) Select [Options] and press [Enter] on the handheld controller. Select [Image Archive] and press [Enter] on the handheld controller.

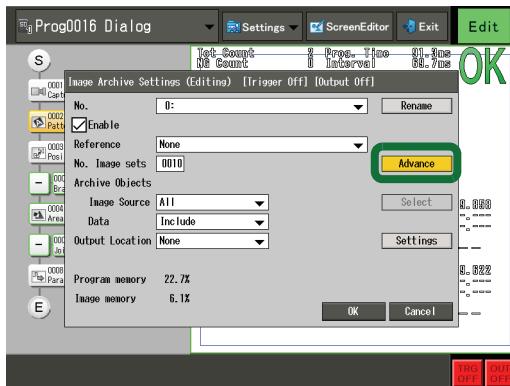


- (2) A confirmation dialog appears. Select [Edit] and press [Enter] on the handheld controller.

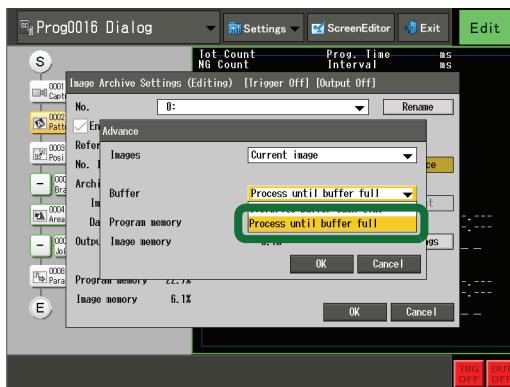


3. Change the advanced settings in the [Image Archive] dialog.

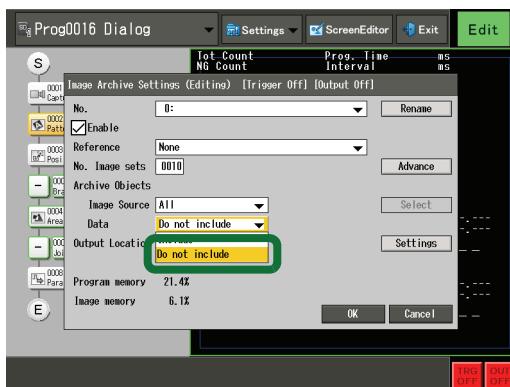
- Select the [Advance] button.



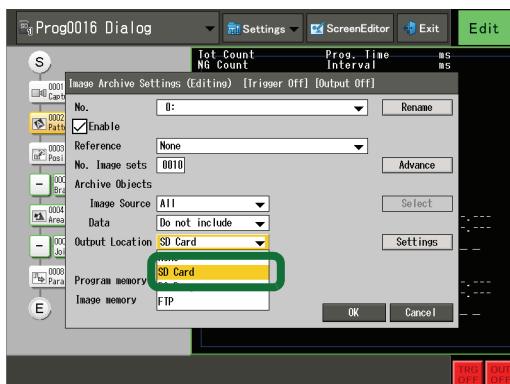
- Select [Process until buffer full] for [Buffer].



- Select [Do not include] for [Data].

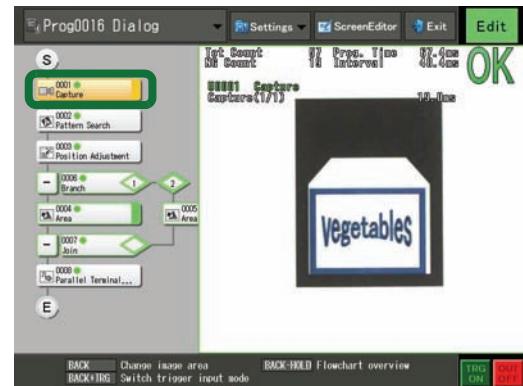


- Select [SD Card] for [Output Location].



4. Change the setting so that images will be processed continuously.

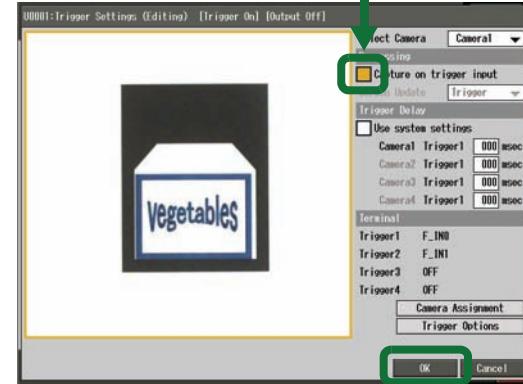
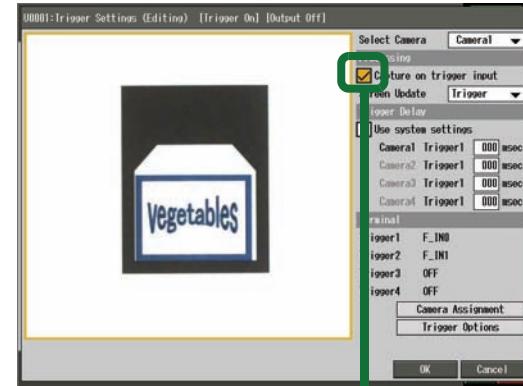
- Select the [U0001:Capture] unit.



- Select [Trigger Set].

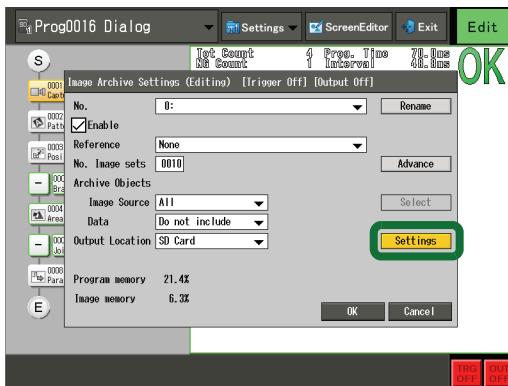


- Remove the check mark for [Processing] - [Capture on trigger input]. This makes image capturing start immediately when the processing proceeds to the capture unit.



- Select [OK] to close the window.

(5) Select [Image Archive Settings] - [Settings].



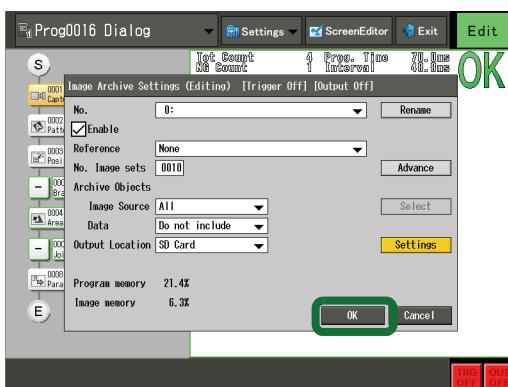
(6) Select "SD1:/xg/" for [Destination].

You can go to "SD1:/xg/" by pressing [Enter] only once for [Destination], and then just moving the 8-way key (up/down/right/left) without pressing [Enter]. Finally, input [Enter].



(7) Close the [Settings] dialog by selecting [OK].

(8) Close the [Image Archive Settings] dialog by selecting [OK].



(9) Select [Function] - [Finish Editing].



5. In Run mode, output the image archive data.

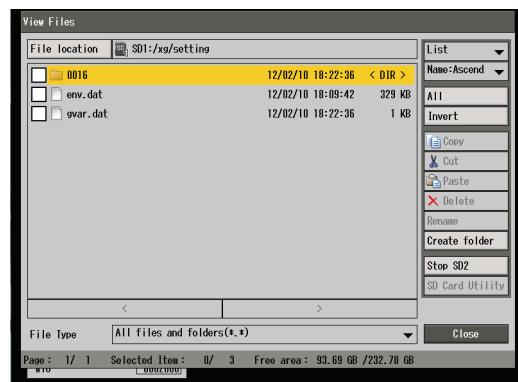
6. Use [View Files] to check the image data written in the SD card.

(1) Select [Function] - [Utility] - [View Files].

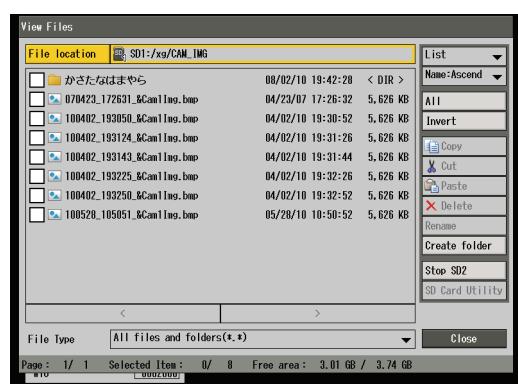


(2) Select "0_100212_182236" (current time data) under "SD1:/xg/".

You can go to "SD1:/xg/0_100212_182236/" by pressing [Enter] only once for [View Files], and then just moving the 8-way key (up/down/right/left) without pressing [Enter]. Finally, input [Enter].



(3) Check that images were output continuously.



Basic Tutorial_4_4: Image Archive Output (FTP)

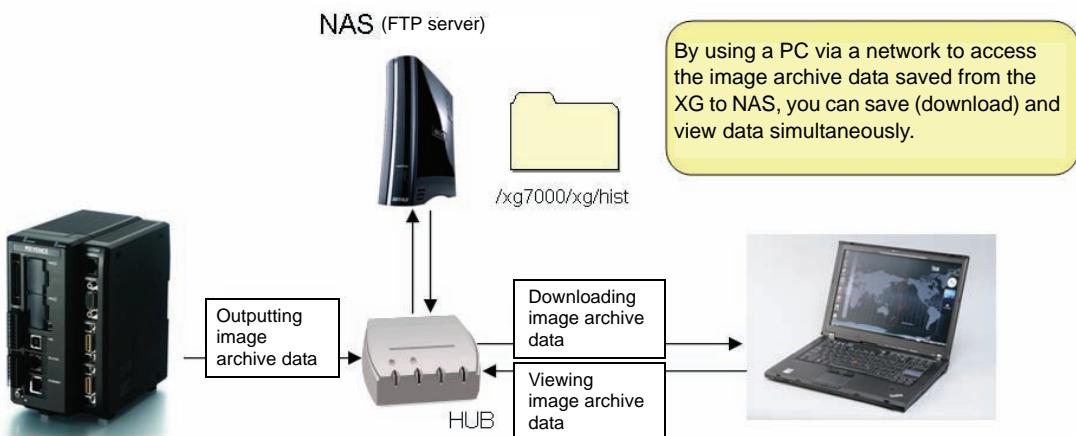
Preparation of NAS

[FTP] has been added as an output destination dedicated for the image archive output function, which offers continuous image output through buffering on the image memory (FTP client function).

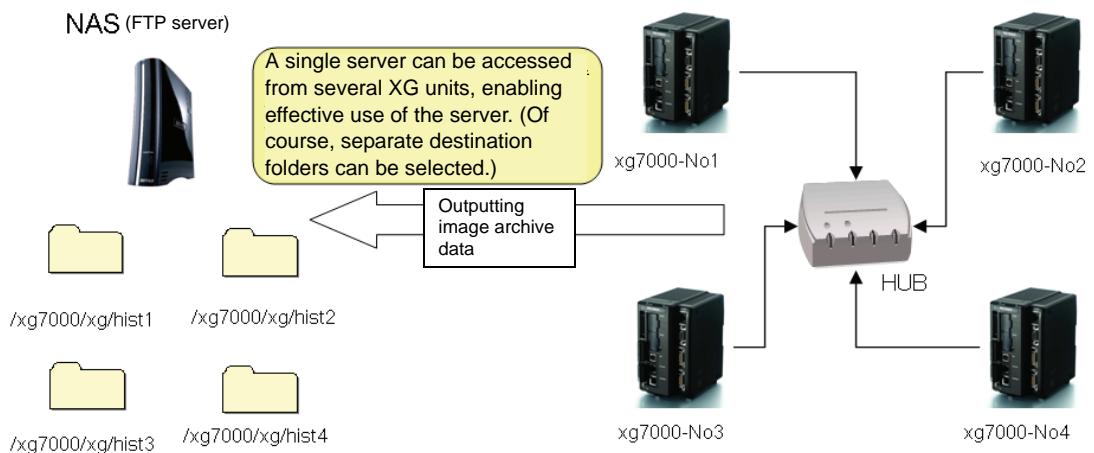
This allows image archive data (image data and replay data) to be directly stored in a PC on an Ethernet network or in a large-capacity network-ready hard disk drive called NAS (Network Attached Storage). (The storing procedure is the same as the conventional output to an SD card.)

■ Connection examples

- (1) To check the image data saved from the XG to NAS by using a PC on a network



- (2) To save image data from several XG units to a single NAS



Preparation of NAS

This section explains the setting procedure to use FTP to output image archive data from the XG to Buffalo's NAS (LS-XH series, etc.) which is connected to LAN.

1. When the NAS is used for the first time, you need to set the following:

- (1) Set an IP address by using the special setup software "NASNavigator2" included with the NAS. For details, refer to the instruction manual of the NAS.

2. After setting the IP address, use the Internet Explorer on the PC connected to LAN to access the NAS administration menu and specify the remaining settings.

- (1) Type "http://***.***.***.***/" (***: IP address) in the address bar of the IE.
- (2) Enter the administrator's name and password to log in to the administration menu ("admin" and "password" by default).

3. Set the details of the NAS in the administration menu.

- (1) Select [Network] > [Network service] > [FTP]. Select [Shared folder] > [Create shared folder] to create an appropriate folder, and check the check boxes for [Shared folder attribute: Writable] and [Destination: FTP].
 - * This folder corresponds to the [FTP destination] in the [Image Archive Settings] setting of the XG.
- (2) At [User/group], add an appropriate user name and set a password.
 - * These correspond to [User ID] and [Password] in [FTP Settings] of the XG.

4. View the FTP public folder of the NAS from the PC.

The following explanation assumes that you created a folder "user" in the NAS as the FTP public folder. It is also assumed that a user name "user" and password "user" have been registered.

- (1) Access to the NAS from the PC and confirm that the "user" folder exists.
Enter the IP address of the NAS which you set in step 1-1 in the address bar of the Internet Explorer, and you can access to the folder in the NAS.

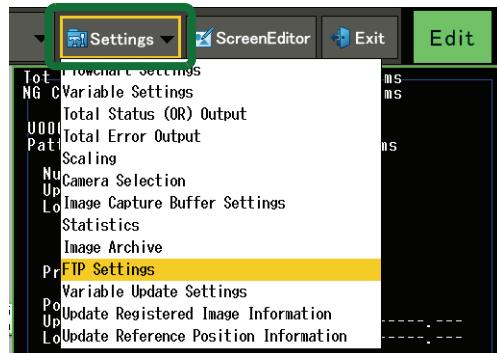


- (2) This completes the preparation of the NAS.

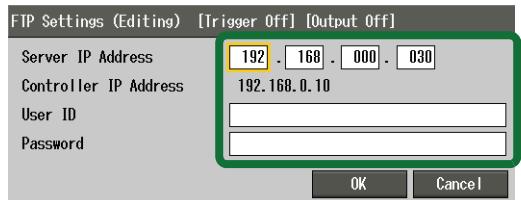
Setting the controller

5. Configure the basic settings to connect to the FTP server.

- (1) From the Flow Editor of the controller, open [Options] > [FTP Settings].

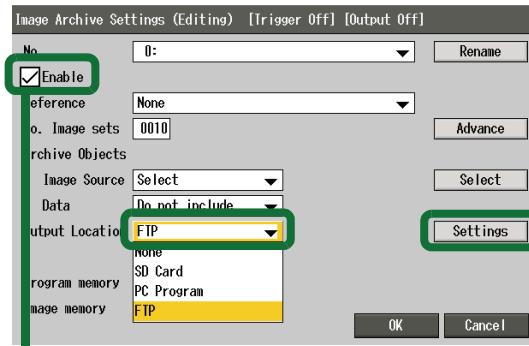
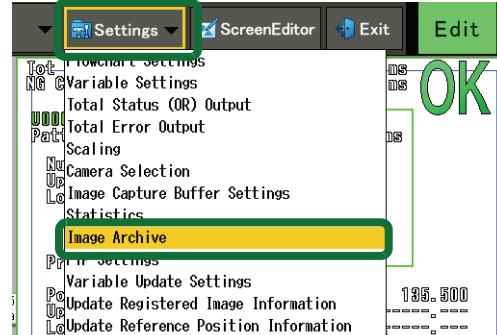


- (2) Specify the IP address of the NAS in [Server IP Address]. For the user ID and password, enter the corresponding settings of the NAS.



6. Set the options for the image archive output (FTP).

- (1) From the Flow Editor of the controller, open [Options] > [Image Archive].

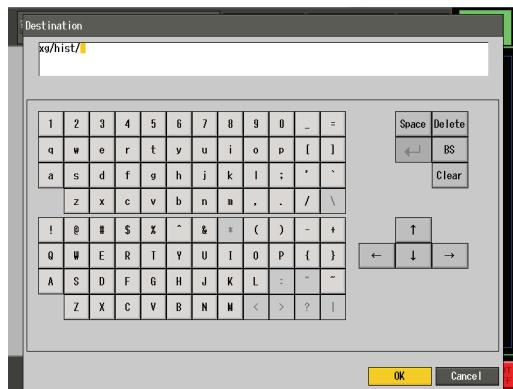
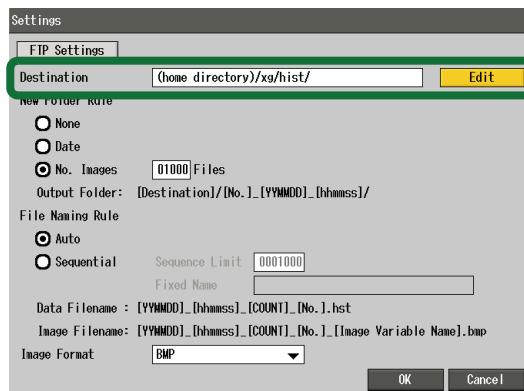


If [Enable] is not checked, actual data output will be disabled despite the setting.

- (2) Select [FTP] for [Output Location] of the image archive criteria with [Enable] being checked, and select the [Settings] button.
 In the [Settings] dialog, select the [Edit] button to set the destination folder of the FTP output.
- (3) Set as follows to output the data to the "user" folder prepared in the NAS setting.

"disk1/user"

→The "disk1" folder does not exist originally in the NAS. It represents a root (top layer) of the NAS file system and must be added to the beginning of the destination for accessing the NAS via FTP. This is specific to the NAS manufactured by Buffalo.



- (4) Now you can output the image archive data to the "user" folder in the NAS. The folder rule specified in [Settings] is also applied to and processed in this "user" folder. The image archive data output to the "user" folder can be viewed from the Internet Explorer on the PC via LAN.

[Reference] Error messages related to FTP output

- (1) "Failed to connect to FTP server."
 Make sure that the IP address of the FTP server is properly set in [FTP Settings]. Confirm that the FTP server is operating.
- (2) "Failed to login to FTP server."
 Make sure that you entered correct [User ID] and [Password] in [FTP Settings].
- (3) "Failed to create file / folder on FTP server."
 The FTP server was logged in successfully but file output failed.
 Confirm that you specified a correct destination folder in [Image Archive].
 Also, make sure that the specified destination folder in the NAS is writable.

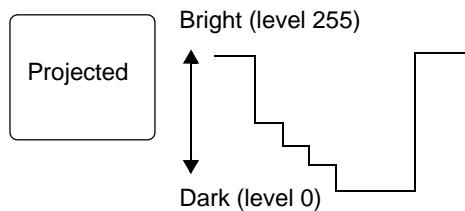
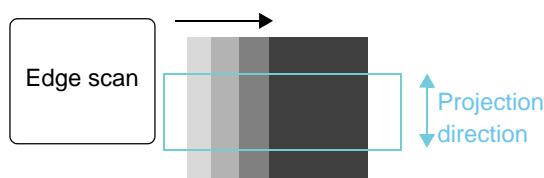
Advanced Tutorial_1_1: Edge

Edge

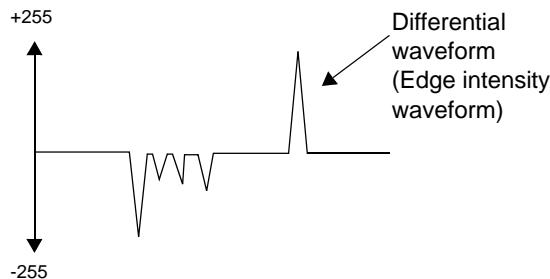
An edge is a border formed between the bright and dark areas in an image. Edge detection is a function to detect a border showing such an intensity change by using image processing. An edge is detected through the following three processes:

■ Edge detection algorithm

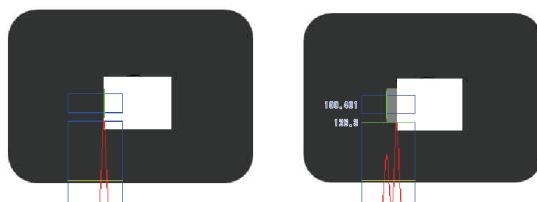
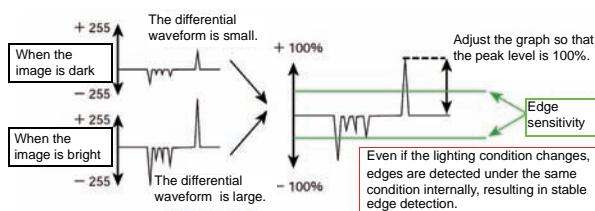
(1) Make a graph of the brightness.P



(2) Make a graph of the change in the brightness.



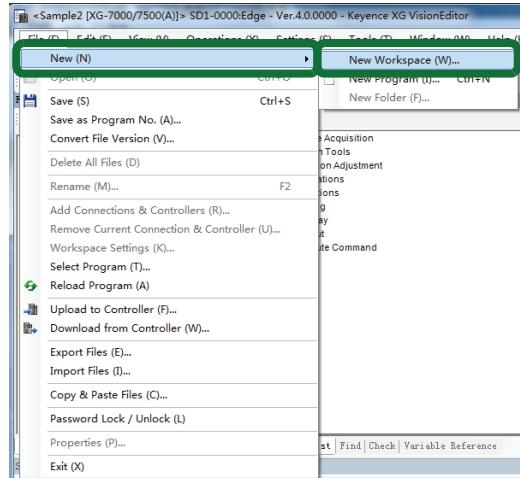
(3) Select the level of the change in the brightness to be recognized as an edge (edge sensitivity).



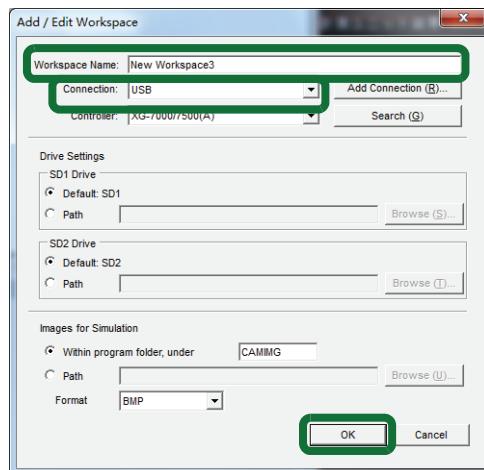
Examining edge detection

1. Create a new "workspace".

(1) Select [File] - [New] - [New Workspace].

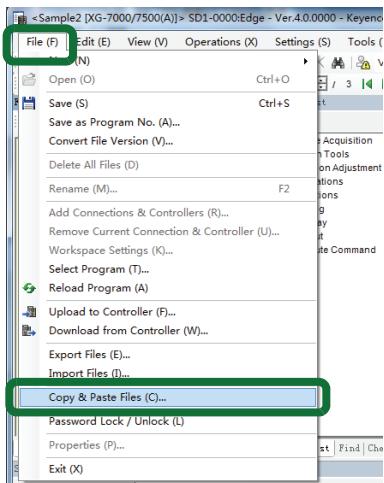


(2) Enter "New Workspace3" for [Workspace Name], select [USB] for [Connection] and click the [OK] button.



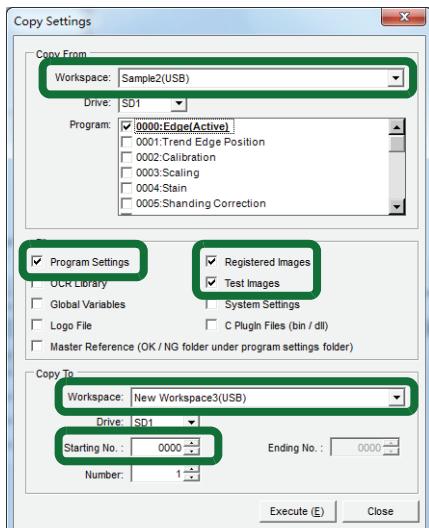
2. Copy a "program".

(1) Select [File] - [Copy & Paste Files].

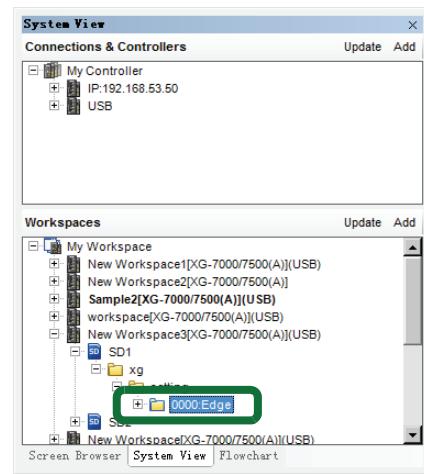


(2) In [Copy Settings], set the options as follows and select [Execute].

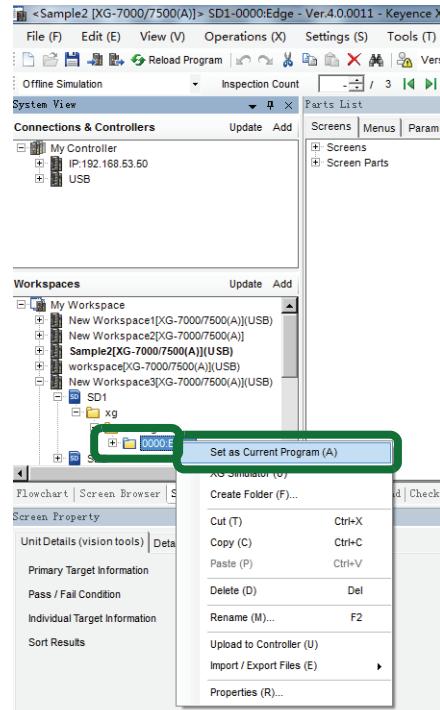
- For [Copy From], select [Sample2(USB)] for [Workspace] and [0000:Edge] for [Program].
- Select [Program Settings], [Registered Images], and [Test Images] for [Files].
- For [Copy To], select [New Workspace3(USB)] for [Workspace] and [0000] for [Starting No.].



(3) Confirm that [0000:Edge] has been added in [Workspaces].

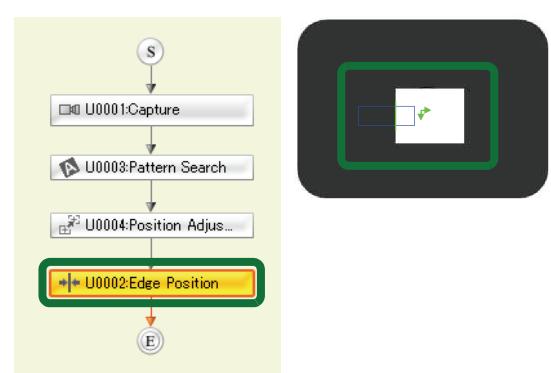


(4) Right-click [0000:Edge] of [New Workspace3] and select [Set as Current Program].



3. See how edges are detected on the VisionEditor.

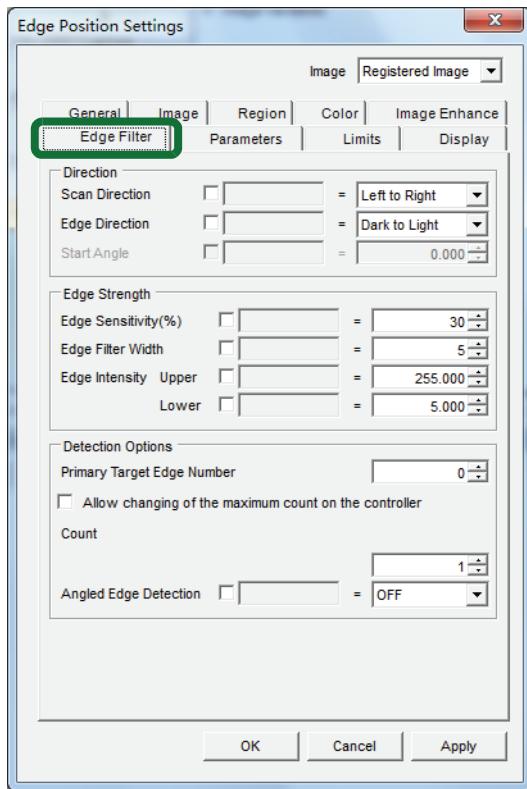
(1) Select [U0002:Edge Position] in the [Flowchart] view and click the [Execute one time] button. See how the edge is detected in [Vision Window].



Examining the adjustment parameters

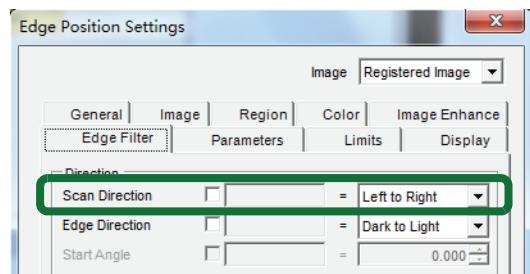
4. Examine the parameter settings.

- (1) Double-click [U0002:Edge Position] in the [Flowchart] view and open its "unit property" setting. Click the [Edge Filter] tab and examine the parameter settings.

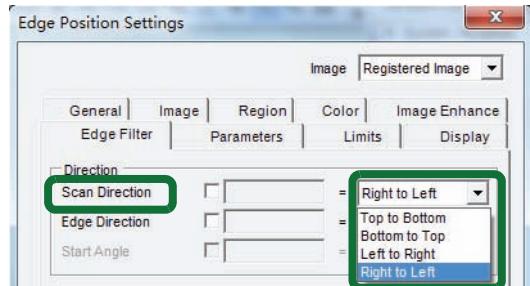


- (2) Try to change the [Scan Direction] setting. Confirm that [Edge Direction] is set to [both].

- (i) Check that [Scan Direction] is set to [→].



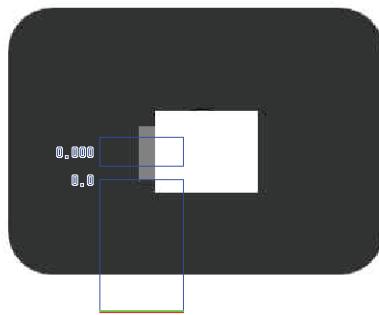
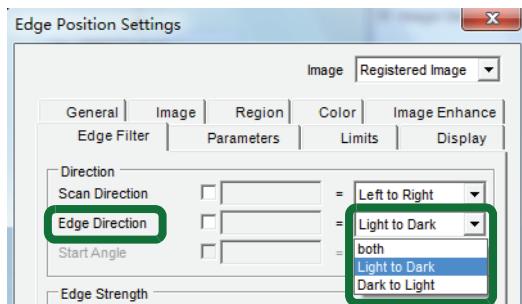
- (ii) Change [Scan Direction] from [Left to Right] to [Right to Left].



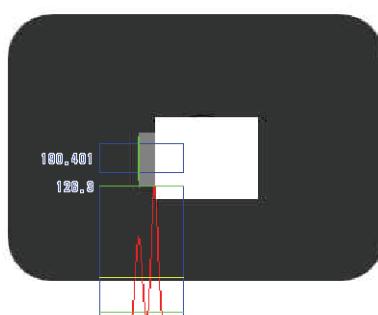
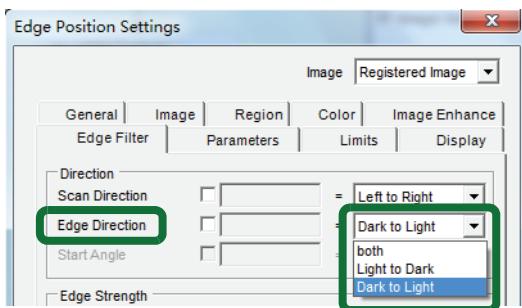
- (3) Change [Scan Direction] from [Right to Left] to [Left to Right].

(4) Change the [Edge Direction] setting.

(i) Change [Edge Direction] to [Light to Dark].

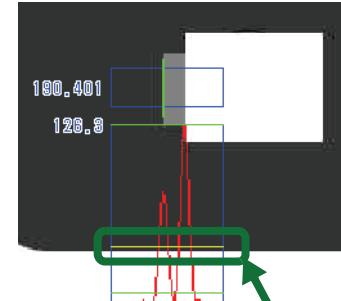
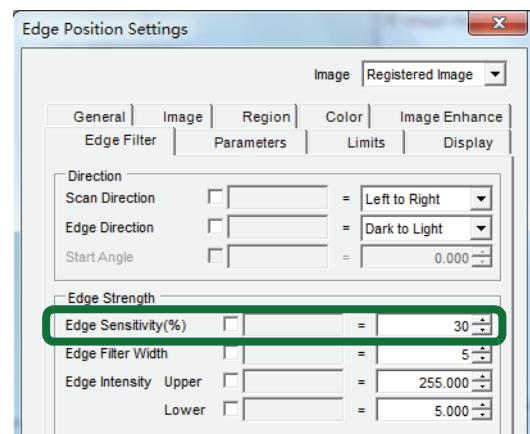


(ii) Change [Edge Direction] to [Dark to Light].

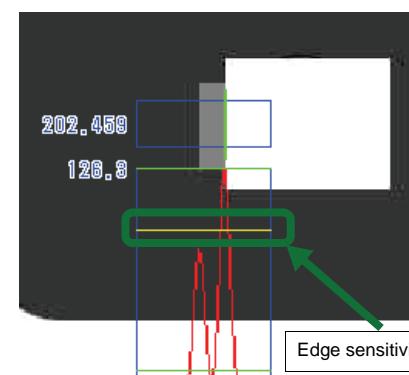
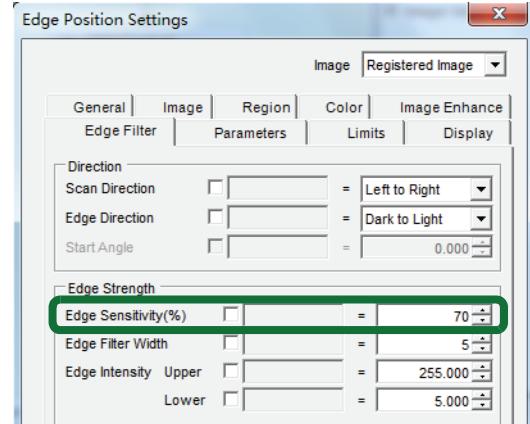


(5) In this exercise, set [Edge Direction] to [Dark to Light].

(6) Change [Edge Sensitivity] from [30] to [70]. Confirm that [Edge Sensitivity] was raised.



Edge sensitivity: 30



Edge sensitivity: 70

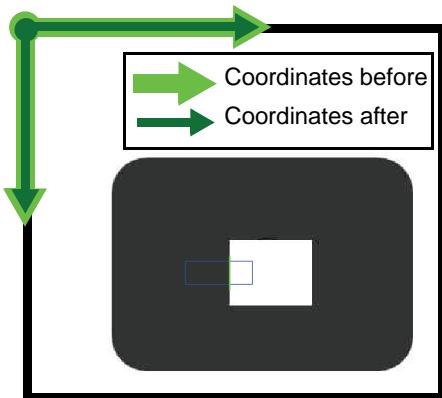
(7) Change [Edge Sensitivity] to [30].

Checking the difference between "Measured value MS" and "Absolute value AB"

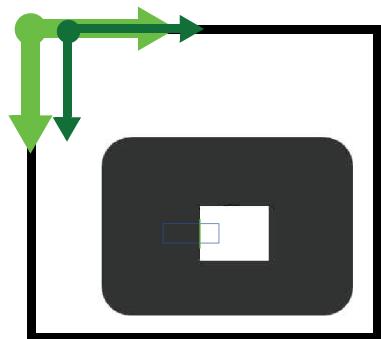
5. View [Unit Result] to check the difference.

MS: Coordinates after position adjustment

AB: Coordinates before position adjustment (camera's coordinate system)



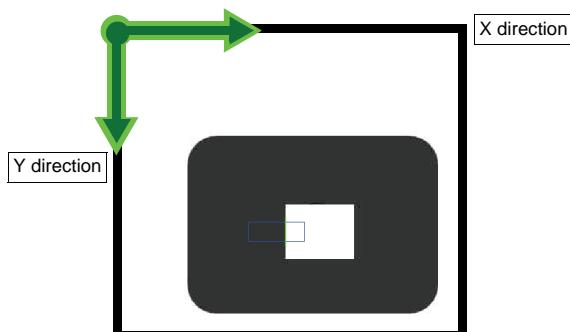
(ii) When [Last measured generation number] is [2/3]



ユニット結果				
ユニット参照変数・結果		システム変数	ローカル変数	グローバル変数
名称	定義	先...	表...	現在値
N-JG	エッジ数: 判定値	-	-	0
□Y		0 - 100	現在	1
[JGL]MS	位置X: 計測値	-	-	+202.464
[JGL]AB	位置X: 絶対計測値	-	-	+272.508

Select [Unit Result] - [Unit] and locate [[JGL]:AB]/[Pos. X:Abs.]/[Current] and [[JGL]:MS]/[Pos. X:Meas.]/[Current].

(i) When [Last measured generation number] is [1/3]



ユニット結果				
ユニット参照変数・結果		システム変数	ローカル変数	グローバル変数
名称	定義	先...	表...	現在値
N-JG	エッジ数: 判定値	-	-	0
□Y		0 - 100	現在	1
[JGL]MS	位置X: 計測値	-	-	+202.476
[JGL]AB	位置X: 絶対計測値	-	-	+202.518

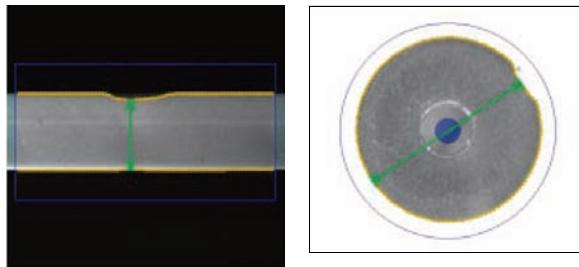
Advanced Tutorial_1_2: Trend Edge

Trend edge detection algorithm

The trend edge mode detects an edge position of each point in a "segment", which is a small, narrow area defined in an inspection region. Since edge positions of multiple points can be detected in a single window, this inspection mode does not miss a subtle change in the target.

■ Applications

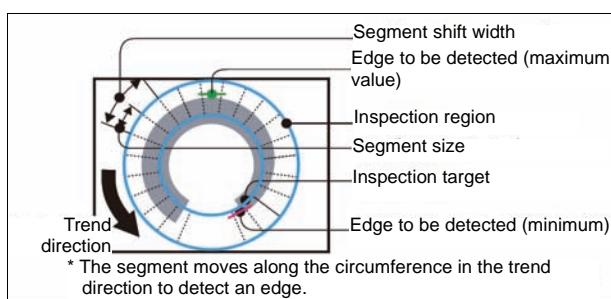
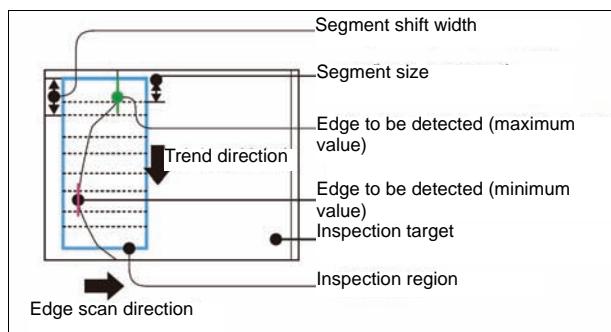
Indentation in plastic parts Chipped rubber packing



Gradual change can reliably be detected.

For a circular target, the segment moves along the circumference to find a point to be detected reliably.

■ Detection principle



The trend direction is the direction in which the segment moves.

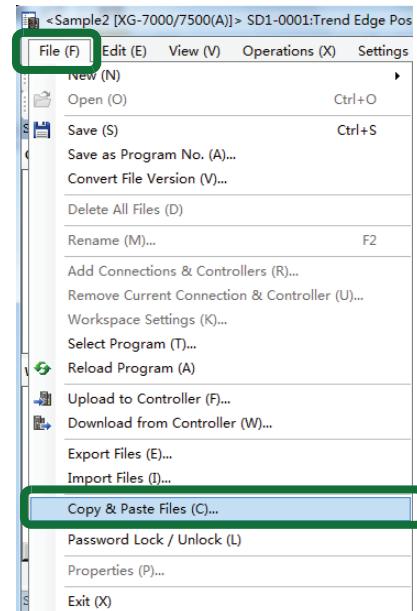
■ Setting tips

- (1) To detect a position with higher accuracy, set [Segment Size] smaller.
- (2) To save the processing time, set [Segment Shift] larger.

Preparation for creating a program

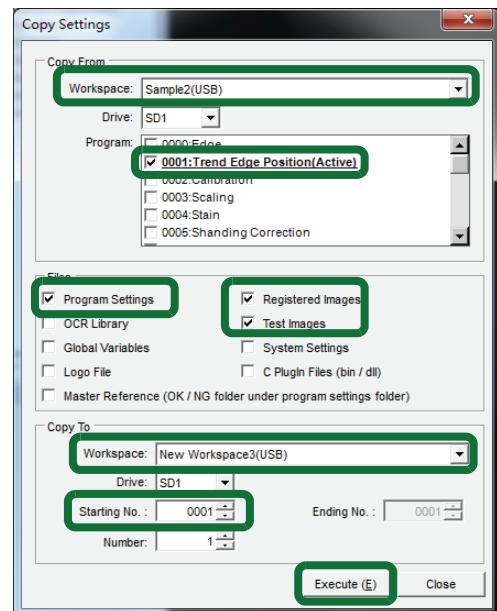
1. Copy program data.

- (1) From [Menu bar] at the top of the screen, select [File] - [Copy & Paste Files].

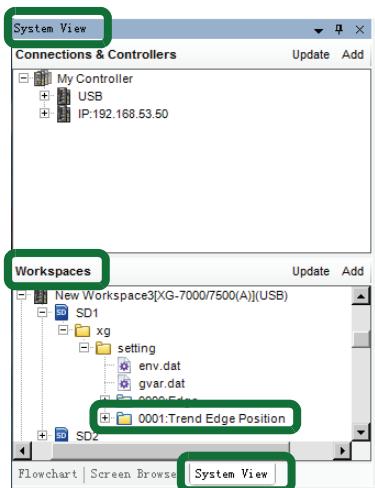


- (2) Copy program data in the following procedure.

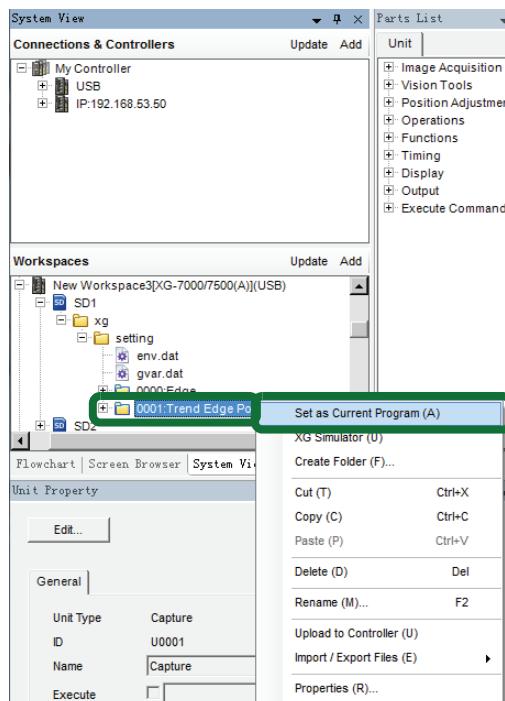
- Select [Copy From] - [Workspace] - [Sample2(USB)] and [Copy From] - [Program] - [0001:Trend Edge Position].
- Select [Program Settings], [Registered Images], and [Test Images] for [Files].
- Select [Copy To] - [Workspace] - [New Workspace3(USB)] and [Copy To] - [Starting No.] - [0001].
- When the setting is complete, click the [Execute] button.



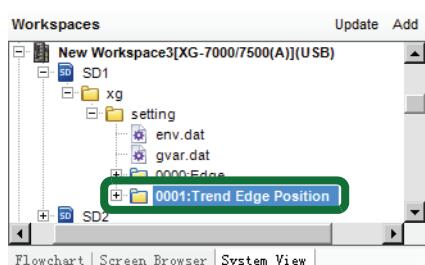
- (3) In [System View], confirm that [Workspaces] - [New Workspace3] - [SD1] - [xg] - [setting] - [0001:Trend Edge Position] has been added.



- (4) Switch [0001:Trend Edge Position] to a "current program". Right-click it and select [Set as Current Program].



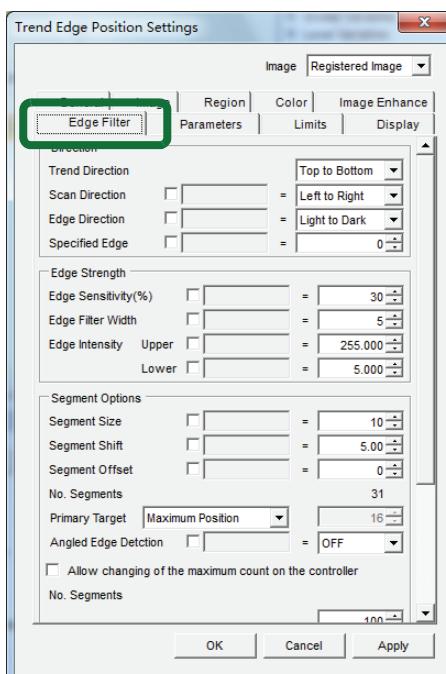
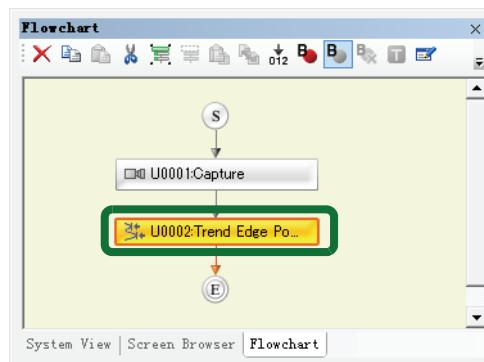
- (5) Confirm that [0001:Trend Edge Position] is shown in boldface.



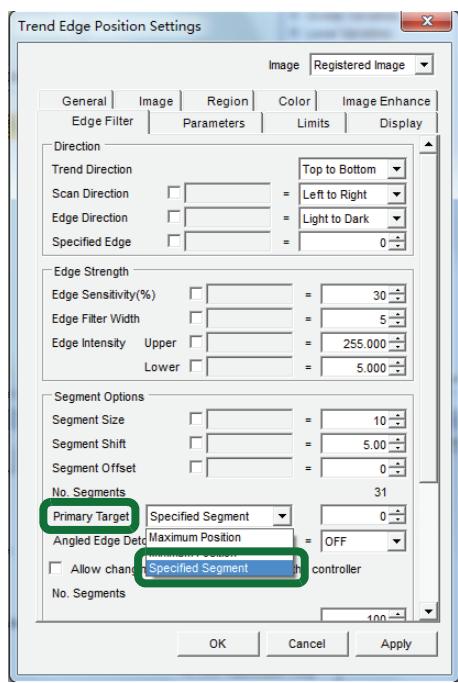
Examining the adjustment parameters

2. Check the edge points detected with the [Trend Edge Position] unit.

- (1) Double-click [U0002:Trend Edge Position] in the [Flowchart] view to open its "unit property" setting. Open the [Edge Filter] tab.



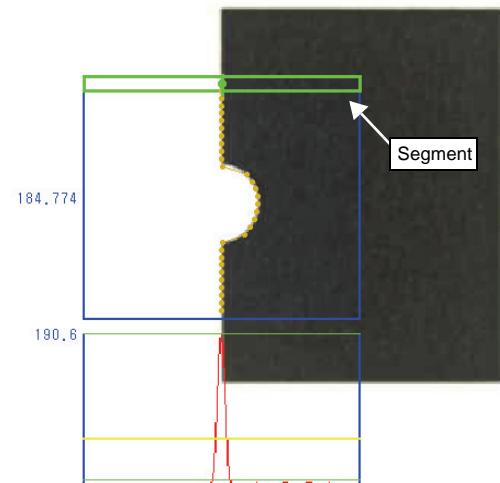
(2) Select [Specified Segment] for [Primary Target].



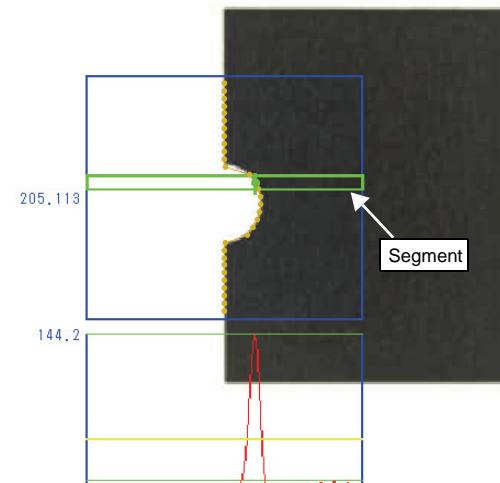
This allows you to specify the "edge point" used for judgment individually.

(3) Increase the value of [Specified Segment] one by one. See that the green segment in [Vision Window] shifts accordingly.

(i) When the value of [Specified Segment] is [0]

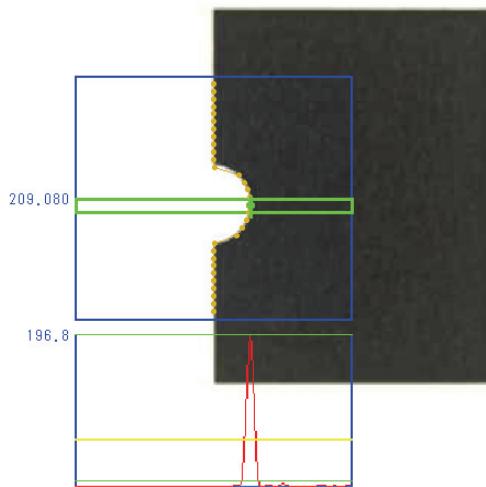
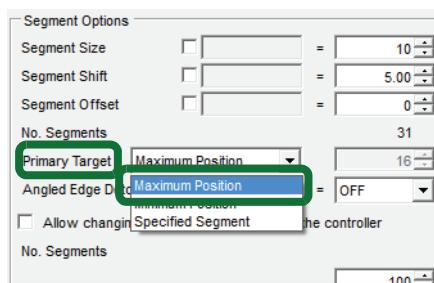


(ii) When the value of [Specified Segment] is [13]

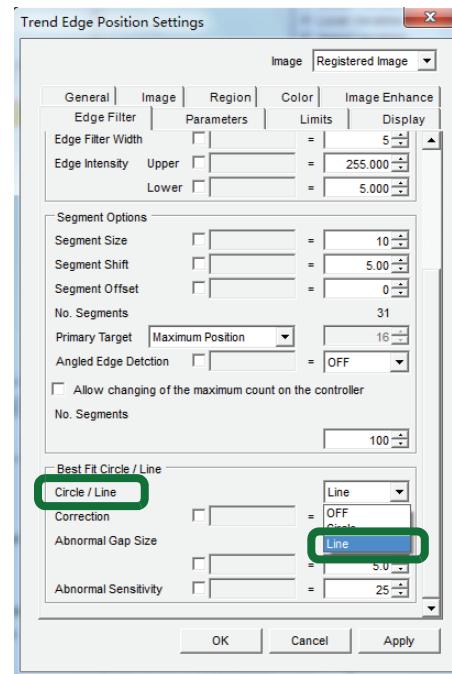


Move the "segment" in this way and check the "edge position" determined for each "segment".

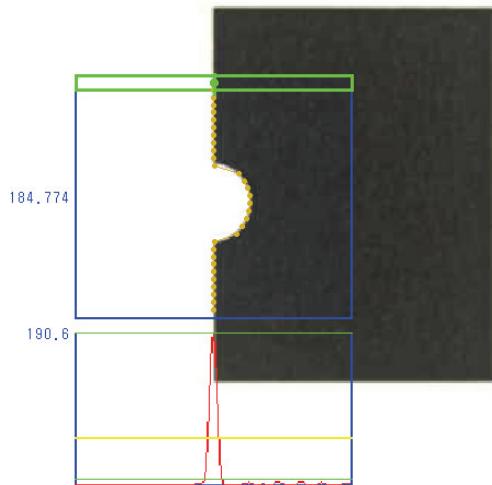
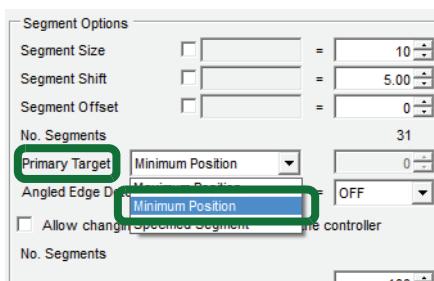
(4) Change [Primary Target] to [Maximum Position].



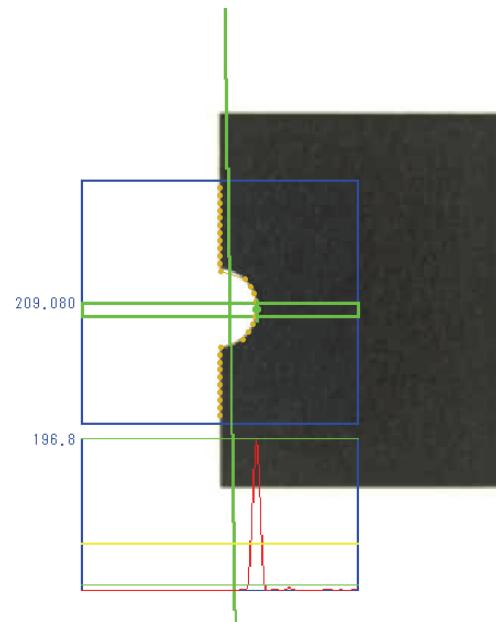
3. Use the obtained information of the multiple edge points to determine an approximate line.
(Specifically, use a least-squares method to detect the line.)
- (1) For [Circle / Line] in the "unit property" setting, select [Line]. (Move the scroll bar to the bottom.)



(5) Change [Primary Target] to [Minimum Position].



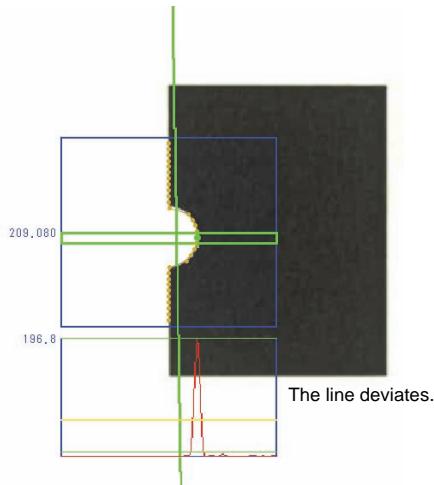
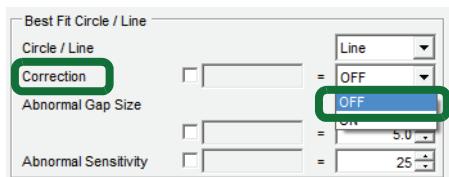
(2) See how the line is detected in [Vision Window].



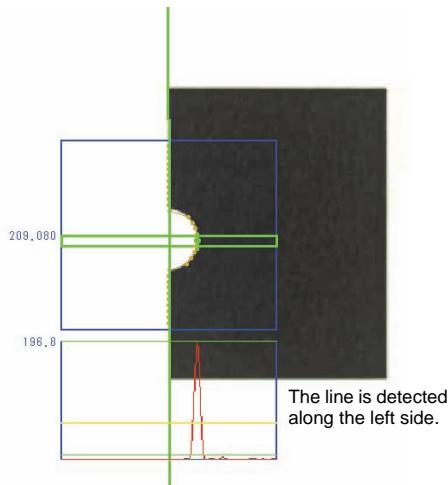
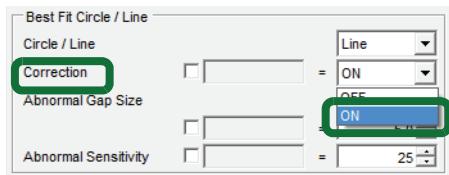
(6) In this exercise, set [Primary Target] to [Maximum Position].

4. Make adjustment so that the line is detected along the left side of the target.

(i) When [Correction] is set to [OFF]



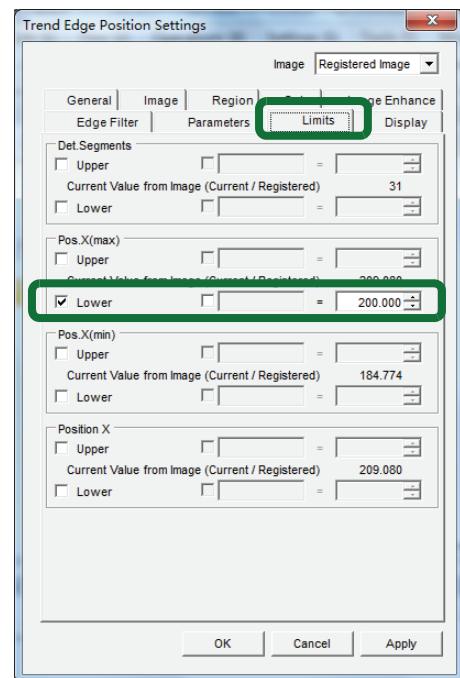
(ii) When [Correction] is set to [ON]



When [Correction] is set to [ON], the [Circle / Line] setting detects a line by ignoring edge points which deviate greatly due to noises or other causes.

5. View the settings in the [Limits] tab and check the total status.

(1) In the [Limits] tab, confirm that [Lower] for [Pos. X(max)] is set to [200].

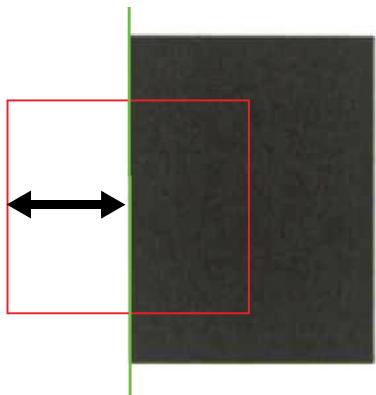


(2) Change [Image] to [Current Image].



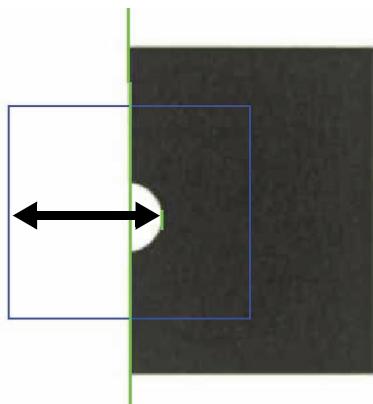
- (3) Click the [Execute one time] button. Confirm that the result is [NG] when [Final measurement generation number] is [1/2].

Pos.X(max)		=	
<input type="checkbox"/> Upper	<input type="text"/>	=	<input type="text"/>
Current Value from Image (Current / Registered) 185.732			
<input checked="" type="checkbox"/> Lower	<input type="text"/>	=	<input type="text"/>
200.000			



- (4) Click the [Execute one time] button. Confirm that the result is [OK] when [Final measurement generation number] is [2/2].

Pos.X(max)		=	
<input type="checkbox"/> Upper	<input type="text"/>	=	<input type="text"/>
Current Value from Image (Current / Registered) 209.080			
<input checked="" type="checkbox"/> Lower	<input type="text"/>	=	<input type="text"/>
200.000			

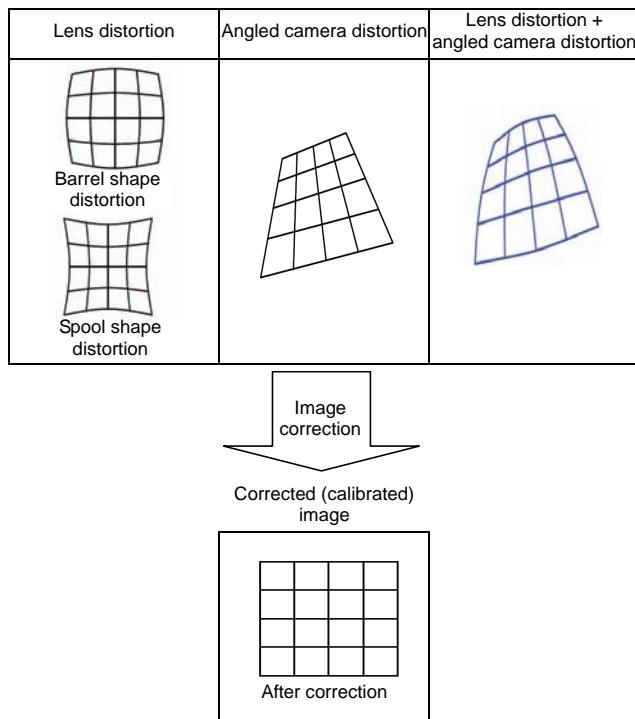


Advanced Tutorial_1_3: Calibration

Calibration unit

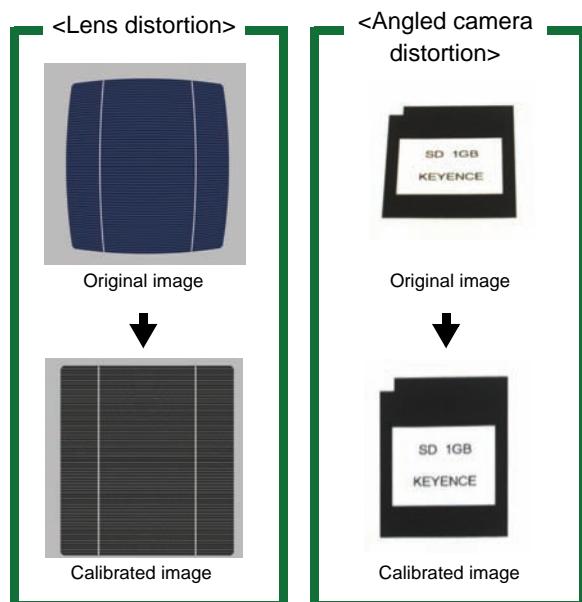
A Calibration unit is used to correct the distorted field of view caused by the intrinsic property of the lens or by the camera installation angle, in order to obtain properly adjusted coordinates or images.

■ What is calibration?

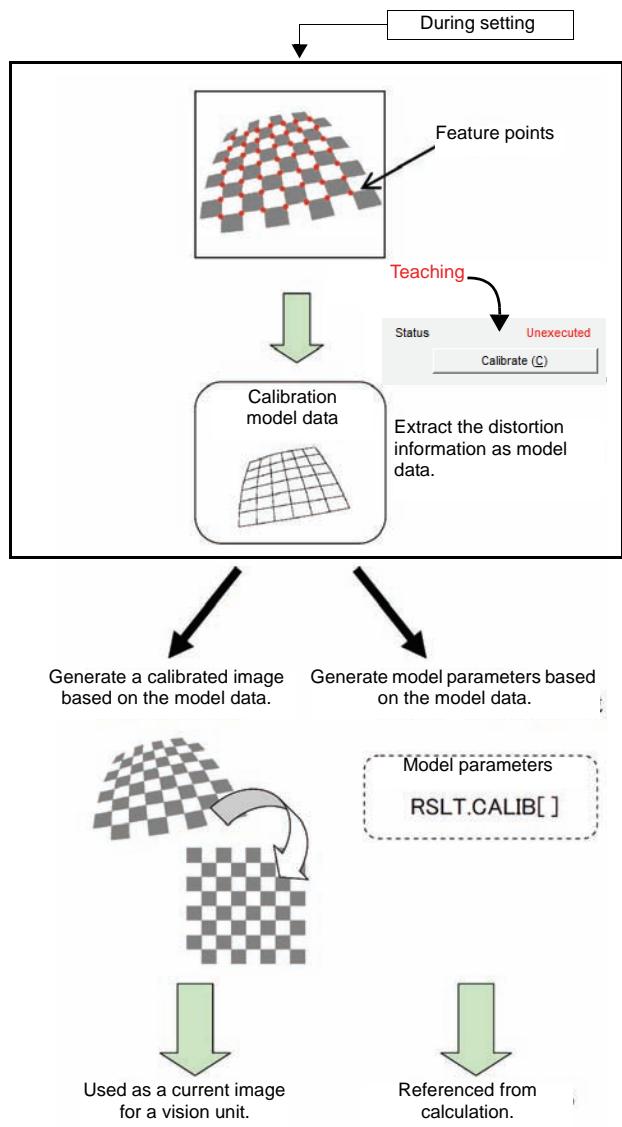


Both lens distortion and angled camera distortion can be corrected simultaneously.

■ Calibration usage example



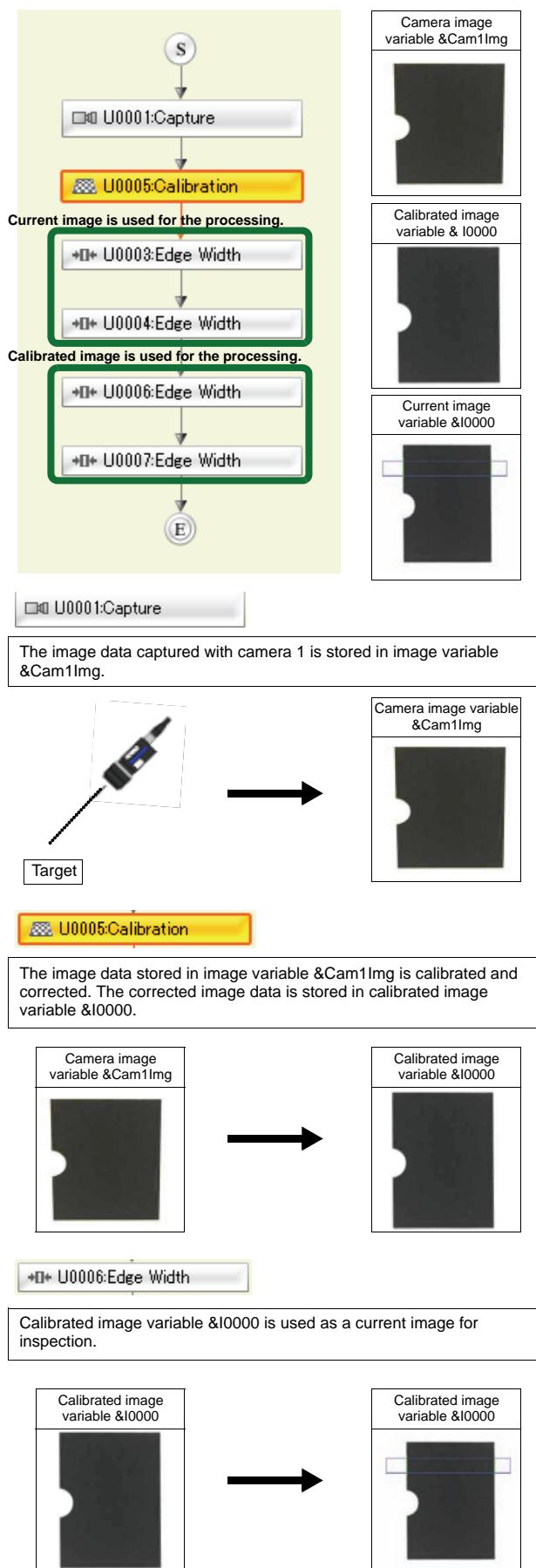
■ What is teaching?



During setting, build a "calibration model" required for calibration from coordinate data of the feature points obtained through capture of an image of a chess board or dot pattern (These images can be printed from the VisionEditor.).

During operation, use the "calibration model" as a base to create a "calibrated image" or "model parameters" required for coordinate conversion.

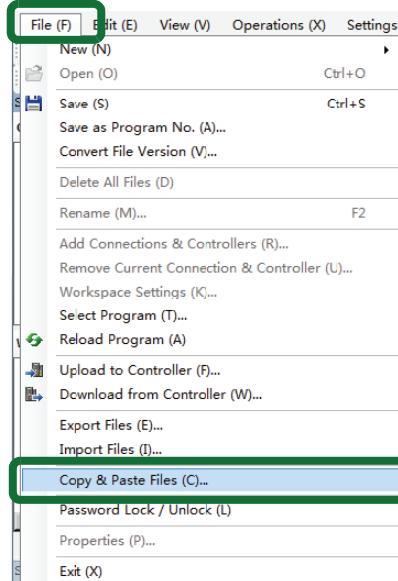
■ Sample flowchart



Check the settings of the program.

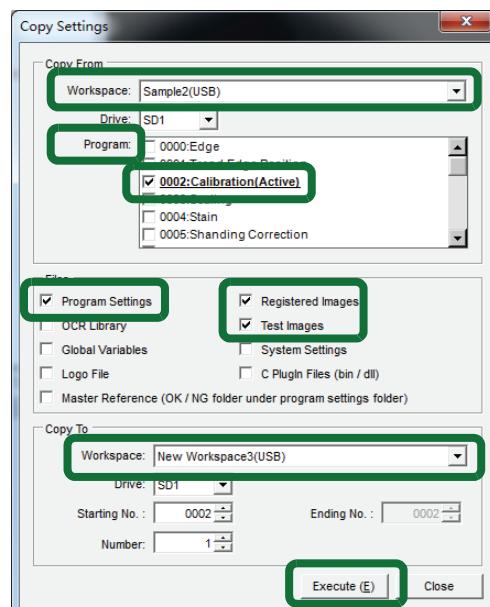
1. Copy program data.

- (1) From [Menu bar] at the top of the screen, select [File] - [Copy & Paste Files].

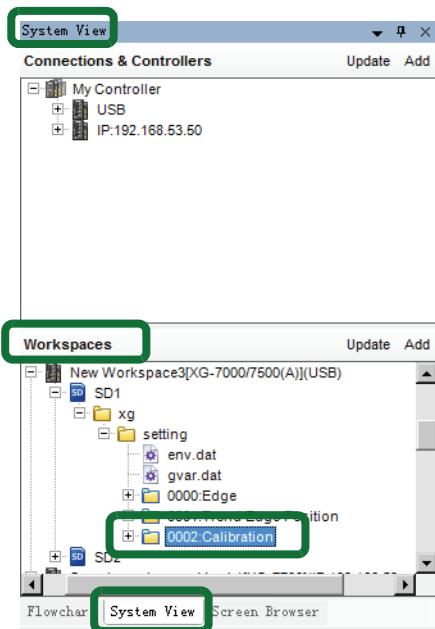


- (2) Copy program data in the following procedure.

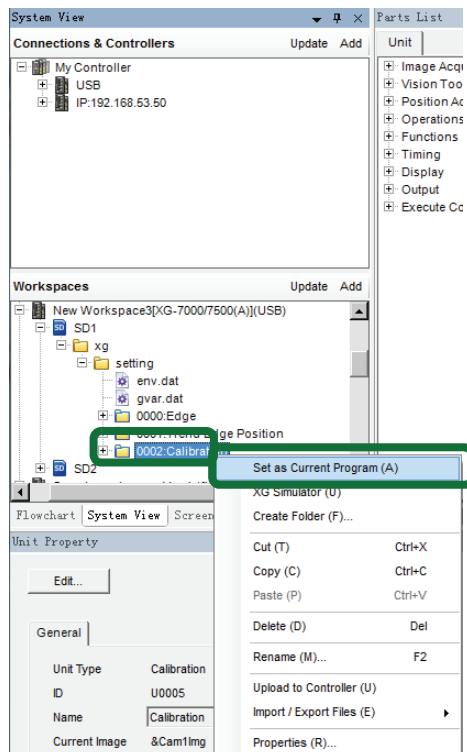
- Select [Sample2(USB)] for [Copy From] - [Workspace] and [0002:Calibration] for [Copy From] - [Program].
- Select [Program Settings], [Registered Images], and [Test Images] for [Files].
- Select [New Workspace3(USB)] for [Copy To] - [Workspace] and [0002] for [Copy To] - [Starting No.].
- When the setting is complete, click the [Execute] button.



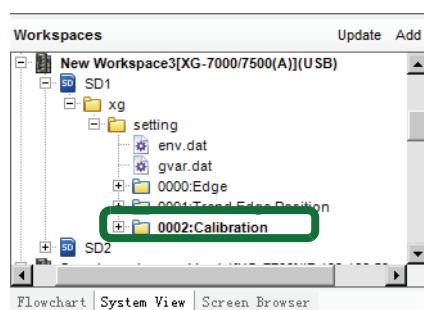
- (3) In [System View], confirm that [Workspaces] - [New Workspace3] - [SD1] - [xg] - [setting] - [0002:Calibration] has been added.



- (4) Switch [0002:Calibration] to a "current program". Right-click it and select [Set as Current Program].

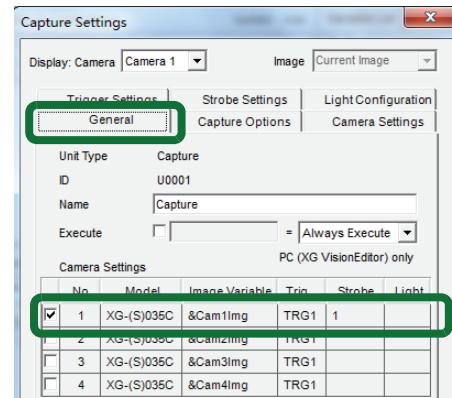


- (5) Confirm that [0002:Calibration] is shown in boldface.

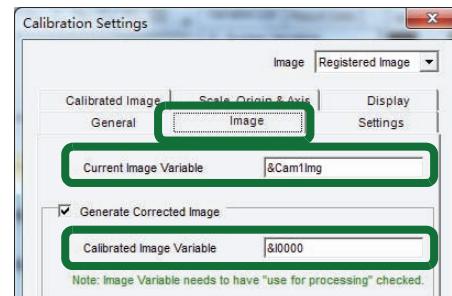


2. Check the settings of the program on the VisionEditor.

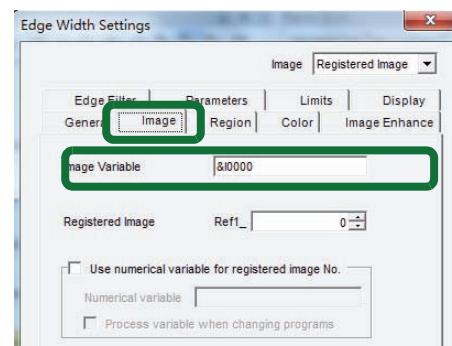
- (1) Double-click [U0001:Capture] and open the [General] tab. Confirm that the image data captured with camera 1 is stored in [Image Variable] [&Cam1Img].



- (2) Double-click [U0005:Calibration] and open the [Image] tab. Confirm that [Current Image Variable] is set to [&Cam1Img] and [Calibrated Image Variable] is set to [&I0000].



- (3) Double-click [U0006:Edge] and open the [Image] tab. Confirm that [Image Variable] is set to [&I0000].



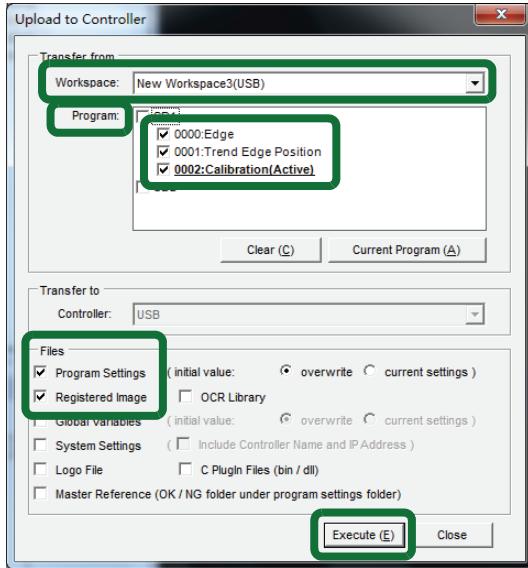
- (4) Confirm the [Image Variable] and [Vision Window] for [U0003/U0004/U0007: Edge Width] units in the same way.

Upload the data to the controller and check the result.

3. Upload the data.

Click the [Upload to Controller] icon at the top of the screen and display the dialog shown below. Set the following options.

- For [Transfer from], select [New Workspace3(USB)] for [Workspace] and [0000:Edge], [0001:Trend Edge Position], and [0002:Calibration] for [Program].
- Select [Program Settings] and [Registered Image] for [Files].
- Confirm the setting and click [Execute].

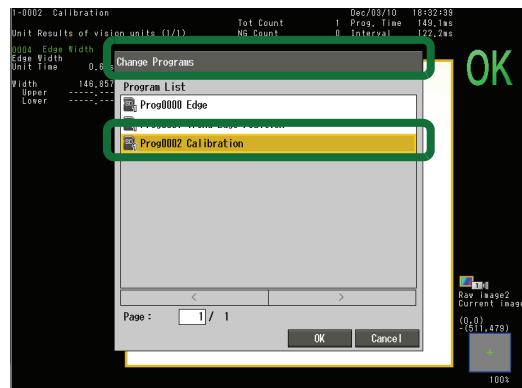


4. Switch the program.

- (1) Press the [FUNCTION] button on the handheld controller. Select [Function] - [Program] - [Change Programs] and press the [Enter] button on the handheld controller.



- (2) In [Change Programs], select [Prog0002 Calibration] and press the [Enter] button on the handheld controller.



5. Switch to "flowchart editing".

- (1) Press the [FUNCTION] button on the handheld controller. Select [Function] - [Edit Flowchart] and press the [Enter] button on the handheld controller.

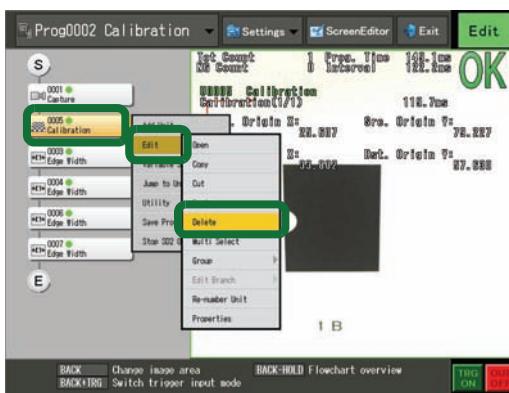


- (2) A "confirmation" message appears. Select [OK] and press the [Enter] button on the handheld controller.

6. Delete the "Calibration" unit.

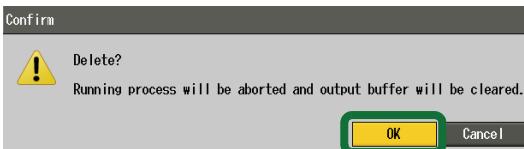
- (1) Delete [U0005:Calibration].

Select [U0005:Calibration] and use the [FUNCTION] button to select [Edit] - [Delete].



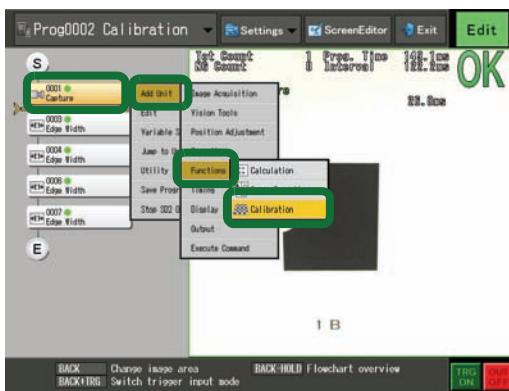
- (2) A "confirmation" message appears.

Select [OK].



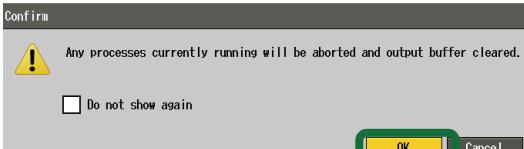
7. Add a new "Calibration" unit.

- (1) Select the [Capture] unit and use the [FUNCTION] button to select [Add Unit] - [Functions] - [Calibration].



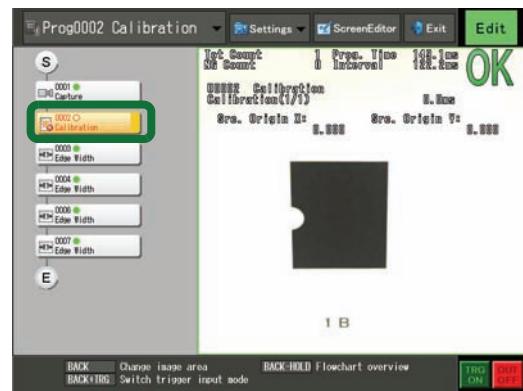
- (2) A "confirmation" message appears.

Select [OK].



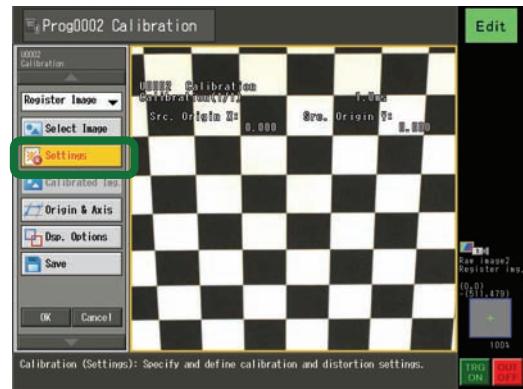
8. Configure the "Calibration" unit.

- (1) Select the [Calibration] unit and press [Enter].



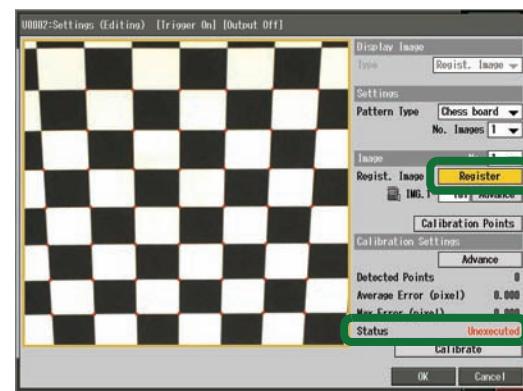
9. Perform "teaching" for angled camera distortion.

- (1) Select [Settings] and press [Enter].



- (2) To perform "teaching", register an image using the chessboard pattern sheet.

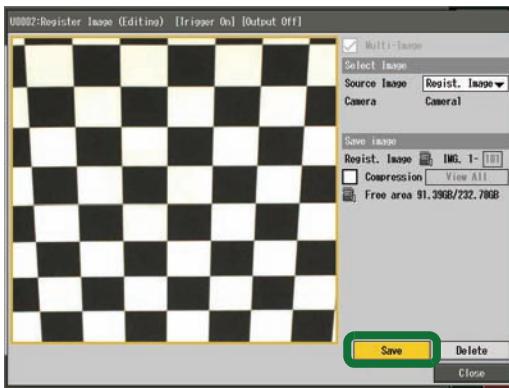
Select the [Register] button.



The above image is an existing image which was registered before.

Since "teaching" has not been performed yet, [Status] is [Unexecuted].

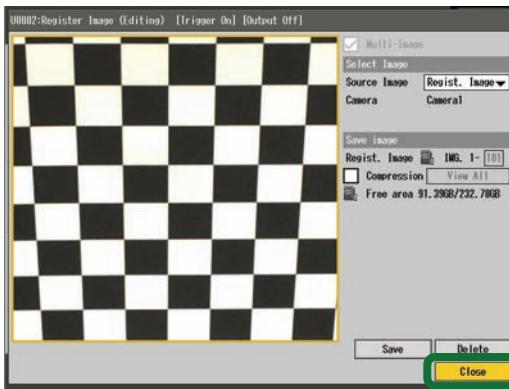
- (3) Display the image of the chessboard pattern sheet and select the [Save] button.



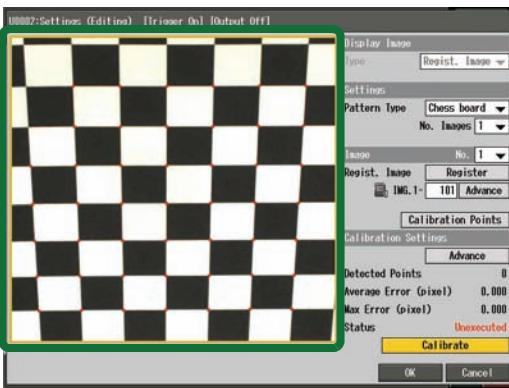
- (4) A "confirmation" message appears.
Select [OK].



- (5) Select [Close] to close the setting.



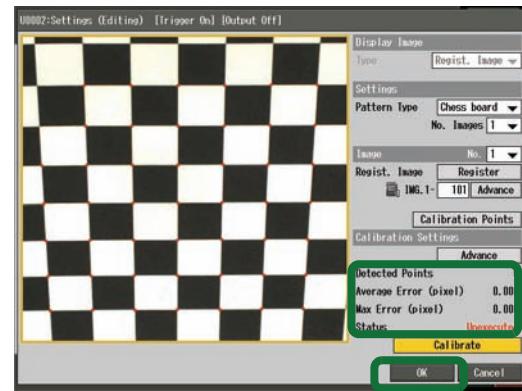
- (6) Red points are displayed at every intersection of the chessboard pattern.
"Teaching" uses the information of these points to convert coordinates or images.
Select the [Calibrate] button.



- (7) Confirm that [Status] changed to [Success].

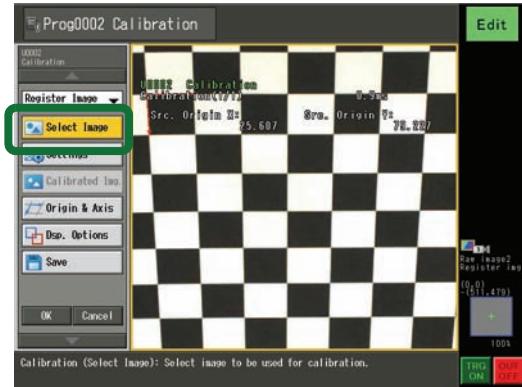
This shows that the "teaching" was completed successfully.

After checking the success, select the [OK] button to close the setting.

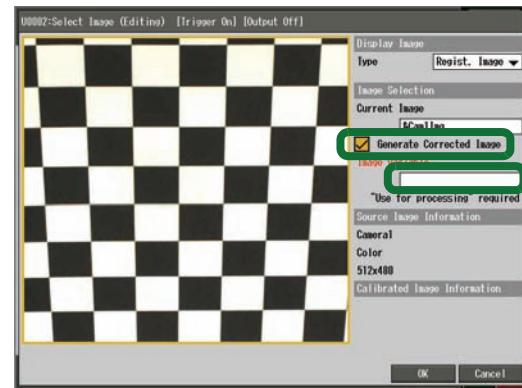


10. Set an "image variable" for the calibrated image.

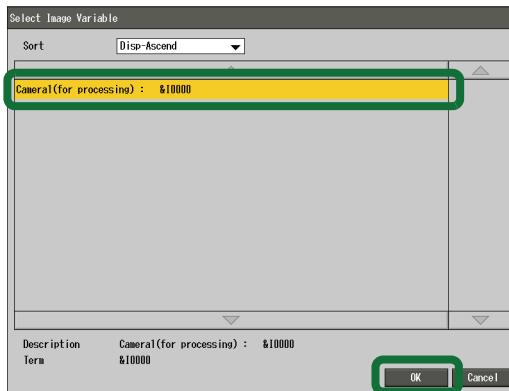
- (1) Select [Select Image].



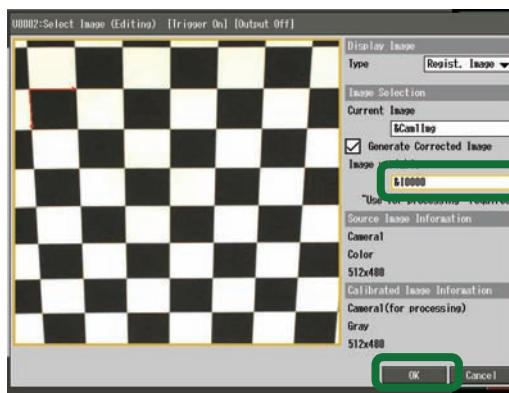
- (2) Check the [Generate Corrected Image] check box, select the [Image variable] field, and press [Enter].



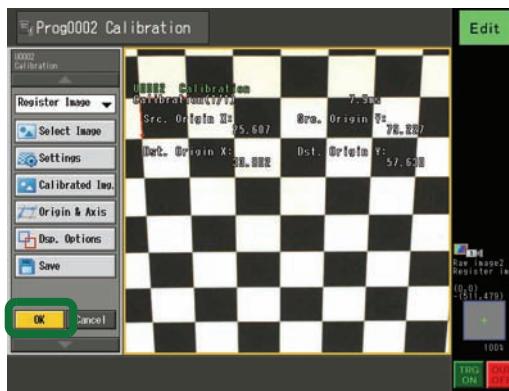
- (3) Select [Camera1(for processing): &I0000] and select [OK].



- (4) [&I0000] is displayed in the [Image variable] field. Select [OK] to close the setting.

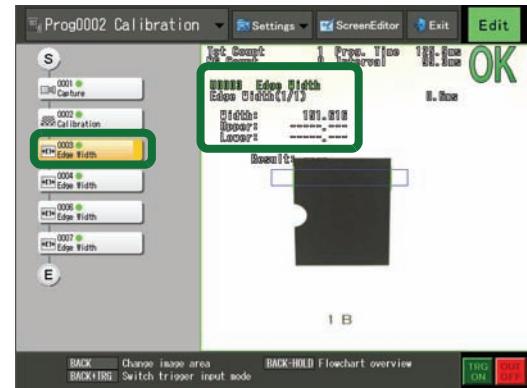


- (5) Select [OK] to close the setting.



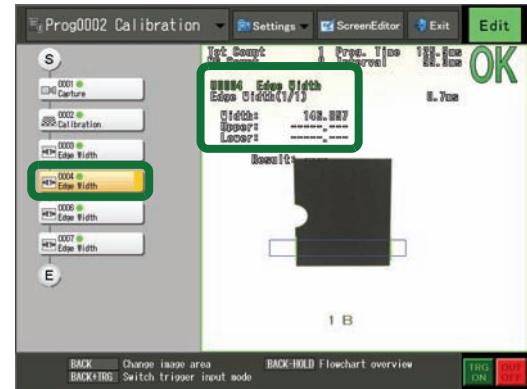
11. Project a target image and check the calibrated image.

- (1) Place the cursor on [0003:Edge Width] and press [TRIGGER] to capture the image of the target.



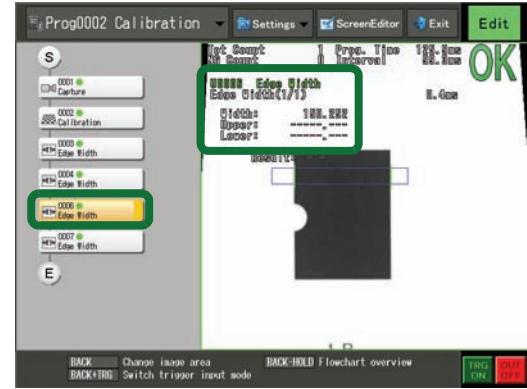
Width measurement is performed using the current image.

- (2) Place the cursor on [0004:Edge Width].



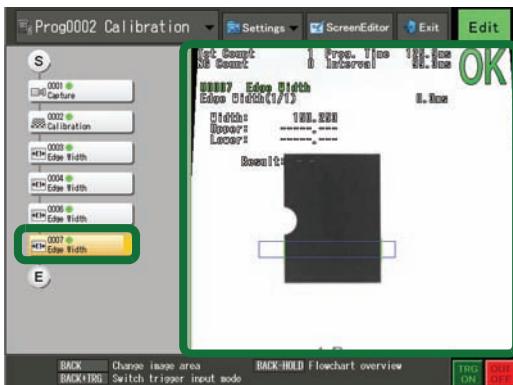
Width measurement is performed using the current image.

- (3) Place the cursor on [0006:Edge Width].



Width measurement is performed using the image which was calibrated with the "camera angle distortion" correction.

- (4) Place the cursor on [0007:Edge Width].

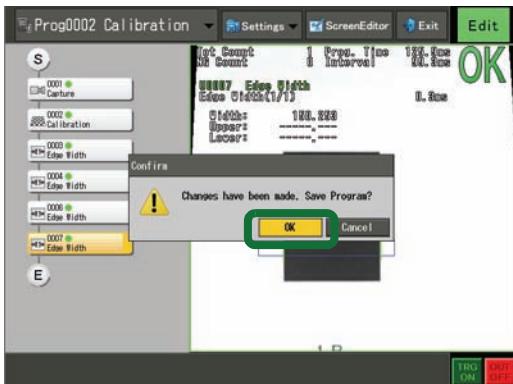


Width measurement is performed using the image which was calibrated with the "camera angle distortion" correction.

12. Confirm the inspection result on the [Run] screen.

- (1) Switch to [Run] mode.

Move the slide switch of the handheld controller downward.

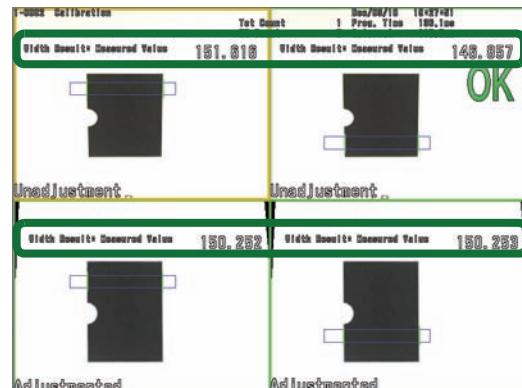


A "confirmation" message appears.

Select [OK].

- (2) Press [TRIGGER] to capture the image of the target.

Compare the inspection results between the "original image" and "calibrated image".

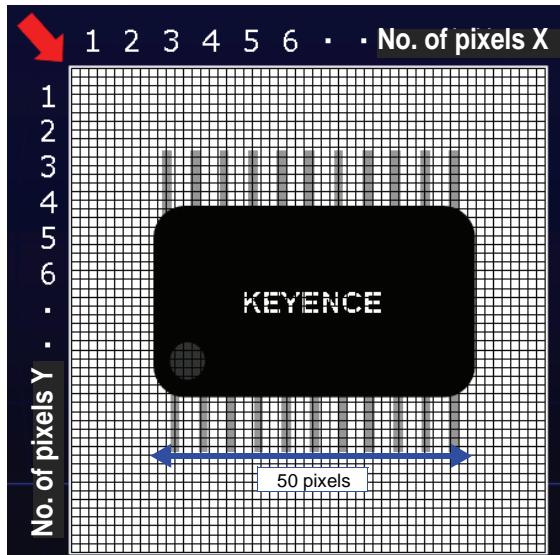


Advanced Tutorial_1_4: Scaling

Scaling

The controller and the XG VisionEditor process image data in pixels internally. However, you can convert the result data and setting parameters used for on-screen display, judgment and calculation to values in any desired unit, such as actual dimension values.

■ What can you do with "scaling"?



By setting the "scaling", you can convert values in "pixels" into "actual dimension values".

For example,
when you set "0.1mm/pixel" for "scaling", "50 (pixels)" are converted into "5 (mm)".

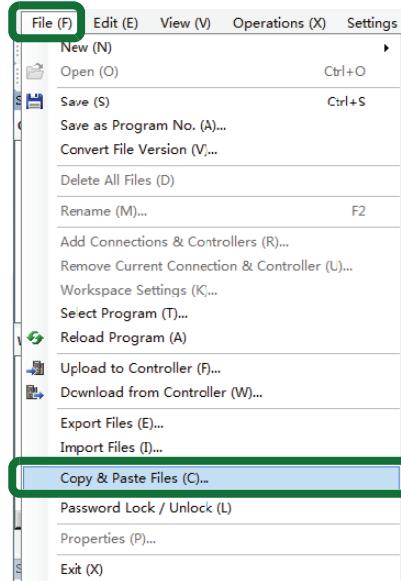
■ Flow of the "scaling" setting

- (1) Specify the scaling value.
- (2) Determine whether to enable the scaling for each unit.

Preparation for examining the setting.

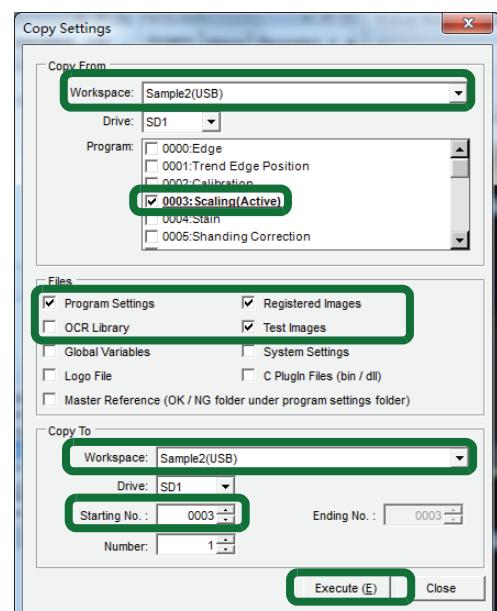
1. Copy a "program" and switch it to a "current program".

- (1) Select [File] - [Copy & Paste Files].

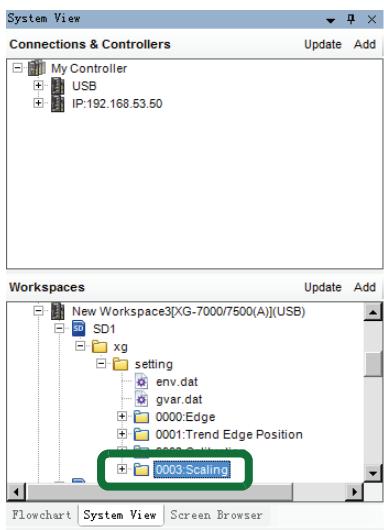


- (2) In [Copy Settings], set the options as follows and select [Execute].

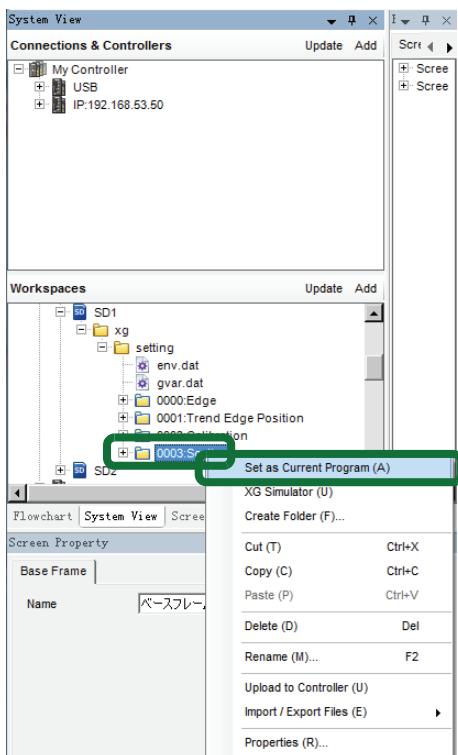
- For [Copy From], select [Sample2(USB)] for [Workspace] and [0003:Scaling] for [Program].
- Select [Program Settings], [Registered Images], and [Test Images] for [Files].
- For [Copy To], select [Sample2(USB)] for [Workspace] and [0003] for [Starting No.].



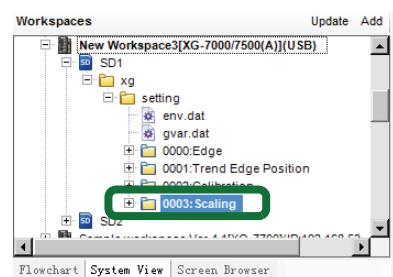
- (3) Confirm that [0003:Scaling] has been added in [Workspaces].



- (4) Right-click [0003:Scaling] of [New Workspace3] and select [Set as Current Program].



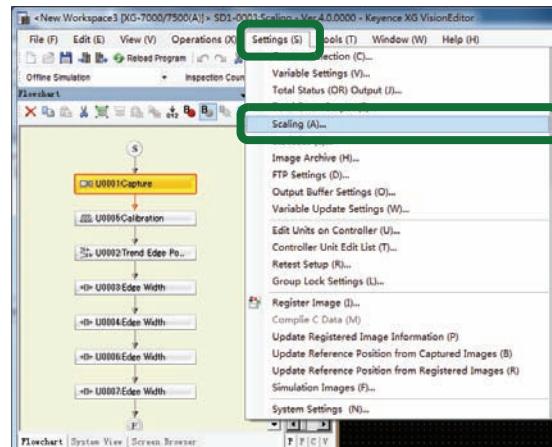
- (5) Confirm that [0003:Scaling] is shown in boldface.



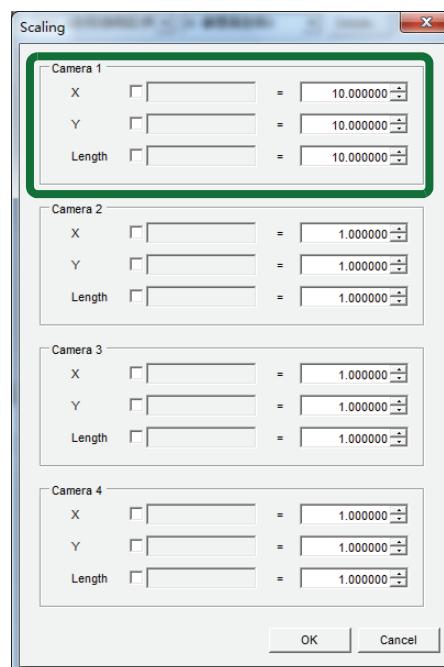
Specifying the scaling factors

2. Set the "scaling factors".

- (1) From [Menu bar] at the top of the screen, select [Settings] - [Scaling].



- (2) Enter "10" in the input fields of [X], [Y], and [Length] for [Camera 1] respectively.



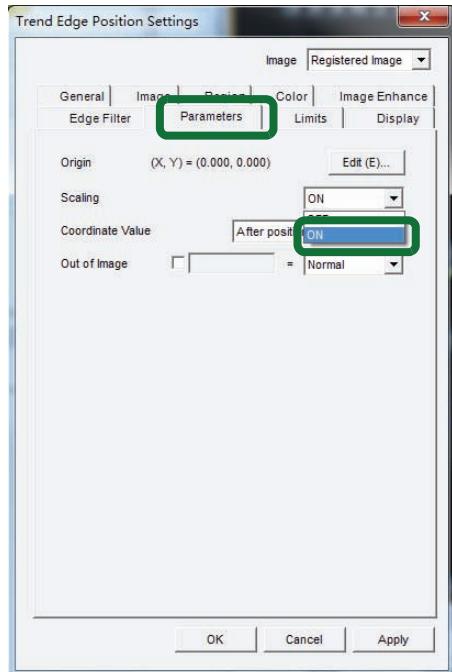
With this setting, each "measured value (MS)" of [X], [Y], and [Length] will be multiplied by "10". (On the other hand, each "absolute value (AB)" of [X], [Y], and [Length] will not be affected by "scaling".)

(For the measured values to which scaling is applicable, refer to page 2-105 and subsequent pages of the Reference Manual (Control/Data Edition).)

Enabling the scaling for each unit

3. Select a unit to apply the "scaling" and set "scaling" to ON.

- (1) Open the unit property setting of [U0002:Trend Edge Position] and set [Parameters] - [Scaling] to [ON].



Checking the effect of the "scaling" with the VisionEditor

4. Check the effect of the "scaling" setting.

- (1) Select [Unit Result] - [Unit] and locate [X] and [Y] in the [Name] column.

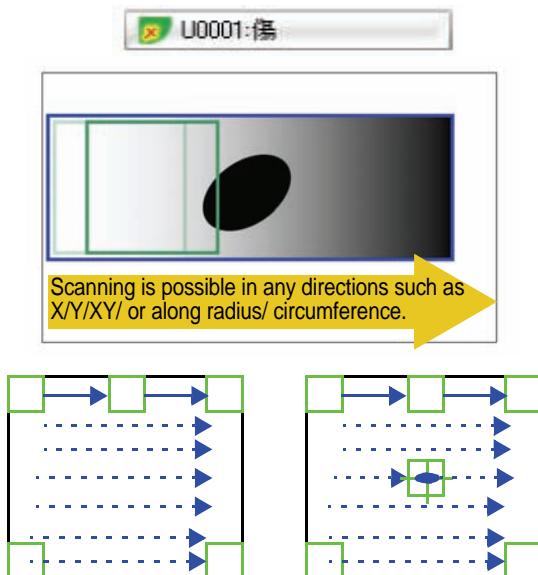
Compare the values between the "measured values (MS)" and "absolute values (AB)". Confirm that the "measured values (MS)" are "10" times larger than the "absolute values (AB)".

Unit Result				
	Name	Definition	Starting Point	Number ...
⊕ X	X:JG	Segment X Edge Position Result: Judgment Value	-	0 100
	XH:MS	Maximum X Edge Position Result: Measured Value	-	+1656.070
	XH:AB	Maximum X Edge Position Result: Absolute Value	-	+165.607
	XH:JG	Maximum X Edge Position Result: Judgment Value	-	0
	XL:MS	Minimum X Edge Position Result: Measured Value	-	+1456.197
	XL:AB	Minimum X Edge Position Result: Absolute Value	-	+145.620
	XL:JG	Minimum X Edge Position Result: Judgment Value	-	0
	XA:MS	Average X Edge Position Result: Measured Value	-	+1499.888
	XA:AB	Average X Edge Position Result: Absolute Value	-	+149.988
⊕ Y	Y:JG	Segment Y Edge Position Result: Judgment Value	-	0 100
	YH:MS	Maximum Y Edge Position Result: Measured Value	-	+2735.000
	YH:AB	Maximum Y Edge Position Result: Absolute Value	-	+273.500
	YH:JG	Maximum Y Edge Position Result: Judgment Value	-	0
	YL:MS	Minimum Y Edge Position Result: Measured Value	-	+1885.000
	YL:AB	Minimum Y Edge Position Result: Absolute Value	-	+188.500
	YL:JG	Minimum Y Edge Position Result: Judgment Value	-	0
	YA:MS	Average Y Edge Position Result: Measured Value	-	+2635.000
	YA:AB	Average Y Edge Position Result: Absolute Value	-	+263.500

Advanced Tutorial_2_1: Stains

"Stain" algorithm

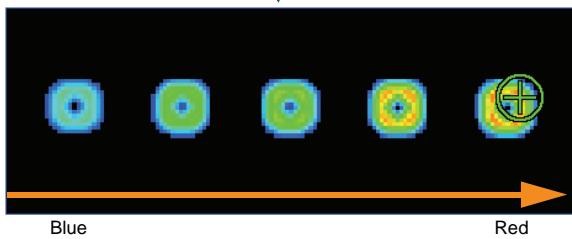
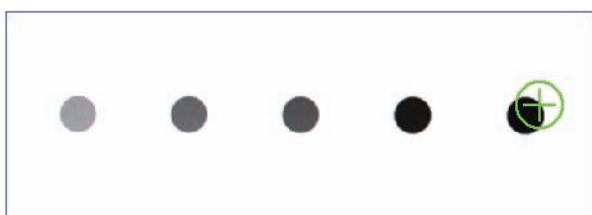
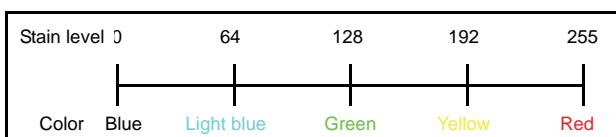
Within a specified inspection region, a small area (segment) can be defined. Within this segment, the average intensity is calculated. An area displaying an intensity more than the threshold level is detected as a "stain". This function is useful when you want to detect stains or flaws on a target.



■ Contrast display

The "contrast display" is very effective to identify the position, size, and intensity of the detected stains.

Stain Level: Change in the brightness (grayscale value) compared with surrounding areas

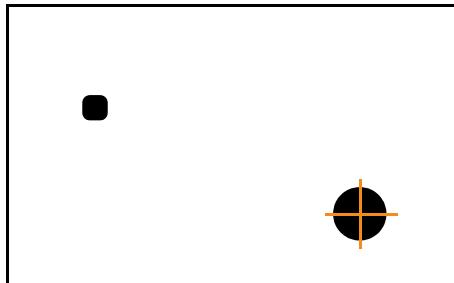


■ Stain grouping function

You can group segments where intensity differences higher than a certain level were detected and measure the number of groups or their positions (**Stain grouping function**).

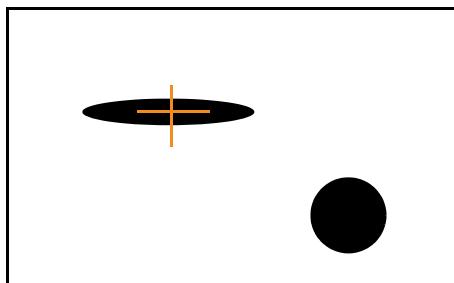
Moreover, you can apply various filters to the groups to detect **"only the groups of desired size or shape"**.

Stain size: Size (segments)



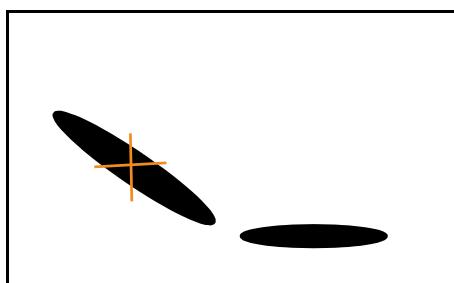
To detect large stains only

Roundness: Similarity to a circle



To detect narrow stains only

Major/minor axes ratio: Major axis/Minor axis

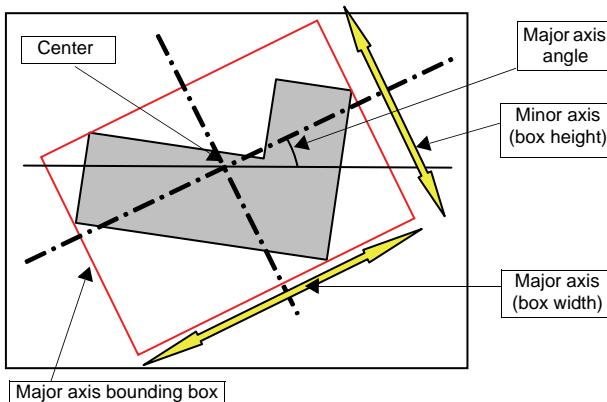


To detect long stains only

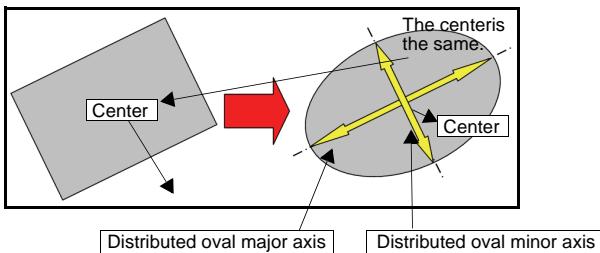
For the method of applying filters, refer to <Reference> on the next page.

Reference

Available filters are: "Roundness", "Major axis", "Major/minor axes ratio", "Distributed oval major axis", and "Distributed oval aspect ratio".



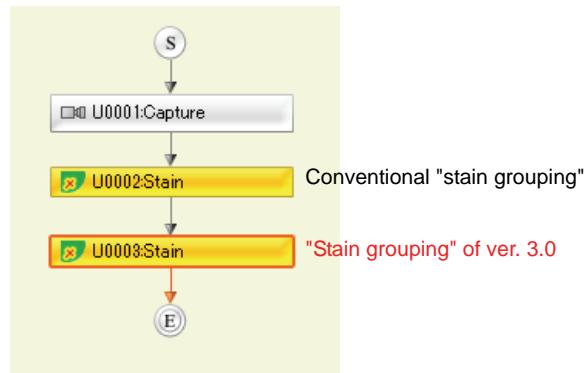
Major/minor axes ratio = Major axis/Minor axis
(The longer and narrower the shape is, the larger the value becomes.)



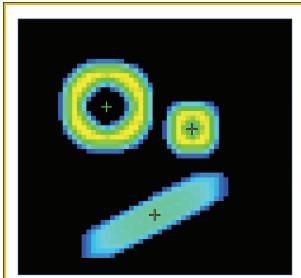
Distributed oval aspect ratio
(The longer and narrower the shape is, the larger the value becomes.)

Distributed oval detected with blob inspection
A "distributed oval" is an approximate oval determined from the results of blob inspection.

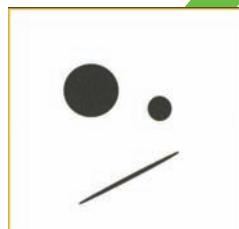
■ Sample flowchart



Previous version



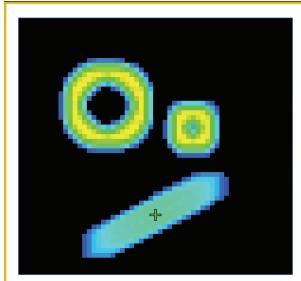
Filtering based on stain size



Detected stain: 3
(Filtering based on stain size only)

ver.3.0

Filtering based on major/minor axes



Detected stain: 1
(Filtering based on major/minor axes ratio, etc.)

In this exercise, you will set two "Stain units" and confirm that you can apply filters to detection targets based on the stain shape determined with the "contrast display".

■ Setting procedure

(1) Copy a "completed" workspace.

(2) Examine the settings of the completed program.

Copying a "program" file

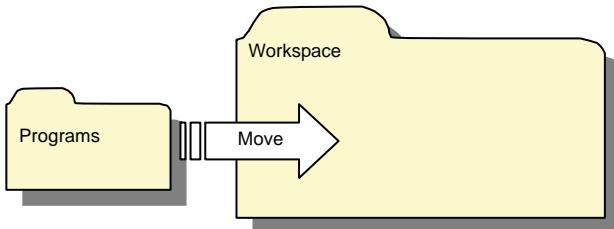
1. Copy a program "in a workspace".

This section describes how to use a workspace (a virtual area on the PC that represents the controller) of the "XG function setting procedures". The XG function setting procedures are organized as "programs" in different folders.

By moving the folder of programs into a workspace, you can view the settings in the workspace.

■ Copying multiple programs

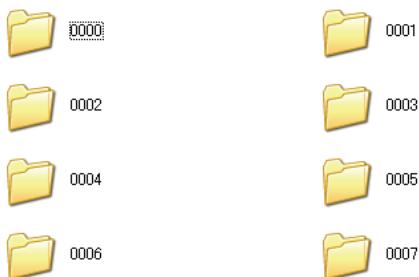
Move the folder of "programs" to a "new workspace".



(1) Open the [Seminar data h] folder on the desktop.

(2) Open [Master 2 base path].

(3) Open [Sample2(USB)] - [SD1] - [xg] - [setting].



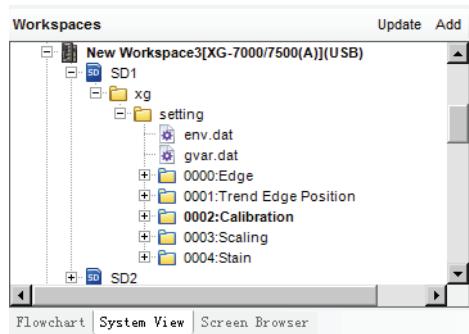
(4) Select from [0004] to [0018].

After selecting them, right-click the mouse and select [Copy].

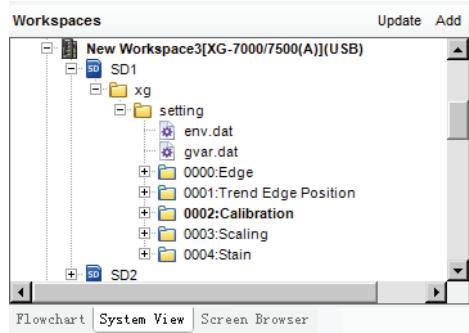
(5) Open [New Workspace3].



(6) Open [SD1] - [xg] - [setting].



(7) Right-click the mouse and select [Paste].



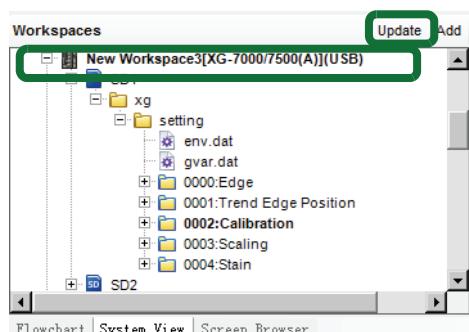
The copied programs are added.

Check the result with the "XG VisionEditor".

(8) View [System View] - [Workspaces].

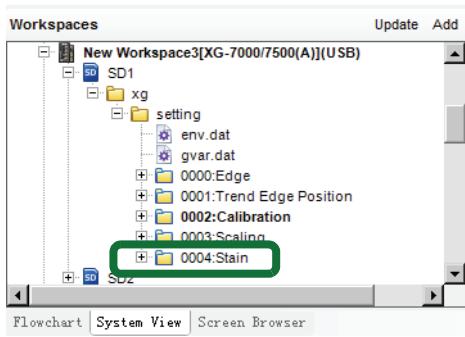
Click [New Workspace3] and click the [Update] button.

You can see the "programs" have been added in [New Workspace3].

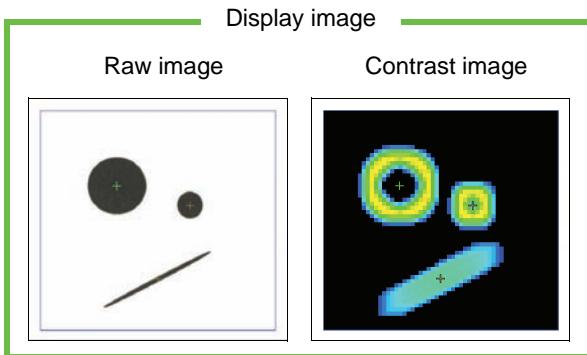
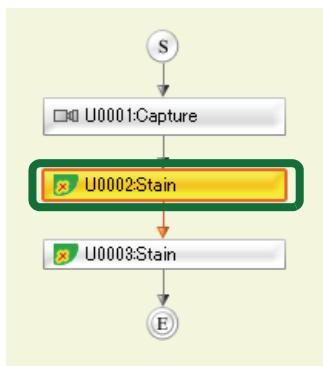


Checking the inspection result

2. Check the result of [Program] - [0004:Stain].
- Select [New Workspace3] - [SD1] - [xg] - [setting] - [0004:Stain] and right-click the mouse. Select [Set as Current Program].



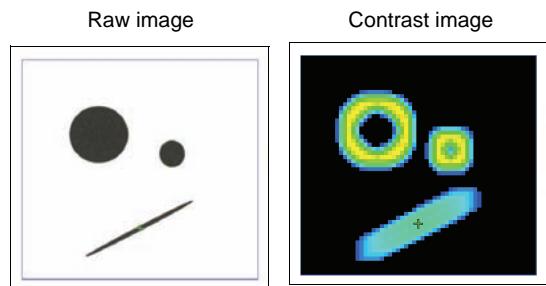
- (2) Open the Flowchart view.
Select [U0002:Stain], click [Execute one time], and check the result.



Three stains are detected.

- To change the display image, select one from [Vision Window] - [Image Type].

- (3) Select [U0003:Stain].



One stain is detected.

- To change the display image, select [Vision Window] - [Image Type].

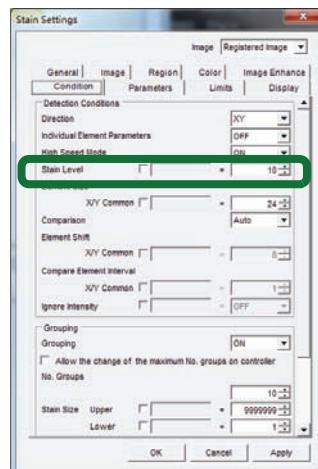
Next, examine the settings of each unit.

3. Examine the [0002:Stain] unit.

- Double-click [U0002:Stain].

The following explains the effect of the "stain level" parameters on the "registered image".

Open the [Condition] tab.



The stain level is expressed in the unit of grayscale values (0 to 255) and shows the difference between the average intensity inside the segment and the intensity of the surrounding area.

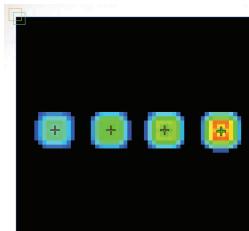
The higher the intensity increases and the larger the size is, the greater the value becomes.

The area exceeding the level value specified in the detection condition is considered to be a stain.

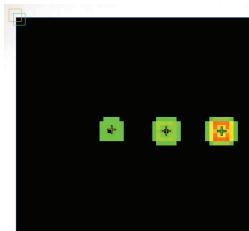
- (2) Change [Stain Level] from "10" to "100", "150", and "200". (You can check the result by inputting [Enter].)

You can see that the detection result changes accordingly.

Stain level: 10



Stain level: 100



Stain level: 150



Stain level: 200



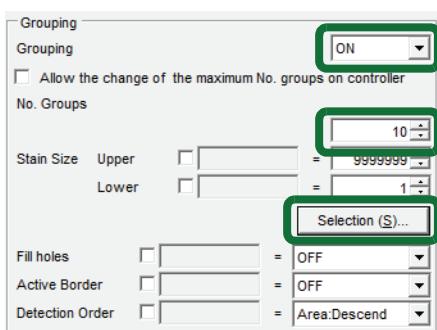
After checking the differences, set [Stain Level: 10].

4. Examine the [0003:Stain] unit.

- (1) Double-click [U0003:Stain].

The following explains the effect of the "grouping" function on the "registered image".

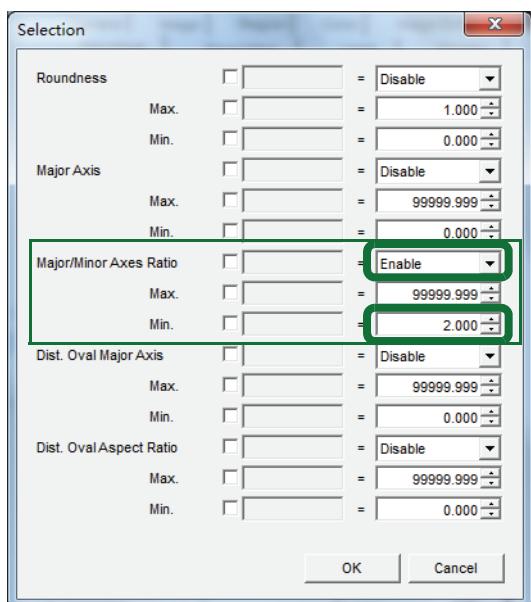
Open the [Condition] tab.



By setting [Grouping] to [ON], you can count the number of stains.

For [No. Groups], enter the maximum number of stains you want to detect.

Click the [Selection] tab.



Major/minor axes ratio = Major axis/Minor axis

When you want to detect long and narrow objects only, use this [Major/Minor Axes Ratio] filter.

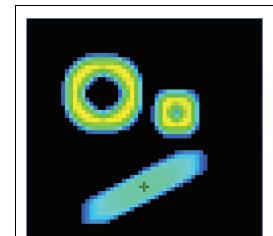
Check the numerical result.

Select [Unit Result] - [Unit] - [N: MS Number of Groups: Measured Value] - [Current] and check that the value is "1".

Unit Result					
Unit	System	Local	Global	Definition	Starting Point
YMS				Stain Y Position Result: Measured Value	
NMS				Number of Groups: Measured Value	
GSA				Number of Groups: Judgment Value	0 100
GSA:G				Stain Area Result: Judgment Value	- - -
GX				Stain Center X Result: Judgment Value	0 100
GX:G				- - -	- - -
GY				- - -	0 100

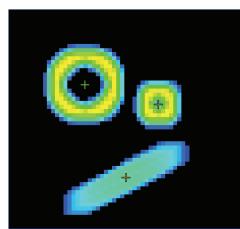
You can see that only a long and narrow foreign object is counted as a stain.

Enable



(2) Change [Enable] to [Disable].

Disable



In [Vision Window], confirm that the number of + marks representing detected targets changed from one to three.

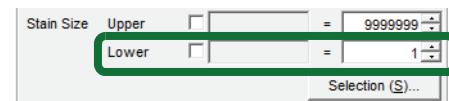
Check the numerical result.

Select [Unit Result] - [Unit] - [N: MS Number of Groups: Measured Value] - [Current] and check that the value is "3".

Unit Result					
Unit		System		Local	
Name	Definition	Starting Point	Number...	Current...	
YMS	Stain Y Position Result: Measured Value	-	-	-	
YAB	Stain Y Position Result: Absolute Value	-	-	-	
NJG	Number of Groups: Judgment Value	-	-	-	
(R) GSA	-	0	100	-	
OSAJG	Stain Area Result: Judgment Value	-	-	-	
(R) GX	-	0	100	-	
GXJG	Stain Center X Result: Judgment Value	-	-	-	
(R) GY	-	0	100	-	

After checking the result, click the [OK] button to close the [Selection] setting.

(3) Adjust the detection by using the conventional "stain size" filtering.



The "stain size" is the number of segments detected in a "foreign object".

This value expresses the size of the "foreign object".

(4) Change the lower limit from "1" to "100".

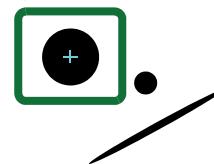
All objects are detected.

Change the lower limit from "100" to "200".
Small objects are excluded from the detection.

Change the lower limit from "200" to "250".
Long and narrow objects, which you want to detect, are excluded from the detection.

Lower limit: 250

Only large objects are detected.

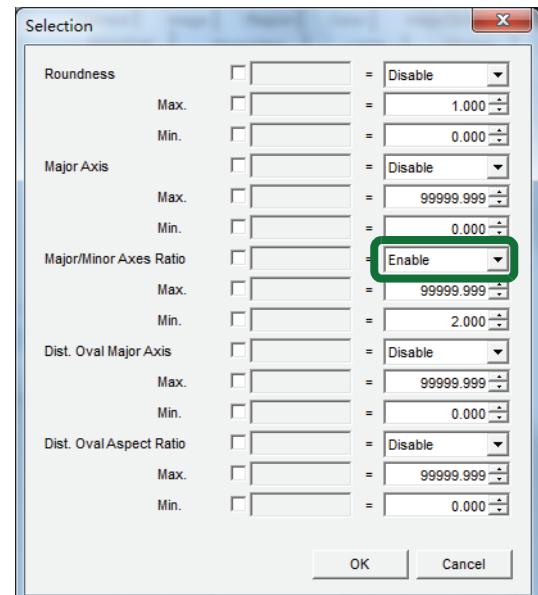


The "stain size" filter cannot be used for this detection.

Change [Stain Size] - [Lower] back to "1".

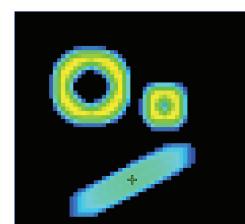
Click the [Selection] button.

(5) Set [Major/Minor Axes Ratio] from [Disable] to [Enable].

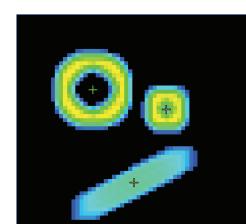


This allows only long and narrow foreign objects be detected.

Enable



Disable



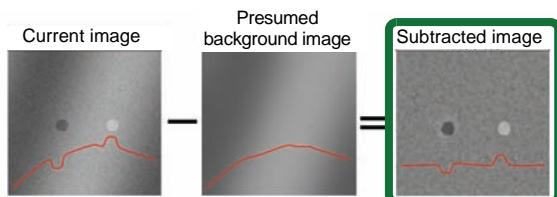
Advanced Tutorial_2_2: Shading Correction

What is shading correction?

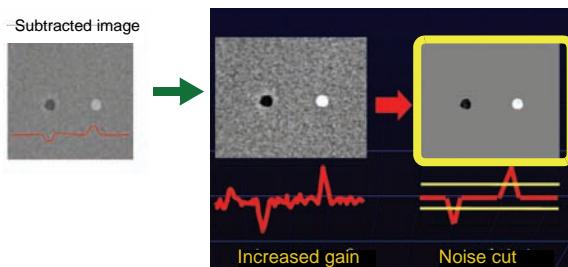
Shading correction is one of the image enhancement tools used when inspection is difficult due to target conditions or external environment. This ensures that an optimum image for inspection is created in real time.

It corrects factors which interfere with stable inspection such as random shading or irregular reflection on the target surface.

■ Shading correction algorithm



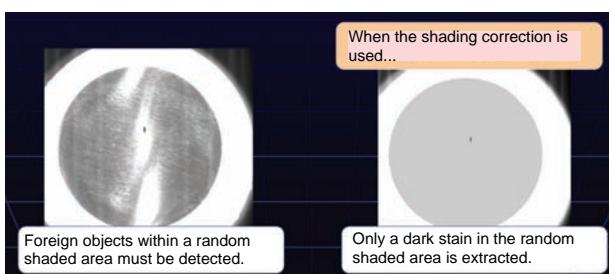
The background image is presumed using filtering.



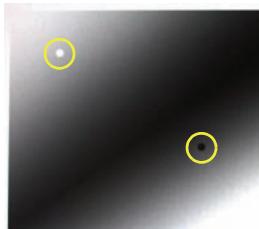
Only foreign objects are emphasized clearly.

■ Application example of the shading correction

Detection of foreign objects on the bottom of a can

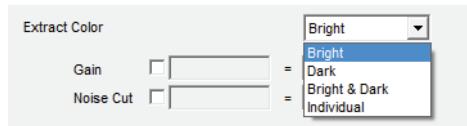


Outline of exercise



Both white and black foreign objects will be recognized.

In this case, the most important thing is the selection of the "extract color" which determines the color to be emphasized.

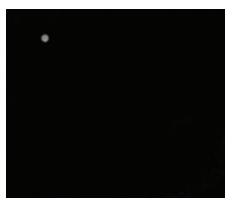


i : When the extract color is set to [Bright]

Before correction



After correction



ii : When the extract color is set to [Dark]

Before correction



After correction



iii : When the extract color is set to [Bright & Dark]

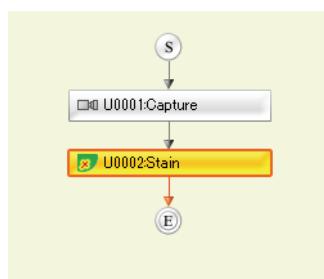
Before correction



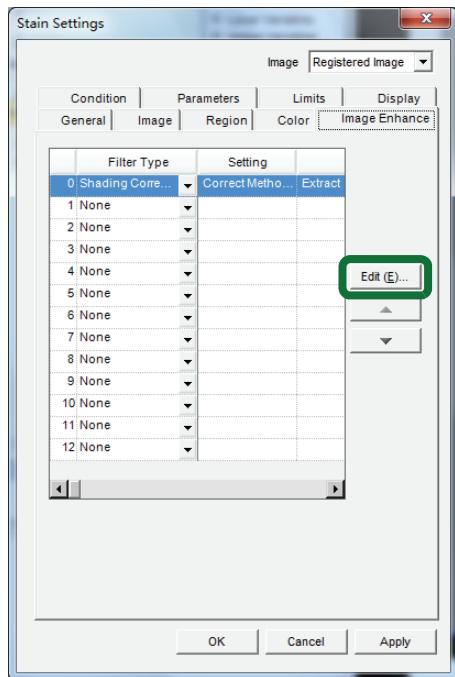
After correction



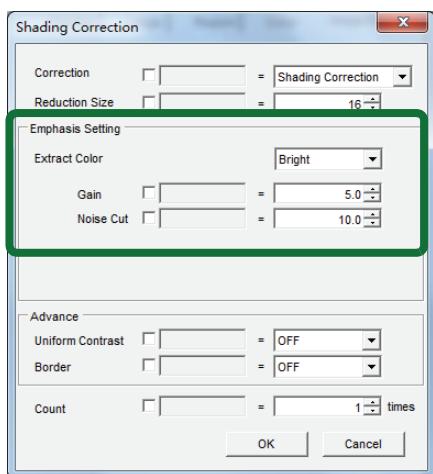
■ Sample flowchart



Select [Stain] unit - [Image Enhance] tab and set the options.



The adjustment options are as follows.

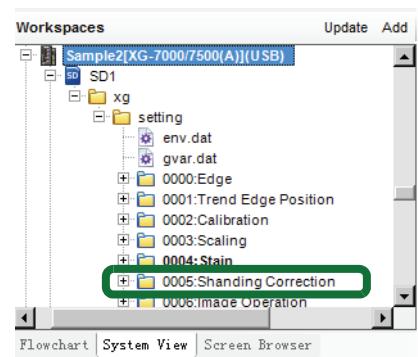


Today, we will learn the options for [Emphasis Setting] shown above.

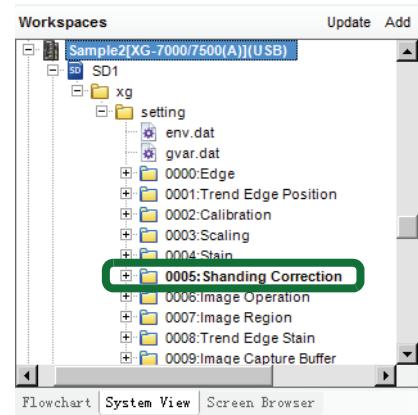
Checking a completed program

1. Switch the program.

- (1) View [System View] - [Workspaces]. Select [Sample2] - [SD1] - [xg] - [setting] - [0005:Shading Correction], right-click the mouse, and select [Set as Current Program].



- (2) Check that [0005:Shading Correction] is shown in boldface, which means that this is the current program.



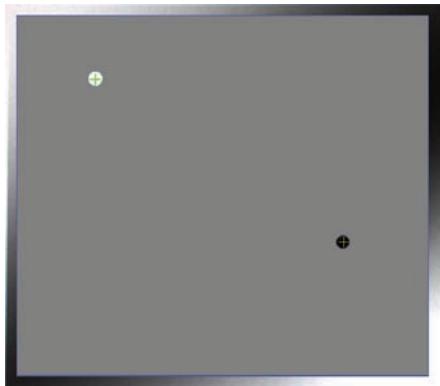
After checking it, return to the [Flowchart] view.

2. Examine the [Stain] unit.

(1) Click the [Stain] unit once.

Select [Vision Window] - [Image Type] and select [Processed 2].

Click [Execute one time] and check the result.

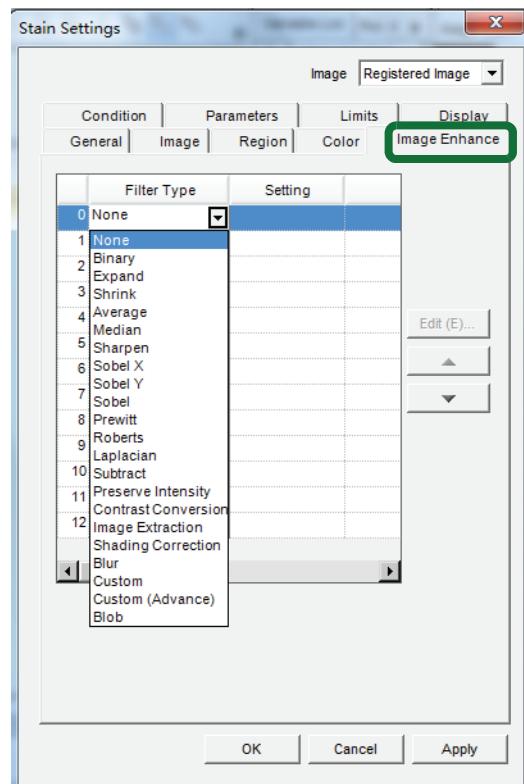


You can see that both black and white foreign objects are emphasized.

Now, we will create this "image enhancement filter".

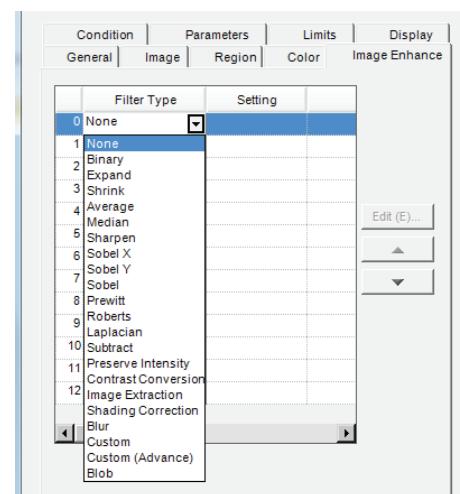
Double-click the [Stain] unit.
Its "unit property" setting opens.

(2) Open the [Image Enhance] tab.



You can set the "image enhancement filter" here.

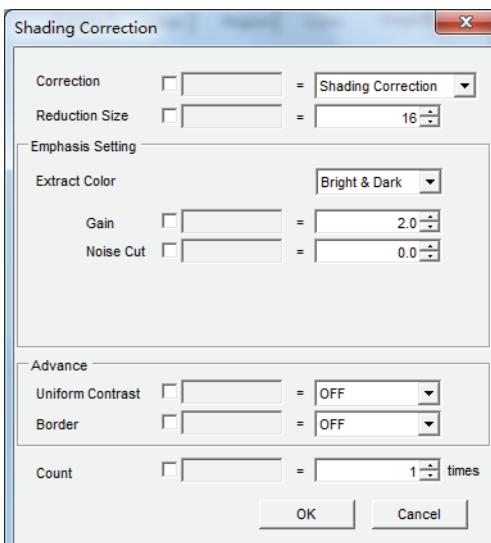
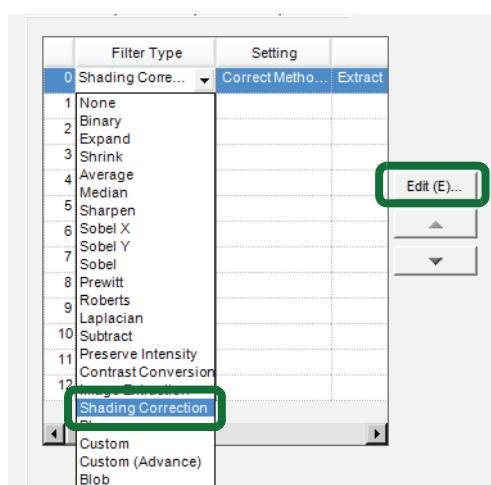
(3) Set [Filter Type] to [None] once.



The filter is canceled.

(4) Set [Filter Type] to [Shading Correction].

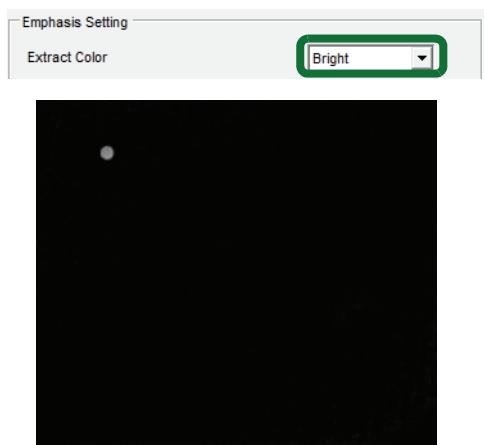
Click the [Edit] button.



Adjust parameters here.

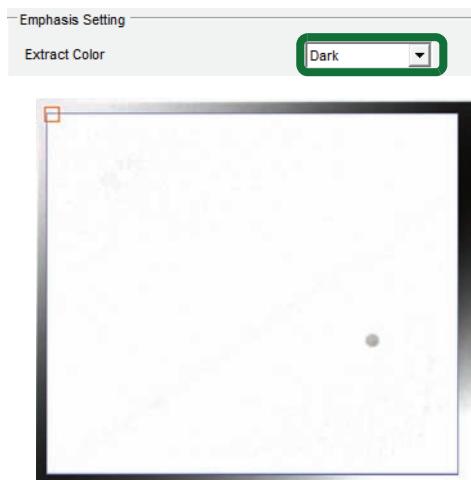
First, set [Extract Color].

(5) Set [Extract Color] to [Bright].



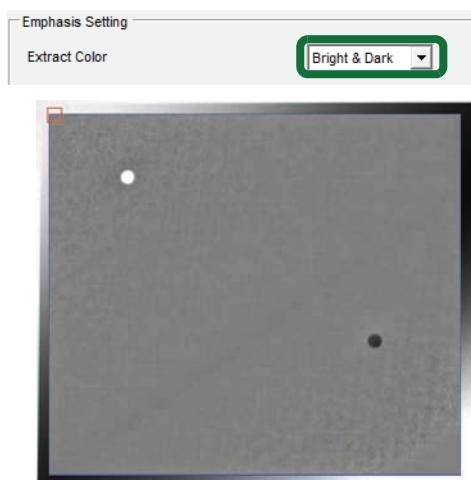
At this point, only "white objects" are emphasized.

(6) Set [Extract Color] to [Dark].



At this point, only "black objects" are emphasized.

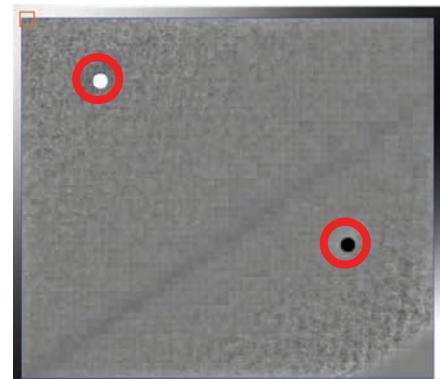
(7) Set [Extract Color] to [Bright & Dark].



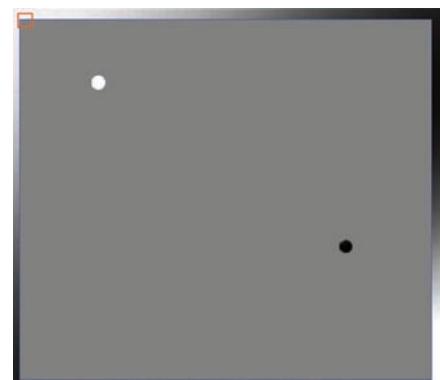
At this point, both "white objects" and "black objects" are emphasized.

As you can see, the selection of [Extract Color] depends on whether the target is brighter or darker than the background.

(8) To increase the contrast difference between the target and background, adjust [Gain]. Set [Gain] to "5".



(9) To eliminate the influence of noise in the background, adjust [Noise Cut]. Change [Noise Cut] from "5" to "10".



When you set [Noise Cut] to "10", you can see that the background noise is eliminated completely.

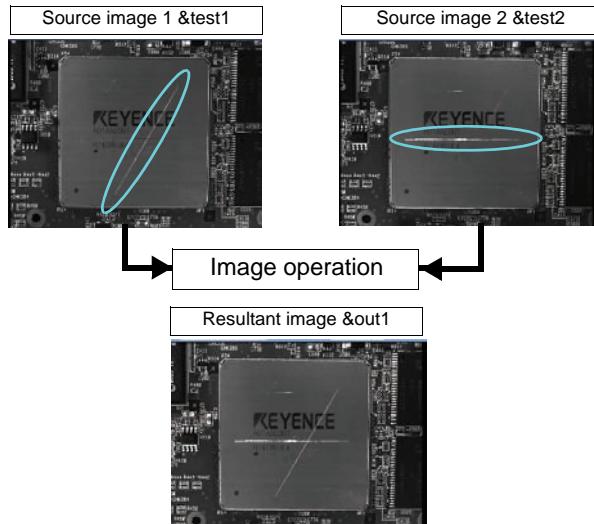
(10) Open the [Condition] tab and confirm that both foreign objects can be detected.

Advanced Tutorial_2_3: Image Operation

Image Operation unit

An Image Operation unit stores values in user-specified variables used for processing. The values 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.

Flow of image operation processing



Available image operations

Conversion		Conversion	
- Add	- NOT	- Add	- Max
- Subtract	- AND	- Subtract	- Min
- AbsoluteDifference	- OR	- AbsoluteDifference	- AND
- Multiply	- XOR	- Average	- OR
- Rotate / Translate	- NAND	- Multiply (Normalized)	- XOR
- Zoom	- NOR	- Multiply	- NAND
- Pixel value conversion	- XNOR	- NOR	- NOR
- Blob	- Right Bit Shift	- Left Bit Shift	- XNOR

Processing patterns using Image Operation units (Reference)

Pattern	Processing images		Conversion	Image operation processing	Image array operation
	Source image 1	Source image 2			
1	1	0	⊗X	X	X
2	1	1	⊗O	O	X
3	n	0	⊗X	⊗ ¹	X
4	n	1	⊗O	⊗ ²	⊗ ³
5	n	n	⊗O	⊗ ³	⊗ 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 set. Selecting [None] will generate a setting error.

Reference

The number of processing images "n" can be set from 2 to 32.

Note

Selecting the operation type to [None] in patterns 2 to 5 will generate a setting error.

Sample flowchart

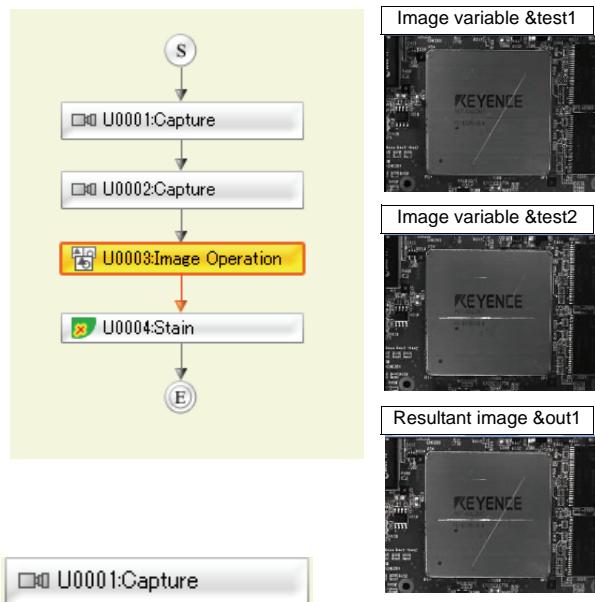


Image data is stored in image variable &test1.

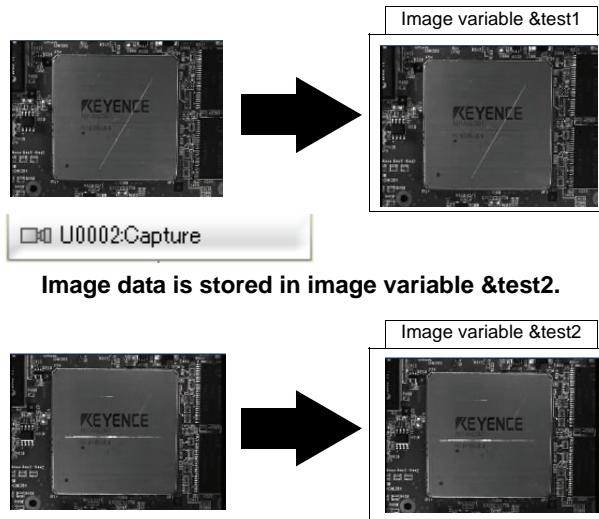


Image data is stored in image variable &test2.

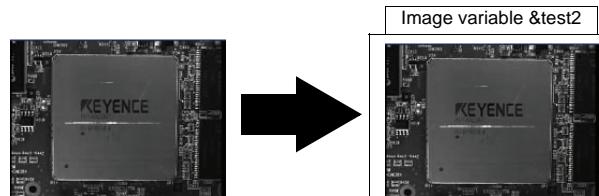
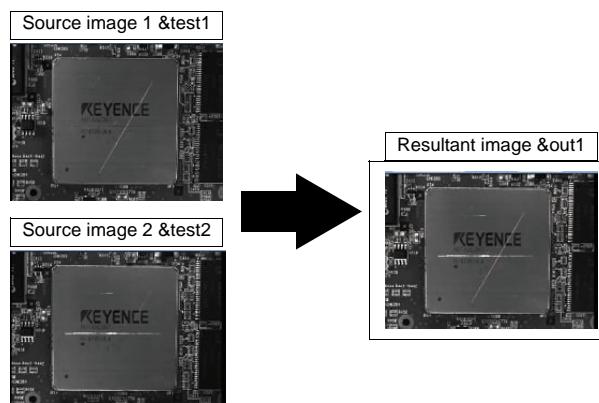


Image operation is performed using &test1 and &test2 as source images (Max: Bright color extraction) and the resultant image is stored in &out1.

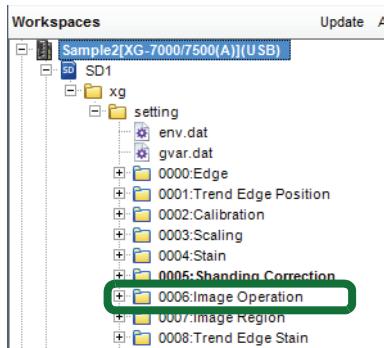


Creating an Image Operation unit

1. Switch the program.

(1) Open [System View].

Select [Workspaces] - [0006:Image Operation], right-click the mouse, and select [Set as Current Program].



Click [Execute one time] and examine each unit.

2. Check the settings of the Capture unit.

Confirm the camera image variables.

Camera image variable set to the U0001 capture unit:
&test1

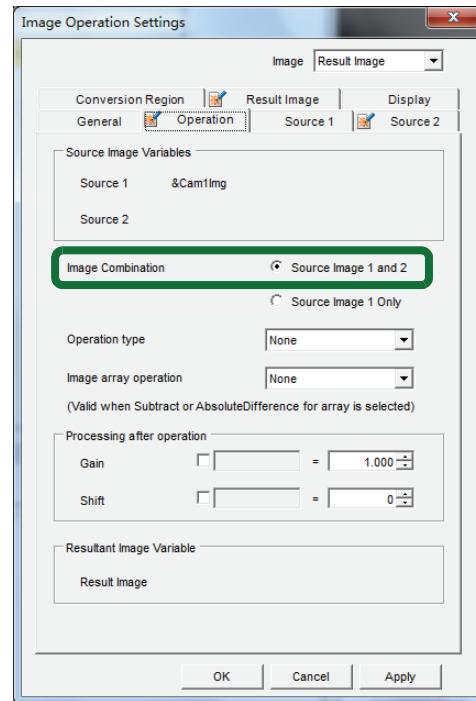
Camera image variable set to the U0002 capture unit:
&test2

3. Delete the [U0003 Image Operation] unit at this time.

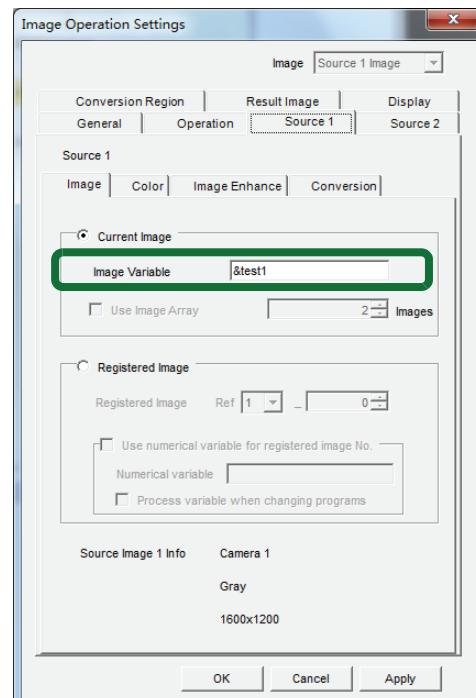
4. Add an Image Operation unit.

(1) Select [Parts List] - [Calc.] - [Image Operation] unit and add it under the [Position Adjustment] unit.

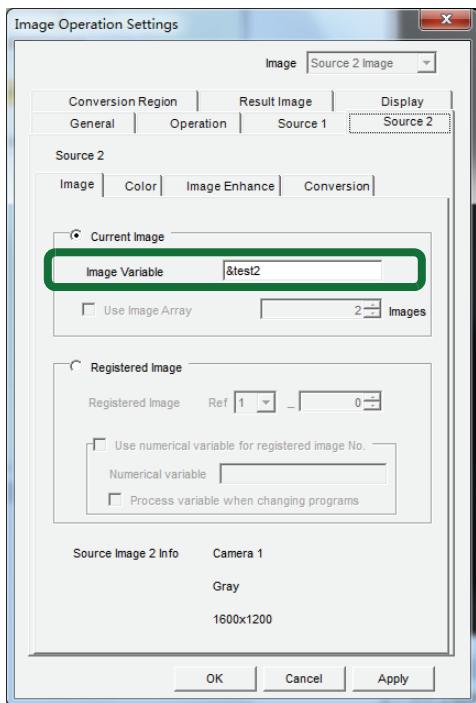
(2) Select [Operation] - [Image Combination] and select [Source Image 1 and 2].



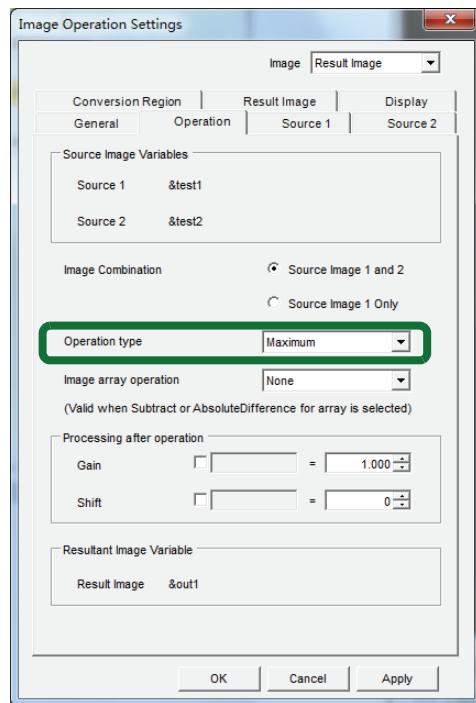
(3) Select [Source 1] - [Image] - [Current Image] and set "&test1" for [Image Variable].



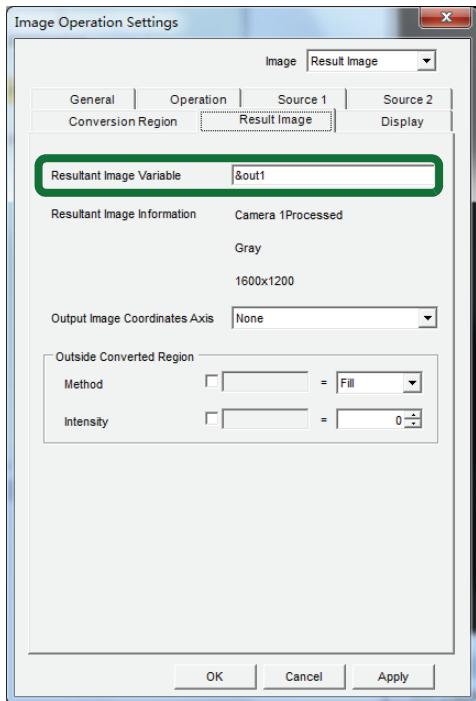
(4) Select [Source 2] - [Image] - [Current Image] and set "&test2" for [Image Variable].



(6) Select [Operation] - [Operation type] and set [Maximum].

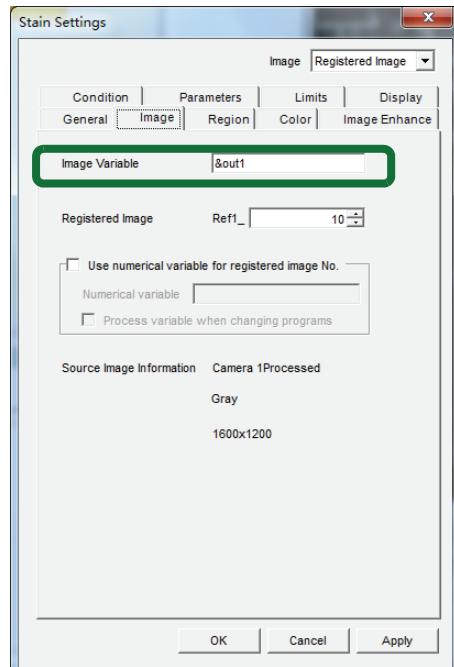


(5) Select [Result Image] - [Resultant Image Variable] and set "&out1".

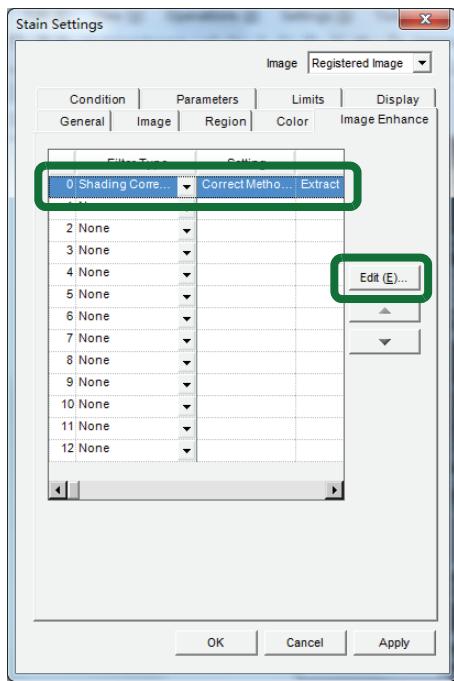


5. Edit the Stain unit.

(1) Select [Image] - [Image Variable] and set "&out1".

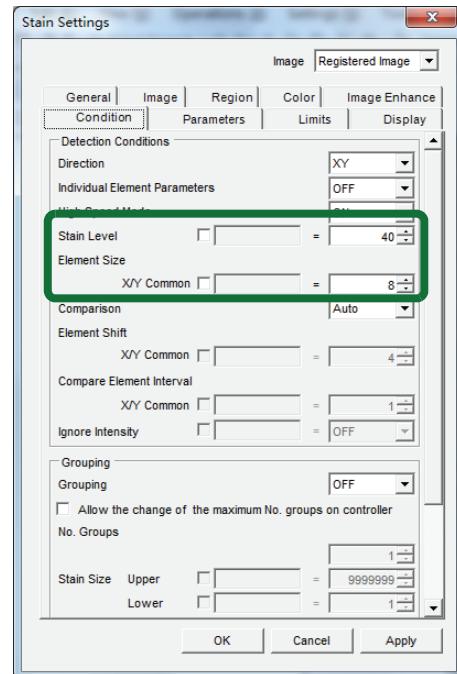


- (2) Select [Image Enhance] - [Filter Type], select [Shading Correction], and click the [Edit] button.



- (4) In the [Condition] tab, adjust options to allow stain detection.

Element Size: 8
Stain Level: 40

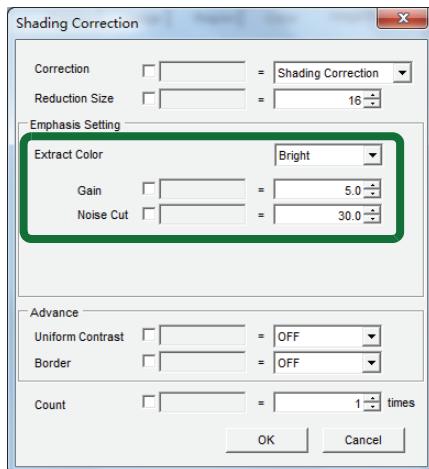


- (3) In [Shading Correction], adjust options to make the contrast difference between cracks and the background greater.

Extract Color: Bright

Gain: 5.0

Noise Cut: 30.0



Advanced Tutorial_2_4: Image Region

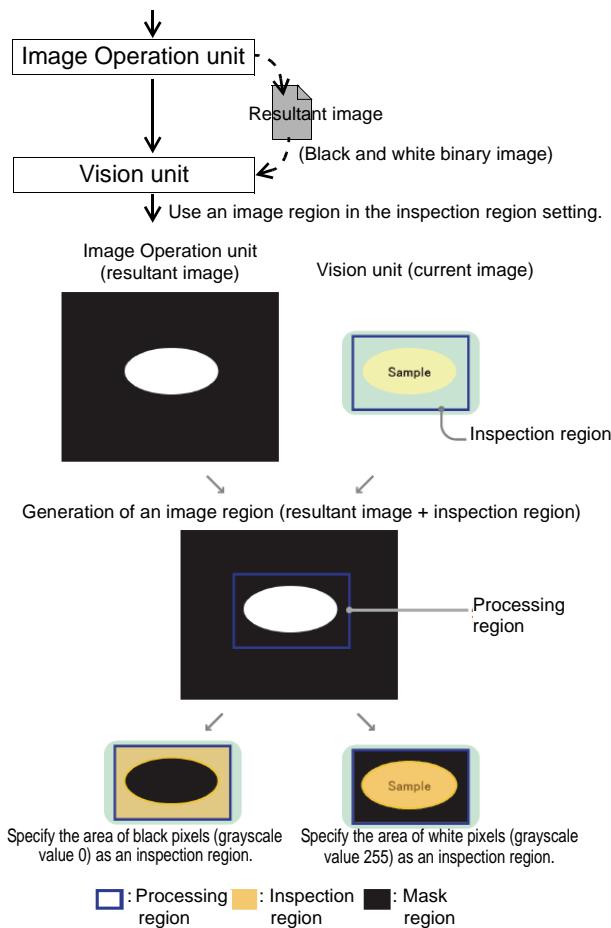
Image region

An image region is a function to use the area of white pixels (grayscale value 255) or black pixels (value 0) in the resultant image from an Image Operation unit as the inspection region for a vision unit.

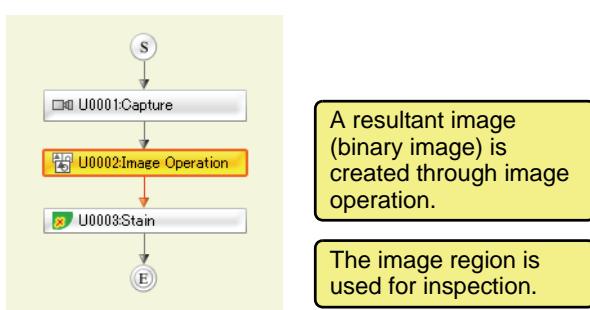
Using an image region brings the following advantages:

- (1) You can inspect only a desired area without creating a region in complicated shape.
- (2) You can inspect only a desired part when each target has a different shape.

■ Example of processing using an image region



■ Sample flowchart

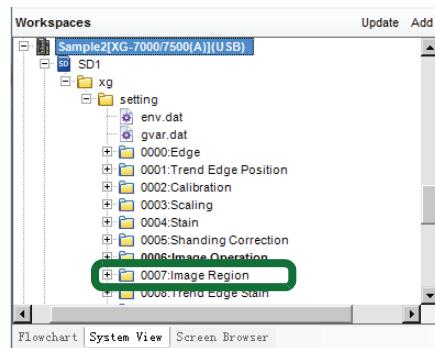


Examining the [Capture] unit

1. Switch the program.

Open [System View].

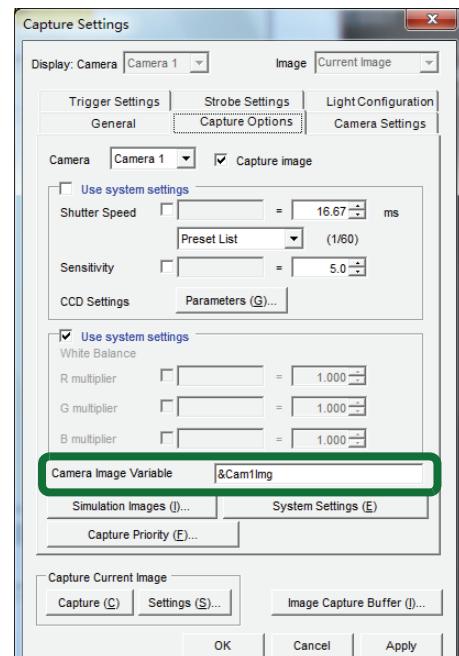
Select [Workspaces] - [0007:Image Region], right-click the mouse, and select [Set as Current Program].



Click [Execute one time] and examine each target.

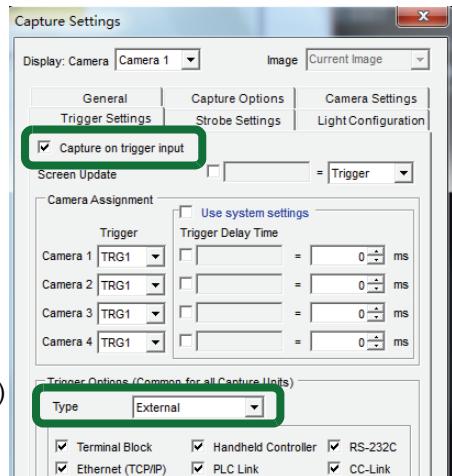
2. In the [Flowchart] view, double-click the [Capture] unit and edit its "unit property" setting.

- (1) Confirm that [&Cam1Img] is set for [Camera Image Variable].



(2) View [Trigger Settings].

- i) Confirm that the check box for [Capture on trigger input] is checked.
- ii) Confirm that [Type] is [External].



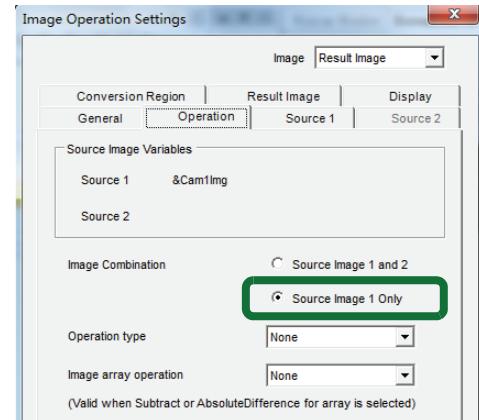
Creating an "Image Operation" unit

3. Add an "Image Operation" unit.

4. In the [Operation] tab, set the operation details.

Check the radio button for [Image Combination] - [Source Image 1 Only].

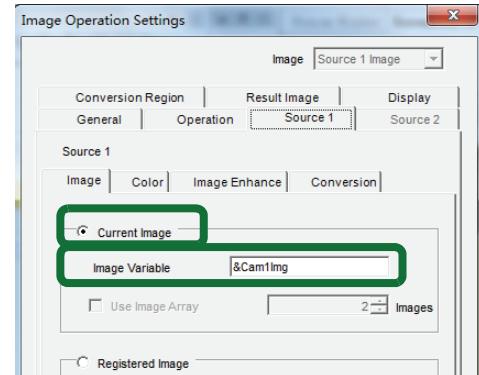
By doing this, you will generate an "image region" for "source image 1" only.



5. Select [Source 1] tab - [Image] tab and confirm the image of source image 1.

[Current Image] radio button - [ON]

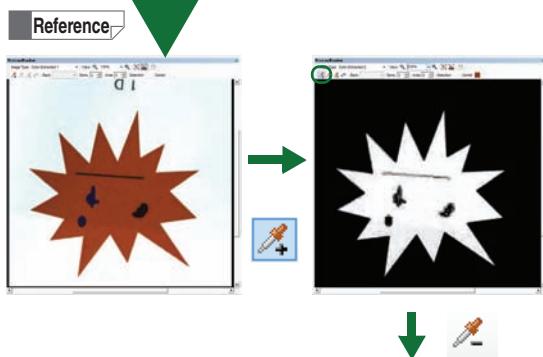
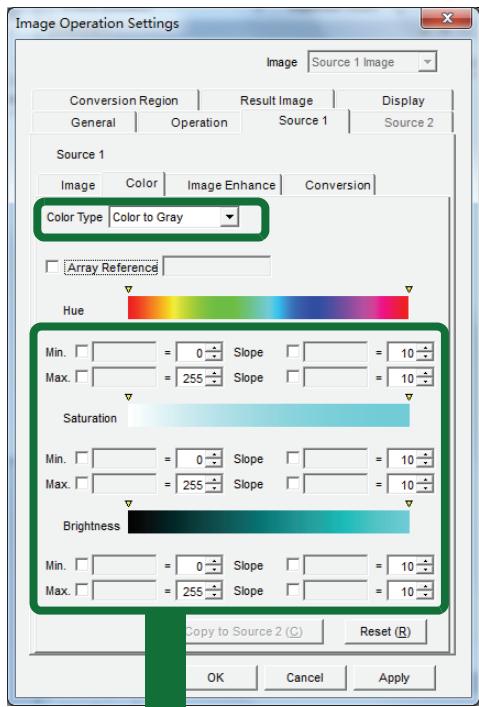
Confirm that [&Cam1Img] is set to [Image Variable].



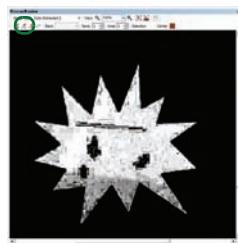
6. Select [Source 1] tab - [Color] tab and set the "color extraction method" for "source image 1".

Set [Color Type] to [Color to Gray].

Select [Vision Window] - [Image Type], set [Color-Extracted 2] and check the image.

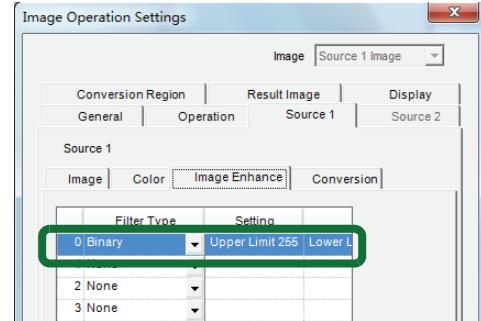


By selecting [Pick] (+) or [Omit] (-), you can adjust all of these 12 parameters automatically.

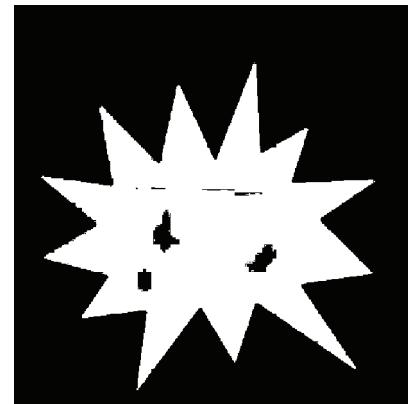


7. Select [Source 1] tab - [Image Enhance] tab and set the "image enhancement" for source image 1.

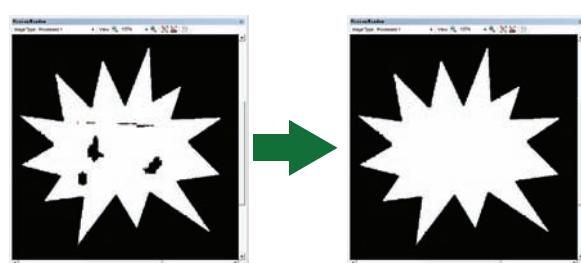
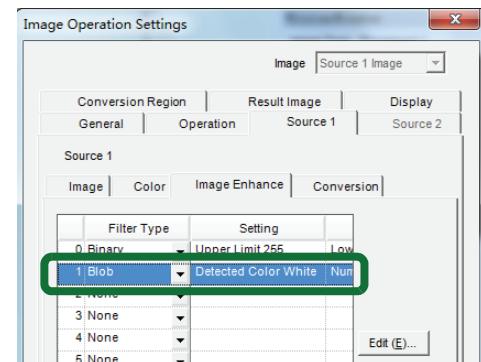
Select [Filter Type] - [Binary].



Binary image

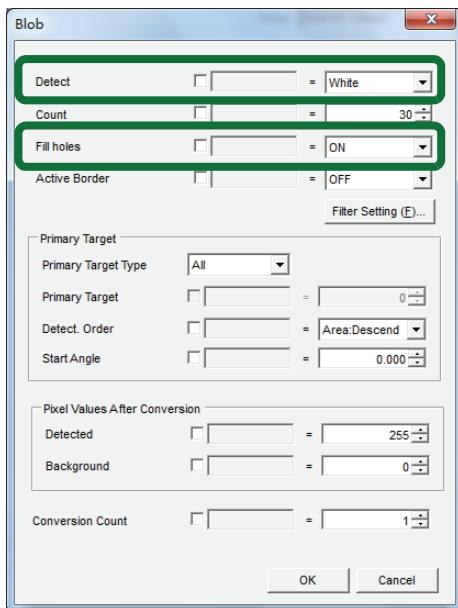


8. Select [Source 1] tab - [Conversion] tab and add [Blob].



You can see that the holes in the foreign object are filled.

Click the [Edit] button.
Examine the internal parameters.

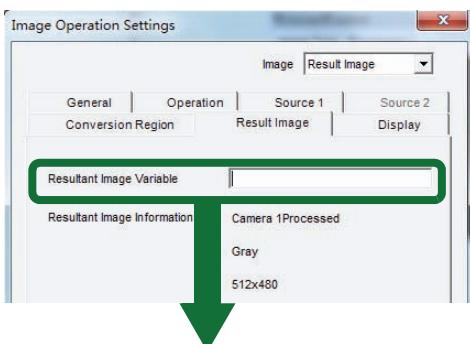


When [Detect] is set to [White], "white" blobs are detected.

When [Fill holes] is set to [ON], the "black" blobs inside a "white" blob can be filled.
Select [ON] or [OFF] to see the difference.

After checking the difference, select [ON].

9. In the [Result Image] tab, set [Resultant Image Variable].



You need to define a "resultant image variable".

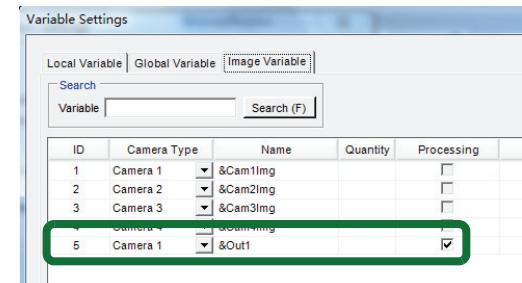
You can leave the "unit property" setting open.

(1) From the top of the screen, open [Settings] - [Variable Settings] - [Image Variable] tab.
Click the [Add] button.

Enter "Out1" in the [Name] column of the added "variable".

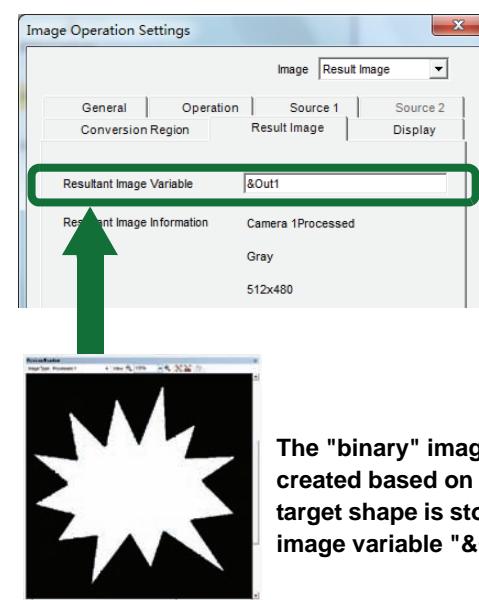
* You do not need to enter the "&" sign because it is added to the beginning of the variable automatically.

Be sure to "check" the [Processing] column of an "image variable" to be used as an "resultant image variable".



When you complete the input, click [OK] to close the setting.

(2) Select [Image Operation] unit - [Result Image] tab - [Resultant Image Variable] and enter "&Out1".



The "binary" image created based on the target shape is stored in image variable "&Out1".

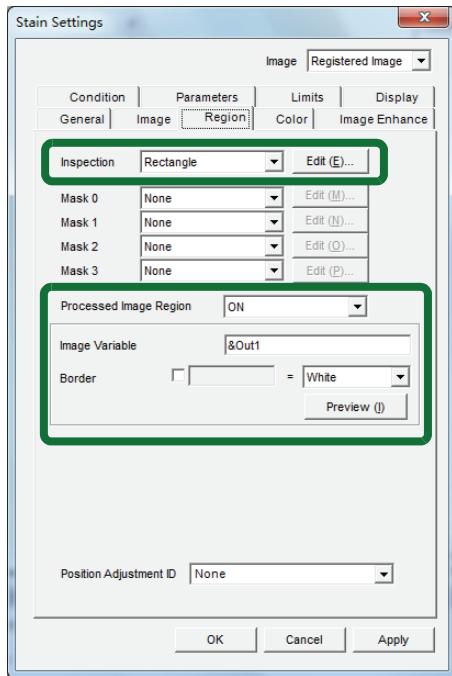
After checking the result, click [OK] to close the unit property setting.

Creating a "Stain" unit

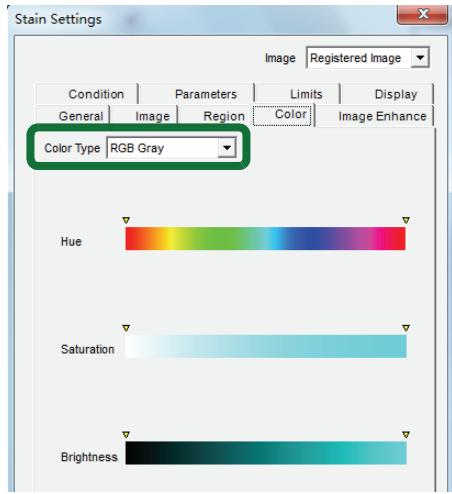
10. Add a Stain unit.

11. Click the [Region] tab.

- (1) Select [Rectangle] for [Inspection].
- (2) Select [ON] for [Processed Image Region].
- (3) Enter "&Out1" for [Image Variable].
- (4) Click [Preview] to see the status of binary conversion, and then select [White] for [Border].



12. Set [Color Type] to [Gray].



13. Set the detection conditions.

Element Size: 8

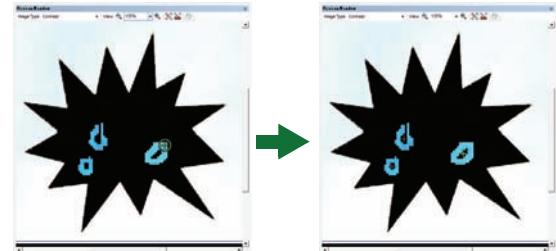
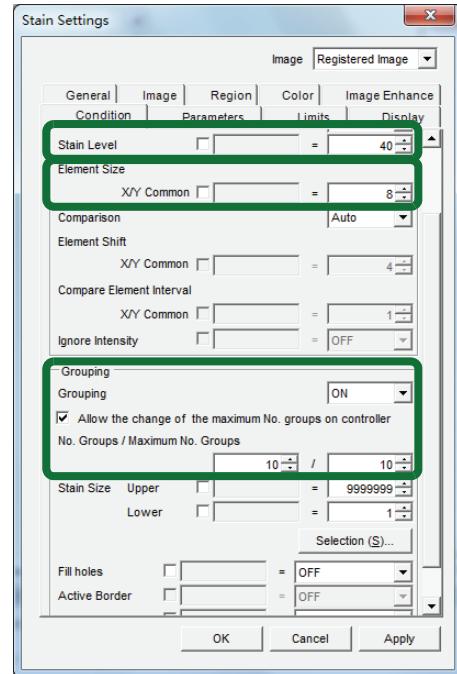
Stain Level: 40

Grouping: ON

[Allow the change of the maximum No. groups on controller] is checked.

No. Groups: 10

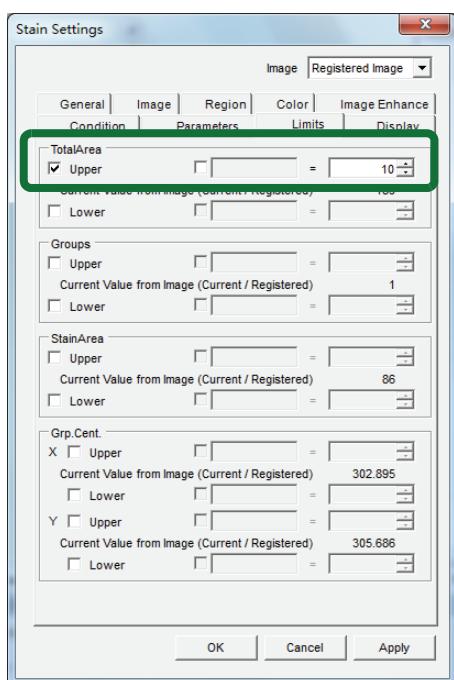
Maximum No. Groups: 10



14. Set the judgment limits.

Check [Upper] for [Total Area].

Total Area: 10

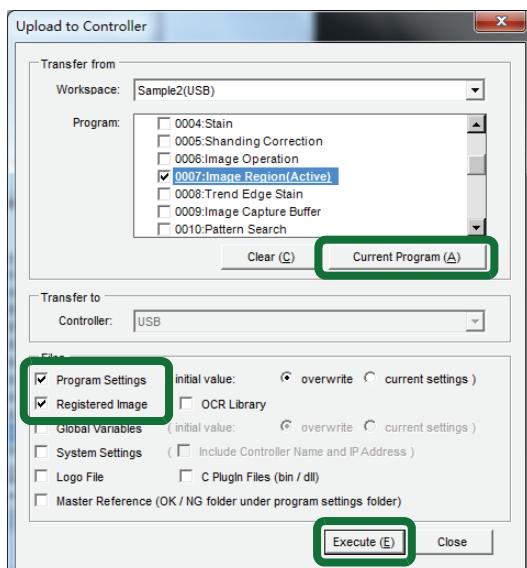


15. Upload the data.

Click the [Current Program] button.

Select [Program Settings] and [Registered Image] for [Files].

Confirm the setting and click the [Execute] button to upload the data.

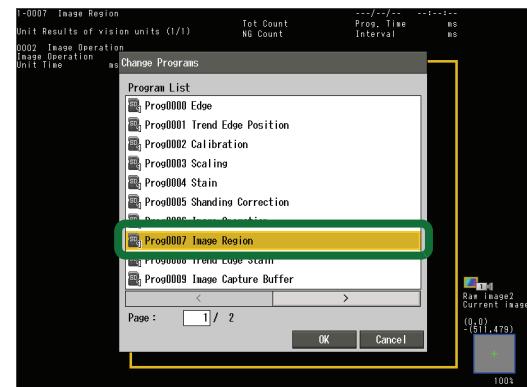
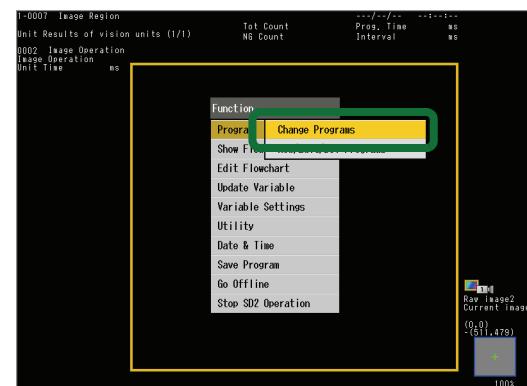


Checking the result with the controller

16. Switch the program.

Select [Function] - [Program] - [Change Programs].

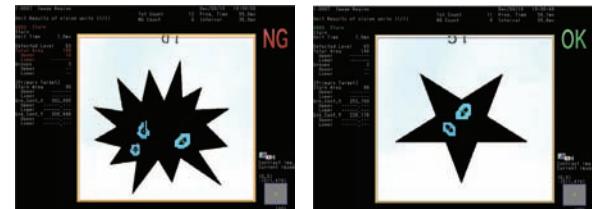
Select [Prog0007 Image Region].



17. Check the inspection result.

Press the [SCREEN] button to show "contrast display".

Press the [TRIGGER] button and check the result.



You can see that all foreign objects can be detected.

Detecting "blue objects" only

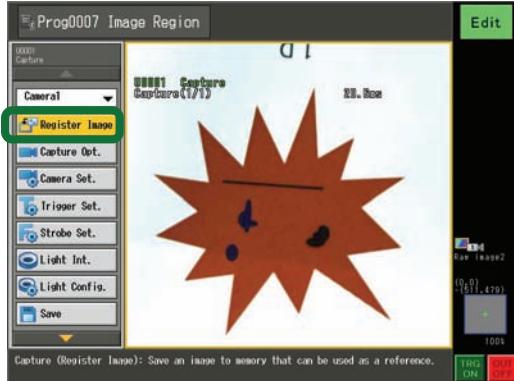
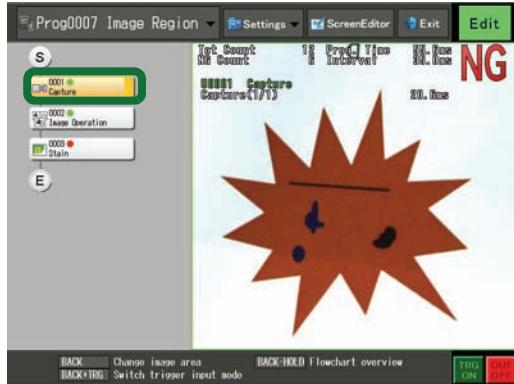
18. Use "on-screen flowchart editing" to change the settings to enable the detection of "blue objects".

Select [Function] - [Edit Flowchart].

A confirmation message appears. Select [OK].



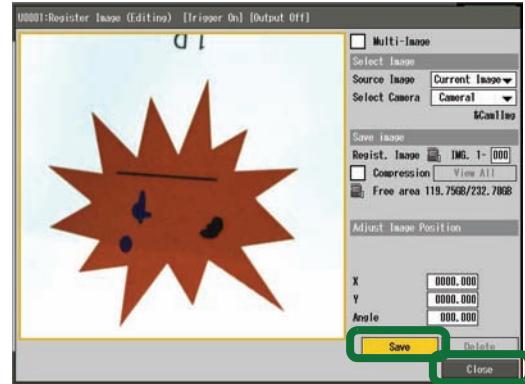
(1) Select [Capture] unit - [Register Image].



(2) Display target "1D" on the screen as shown below.

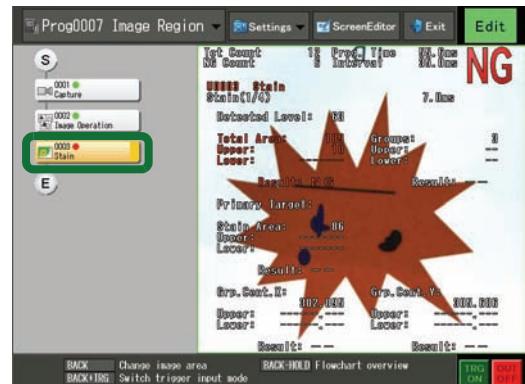
Select the [Save] button.

Select [Close].

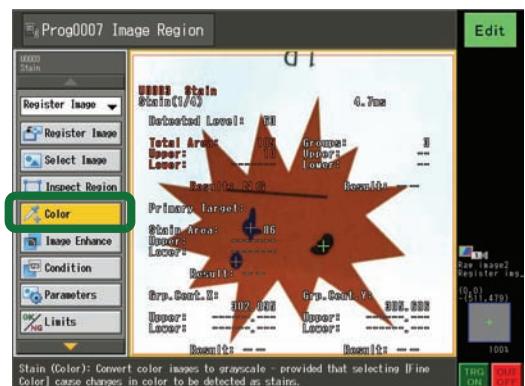


19. Change the settings of the [Stain] unit.

Open the [Stain] unit.

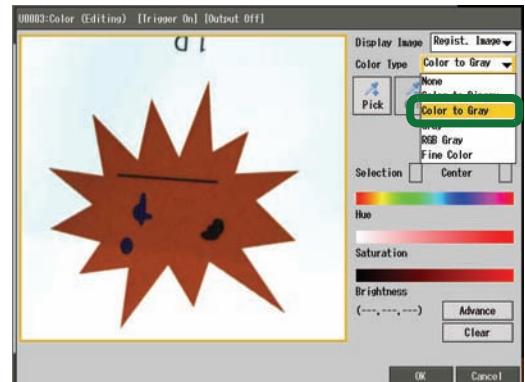


(1) Select [Color].

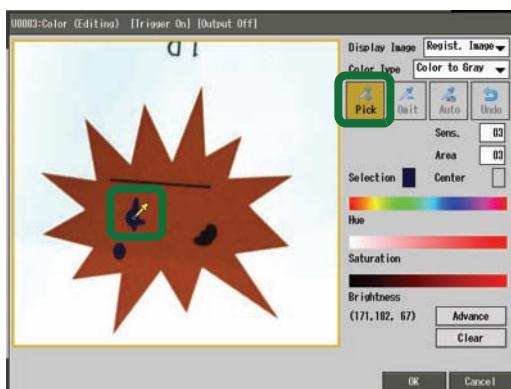


(2) Change [Color Type] from [Gray] to [Color to Gray].

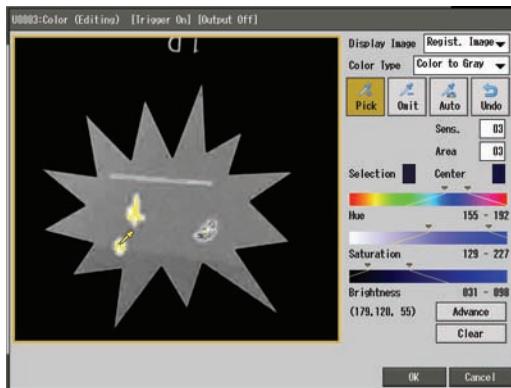
By extracting "blue" on this screen, set the unit to detect blue objects only.



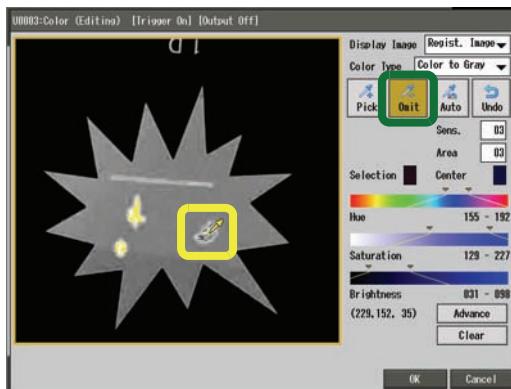
- (3) Select the [Pick] tool.
Extract "blue" in the image.



- (4) Repeat extracting blue several times.



- (5) Then, use the [Omit] tool to "omit" colors other than "blue".

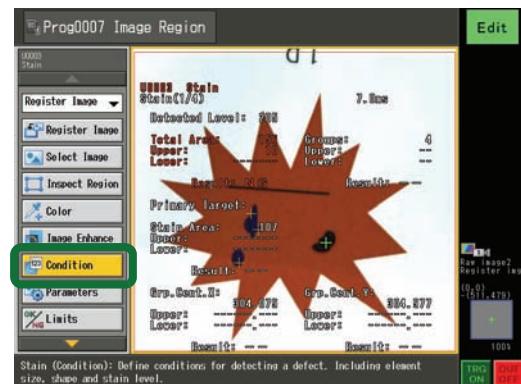


Repeat omitting several times until only "blue objects" are profiled.

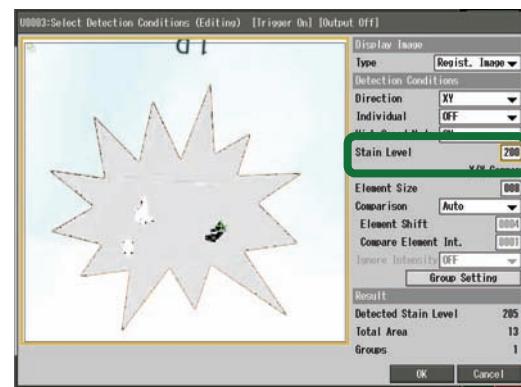


Select [OK] to close the setting.

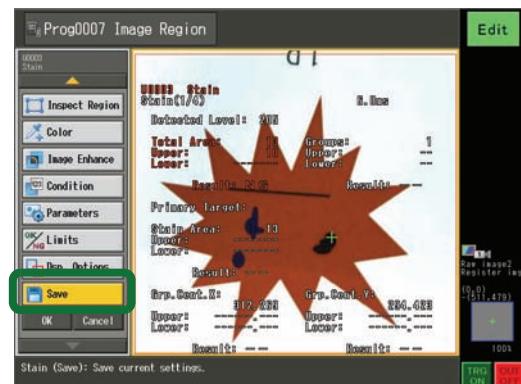
- (6) Open the [Condition] tab.



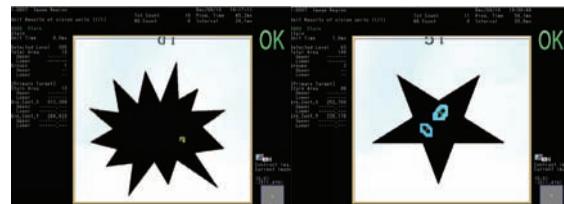
- (7) Select [Current Image] for [Type].
Input [TRIGGER] signals for both targets and check [Stain Level].
Change [Stain Level] from "40" to "200".



- (8) Select [Save] to close the setting.



20. Check the result.



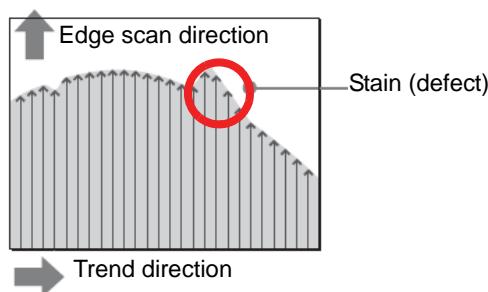
Advanced Tutorial_2_5: Trend Edge Stain

What is a trend edge stain inspection?

The trend edge stain inspection processes information of multiple edge positions to determine a base model line (straight line, circle, oval or free curve) to be used as a contour of the detection target. A defect (protrusion or indentation) is detected when there is a deviation that exceeds the threshold value from the base model line. The stain level (stain height and depth), number of stain segments (stain width), stain size (total stain area), stain position and stain count can be returned as measurement results.

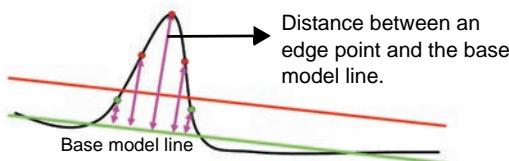
■ Stain detection method

Example of an inspection region with a curved base model line

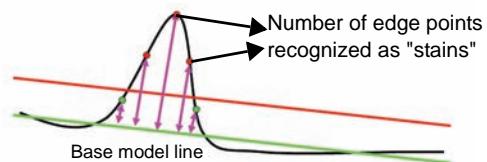


A protrusion or indentation from the base model line is detected as "stain" (defect).

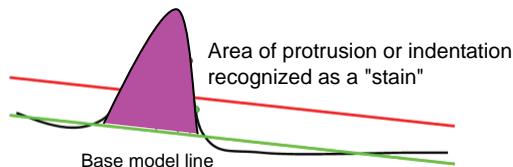
Stain level (height)



Number of stain segments (width)

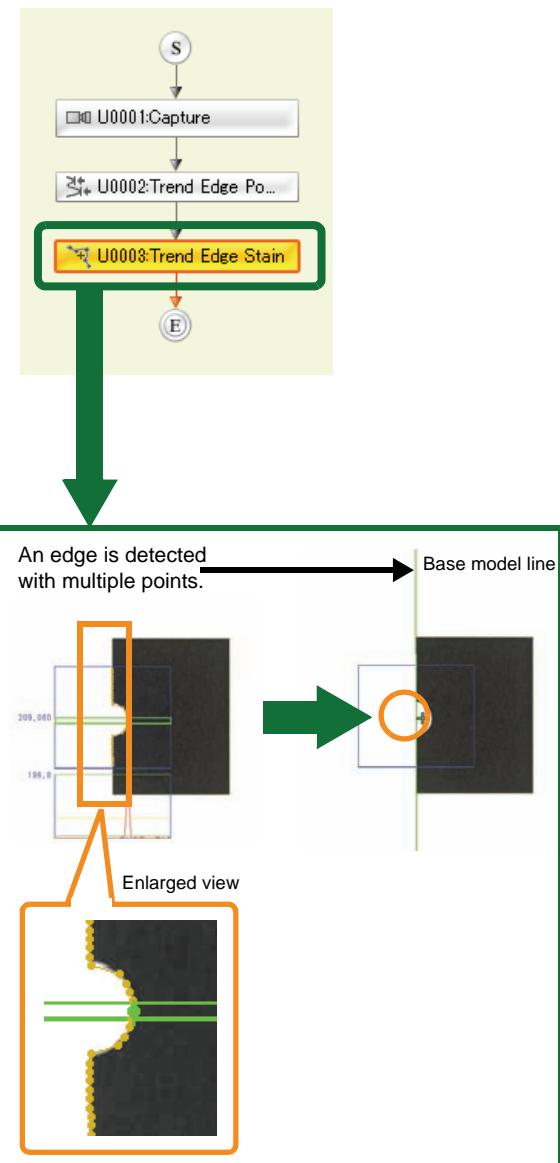


Stain size (area)



Judgment will be made based on these threshold values.

■ Sample flowchart

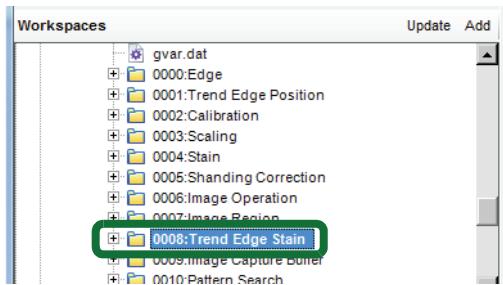


Understanding the functions of a Trend Edge Stain unit

1. Switch the program.

Open [System View].

Select [Workspaces] - [0008:Trend Edge Stain], right-click the mouse, and select [Set as Current Program].

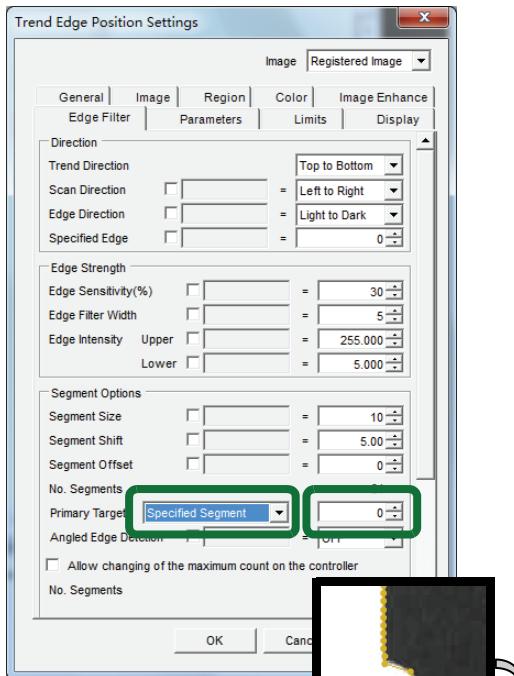


Click [Execute one time] and examine each target.

2. Examine the [Trend Edge Position] unit.

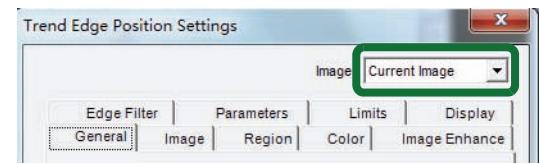
(1) Open the [Flowchart] view.

Open [U0002:Trend Edge Position] - [Edge Filter]. Select [Specified Segment] for [Primary Target] and increase the number one by one from "0" to check the edge points.



After checking the points, reset the setting to [Maximum Position].

(2) Setting [Primary Target] - [Maximum Position] allows the detection of the coordinates of the edge point which is the farthest from the base line. Change [Image] to [Current Image]. Click [Execute one time] and check the result.



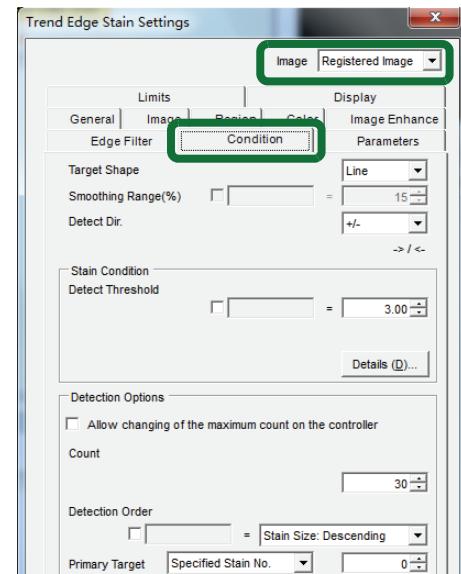
(3) Select [Unit Result] - [Unit] - [U0002.RSLT] - [Segment X Edge Position Result: Measured Value], click [Execute one time] and check the result.

Name	Definition	Starting Point	Number ...	Current Value	Initial Value
NLO:MS	Minimum Number of Edges Result: Measured Value			1	
[0]1:MS	Segment X Edge Position Result: Measured Value			+200.000	
[0]1:AB	Segment X Edge Position Result: Absolute Value			+184.774	
[1]1:MS	Segment X Edge Position Result: Measured Value			+184.793	
[1]1:AB	Segment X Edge Position Result: Absolute Value			+184.793	
[2]1:MS	Segment X Edge Position Result: Measured Value			+184.793	

Although this value shows how deep the burr or crack is based on position coordinates, you cannot determine its size and width.

3. Examine the [Trend Edge Stain] unit.

(1) Open [U0003:Trend Edge Stain] - [Condition]. Click [Execute one time] and check the result.



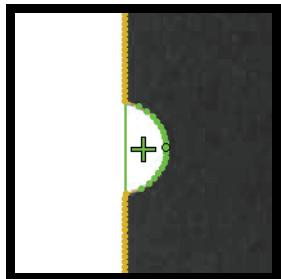
- (2) Select [Unit Result] - [Unit] - [U0003.RSLT] - [Segment X Edge Position Result: Measured Value], click [Execute one time] and check the result.

Unit Result					
Unit	System	Local	Global		
TSTG-MS	Total Stain Size Result: Measured Value	-	-	324.599	
TSTG-JG	Total Stain Size Result: Judgment Value	-	-	0	
TSTL-MS	Total Stain Level Result: Measured Value	-	-	24.132	
TSTL-JG	Total Stain Level Result: Judgment Value	-	-	0	
STG					
STG-MS	Stain Size Result: Measured Value	-	0	100	
STG-JG	Stain Size Result: Judgment Value	-	-	0	
STGH-MS	Maximum Stain Size Result: Measured Value	-	-	324.599	
STGH-JG	Maximum Stain Size Result: Judgment Value	-	-	0	
STGL-MS	Minimum Stain Size Result: Measured Value	-	-	324.599	
STGL-JG	Minimum Stain Size Result: Judgment Value	-	-	0	
STL					
STL-MS	Maximum Stain Level Result: Measured Value	-	0	100	
STL-JG	Maximum Stain Level Result: Judgment Value	-	-	24.132	
STLLO-MS	Minimum Stain Level Result: Measured Value	-	-	24.132	
STW					
STW-MS	Maximum Stain Width Result: Measured Value	-	0	100	
STW-JG	Maximum Stain Width Result: Judgment Value	-	-	17	
STWLO-MS	Minimum Stain Width Result: Measured Value	-	-	17	
STA					
STX-MS	Stain X Position Result: Measured Value	-	0	100	
STXH-MS	Maximum Stain X Position Result: Measured Value	-	-	+195.242	
STXH-JG	Maximum Stain X Position Result: Judgment Value	-	-	0	
STXL-MS	Minimum Stain X Position Result: Measured Value	-	-	+195.242	
STXL-JG	Minimum Stain X Position Result: Judgment Value	-	-	0	
STY					
STY-MS	Stain Y Position Result: Measured Value	-	0	100	
STYH-MS	Maximum Stain Y Position Result: Measured Value	-	-	+267.380	
STYH-JG	Maximum Stain Y Position Result: Judgment Value	-	-	0	
STYLO-MS	Minimum Stain Y Position Result: Measured Value	-	-	+267.380	

Stain Size: Area of the detected "stain"

Stain Level: Distance between the deepest point of the "stain" and the base model line

Stain Width: "Number of segments" corresponding to the width of the "stain"



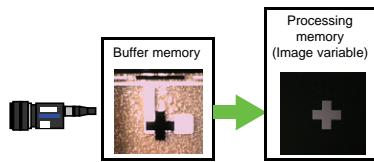
Advanced Tutorial_2_6: Image Capture Buffer

What is an image capture buffer?

It is a mechanism to allow capturing images independently of flowchart processing.

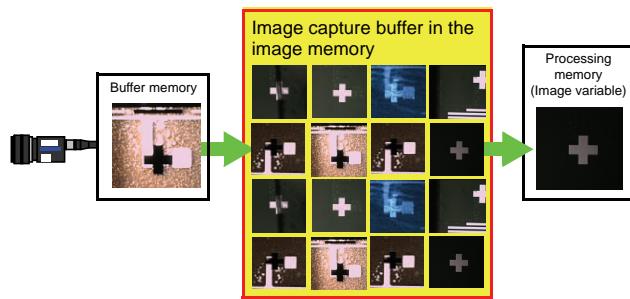
Like the image archive function, data of captured images can be buffered in the image memory, allowing usage which was impossible with the conventional double buffer only. This is called an image capture buffer function.

i) Image capturing mechanism of typical image processing devices



During image processing, only one image can be captured and stored.

ii) Image capture buffer function (XG-7000 Series)



Images can be captured in parallel with image processing.

The image capture buffer (in the image memory) can store up to 1013 images.

(For XG-035M*1: The number of image capture buffers that can be retained depends on the camera to be used and its settings.)

Images up to the allowed number can be stored without being affected by image processing.

■ Advantages of the image capture buffer function

Image capture buffer operation

Conventional operation (double buffer)

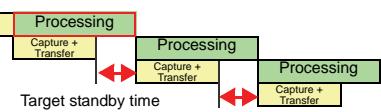
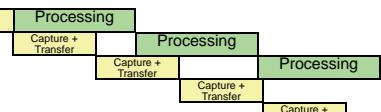


Image capture buffer



With the conventional XG Series, storage was limited to "double buffer".

Consequently, targets are put on standby whenever the processing time is longer than the capture and transfer time, resulting in a waste of time.

The "image capture buffer" enables continuous image capturing without a need for putting targets on standby. Since image processing can be proceeded simultaneously, the overall tact time and yield can be improved.

■ Usage examples of the image capture buffer function

Application 1: Advanced image capturing

Appearance inspection of targets rotating at high speed

Previous version



Capture Image processing Capture Image processing Capture Image processing Capture Image processing

XG Ver3



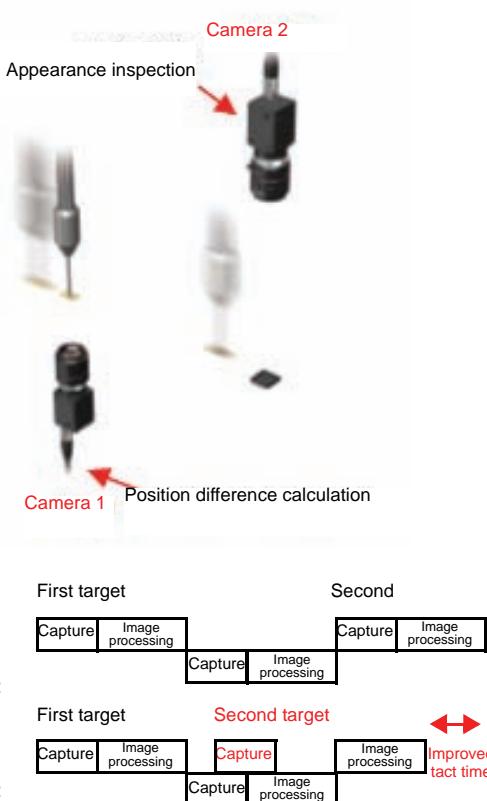
Capture Capture Capture Capture Capture Capture Capture Capture Capture

Image processing Image processing Image processing Image processing Image processing Image processing Image processing

The mouth of a bottle is checked for foreign objects. The bottle is rotated at high speed, and the conventional model had to wait for the completion of the processing of the second previous image before capturing the next image, even when the double buffer was used. With the XG Ver. 3.0, images can be captured at the maximum speed without any attention paid to the completion of image processing.

Application 2: Different inspections on a single line

Example: Position correction and appearance inspection in a chip mounter by using two cameras

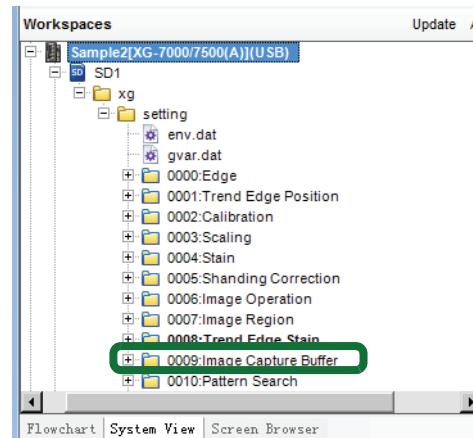


Understanding the image capture buffer function

1. Switch the program.

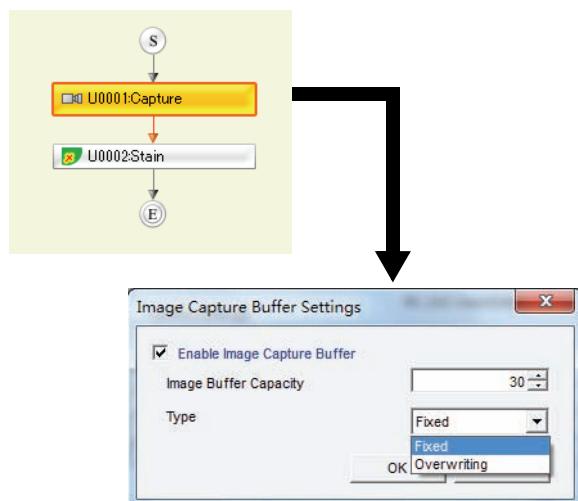
Open [System View].

Select [Workspaces] - [0009:Image Capture Buffer], right-click the mouse, and select [Set as Current Program].



Click [Execute one time] and examine each target.

■ Sample flowchart/setting



Fixed:

When the image capture buffer is full, no more images are captured. When a space becomes available in the buffer, image capturing resumes.

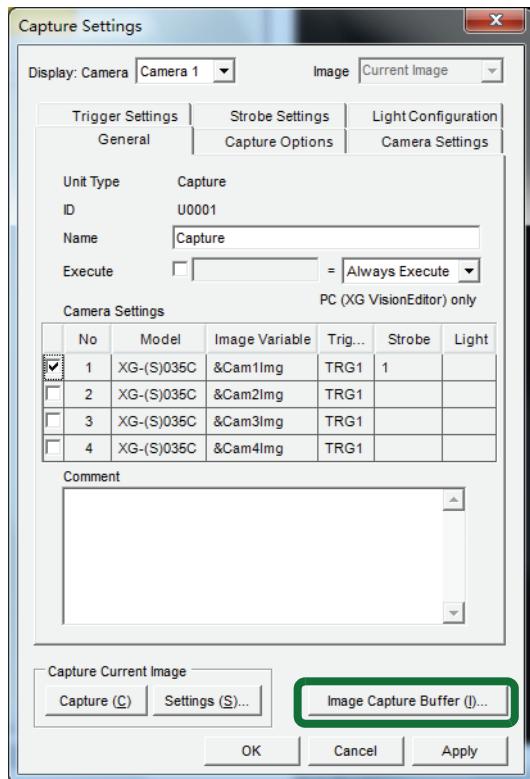
Overwriting:

When the image capture buffer is full, image capturing continues by overwriting the oldest image.

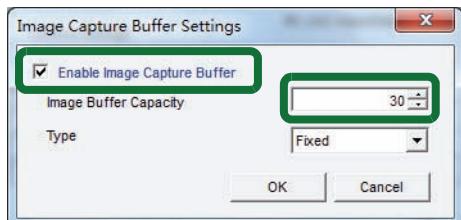
Setting the image capture buffer

2. Set the image capture buffer.

- (1) Open the unit property setting of the "Capture unit" and click [Image Capture Buffer] located at the bottom.



- (2) Check the check box for [Enable Image Capture Buffer] and set [Image Buffer Capacity] to "30".



Set [Type] to [Fixed]. This setting allows up to 30 images to be stored in the memory called image capture buffer, and halts the subsequent image capturing until space becomes available in the buffer.

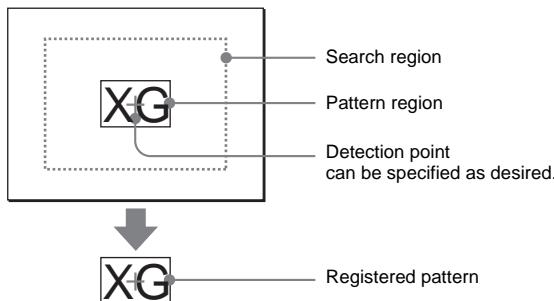
Advanced Tutorial_3_1: Pattern Search

What is pattern search?

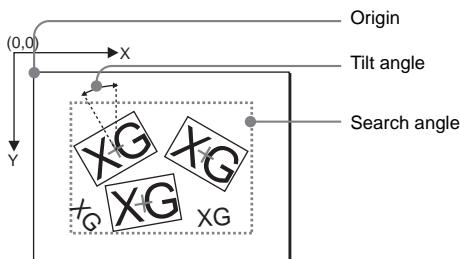
This function registers a pattern which represents features of a registered image.

It searches a current image for a section which most resembles the registered pattern and then measures the position, angle, and matching ratio (resemblance) of the found pattern.

When a pattern is registered

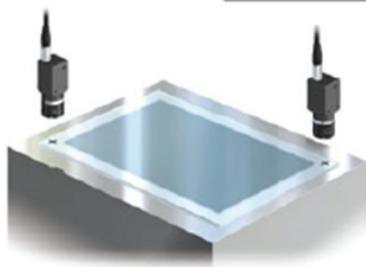


During Run mode



■ Pattern search applications

Positioning of glass substrates



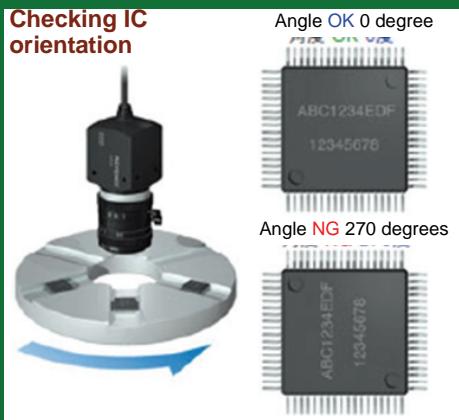
Before glass substrates are bonded, the positions of the marks at the opposite corners are detected for alignment.

Inspection for improperly positioned bottle labels



The positions of the labels pasted on bottles are inspected. Since 100% inspection is possible even in a fast-moving production line, this prevents defective products from being overlooked.

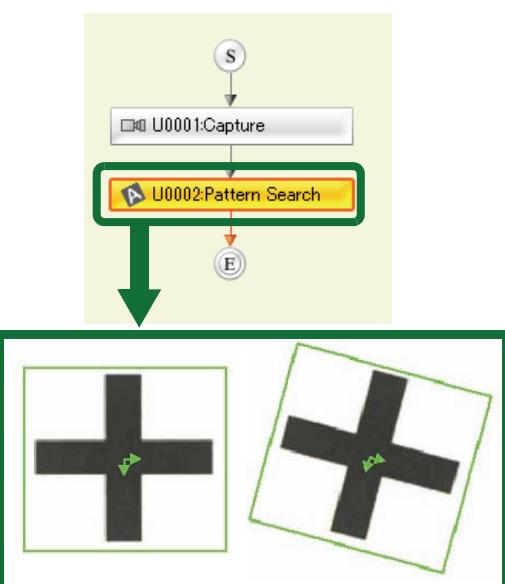
Checking IC orientation



The printing on the IC placed on an index table is searched for and the detected angle is used to determine the orientation.

A high processing ability enough for a high-speed production line is required.

■ Sample flowchart

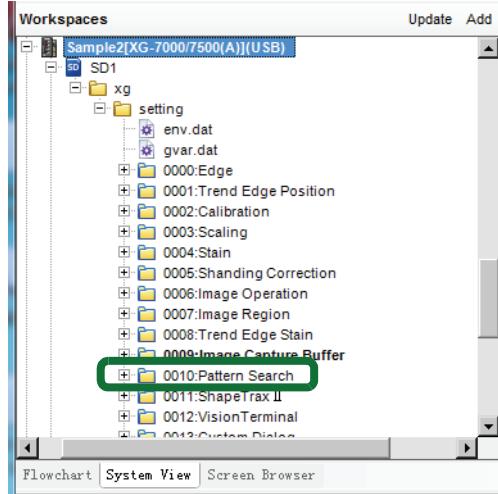


Understanding the function of a Pattern Search unit

1. Switch the program.

Open [System View].

Select [Workspaces] - [0010:Pattern Search], right-click the mouse, and select [Set as Current Program].



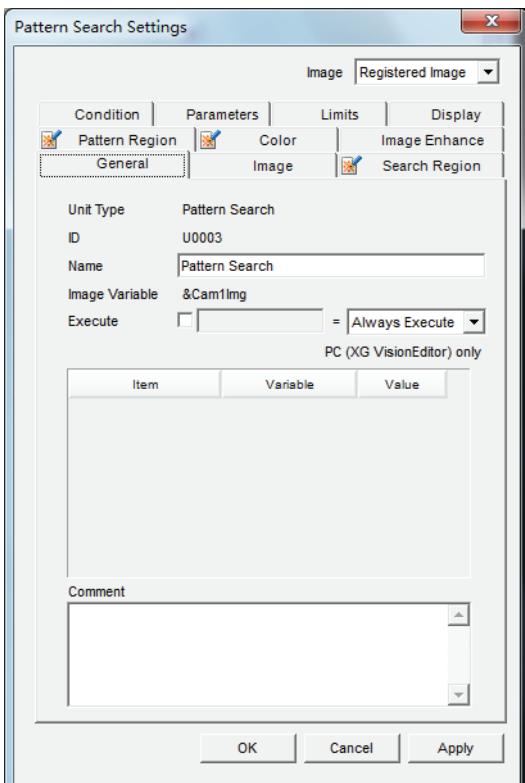
Click [Execute one time] and examine each target.

2. Add a "Pattern Search" unit.

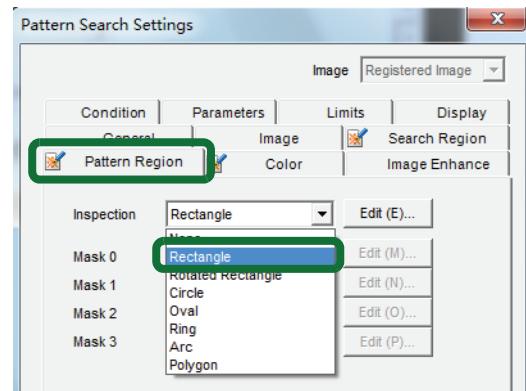
(1) Open the [Flowchart] view.

Select [Parts List] - [Vision Tools] - [Pattern Search] and drag and drop it under the [Capture] unit in the [Flowchart] view.

The "unit property" setting opens.

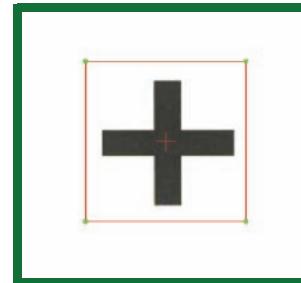


(2) Select [Pattern Region] tab - [Inspection].
Select [Rectangle].

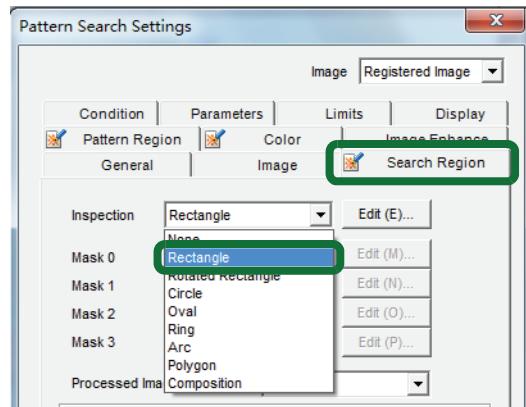


Draw a rectangle according to the size of the cross mark.

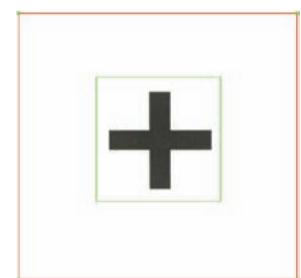
Determine the size that is not too large or too small for the mark.



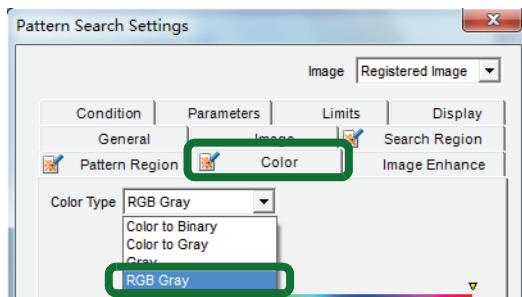
(3) Select [Search Region] tab - [Inspection].
Select [Rectangle].



Set a region to cover the field of view of the camera entirely.

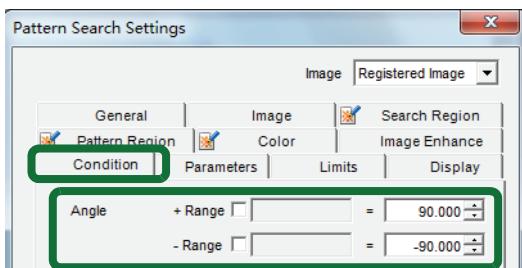


- (4) Open [Color] tab - [Color Type].
Select [RGB Gray].

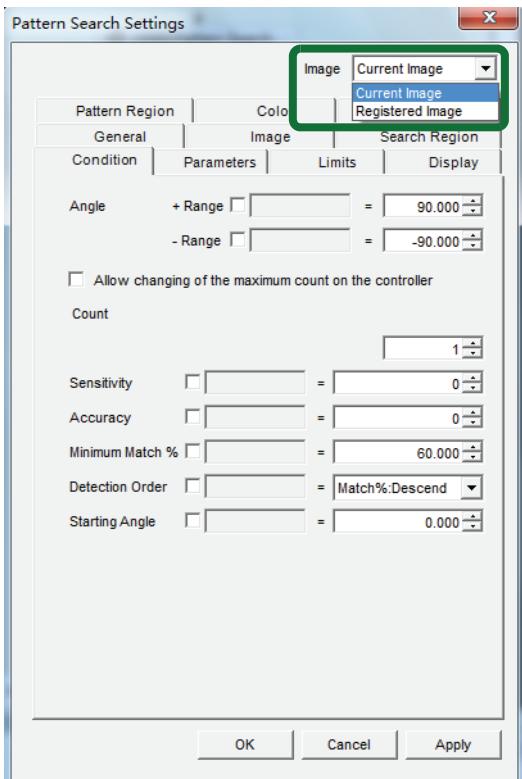


- (5) Select [Condition] tab - [Angle].
Enter "90" for [+ Range] and "-90" for [- Range].

This enables a search even when the target rotates up to "±90 degrees" from the base position.



- (6) Set [Current Image] for [Image].
Click [Execute one time] and check the result.



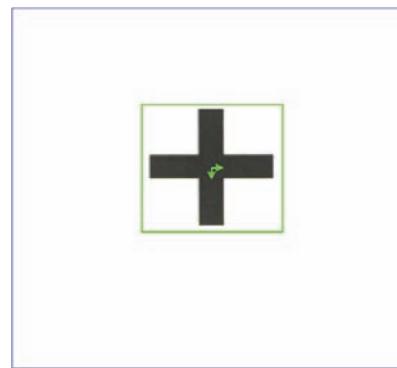
3. Checking the search result

- (1) Check the numerical result at the same time.
Select [Unit Result] - [Unit] - [!U[0002].RSLT] - [C] - [Pattern % Match Result: Measured Value] and check the value.

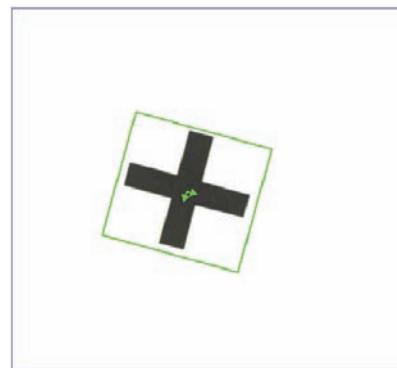
Unit	Name	Definition	Starting Point	Number...	Current Value
[!U[0002].RSLT]	UJG	Unit Result	-	-	0
	UJGP	Unit Result (OK)	-	-	0
	UJGN	Unit Result (NG)	-	-	1
	UERR	Unit Error	-	-	0
	UEID	Unit Error Code	-	-	0
	EXTM	Execution Time	-	-	70.062
	EXCT	Processing Count	-	-	1
	NGCT	Fail (NG) Count	-	-	0
	SCLX	Scale Factor (X)	-	-	+1.000000
	SCLY	Scale Factor (Y)	-	-	+1.000000
	SCLL	Scale Factor (Length)	-	-	1.000000
[!RGN]	PTSTX	Detected Pattern Center X	-	-	+262.000
	PTSTY	Detected Pattern Center Y	-	-	+215.000
	N.MS	Number: Measured Value	-	-	1
	N.JG	Number: Judgment Value	-	-	0
[!X]	X.JG	Pattern X Position Result: Judgment Value	0	100	0
[!Y]	Y.JG	Pattern Y Position Result: Judgment Value	0	100	0
[!T]	T.JG	Pattern Angle Result: Judgment Value	0	100	0
[!JGL]MS	Pattern % Match Result: Measured Value	-	-	-	99.999
[!JGL]MS	Pattern % Match Result: Judgment Value	-	-	-	0

- (2) Compare the "matching ratio" with the image in the [Vision Window] and check the result.

Matching ratio: 99.999 No position deviation

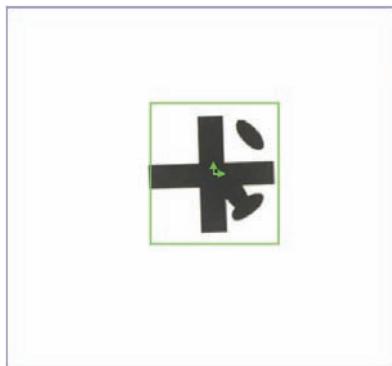


Matching ratio: 97.999 No position deviation



Matching ratio: 79.903

Position deviation



When a foreign object overlaps with the mark, the "matching ratio" drops sharply.

You can also see that the position is detected as deviated, which is not correct.

There is another function using the contour edge information of the target to allow stable search even when foreign objects overlap with the target or when the size or intensity of the target changes, .

This can be done with a "ShapeTrax2" unit which will be introduced in the next exercise.

Advanced Tutorial_3_2: ShapeTrax2

What is ShapeTrax2?

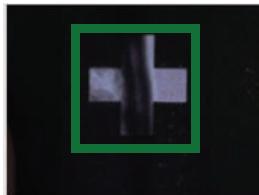
This function uses edge information obtained from a registered image pattern and a current image for comparison to detect a section which matches most closely, and then measures the position, tilt angle and correlation value of the found pattern.

Unlike pattern search, ShapeTrax2 references edge information based on mainly the contour of the target, so it is suitable for position detection which requires accuracy and stability against the surface condition variation or the missing parts of the target.

Registered image



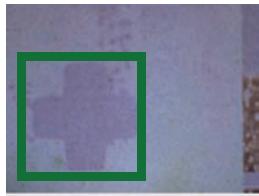
Missing parts



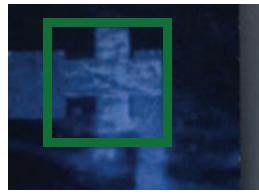
Reversed



Low contrast



Background noise

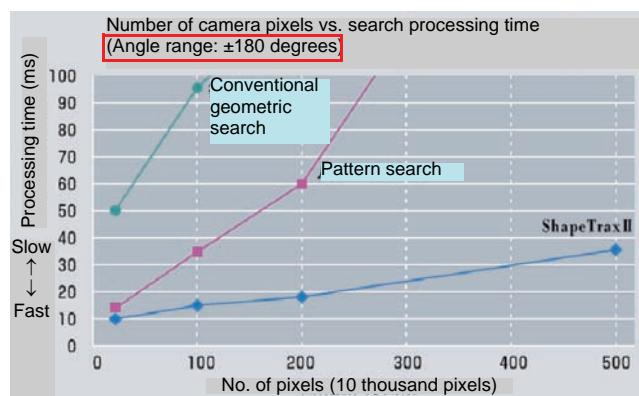


Out of focus



Even when the target condition varies greatly, the search based on the contour edge information ensures stable detection.

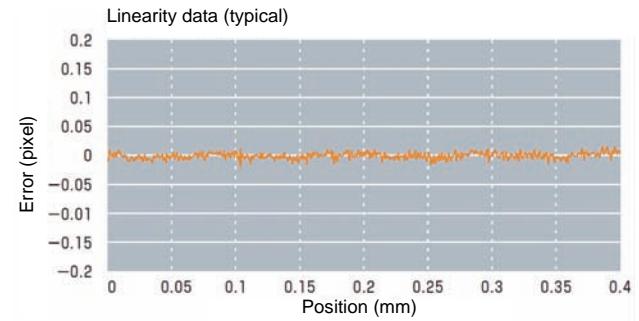
■ Processing time of ShapeTrax2



The more the number of camera pixels increases, the wider the region to be searched becomes, resulting in longer processing time.

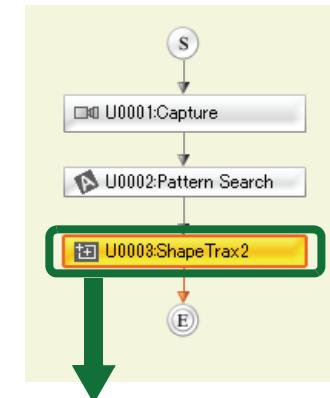
Using "ShapeTrax2" enables high speed processing even when the number of camera pixels is high.

■ Repeatability of ShapeTrax2



The detection repeatability is ± 0.025 pixel, which ensures highly accurate position detection.

■ Sample flowchart



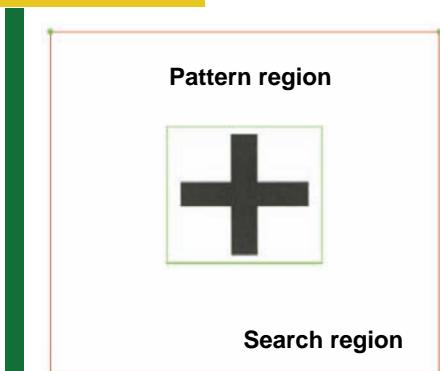
Accurate search
regardless of the
change in target
conditions



Feature comparison between pattern search and ShapeTrax2

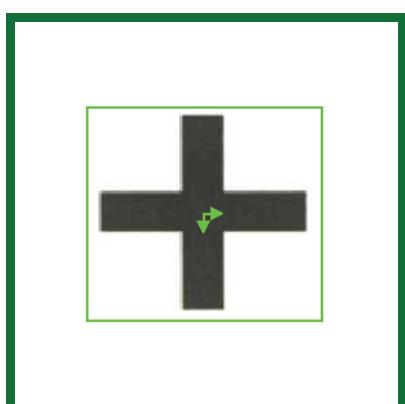
■ <Pattern search>

Specify a "region".



No Equivalent Setting

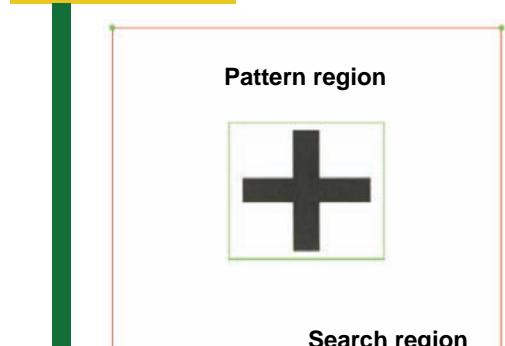
Determine the matching ratio of the "region".



The setting is easy.

■ <ShapeTrax2>

Specify a "region".



Extract the "contour edge".



Check the matching ratio of the "contour edge".



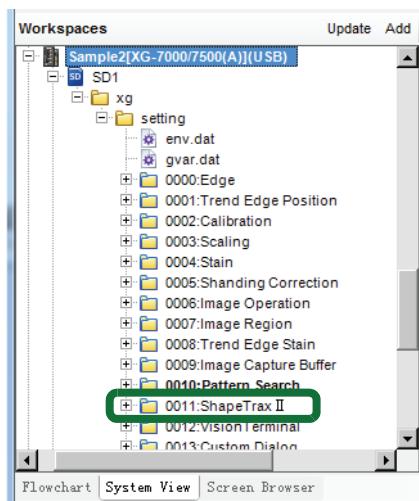
The customization (edge extraction) of a pattern makes a difficult search possible.

Understanding the function of a ShapeTrax2 unit

1. Switch the program.

Open [System View].

Select [Workspaces] - [0011:ShapeTraxII], right-click the mouse, and select [Set as Current Program].



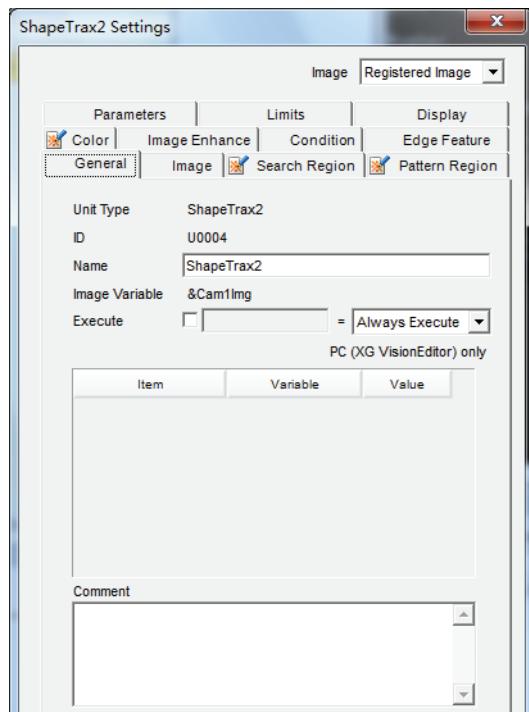
Click [Execute one time] and examine each target.

2. Add a "ShapeTrax2" unit.

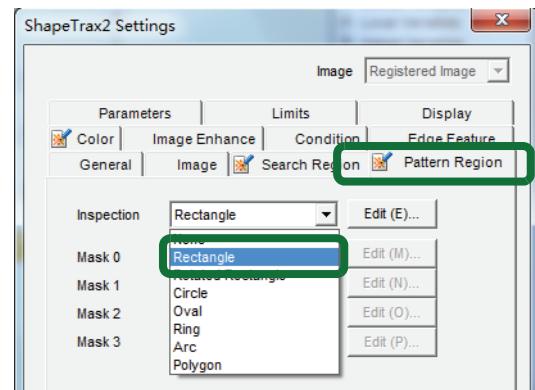
(1) Open the [Flowchart] view.

Select [Parts List] - [Vision Tools] - [ShapeTrax2] and drag and drop it under the [Pattern Search] unit in the [Flowchart] view.

The "unit property" setting opens.

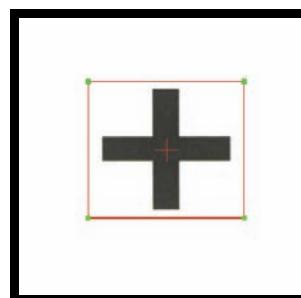


(2) Open [Pattern Region] tab - [Inspection].
Select [Rectangle].

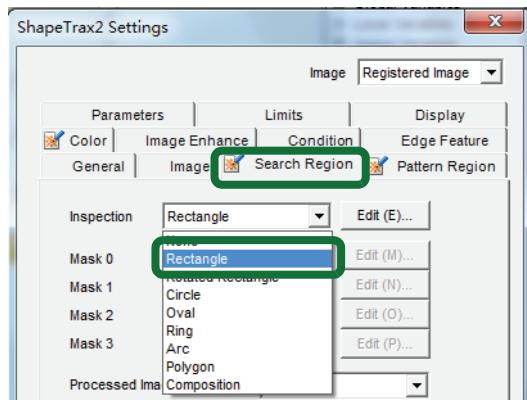


Draw a rectangle according to the size of the cross mark.

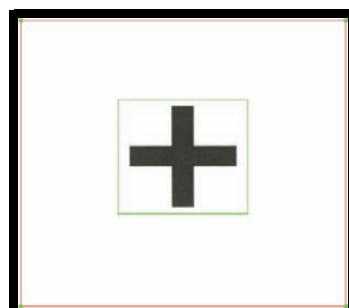
Refer to the figure below and determine a size that is slightly larger than the mark.



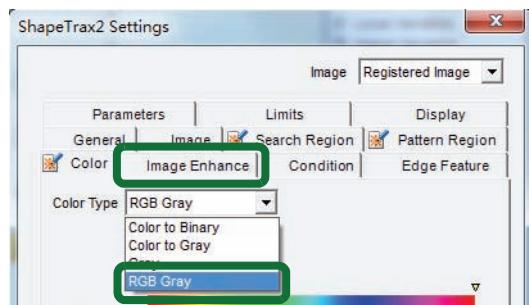
(3) Open [Search Region] tab - [Inspection].
Select [Rectangle].



Set a region to cover the field of view of the camera entirely.



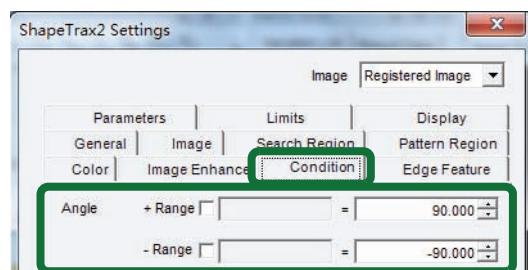
- (4) Open [Color] tab - [Color Type] and select [RGB Gray].



- (5) Select [Condition] tab - [Angle].

Enter "90" for [+ Range] and "-90" for [- Range].

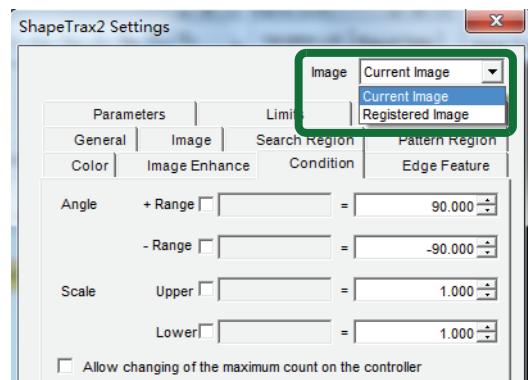
This enables a search even when the target rotates up to " ± 90 degrees" from the base position.



This completes the basic setting.

- (6) Set [Current Image] for [Image].

Click [Execute one time] and check the result.



3. Check the search result.

- (1) Check the numerical result at the same time.

Select [Unit Result] - [Unit] - [!U[0003].RSLT] - [C] - [Pattern % Result: Measured Value] and check the value.

Unit Result				
Unit	System	Local	Global	
[!U[0003].RSLT]				
UJOP	Unit Result (OK)	-	-	0
UJON	Unit Result (NG)	-	-	1
UERR	Unit Error	-	-	0
UED	Unit Error Code	-	-	0
EXTM	Execution Time	-	-	106.808
EVCT	Processing Count	-	-	1
NCNT	Fall (NG) Count	-	-	0
SCLX	Scale Factor (X)	-	-	+1.000000
SCLY	Scale Factor (Y)	-	-	+1.000000
SCLL	Scale Factor (Length)	-	-	1.000000
[!RGN]				
PTSTX	Detected Pattern Center X	-	-	+263.000
PTSTY	Detected Pattern Center Y	-	-	+214.500
NMS	Number of Detected Patterns Result: Measured Value	-	-	1
NJG	Number of Detected Patterns Result: Judgment Value	-	-	0
[!X]				
X:JG	Pattern X Position Result: Judgment Value	-	-	0
[!Y]				
Y:JG	Pattern Y Position Result: Judgment Value	-	-	0
[!T]				
T:JG	Pattern Angle Result: Judgment Value	-	-	0
[!C]				100
[!SGL1]MS	Pattern % Match Result: Measured Value	-	-	99.999
[!SGL1]VS	Pattern % Match Result: Measured Value	-	-	99.999
CJG	Pattern % Match Result: Judgment Value	-	-	0

- (2) Compare the "matching ratio" with the image in the [Vision Window] and check the result.

ShapeTrax2



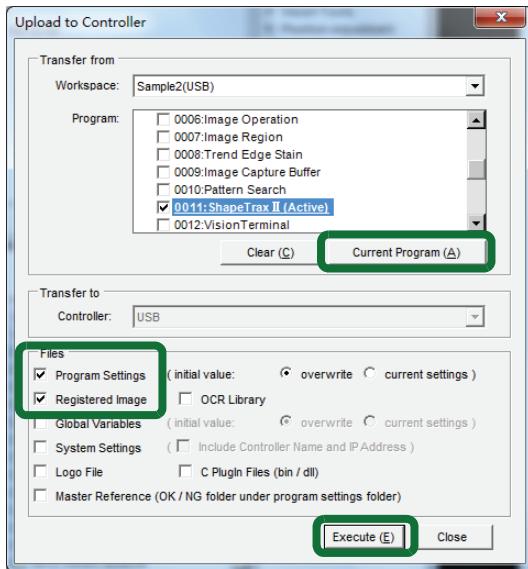
Pattern search



Stable search is ensured even when dirt or a foreign object overlaps with the mark.

4. Upload the data to the controller.

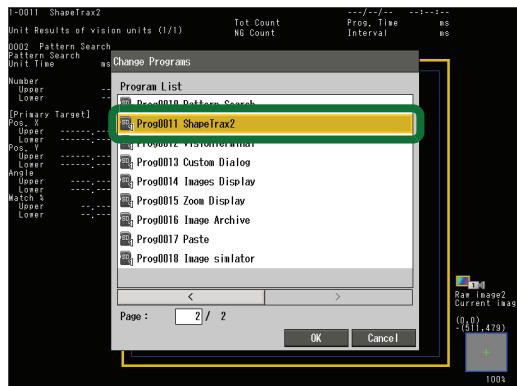
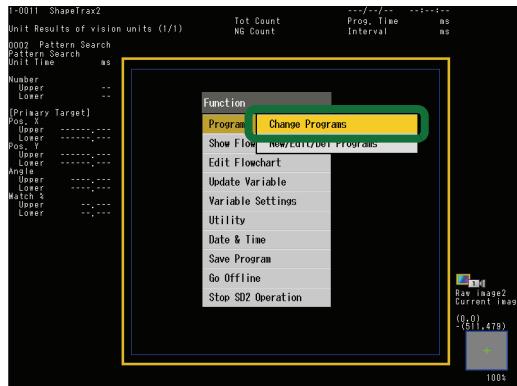
- (1) Click the [Current Program] button and confirm that the check box for [0011:ShapeTraxII] is checked. Select [Program Settings] and [Registered Image] for [Files].



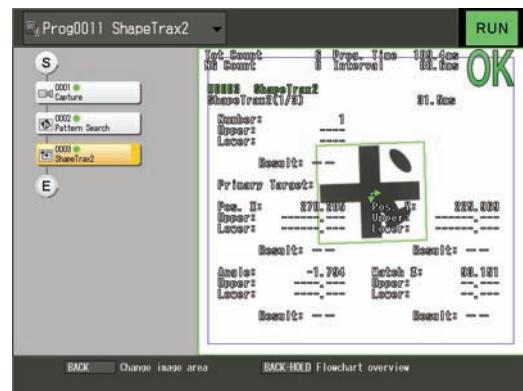
Check the result with the controller.

- (2) Switch the "program".

From [Handheld controller], select [Function] - [Program] - [Change Programs] - [Prog0011 ShapeTrax II].



- (3) Input [TRIGGER] and check the inspection result.



Advanced Tutorial_4_1: XG VisionTerminal

Measured value output using a Data Output unit

Output the measurement result data by using a Data Output unit and log it with the XG VisionTerminal.

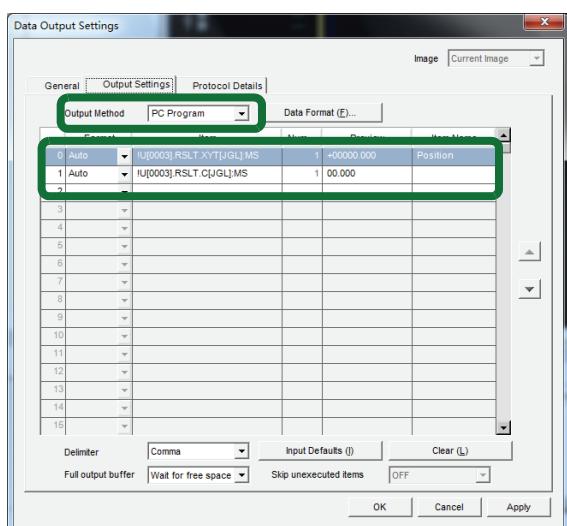
The XG VisionTerminal receives the data from the controller via dedicated communication, and creates a log file in the location specified in the Data Output unit setting.

■ Data Output unit



Set this unit to output numerical data to the following destinations.

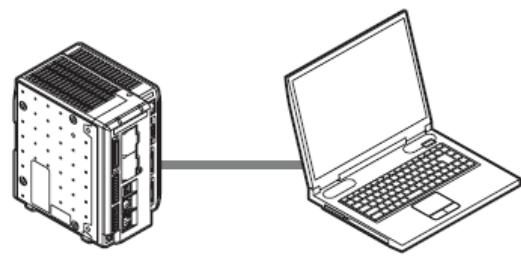
- SD card**
Specify data to be saved to an SD card.
- RS-232C**
Specify data to be output via the RS-232C no protocol communication.
- Ethernet**
Specify data to be output via the Ethernet no protocol communication.
- PLC-Link**
Specify data to be output via PLC-Link.
- CC-Link**
Specify data to be output via CC-Link.
- PC Program**
Specify data to be output to the XG VisionTerminal or ActiveX Control.



Data logging with the XG VisionTerminal

The XG VisionTerminal uses a remote desktop function that allows users to view the monitor output from the XG-7000 Series on a PC, as well as to issue commands for the handheld controller from a PC.

The XG VisionTerminal also collects image and measurement data from the XG-7000 Series via an Ethernet or USB connection.



Ethernet or USB connection

Remote desktop

The XG VisionTerminal allows you to view the monitor output from the XG-7000 Series on a PC. The program parameters can also be updated and viewed in real time.

Data collection (logging)

The XG VisionTerminal can collect and store inspection results, images, and archived data output from the XG-7000 Series. A log view provides the most recent results in real time.

Handheld controller input

While using the remote desktop, users can send console button instructions to the XG-7000 Series. In addition to clicking console buttons visualized on the PC, users can also use a joypad connected to the PC to send instructions.

File acquisition

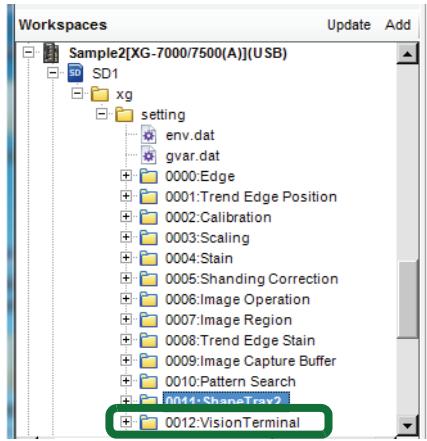
The XG VisionTerminal can acquire program files, global setting files, and archived images from the XG-7000 Series controller and store them on the PC.

Setting a Data Output unit to specify data to be output

1. Switch the program.

Open [System View].

Select [Workspaces] - [0012:Vision Terminal], right-click the mouse, and select [Set as Current Program].

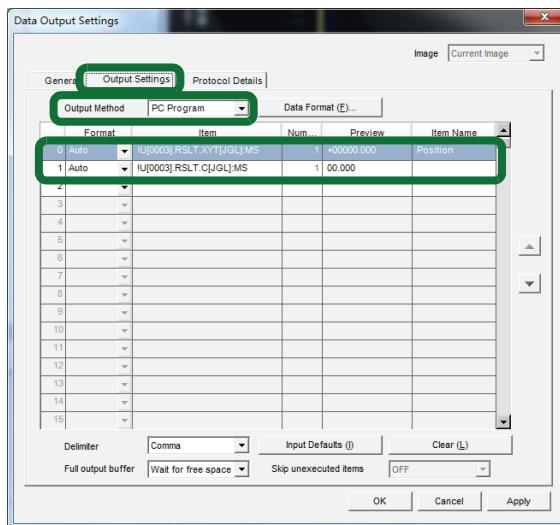


2. Check the settings of the [Data Output] unit.

Open the [Flowchart] view.

Double-click [U0004:Data Output] to open it.

Open the [Output Settings] tab.



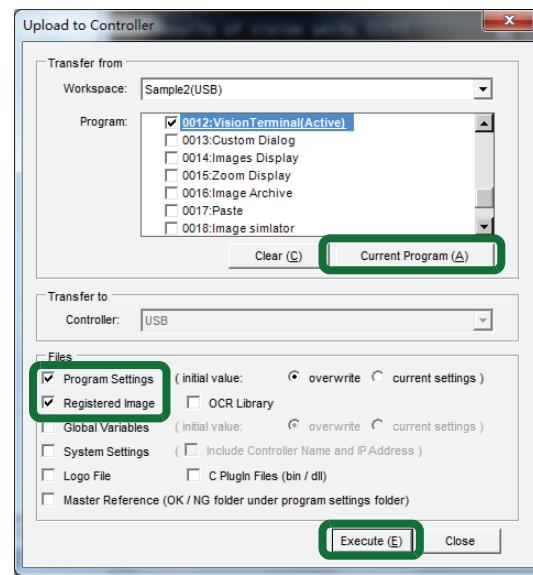
Check the [Output Method] and "output data" settings. In this exercise, you will output the "XY coordinates: Measured values" and "matching ratio" of "ShapeTrax2".

After checking the settings, click the [OK] button to close the setting and then upload the data.

3. Upload the data to the controller.

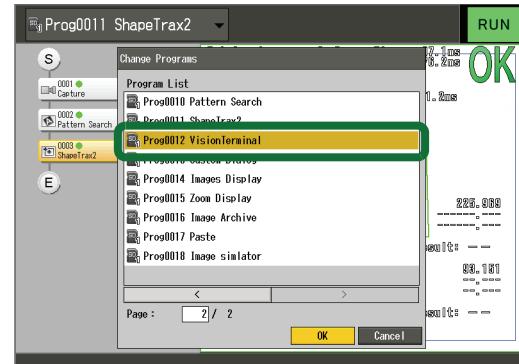
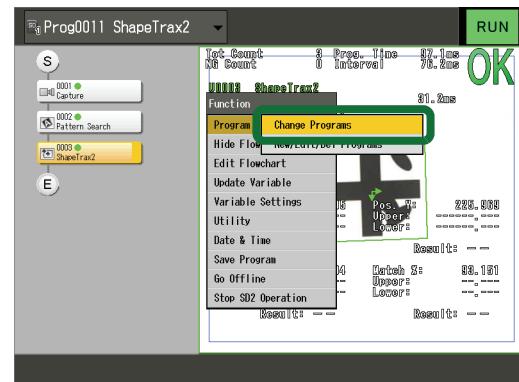
Click the [Current Program] button.

Confirm that [Program Settings] and [Registered Image] are selected for [Files].



4. Switch the program.

From [Handheld controller], select [Function] - [Program] - [Change Programs] - [Prog0012 Vision Terminal].

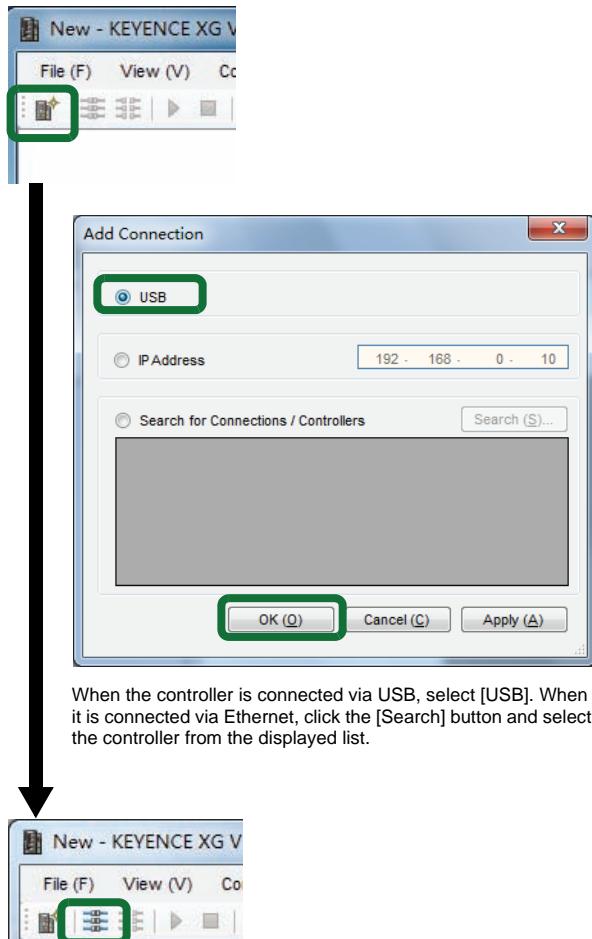


Logging the measured values with the XG VisionTerminal

Reference

For details of the operating instruction of the XG Vision Terminal, refer to the User's Manual which can be accessed from the Help menu.

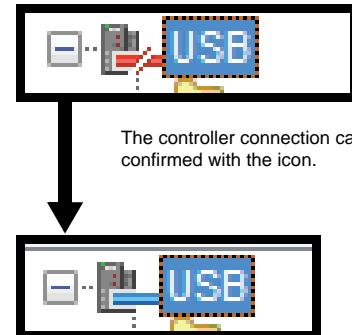
5. Start the XG VisionTerminal, select [File] - [New], and click the [Add Connection] icon.



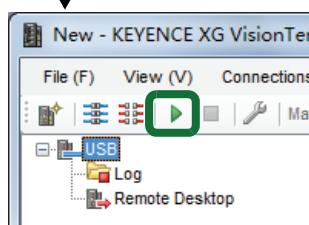
When [Add Connection] is set, the [Connect All] icon is enabled.

6. Connect to the added "controller".

Click the [Connect All] icon.



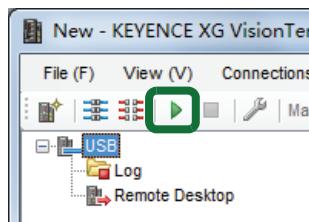
The controller connection can also be confirmed with the icon.



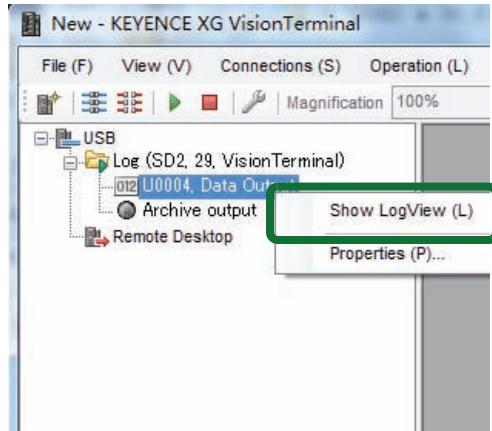
When connection is established, the [Connection] icon is enabled.

7. Start logging.

Click the [Connection] icon.

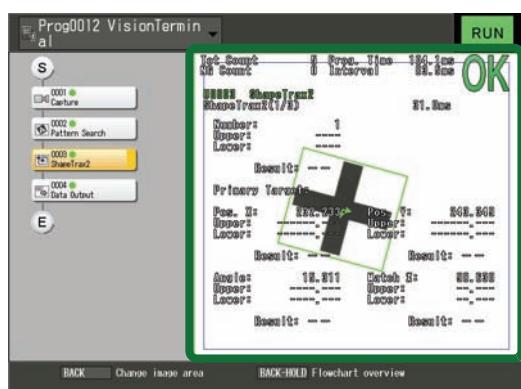
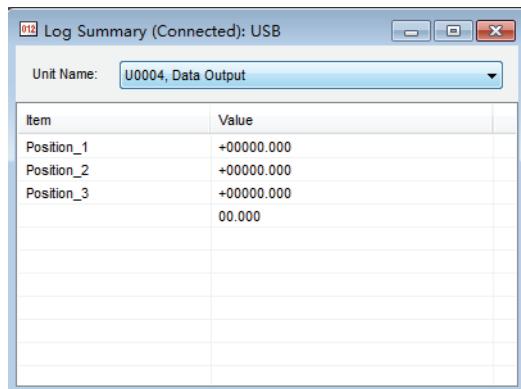


8. To view the logging progress, select [USB] - [Log] - [U0004:Data Output] and right-click the mouse. Select [Show LogView].



9. See the inspection results displayed in [Log Summary (Connected)].

Input [TRIGGER] and confirm that the results correspond to those displayed on the monitor.



Advanced Tutorial_4_2: Custom Menu

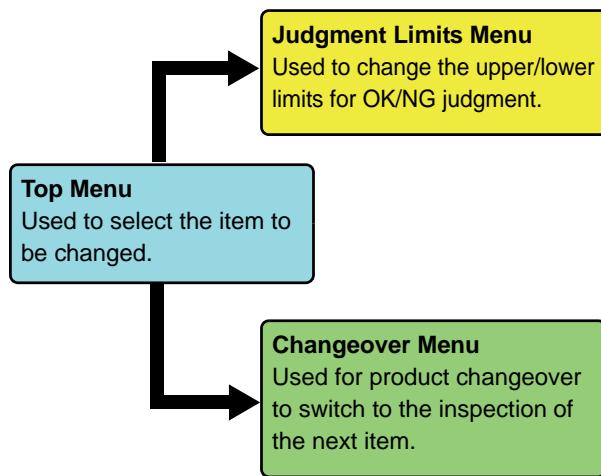
Custom menu

You can create a cascade type menu by using [Open menu] or other functions of the button elements (option button, confirmation button) on a menu. A cascade type menu is useful for simplifying the items displayed on the screen at the same time or for maintenance such as adding functions. The structure of the menu is shown on the Screen Browser as a tree view.

Creating a menu to set several items one by one

Create a menu to set the following items for a specific vision unit in the initial state from the controller

■ Menu structure



■ Recommended procedure for creating a cascade type menu

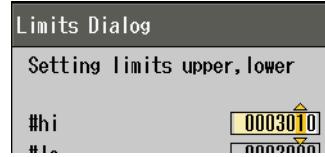
Create a menu and set elements.

Assign functions to the elements of the menu.

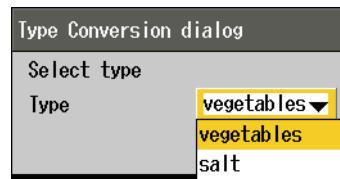
Modify the menu layout.

■ Basic elements used for changing the values of variables

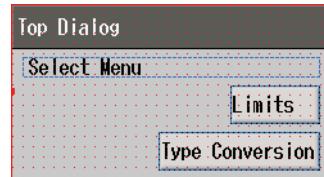
(1) Numerical Input: Specify a numerical value.



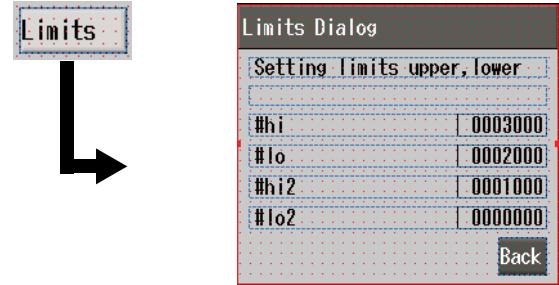
(2) Drop Down Menu: Select from candidates.



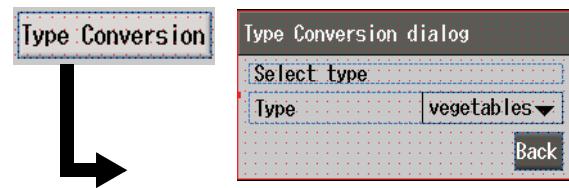
■ Menu to be created in this exercise



In [Top Dialog], decide whether to change [Limits] or [Type Conversion].



Selecting the [Limits] button opens [Limits Dialog]. Use [Numerical Input] to specify numerical values.



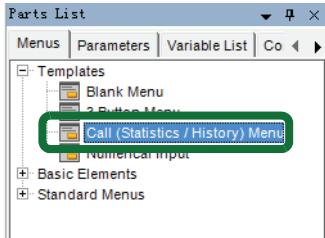
Selecting the [Type Conversion] button opens [Type Conversion dialog]. Use [Drop Down Menu] to select from the candidates.

Creating a menu and setting elements

1. Change to layout 2.

2. Create D100:Menu.

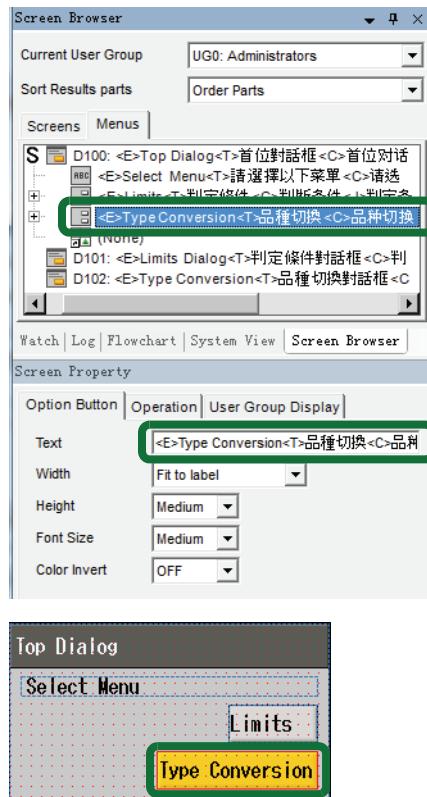
- (1) Add [Parts List] - [Templates] - [Call (Statistics / History) Menu].



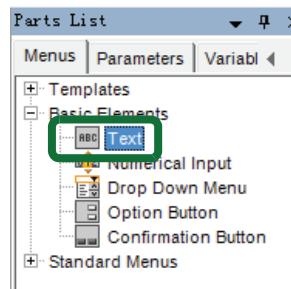
- (2) Select the upper button in [Screen Browser], select [Screen Property] - [Option Button] - [Text] and change the text to [Limits].



- (3) Select the lower button in [Screen Browser], select [Screen Property] - [Option Button] - [Text] and change the text to [Type Conversion].



- (4) Add [Parts List] - [Basic Elements] - [Text].

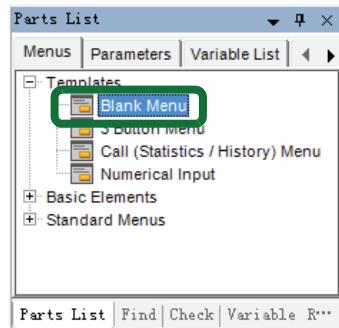


- (5) Select [Text] in [Screen Browser], select [Screen Property] - [Option Button] - [Text] and change the text to [Select the menu below.].

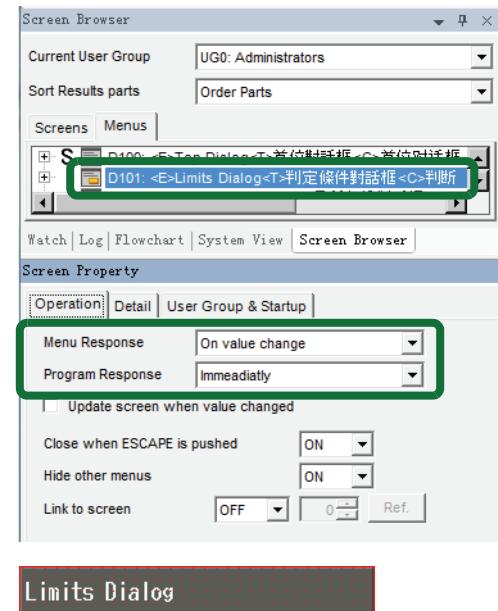


3. Create D101: Limits Dialog.

- (1) Add [Parts List] - [Templates] - [Blank Menu].

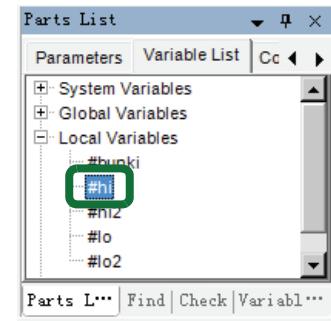


- (2) Select [Screen Property] - [Advance] tab and change the menu name to [Limits Dialog]. Then, select the [Operation] tab and change [Menu Response] to [On value change], and change [Program Response] to [Immediately].

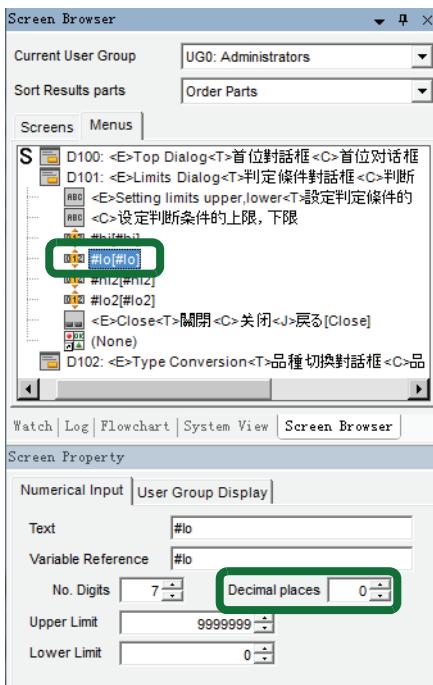


Limits Dialog

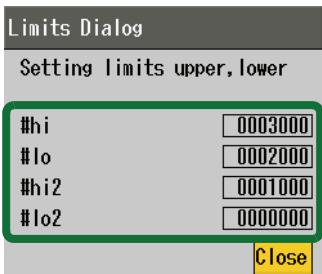
- (3) Select [Parts List] - [Variable List] - [Local Variables] - [#hi], and drag and drop it onto [Screen Editor].



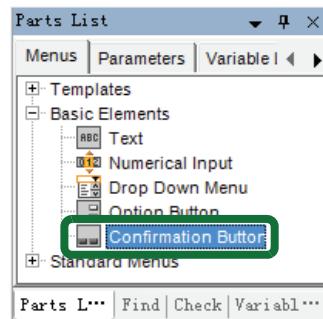
- (4) Select [Numerical Input] for [#hi] in [Screen Browser], select [Screen Property] - [Numerical Input] - [Decimal places] and change the value to [0].



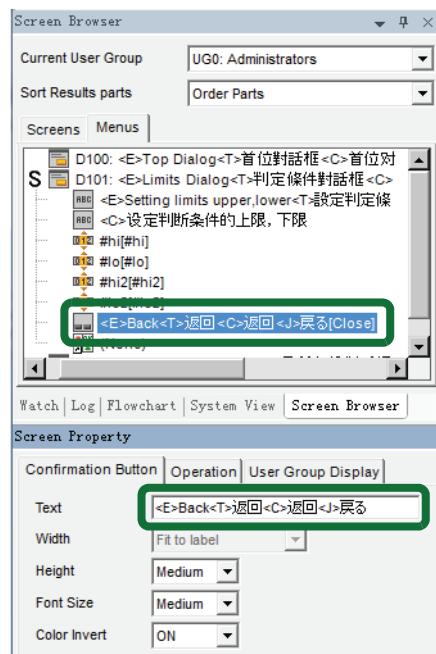
- (5) As in the case with [Numerical Input] for [#hi], create [Numerical Input] for [#lo], [#hi2], and [#lo2].



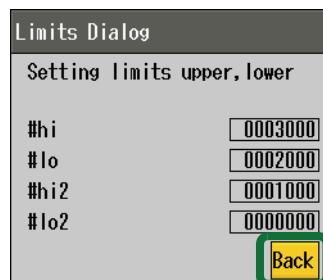
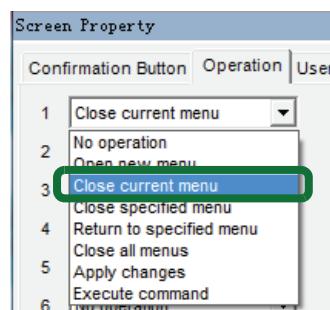
- (6) Select [Parts List] - [Basic Elements] - [Confirmation Button] and drag and drop it to [Screen Editor].



- (7) In [Screen Property], select [Confirmation Button] tab - [Text] and change the text to [Back].

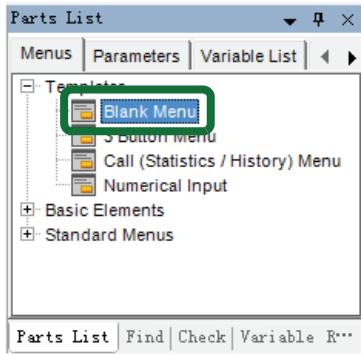


- (8) Next, select the [Operation] tab and select [Close current menu].

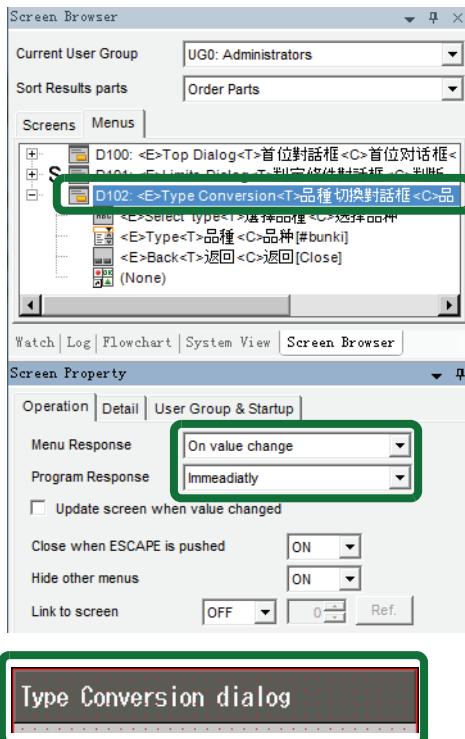


4. Create D102:Type Conversion menu.

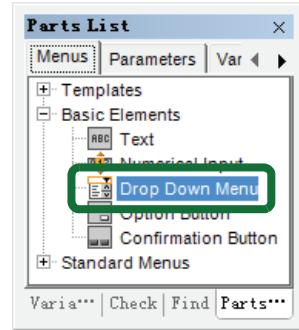
- (1) Add [Parts List] - [Templates] - [Blank Menu].



- (2) Select [Screen Property] - [Advance] tab and change the menu name to [Type Conversion]. Then, select the [Operation] tab and change [Menu Response] to [On value change], and change [Program Response] to [Immediately].



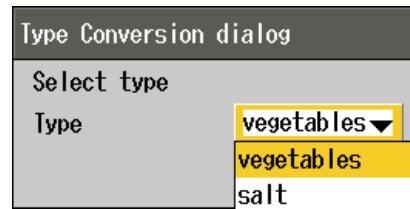
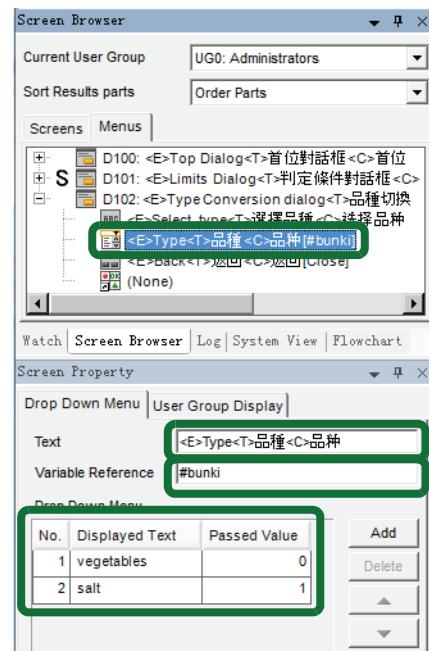
- (3) Add [Parts List] - [Basic Elements] - [Drop Down Menu].



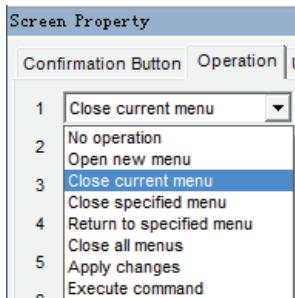
- (4) Select [Screen Property] - [Drop Down Menu] tab - [Title] and change the text to [Type].

Enter "#bunki" for [Variable Reference].

In [Drop Down Menu], specify the following values:
No. 1: vegetables: Value 0
No. 2: salt: Value 1

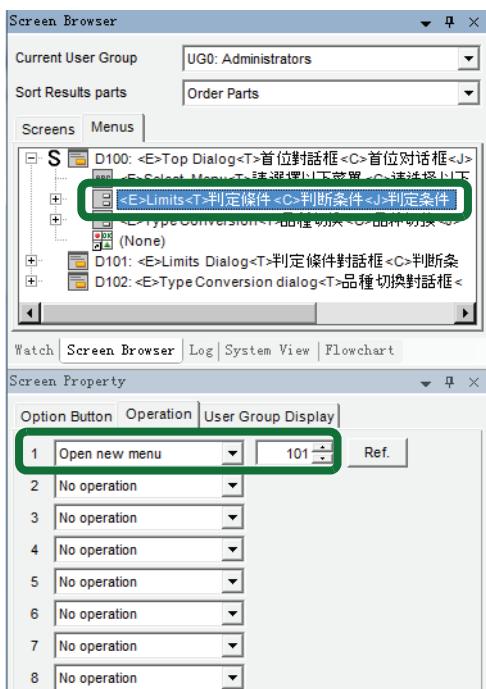


- (5) As in the case with D101, select [Parts List] - [Basic Elements] - [Confirmation Button] and drag and drop it to [Screen Editor].
- (6) As in the case with D101, select [Confirmation Button] tab - [Displayed Text] in [Screen Property] and change the text to [Back].
- (7) As in the case with D101, select [Close current menu] in the [Operation] tab.

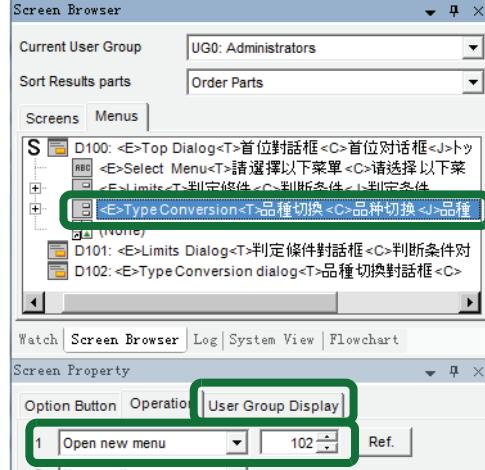


Assigning functions to the elements of the menu

5. Change the setting so that D101 [Limits Dialog] opens when the [Limits] button on D100 is selected.
- (1) In the Screen Browser, select D100 - [Limits] button.
- (2) Click [Screen Property] - [Operation] tab.
- (3) Select [Open new menu] and [101] for operation 1.



6. Change the setting so that D102 [Type Conversion dialog] opens when the [Type Conversion] button on D100 is selected.
- (1) In the Screen Browser, select D100 - [Type Conversion] button.
- (2) Click [Screen Property] - [Operation] tab.
- (3) Select [Open new menu] and [102] for operation 1.



Advanced Tutorial_4_3: Multi-Image Display

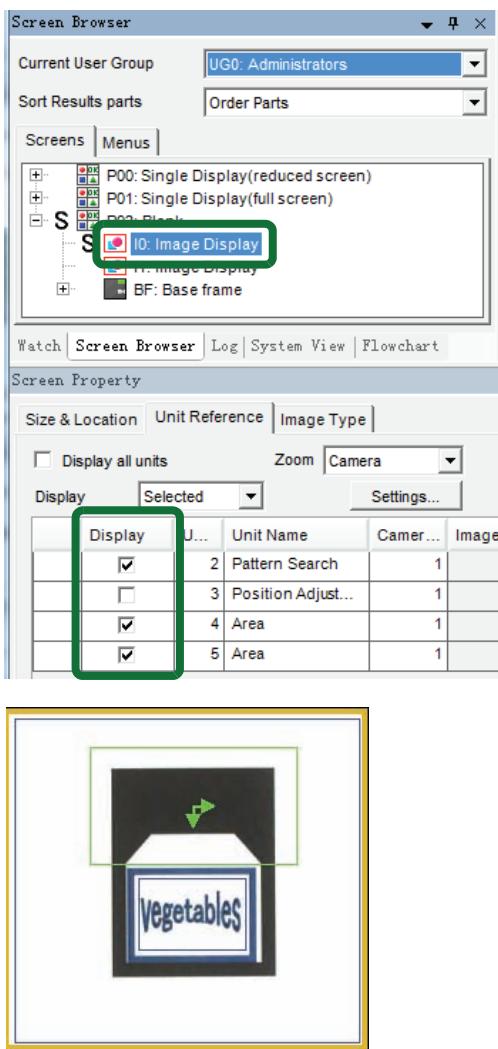
Multi-image display

You can display two or more image displays on the monitor connected to the controller.

When two or more cameras are used, their image displays can be shown simultaneously for comparison. Moreover, you can select images to be displayed according to the usage, such as a row image on one side and a magnified image on the other.

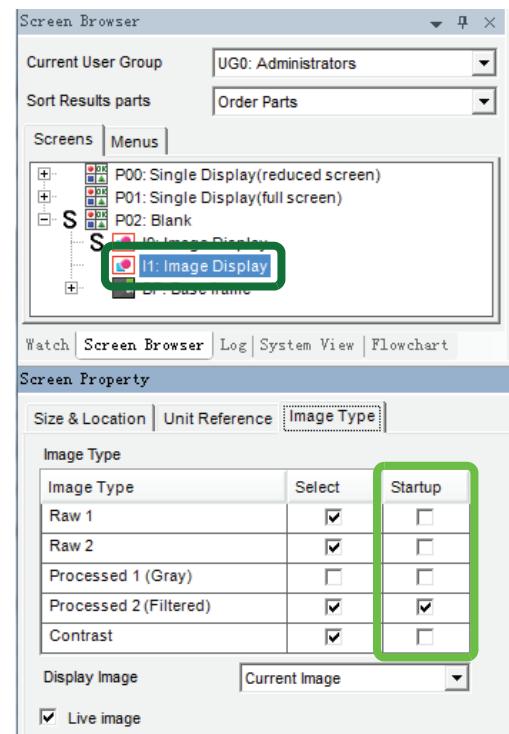
■ Available image display settings

(1) You can select a unit to be displayed.



Both Area and Pattern Search units are displayed.

(2) You can select the image type to be displayed.



Raw image 2



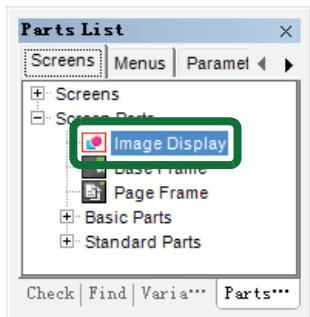
Filtered image



Selecting the units to be displayed in the image display

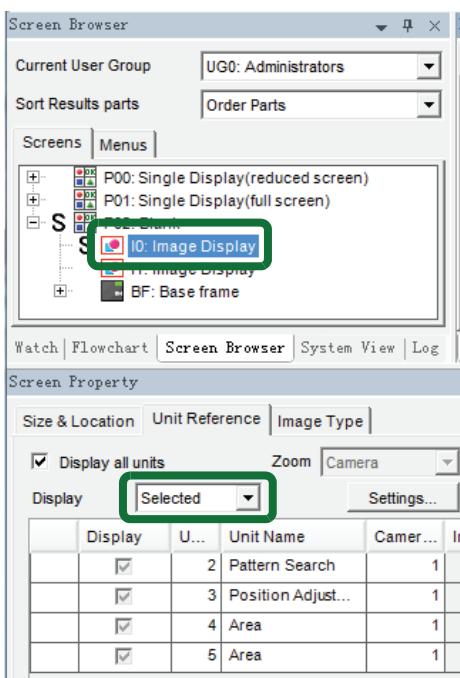
1. Add an image display.

- Select [Parts List] - [Screens] - [Screen Parts] - [Image Display], and add it to [Screen Editor].

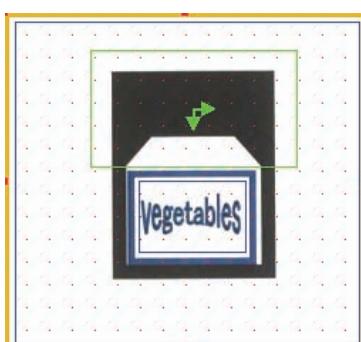


2. Set all units to be displayed simultaneously.

- Select [I0:Image Display] in [Screen Browser], select [Screen Property] - [Unit Reference] - [Display] and change the setting to [Selected].



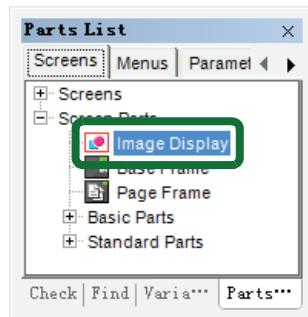
- Confirm that all units are displayed simultaneously.



Selecting the display type of the image displayed in the image display

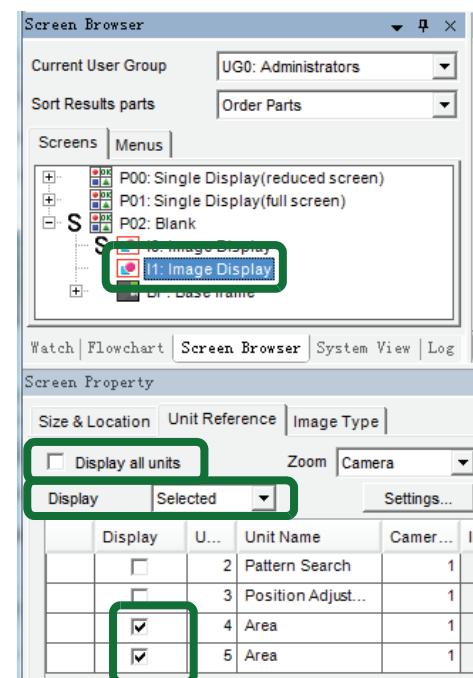
3. Add an image display.

- Select [Parts List] - [Screens] - [Screen Parts] - [Image Display], and add it to [Screen Editor].

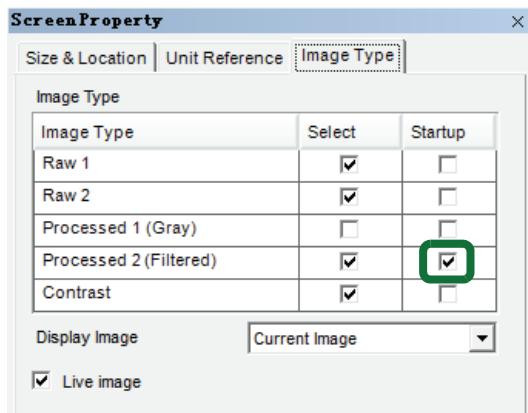


4. Set all units to be displayed simultaneously.

- Select [I1:Image Display] in [Screen Browser], select [Screen Property] - [Unit Reference] - [Display] and change the setting to [Selected].
- Remove the check mark from [Display all units].
- Change the setting of [Display] to [Selected].
- Check the check boxes for [U0004:Area] and [U0005:Area].



- (5) Select [Screen Property] - [Image Type] - [Image Type: Processed 2 (Filtered)] and check the check box for [Startup].



- (6) Confirm that the image after filtering is displayed.



Advanced Tutorial_4_4: Zoom Display

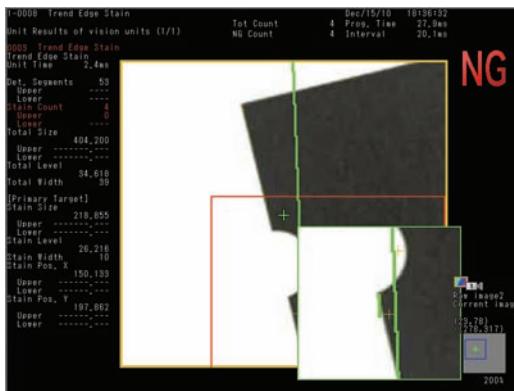
Zoom display

You can zoom in the image display shown on the monitor connected to the controller.

Two methods are available for zooming: (1) Zooming in the image around the detection point and (2) Zooming in the image inside the inspection region. Setting the zoom display makes the observation of the detection status easier than the case using a normal display.

■ Two zooming-in methods

(1) Detection point tracking



The image around the detection point is magnified.

(2) Inspection region tracking

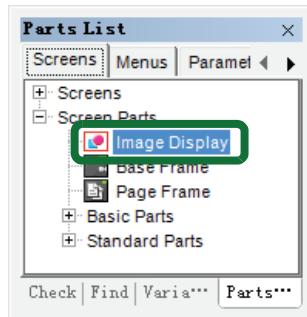


The image inside the inspection region is magnified.

Showing a zoom display

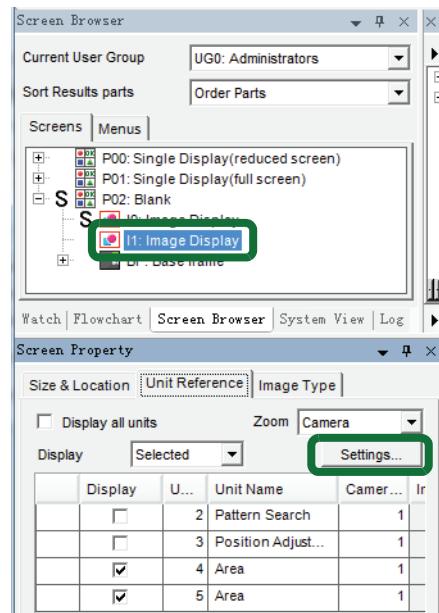
1. Add an image display.

Select [Parts List] - [Screens] - [Screen Parts] - [Image Display], and add it to [Screen Editor]

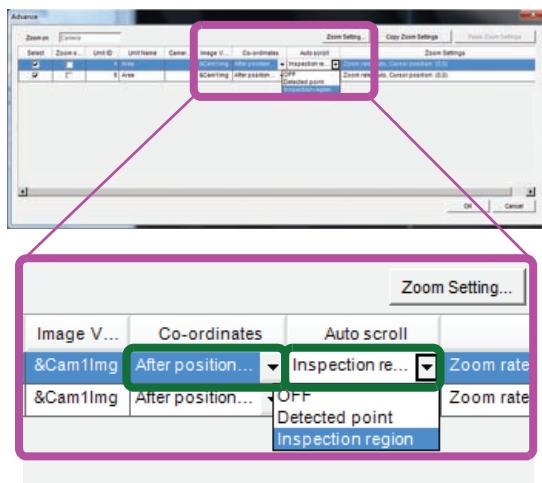


2. Set the zoom display options.

(1) Select [I1:Image Display] in [Screen Browser] and select [Screen Property] - [Unit Reference] - [Settings].

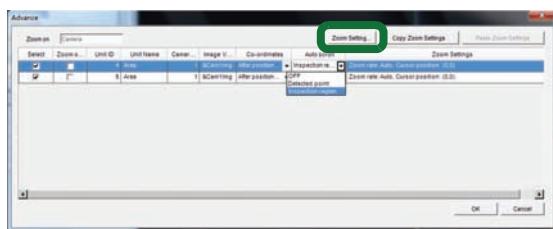


- (2) In [Advance], select [Inspection region] for [Auto scroll] to set zoom tracking. Also, select [After position adjust] for [Co-ordinates] in case the target is tilted.

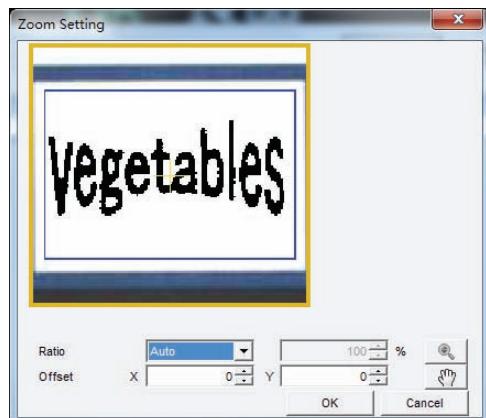


3. Set the zoom display options.

- (1) Select [Advance] - [Zoom Setting] to open [Zoom Setting].



- (2) You can set [Zoom Setting] - [Ratio] to change the zoom ratio.



Advanced Tutorial_4_5: Archive Display

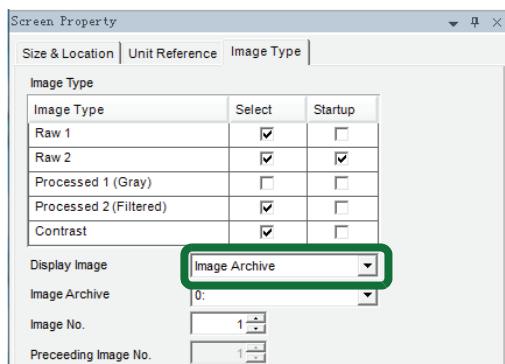
Archive display

You can add an archive display to the image display shown on the monitor connected to the controller.

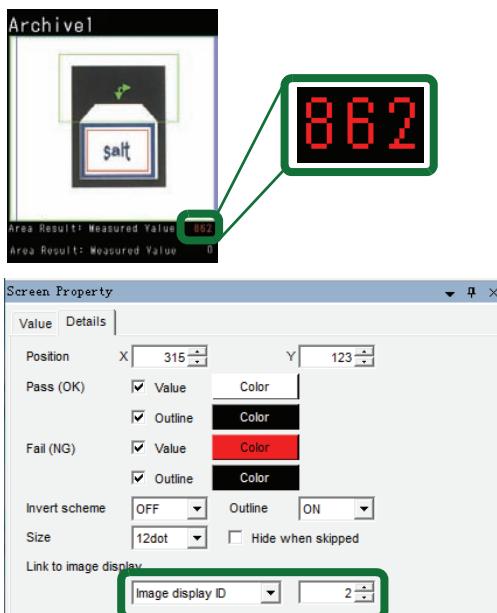
By storing archive data (image data and result data) in the memory, you can display it as necessary, such as showing the previous image or the latest NG image.

■ Archive display setting procedure

- (1) Creation of the image display to display an archive image



- (2) Creation of the result data display to display archive data

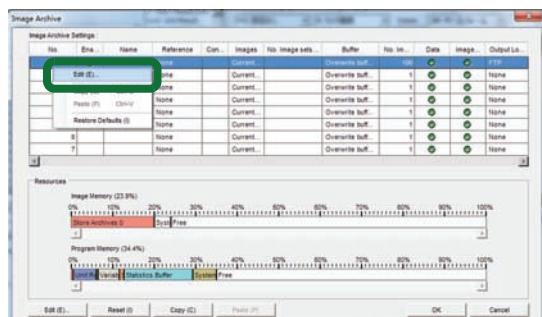


Link the data display to the image display which displays archive data.

Image archive criteria setting

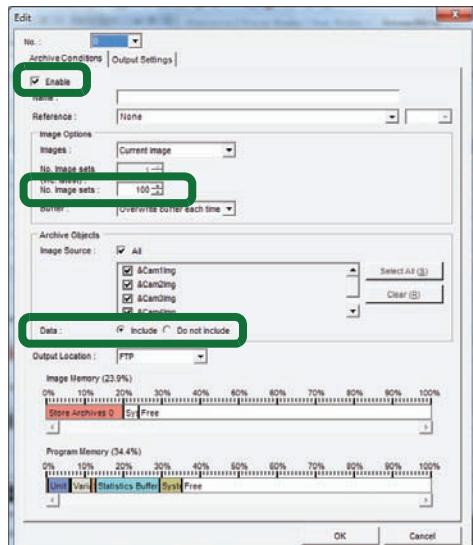
1. Set the criteria for image archive operation.

- (1) From the menu bar at the top of the screen, open [Settings] - [Image Archive].
- (2) Place the cursor on "0" for [Image archive] - [No.], right-click the mouse, and select [Edit] to open [Edit].

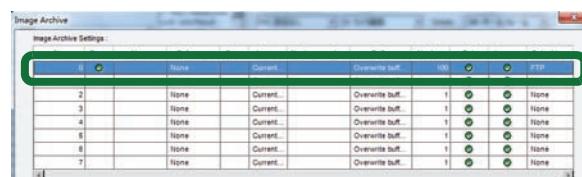


- (3) In [Edit], set the following items.

- Enable: Checked
- No. Image sets: 100 sets
- Image Source: Checked
- Data: Include



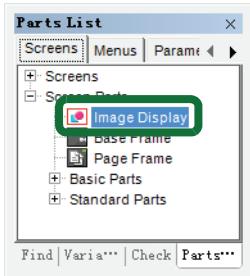
- (4) Click [OK] to close [Edit], confirm the settings in [Image Archive Settings], and click [OK] to close [Image Archive Settings].



Showing an archive display

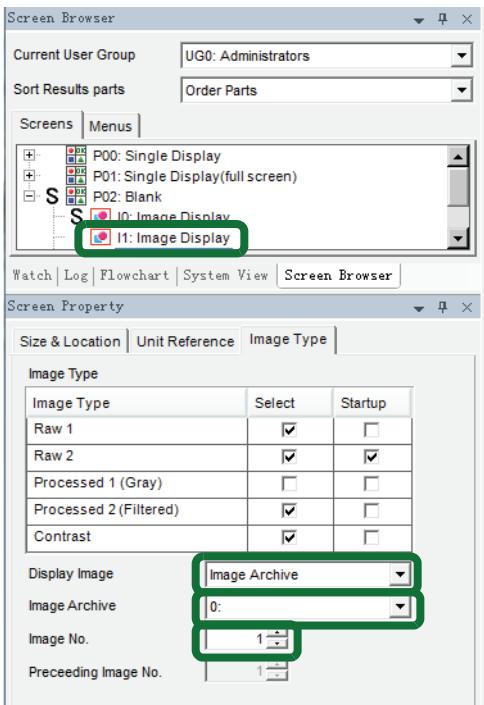
2. Add an image display.

- (1) Select [Parts List] - [Screens] - [Screen Parts] - [Image Display], and add it to [Screen Editor].



3. Enable an archive display.

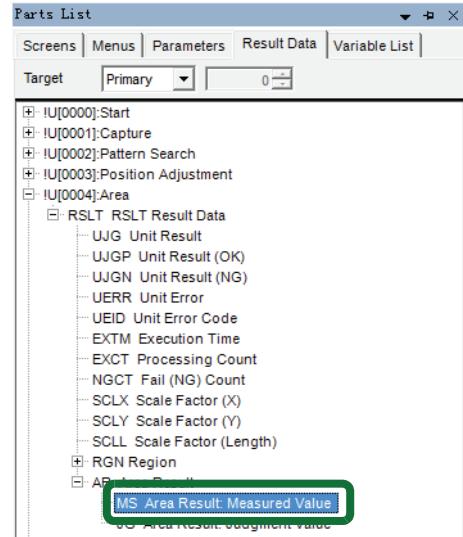
- (1) Select [I1:Image Display] in [Screen Browser] and select [Screen Property] - [Image Type] tab.
- Display Image: Image Archive
 - Image Archive: 0
 - Image No.: 1



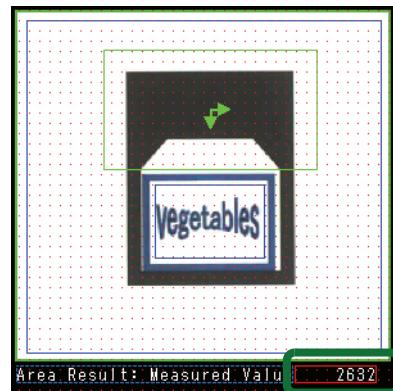
Showing archive result data

4. Add result data.

- (1) Select [Parts List] - [Result Data] tab - [!U[0004]:Area] - [RSLT Result Data] - [AR Area Result] - [MS Area Result: Measured Value], and drag and drop it onto [Screen Editor].

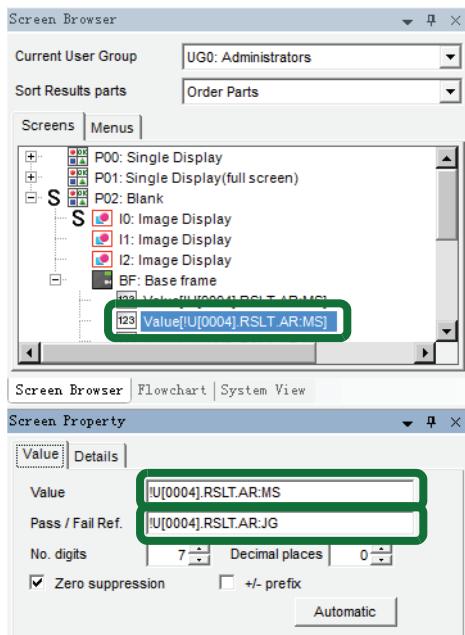


- (2) In [Screen Editor] or [Screen Browser], select only the numerical value of the added result data.

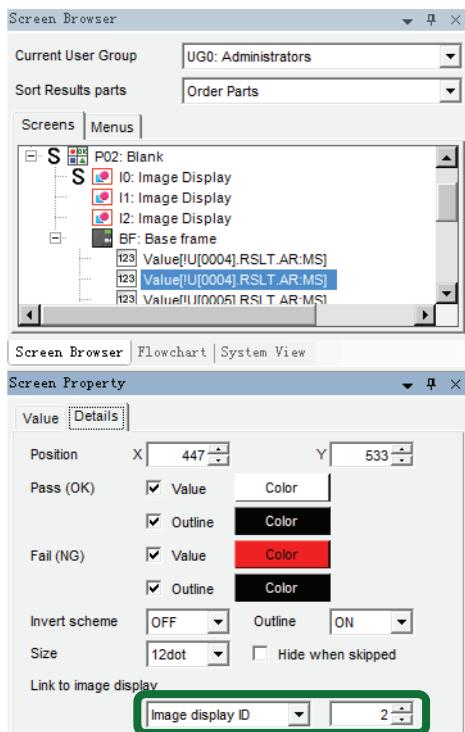


5. Set the result data to be linked to the archive display.

- In [Screen Browser], select [Value] `!U[0004].RSLT.AR:MS`] and view [Screen Property] - [Value] - [Value] to confirm that the value is specified properly.



- Select [Screen Property] - [Details] - [Link to image display] and select [Image display ID] to [2] to link the display to the image display showing the archive data.



Checking whether the archive display has been set properly

6. Check the archive display with the simulator alone.

- Select [Tools] - [XG Simulator] to start up [XG Simulator].

- Click [Execute one time] and confirm that the preceding image display and result data are displayed.



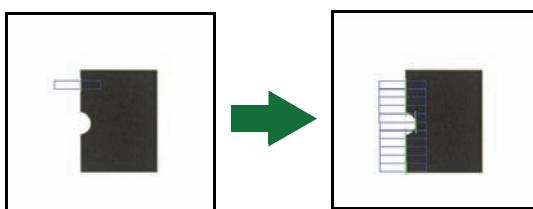
Advanced Tutorial_4_6: Pasting and Aligning

VE's useful functions such as pasting and aligning

The VE (XG VisionEditor) can offer various useful functions for flowchart creation, such as pasting and aligning. Frequently used functions are: [Multiple paste], [Partial paste], [Align all regions], and [Move all regions].

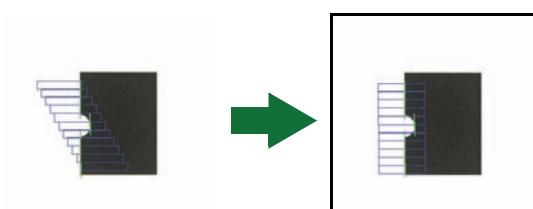
■ VE's useful functions

(1) Multiple paste



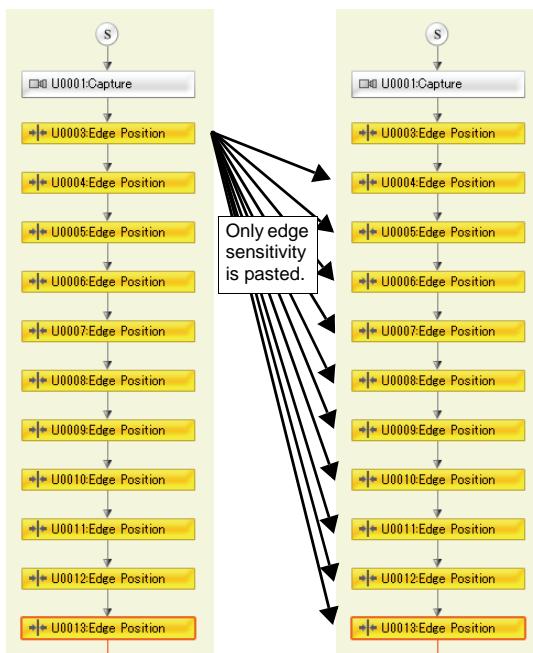
You can paste a copied unit repeatedly.

(2) Align all regions



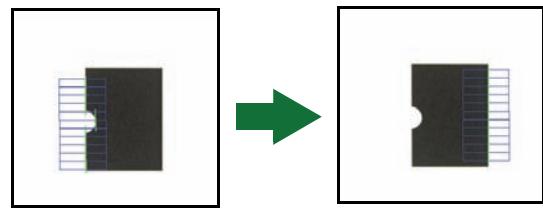
You can align two or more units along a line or an arc simultaneously.

(3) Partial paste



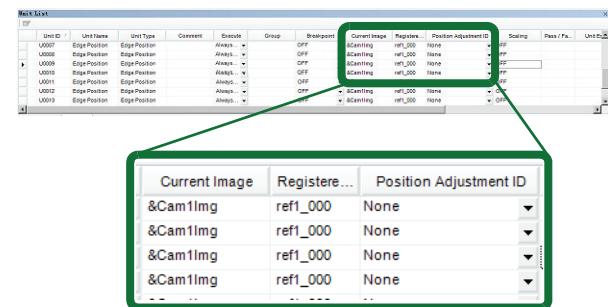
You can paste only a certain parameter of one unit to the other units.

(4) Move all regions



You can move two or more units simultaneously.

(5) Lists of units

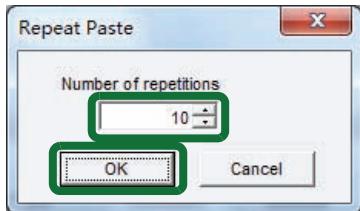


You can view the setting parameters of several units in a list. Clicking an item automatically opens the unit property setting of the unit.

Multiple paste

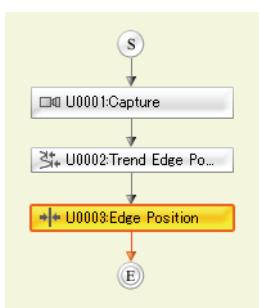
1. Paste a unit repeatedly.

- (1) Select [U0003:Edge Position], right-click the mouse, and select [Copy].
- (2) Select [U0003:Edge Position], right-click the mouse, and select [Repeat Paste].
- (3) In [Number of repetitions], enter "10" and click [OK] to close the setting.

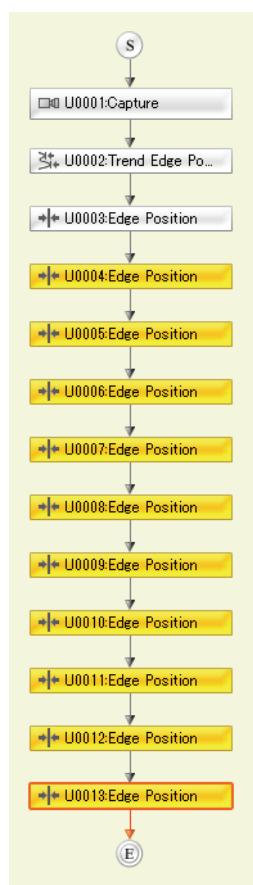


- (4) Confirm that the specified number of copied units have been added.

Before pasting



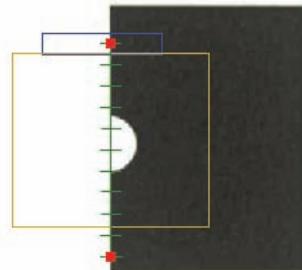
After pasting



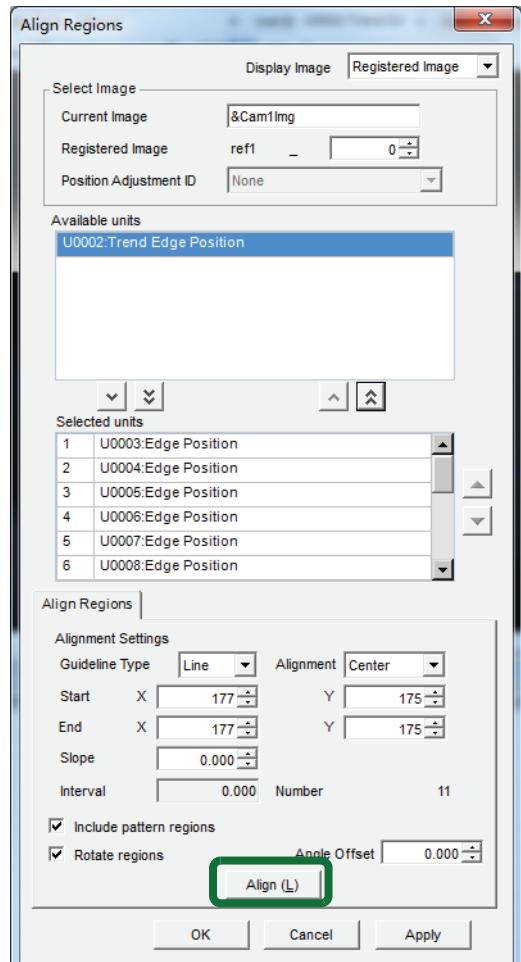
Align all regions

2. Align all regions simultaneously.

- (1) Select units between [U0003:Edge Position] and [U0013:Edge Position], right-click the mouse, and select [Align All Regions].
- (2) In the Vision Window, drag the cursor to specify the range between the "start point" and "end point".



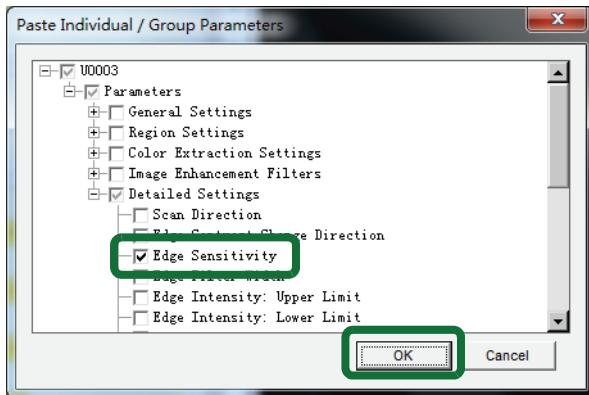
- (3) Select [Align Regions] - [Align Regions] - [Align] to align the regions.



Partial paste

3. Paste a unit partially.

- (1) Select [U0003:Edge Position] - [Edge Filter] tab and set [Edge Sensitivity] to "80".
- (2) Select [U0003:Edge Position], right-click the mouse, and select [Copy].
- (3) Select units between [U0004:Edge Position] and [U0013:Edge Position], right-click the mouse, and select [Partial Paste].
- (4) Check the check boxes for [U0003] - [Parameters] - [Detailed Settings] - [Edge Sensitivity] and click [OK] to close the setting.



- (5) Open the unit property setting for the units between [U0004:Edge Position] and [U0013:Edge Position] and confirm that [Edge Filter] tab - [Edge Sensitivity] has been changed to "80".

Lists of units

4. Confirm the setting in the list of units.

- (1) Select [Main Lists] - [Registered Image] and confirm that [&Cam1Img1] is selected for all vision units.

Unit	Unit ID	Unit Name	Unit Type	Comment	Execute	Group	Breakpoint	Current Image	Register...	Position Adjustment ID	Scaling	Pass / Pa...	Unit ID
U0003	U0003	Edge Position	Edge Position		Always	OFF	Scanning	ref1_000	None				
U0004	U0004	Edge Position	Edge Position		Always	OFF	Scanning	ref1_000	None				
U0005	U0005	Edge Position	Edge Position		Always	OFF	Scanning	ref1_000	None				
U0006	U0006	Edge Position	Edge Position		Always	OFF	Scanning	ref1_000	None				
U0007	U0007	Edge Position	Edge Position		Always	OFF	Scanning	ref1_000	None				
U0008	U0008	Edge Position	Edge Position		Always	OFF	Scanning	ref1_000	None				
U0009	U0009	Edge Position	Edge Position		Always	OFF	Scanning	ref1_000	None				
U0010	U0010	Edge Position	Edge Position		Always	OFF	Scanning	ref1_000	None				
U0011	U0011	Edge Position	Edge Position		Always	OFF	Scanning	ref1_000	None				
U0012	U0012	Edge Position	Edge Position		Always	OFF	Scanning	ref1_000	None				
U0013	U0013	Edge Position	Edge Position		Always	OFF	Scanning	ref1_000	None				

- (2) Double-click the [Registered Image] value of a desired unit and open its unit property setting.
- (3) Edit the unit properties.

Advanced Tutorial_4_7: Simulation Using a Great Number of Images

Simulation using a great number of images

The VE (XG VisionEditor) has a capability to run simulation using a great number of images.

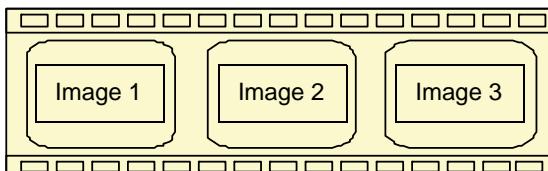
The images used for a single simulation are those registered as simulation images in the XG VisionEditor or those stored in a specified folder. By using the latter, or the images in a specified folder, you can set a simulation using images of 50,000 inspections maximum.

■ VE's useful function

Simulation setting



Images used for a simulation



The following two types of images can be selected for a simulation:

- (1) Images registered as simulation images in the VE
Up to 256 generations
- (2) Images stored in a folder
Up to 50,000 generations

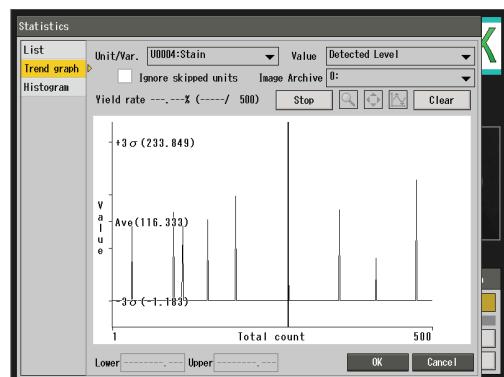
■ How to use the simulation function

(1) Simulation using a great number of images



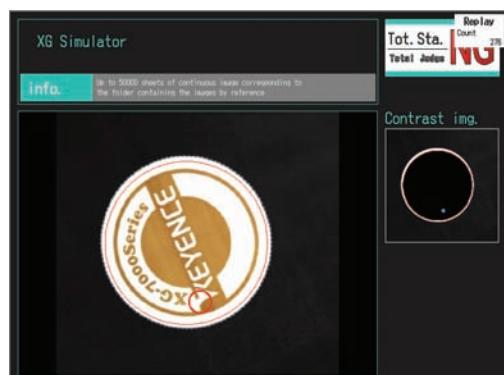
You can perform a simulation.

(2) Viewing statistical analysis of data of 100,000 inspections at maximum



You can check the fluctuations in the inspection data.

(3) Calling back archive data from a trend graph, etc. for confirmation



You can check the image of the inspection data of interest as well as the detailed results of the inspection.

■ Objective of this exercise

Select the images in a folder and use them for a simulation of a great number of images.

Simulation using a great number of images

1. Specify a folder which contains image files.

- (1) From the menu bar at the top of the screen, select [Tools] - [XG Simulator].
- (2) Open [XG Simulator] - [Settings].



- (3) For [Settings] - [Looping Mode], specify [Cycle once].
- (4) For [Settings] - [Simulator Images], specify [Specify Camera / Image Folders].
- (5) Select [Browse] for [Settings] - [Simulator Images], specify [Specify Camera / Image Folders] - [Camera1].
- (6) Select [SeminarDatah] - [Intermediate base path] - [100126IntermediateWorkspace] - [SD1] - [xg] - [setting] - [0018] - [CAMIMG], and then click [OK] to close the setting.

2. Execute a simulation.

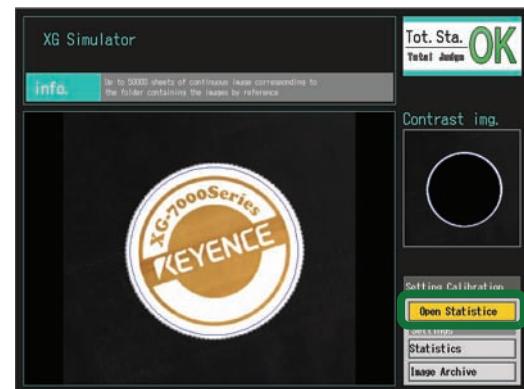
- (1) Click [XG Simulator] - [Continuous].



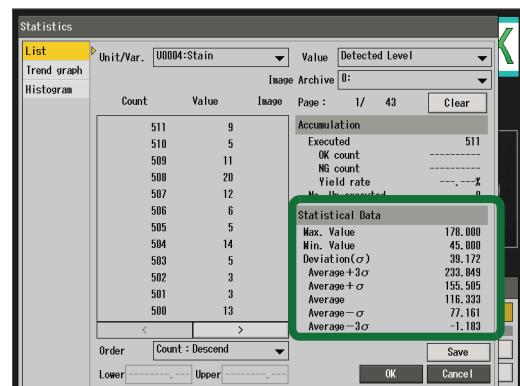
- (2) A simulation is executed for one cycle by using the images in the specified folder.

3. Confirm the statistical analysis.

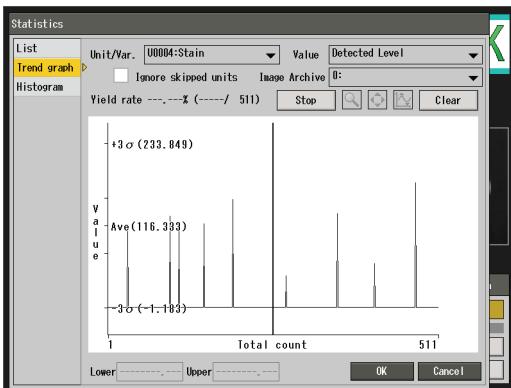
- (1) Select the [Setting Calibration] menu - [Open Statistics] button, and input [Enter].



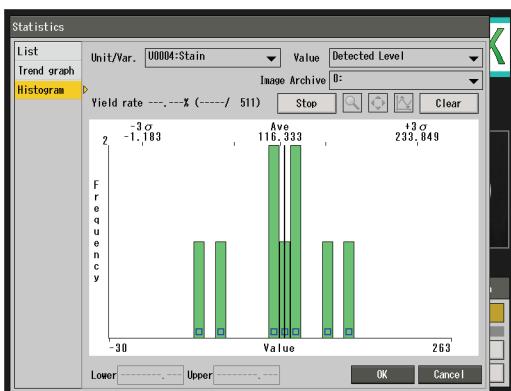
- (2) Select [List] and confirm the values in the [Statistical Data] section.



- (3) Select [Trend graph] and confirm the "chronological change of the measured values".



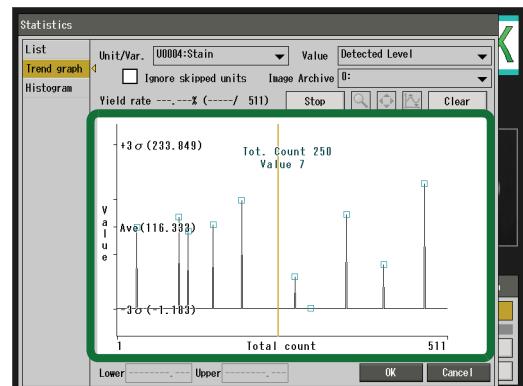
- (4) Select [Histogram] and confirm the "dispersion of the measured values".



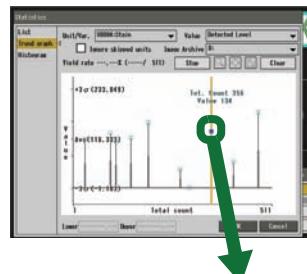
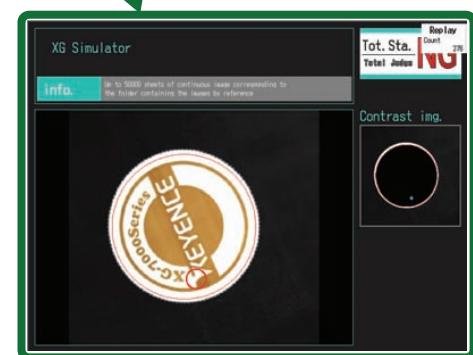
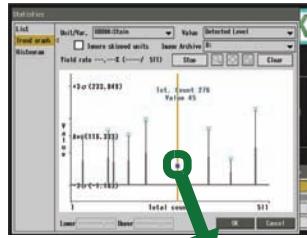
4. Execute a simulation.

- (1) Select [Trend graph], move to the trend graph shown at the lower right and input [Enter].

The symbols on the trend graph indicate that archive data is available for the item.



- (2) You can view the archive data by selecting and input [Enter].



Specifications are subject to change without notice.

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