Cat. No. Z275-E1-01

Vision Sensor
FZ2 Series

Xpectia[FZ]

User‘s Manual

OMRON

FZ2 Series / FZD Series User's Manual
Vision Sensor
Rev.B

How This Manual Is Organized

This Manual includes two manuals, "User's Manual", which describes the basic operations and settings of vision sensors, and "Processing Item List Manual", which describes the setting options of each processing item.

Conventions Used in This Manual

■ Symbols

The symbols used in this manual have the following meanings.

Indicates the relevant operational precautions that must be followed.

Indicates operation-related suggestions from OMRON.

■ Punctuation Marks

In this manual, Menu, among others, is defined as follows.

[ ]	Menu	indicates the name of menu or Processing item shown in the menu bar.
" "	Item name	indicates the item name displayed in the screen.

Version Upgrade Information

The newly added functions are described here.

Table: Revision history from Version 1.1 to 1.12

Added Function	Notes of Newly-added Functions	Reference in Manual
Auto update reference color with color data	You can select whether to perform Auto Update for reference colors during region setting.	Processing Items List Manual, "3.1Color Data", P.1
Password setting when switching the RUN window	You can set passwords when switching from the RUN window to another as a security measure.	User's Manual, "9.3.6Setting Password on the RUN window [Password setting]", P.12

Table: Revision history from Version 1.1 to 1.12

Added Function	Notes of Newly-added Functions	Reference in Manual
Setting operation priority	You can specify which to have the priority, measurement result or menu operation.	User's Manual, "9.3.4Setting the Status at the Startup [Startup setting]", P.9
Setting measurement initialization priority	Measurement initialization is performed immediately after switching scene or editing flow. You can specify which to have the priority, measurement trigger receipt or processing of re-drawing on screen, during measurement initialization.	

User's Manual

This manual describes the basic operations and all settings when using vision sensors.
This Manual includes two parts: Operation and Environment Settingas Parts. The contents are shown as follows.

■ "Operation Part", P.1

This part describes how to measure according to the workflow chapter by chapter.
First, prepare to measure by performing "Preparation"→"Design Contents to be Measurement"→"Set up Contents to be Measurement".
Then, confirm whether or not to measure exactly against the expected objectives by performing "Measurement Test"→"Adjusting Measurement Contents" repeatly.
Finally, perform "Actual Measurement"→"Verify Measurement Results".
In addition, this part also describes the operations of controller and how to utilize and analyze the measurement results.

■ "Environment Setting Part", P.1

This part describes the measurement environment (camera and lighting, etc.) and the required system setting and configuration to facilitate the measurement.
In addition, this part also describes the required setting for outputting the measurement results to external devices and how to store data.
For the Q&A and how to treat the encountered faults, see Appendix. Please read as required.

Operation Part

This part describes the operation flow from planning to actual measurement and result verification.

Chapter 1 -Before Operation 1
Chapter 2 -Design 1
Chapter 3 -Preparation 1
Chapter 4 -Setting up Scene (Measurement Flow) 1
Chapter 5 -Test Measurement/Re-measurement/Adjustment 1
Chapter 6 -Starting Operation 1
Chapter 7 -Utilizing/Analyzing Measured Data 1

1

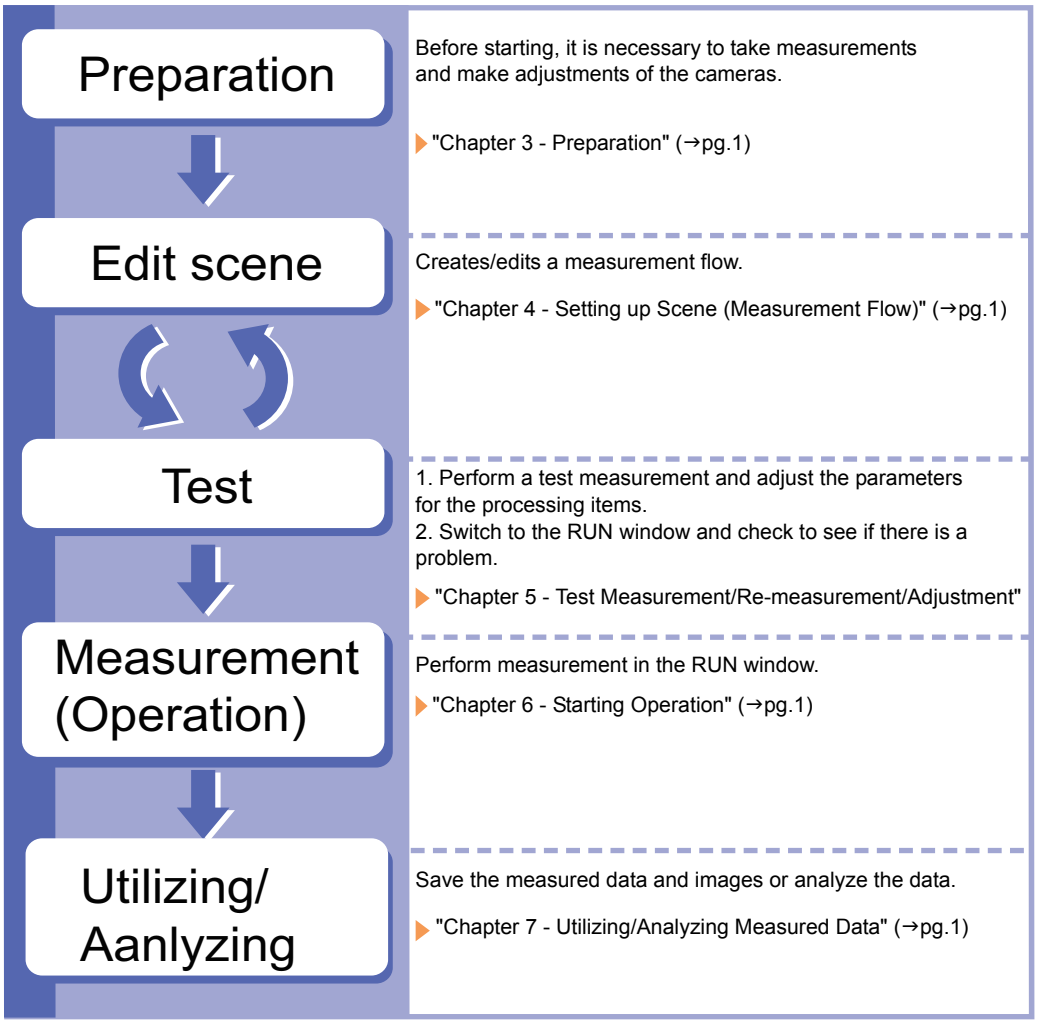
Chapter 1 - Before Operation

This chapter describes fundamental operations and designations of components of this product.

1.1 Operation Flow 2
1.2 Screens/Windows 3
1.3 Input Operation 16
1.4 Inputting a Value 18
1.5 Inputting a Text 19
1.6 Selecting Files and Folders 20
1.7 Operations of ProcItem Setting Window 23
1.9 Setting Figures 25
1.10 Saving Settings and Powering Off 42

1.1 Operation Flow

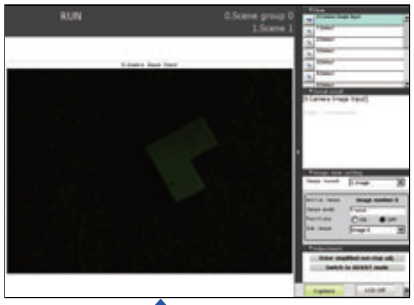
Here describes the operation flow.



1.2 Screens/Windows

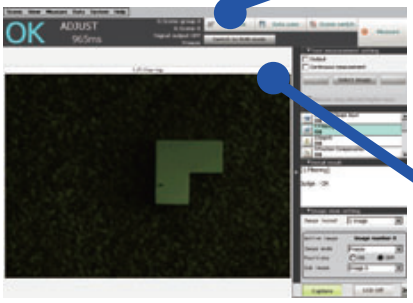
The screen varies with the operating state. Some typical interface structures and various buttons are functionally described hereto.

Main screen (RUN window)



Edit Flow window

Main screen (ADJUST window)

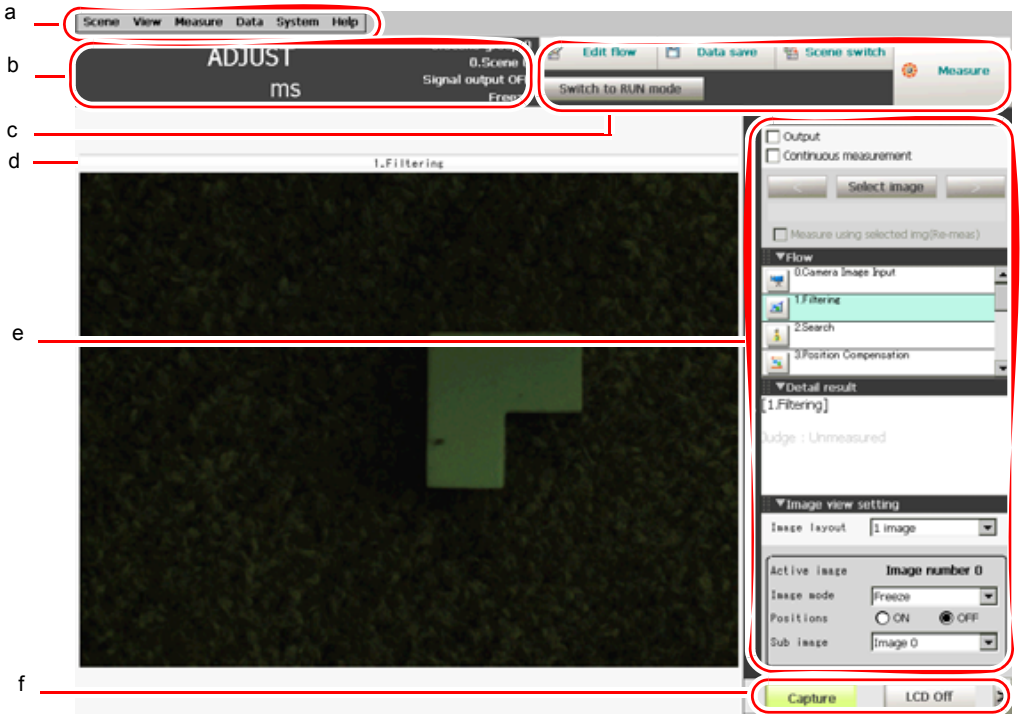


ProcItem Setting window

Setting Expression window

1.2.1 Main Screen (ADJUST window)

The screen is used for carrying out measurement, from which measurement results can be verified.

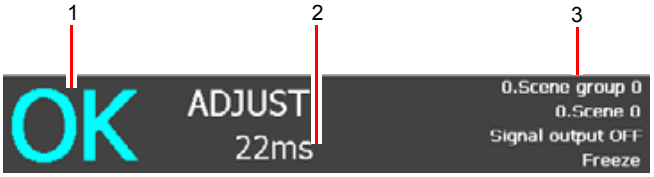


a Menu bar

To select the menu used for measurement-related operation or setting.

"11.5.1 Main Screen Menu" (→pg.17)

b "Measurement information display" area



1. Overall judgement

   Displays the result of the overall judgement of a scene ([OK]/[NG]).

   The judgement result for each processing item is displayed in each flow unit of the "Control" area.

2. Process time

   Displays the time required for the measurement process.

3. Status display

   Displays the scene group number, the scene number, the external output status, and the image mode for the currently displayed content.

c Toolbar

Some common functions are reserved in Toolbar.

- Edit flow
  Displays the Edit Flow window. In the displayed window, you can add, delete, or edit processing units.
  "4.1 What is Scene" (→pg.2)
  "1.2.3 Edit Flow Window" (→pg.9)
- Data save
  Setting data is saved into flash memory in the controller. Scene group data can also be saved to USB memory. Modified settings must be saved.
  "8.1.1 Saving Setting Data in the Controller's Memory [Data save]" (→pg.6)
- Scene switch
  To switch a scene group or a scene.
  "4.4 Changing Steps (Scene Switch)" (→pg.20)
- Measure/Stop meas.
  Starts/stops measurement. The measurement is performed in accordance with [Test measurement] settings in the "Control" area.
  "5.1 Test Measurement before Actual Operation" (→pg.2)
- Switch to RUN mode
  Switches the display to the RUN window.
  "1.2.3 Edit Flow Window" (→pg.9)

d "Image display" area

Displays the measured image.

1. ProcItem setting button
   Displays the name of the processing item for the currently selected processing unit. When tapping the button, the ProcItem Setting window is displayed.

e "Control" area

Displays "Test measurement setting", "Flow", "Detail result", and "Image view setting". You can expand or collapse each item by tapping its panel.

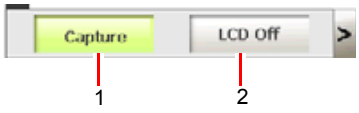
When all items are expanded

When all items are collapsed

When the "Control" area is closed

- Test measurement setting
  Sets up test measurement or re-measurement using a previously input image.
  "5.1 Test Measurement before Actual Operation" (→pg.2)
- Flow
  Displays the measurement flow for the scene used for measurement. Tap a button for each unit to display the ProcItem Setting window and change the processing unit settings.
  "1.7 Operations of ProcItem Setting Window" (→pg.23)
  The size of the processing unit buttons can be switched by tapping [Display] - [Display the enlarged measurement flow].
- Detail result
  Displays with the text, detailed measurement results of the processing units selected in the measurement flow.
- Image view setting
  Specifies the display settings for the "Image display" area. "6.3.1 Image Display Setting" (→pg.5)

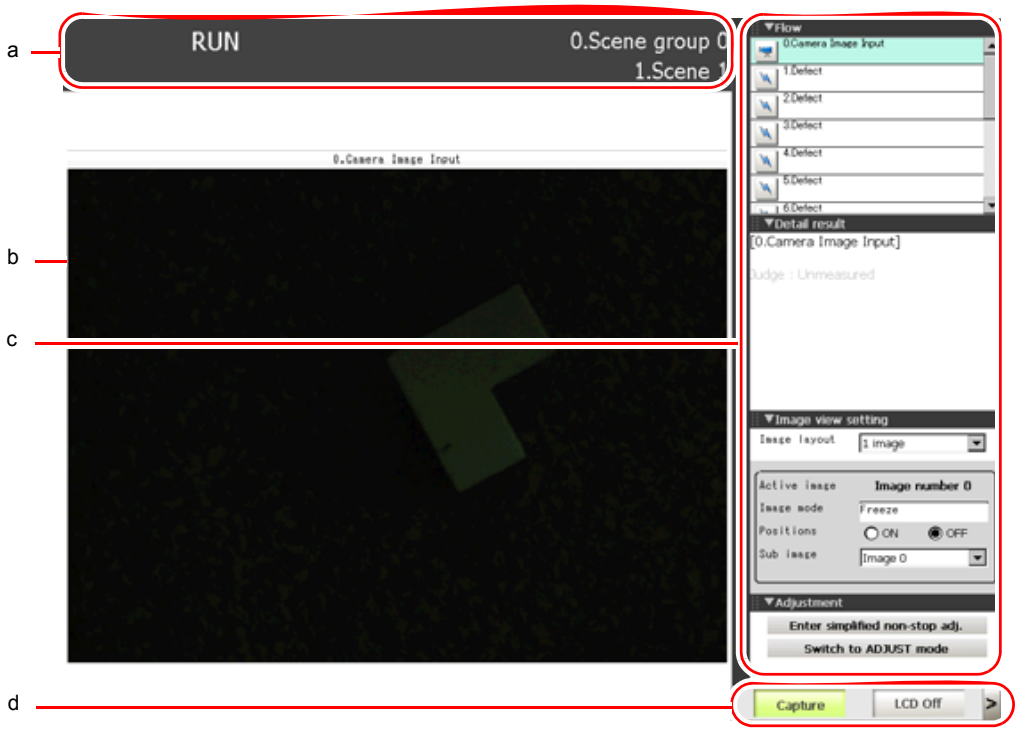
f Measurement Manager bar



1. [Capture]
   Saves the content displayed on the monitor as an image.
   For settings and operation of [Capture], see "9.5 Setting the Destination to Save Capture Image [Screen capture setting]" (→pg.17).
2. [LCD Off]
   Turns off the power of the LCD monitor. For settings and operation of [LCD Off], see "1.10.1 Powering Off LCD" (→pg.42).

1.2.2 Main Screen (RUN window)

This is the window used during operation.



a "Measurement information display" area

1. Overall judgement
   Displays the result of the overall judgement of a scene ([OK]/[NG]).
   The judgement result for each processing item is displayed in each flow unit of the "Control" area.
2. Disp mode
   The current image mode, [Through], [Freeze], or [Last NG], is displayed.
3. Scene group name and Scene name
   Displays the scene group number and the scene number.

b "Image display" area

Displays the measured image.

1. ProcItem setting button

   Displays the name of the processing item for the currently selected processing unit. If this button is tapped during simplified non-stop adjustment, the ProcItem Setting window is displayed.

c "Control" area

Displays "Flow", "Detail result", "Image view setting", and "Adjustment". You can expand or collapse each item by tapping its panel.

When all items are expanded

When all items are collapsed

When the "Control" area is closed

- Flow

  Displays the measurement flow for the scene used for measurement. When a simple non-stop adjustment is executed, if you tap a button (icon) of each unit (icon), judgement conditions are displayed in of the ProcItem Setting window, and the settings can be changed.

  "6.4 Changing Judgement Condition of a Unit during Measurement" (→pg.15)

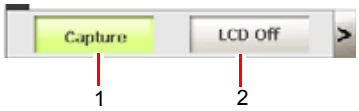
Important

- When simplified non-stop adjustment is not being performed, the ProcItem Setting window is not displayed even if a button for a processing unit is tapped.

In the RUN window, the size of processing unit buttons cannot be changed. To change the size of processing unit buttons of the RUN window, set the size of buttons in the ADJUST window, select "Data save", and then switch back to the RUN window.

- Detail result
  Displays with the text, detailed measurement results of the processing units selected in the measurement flow.
- Image view setting
  Specifies the display settings for the "Image display" area."6.3.1 Image Display Setting" (→pg.5)
- Adjustment
  Starts and stops simplified non-stop adjustment, and switches to the ADJUST window.

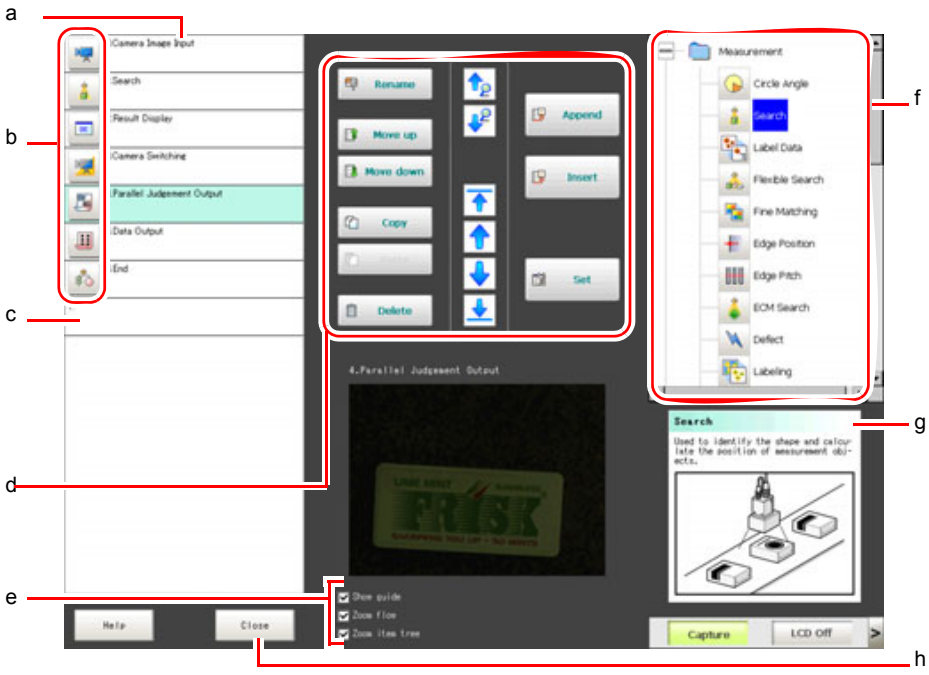
d Measurement Manager bar



1. [Capture]
   Saves the content displayed on the monitor as an image.
   For settings and operation of [Capture], see "9.5 Setting the Destination to Save Capture Image [Screen capture setting]" (→pg.17).
2. [LCD Off]
   Turns off the power of the LCD monitor. For settings and operation of [LCD Off], see "1.10.1 Powering Off LCD" (→pg.42).

1.2.3 Edit Flow Window

This window is used to create a scene (measurement flow). For scenes, see "4.1 What is Scene" (→pg.2).



a Unit list

Lists the processing units included in the flow. For each processing unit, "b ProcItem setting button" (→pg.10) and the name of the processing unit are displayed.
You can create a flow for a scene by adding processing items in the unit list.
"4.2 Creating a New Scene" (→pg.4)

b ProcItem setting button

Displays the ProcItem Setting window for each processing unit having a detailed set up.

c End marker

Indicates the end of the flow.

d Flow editing buttons

- Search up/Search down ( )
  Selects a processing unit by searching a processing item name.
  "4.3.1 Selecting the Processing Unit to Edit" (→pg.7)
- Select top/Select bottom ( )
  Selects the processing unit at the top or bottom of the flow.
  "4.3.1 Selecting the Processing Unit to Edit" (→pg.7)
- Select above/Select below ( )
  Selects the processing unit located one above or one below the currently selected processing unit.
  "4.3.1 Selecting the Processing Unit to Edit" (→pg.7)
- Rename
  Displays a window to rename the selected processing unit.
  "4.3.4 Renaming a Processing Unit" (→pg.14)
- Move up/Move down
  Moves the selected processing unit upward or downward.
  "4.3.6 Moving a Processing Unit" (→pg.16)
- Copy
  Copies the selected processing unit.
  "4.3.7 Copying and Pasting a Processing Unit" (→pg.17)
- Paste
  Pastes the copied processing unit immediately before the selected processing unit. You can only paste the unit right after the copy action without any intervening operations.
  "4.3.7 Copying and Pasting a Processing Unit" (→pg.17)
- Delete
  Deletes the selected processing unit.
  "4.3.8 Deleting a Unit" (→pg.18)
- Append
  Adds a processing unit to the bottom of the flow.
  "4.3.2 Appending a Processing Unit at the Bottom" (→pg.11)
- Insert
  Inserts a new processing unit immediately before the selected processing unit.
  "4.3.3 Inserting a Processing Unit" (→pg.12)

- Set
  Displays the ProcItem Setting window for the selected processing unit.
  "4.3.5 Setting Details of a Processing Unit" (→pg.15)

e Display options

- Show guide
  When checked, the explanation for the processing items ("g Guide" (→pg.11)) is displayed.
- Zoom flow
  When checked, the flow in "a Unit list" (→pg.10) is displayed using large icons.
- Zoom Item tree
  When checked, "f Processing item tree" (→pg.11) is displayed using large icons.

f Processing item tree

This is an area for selecting a processing item to be added to the flow. Processing items are classified by type and displayed as a tree. If a plus sign "+" for each item is tapped, the contents under the item is expanded. If a minus sign "-" for each item is tapped, the contents under the item collapse.

g Guide

Shows an explanation for the processing item selected in the processing item tree. This is for your reference to select a processing item. To display the guide, check "Show guide" in "e Display options" (→pg.11).

h [Close]

Returns to the Main screen.

1.2.4 ProcItem Setting Window

This window is used to set the Measurement parameters and judgement conditions, etc, of Processing Item. For window operations, see "1.7 Operations of ProcItem Setting Window" (→pg.23).

a "Item tab" area

Displays detailed setting items as tabs, for the processing unit selected in the Edit Flow window or in [Flow] of the "Control" area on the Main screen.

b "Detail" area

Displays and changes settings for the detailed setting item selected in the "Item tab" area.

c "Image display" area

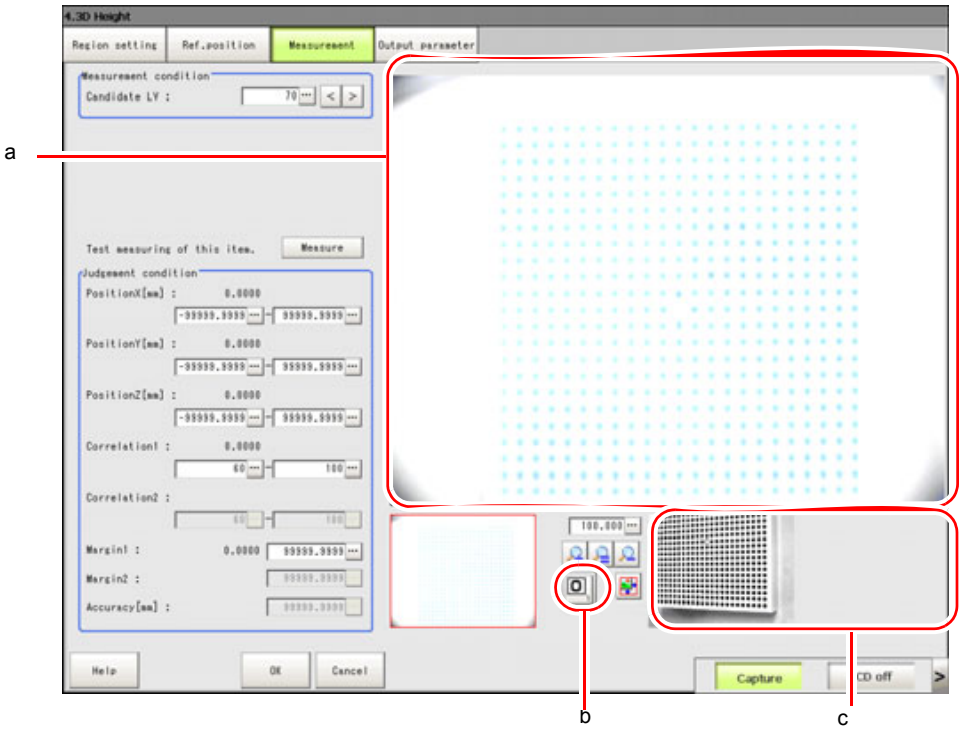
To display the Coordinate, figure and images captured from camera, etc.

d "Zoom browser" area

Zooms in and out of the displayed image.

"1.8 Using Zoom Function" (→pg.24)

3D Processing Item Window



a "Image display" area

Displays the coordinates, figures and images captured from cameras, etc.

b 3D camera switching button

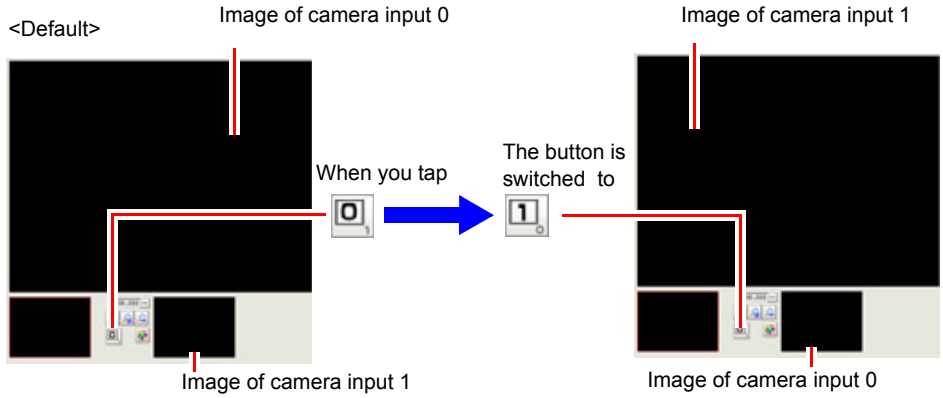
When tapping the button, the camera image in the "Image display" area is switched.
The button number indicates the camera image currently displayed in the "Image display" area.
Depending on the camera used, the buttons will change as described below.

Table: 3D camera switching button

Camera number	Buttons displayed
When using camera input 0 and 1.	[0] and [1] are switched.
When using camera input 2 and 3.	[2] and [3] are switched.
When using camera input 0, 1, and 2.	[0], [1] and [2] are switched in order.

Example) A display when camera input 0 and 1 are used.

Tapping [0] switches it to [1], and the image of camera input 1 is displayed in the "Image display" area.



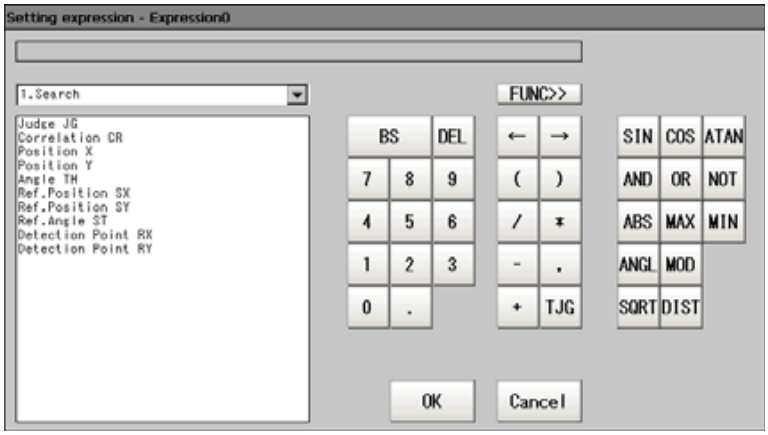
Tapping [1] switches it to [0], and the image of camera input 0 is displayed in the "Image display" area.

c "Sub image" Area

A camera image other than the image displayed in the "Image display" area is displayed.

1.2.5 Setting Expression Window

This window is used for setting expressions for measurement. For the contents and operation of this window, see "4.1.5 How to Display Setting Expression Window" (→pg.8), of "Processing Items List Manual".



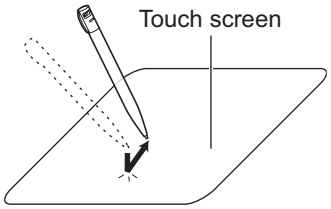
1.3 Input Operation

This section describes the basic operations of input devices of this product.

1.3.1 Operations of Touch Pen (for Users of Panel-type Controller)

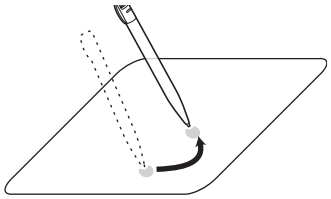
The touch pen is used in the touch screen in either of the following ways.

Tapping



Touch the screen slightly with the touch pen, and then take off immediately in order to select Processing items.

Drag & Drop



Draw while tapping the screen slightly with the touch pen.

Important

- For touch screen operation, the supplied touch pen must be used. Otherwise, the touch screen would be damaged when using a pencil or a ballpoint pen.
- In addition, delay may occur when tapping touch screen continuously and rapidly.

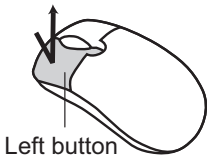
1.3.2 Basic Operations of Mouse and Trackball (for Users of BOX-type Controller)

Please use currently available mouse or trackball with USB interface.
(See the list for recommended products. Please refer to product catalogue.)

POINT

- Don't use the right mouse button, roller and other keys.

Tapping

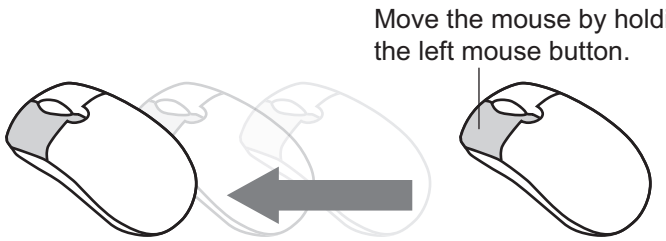


Press the left mouse button to select Processing items.

POINT

- This document primarily describes the operation of "Tapping". If you use mouse or trackball, "Tapping" is deemed to be "Clicking".

Drag & Drop



Move the mouse by holding down the left mouse button.

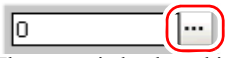
1.4 Inputting a Value

This section describes how to input the data required for setting the Judgement conditions and communication specifications. There are a few input ways according to different settings.

- Setting by drawing a figure (Setting the coordinates on the figure as values)
  When carrying out "Model registration"/"Region" for specific Processing items, visual operation is possible without considering the related value. For details, see "1.9 Setting Figures" (→pg.25).
- Specify values directly with the numeric keyboard
  Used when the value to be inputted is specific.
- Set up values by dragging the slider
  Dragging the slider on the screen allows to setting up values.

Here we'll describe how to use the numeric keyboard to set up values. For other methods, refer to individual setting descriptions.

1 Tap the Processing item's [...] to specify values.



The numeric keyboard is displayed.

2 Tap numeric key to input value.

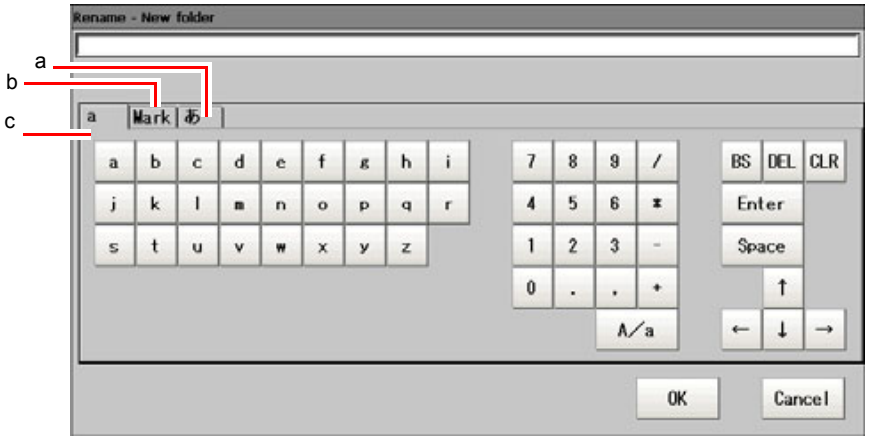
The numerical value is input.

3 Tap [OK].

Verify the value, and close the numeric keyboard.

1.5 Inputting a Text

This section describes how to input File names and descriptive text.
The following software keyboard is viewed in the input text screen.



a Japanese input mode

b Mark (One-byte Characters Input Mode)

c a (Alphanumeric Characters Input Mode)

To toggle between uppercase and lowercase mode, tap "A/a". The initial state is lowercase mode.

Operation Method

1 Tap [...] for the item to set a character string.

The software keyboard is displayed.

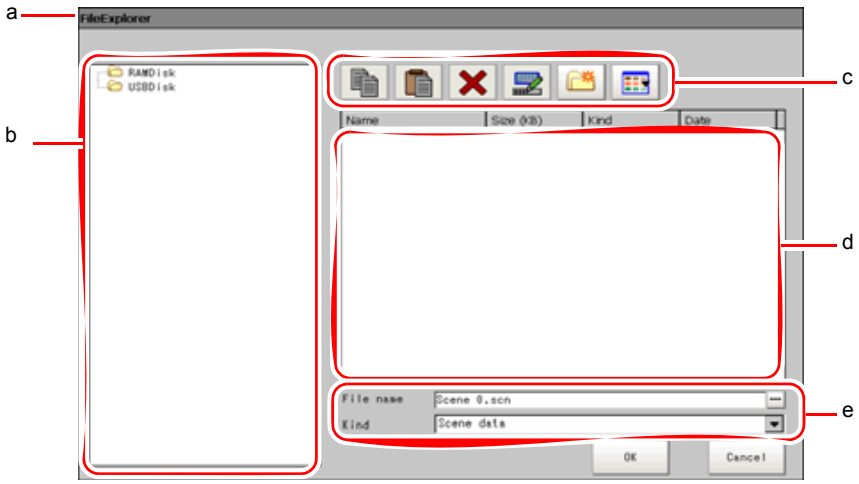
2 Choose your desired language from the tab.

3 Enter text and tap [OK].

The software keyboard is Closed.

1.6 Selecting Files and Folders

This section describes how to select a destination folder for images captured from such operations as saving data/load and re-measurement.
The following window will appear in File and Folder Selection window.



a Window Title

When specifying a file, the title is "FileExplorer". When selecting a folder, the title is "Select folder".

b "Folder view" area

Lists folders on the RAM disk and folders in the mounted USB memory. At the root of the tree, all accessible USB memory drives are displayed (ex. "USBDisk", "USBDisk2").

c Toolbar

- Copy ( )
  Enabled when a folder or file is selected in the "d "List view" area" (→pg.21). After tapping and copying, the Paste option will become enabled.
- Paste ( )
  Enabled when performing copying. Paste copied files or folders.
- Delete ( )
  Enabled when a folder or file is selected in the "d "List view" area" (→pg.21). Tapping allows to opening a window for you to confirm the deletion.
- Rename ( )
  Enabled when a folder or file is selected in the "d "List view" area" (→pg.21). When tapped, the Rename window is displayed.
- New a Folder ( )
  Create a new folder.

- Toggle List View( )
  Switches the display style of the "d "List view" area" (→pg.21).

d "List view" area

To display the list of the files and folders contained in the folder which is selected from the "Folders view" area.
In addition, when an extension name is selected from "Type", then only the files with the selected extension name can be viewed. To change a viewed list, tap "Toggle List View" button ( ).

e "File name view" area

- Name
  To display the names of the files selected from the "d "List view" area" (→pg.21) .
- Type
  Specifies the type of the file displayed in "d "List view" area" (→pg.21), such as "Scene data (*.scn)" and "System data (*.ini)".

1.6.1 Available Operations in File Selection Window

This section describes available operations from the File Selection screen.

POINT

- When the target file is not viewed in the "List view" area, please check to ensure that a file type is selected from the "Type".

Copying/Pasting a File or Folder

1 Tap a folder or file that you want to copy in the "List view" area.
A folder or a file is selected.

2 Tap "Copy" ( ).

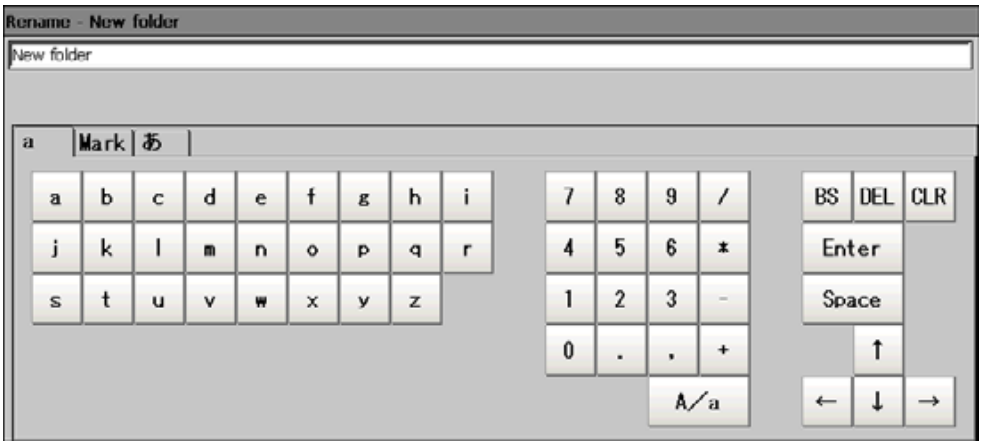
3 Select the destination folder, and tap "Paste" ( ).

Renaming a Folder or a File

1 From the "List view" area, tap the name of file or folder to be renamed.
The file or folder will be selected.

2 Tap "Rename" ( ).
The software keyboard is displayed.

3 Enter a new name.



How to input text: "1.5 Inputting a Text" (→pg.19)

POINT

- When a file with the same name exists, a prompt will be viewed telling you that you cannot select the name.

Deleting a Folder or a File

1 From the "List view" area, tap the name of file or folder to be selected.

The file or folder will be selected.

2 Tap [Delete] ( ).

A window will be viewed for your confirmation.

3 Tap [OK].

The selected file or folder will be deleted.

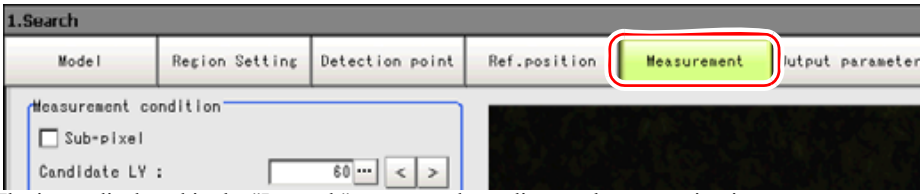
1.7 Operations of ProcItem Setting Window

Detailed settings for each processing unit are set in the ProcItem Setting window. This section explains basic common operations in the ProcItem Setting window.

1 Display the ProcItem Setting window.

The ProcItem Setting window can be displayed from the Main screen or the Edit Flow window. For the ProcItem Setting window, see "1.2.4 ProcItem Setting Window" (→pg.12).

2 Tap one of the setting items in the "Item tab" area.



The items displayed in the "Item tab" area vary depending on the processing item. According to the item selected in the "Item tab" area, the displayed contents change in the "Detail" area and the "Image display" area.

3 You can change parameters from the "Detail" area.

For more Details about the setting of Processing items, see " Processing Items List Manual" (→pg.1).

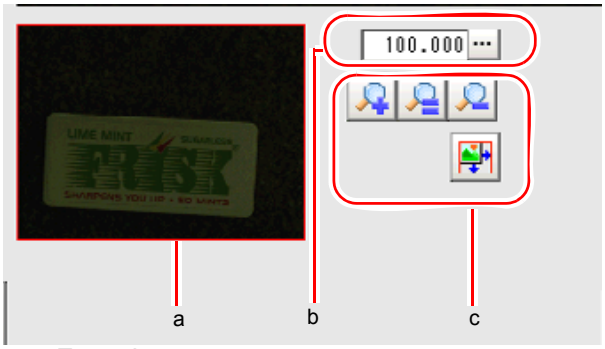
4 If necessary, repeat Steps 2 and 3.

5 Tap [OK].

The new settings are applied and the ProcItem Setting window closes.

1.8 Using Zoom Function

Specifies the magnification settings of the displayed image in the ProcItem Setting window.



a Zoom browser

Indicates the zoomed area in the original image.

b Magnification factor

Enters the magnification factor between 25% and 1600%.

c Operation buttons

- Zoom-in button ( )

  Enlarges the selected area two times.

- Original size button ( )

  Displays the selected area in the original size.

- Zoom-out button ( )

  Reduces the selected area by half.

- Full-screen button ( )

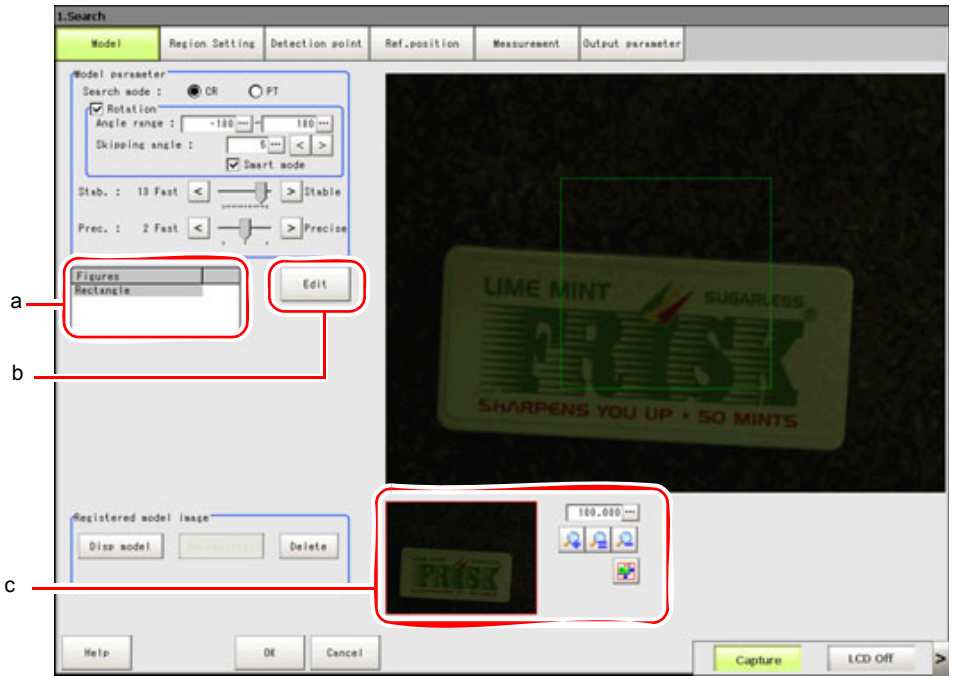
  Displays the selected area in full screen mode.

1.9 Setting Figures

This section describes how to set up objcets (figures and text) when registering models or measurement regions.
The type and number of objects differ depending on different setting options. For the available setting options, see "11.6 Corresponding Image List of Processing Items" (→pg.20) and " Processing item List" (→pg.1), of "Processing Items List Manual".

1.9.1 "Figure Setting" Area

Registers a figure when registering or setting a measurement region or model.

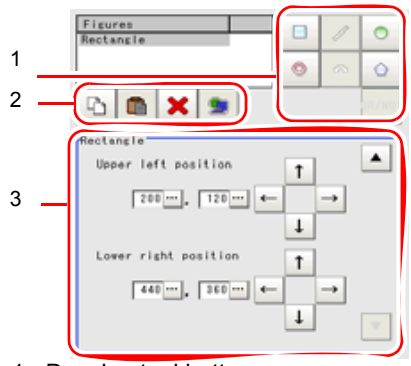


a Figures

Lists the names of the registered objects. The figure at the bottom of the list is the most foreground object. The upper place the object is listed in, the more background it is displayed.

b [Edit]

Used to edit a figure. The following figure editing tool is displayed.



1. Drawing tool buttons

   Sets up objects, such as figures and text. The number and type of the objects available are different depending on the item to work with (ex. "Result display", "Model", "Region setting"). For details, see "11.6 Corresponding Image List of Processing Items" (→pg.20).

2. Object editing buttons

   Buttons for editing objects

3. Details

   Shows the details of the selected figure. Object coordinates or radius can be specified.

   Tapping [▲] or [▼] will display the items currently not displayed.

c "Zoom browser" area

Magnifies the "Image display" area by the selected magnification factor."1.8 Using Zoom Function" (→pg.24)

1.9.2 How to Set up

The settable objects are as follows:

Table: Figure Object List

Objects	Initial State		see
	Result Display	Other Than the Result Display	
Rectangle	Height: 201 pixels Width: 201 pixels	Height: 241 pixels Width: 241 pixels	" Rectangle" (→pg.27)
Line	Length: 201 pixels Width: 2 pixels	Length: 320 pixels Width: 20 pixels	" Line" (→pg.28)
Circle/Ellipse	Radius: 100 pixels	Radius: 120 pixels	" Circle/Ellipse" (→pg.29)
Circumference	Radius: 100 pixels Width: 5 pixels	Radius: 120 pixels Width: 10 pixels	" Circumference" (→pg.31)
Arc	Radius: 100 pixels Width: 5 pixels Start angle: 180 degrees End angle: 180 degrees	Radius: 120 pixels Width: 10 pixels Start angle: 0 degrees End angle: 180 degrees	" Arc" (→pg.33)

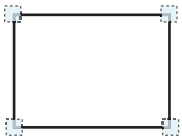
Table: Figure Object List

Objects	Initial State		see
	Result Display	Other Than the Result Display	
Cursor	Central coordinate X: 150 Central coordinate Y: 150	-	" Cursor" (→pg.35)
Polygon	-	-	" Polygon (Triangle to Decagon)" (→pg.35)
Text	-	-	" Text" (→pg.37)
Time	-	-	" Time" (→pg.37)

When an image is difficult to view or if you want to observe a region in more detail, magnify the image.
"1.8 Using Zoom Function" (→pg.24)

Rectangle

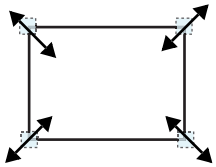
- Image selected



Four points are displayed at each corner.

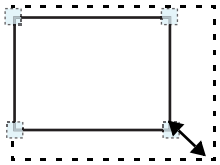
- Dimension Adjust

Drag one of the points.



- Example) To enlarge

Drag the point in the lower right corner to the lower right direction.



- Setting Item

  Setting items can be switched by tapping [▲] or [▼].

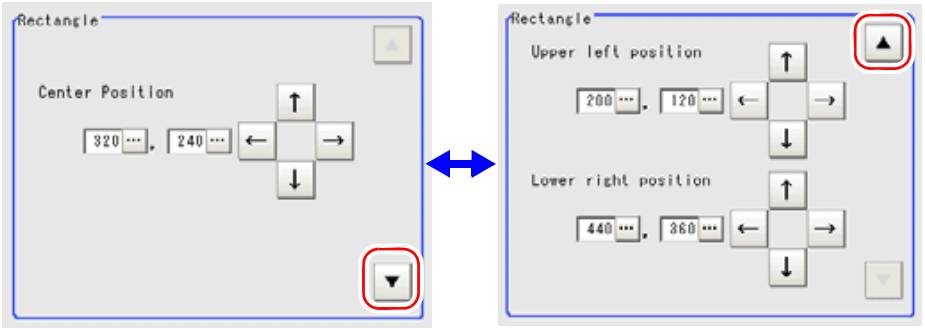


Table: Detail Setting (Rectangle)

Item	Description
Center position (X, Y)	The X and Y coordinate values at the center of the rectangle are displayed. To edit each value, tap the button to the right of the value, and specify a value in the window displayed.
Upper left position (X, Y)	The X and Y coordinate values at the upper left corner of the rectangle are displayed. To edit each value, tap the button to the right of the value, and specify a value in the window displayed.
Lower right position (X, Y)	The X and Y coordinate values at the lower right corner of the rectangle are displayed. To edit each value, tap the button to the right of the value, and specify a value in the window displayed.

Line

- Image selected

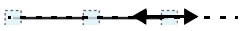
  View points of start, middle and end points of lines.

- Dimension Adjust

  Drag one of the points.

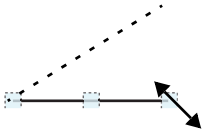
  - Example) When changing the length of lines

    Drag the points towards intended direction.

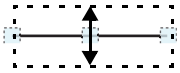


  - Example) When changing the oblique direction

    Drag the points towards intended direction.



- Example) When changing the line width
  Drag the center points towards vertical direction of lines.



- Setting Item

Setting items can be switched by tapping [▲] or [▼].

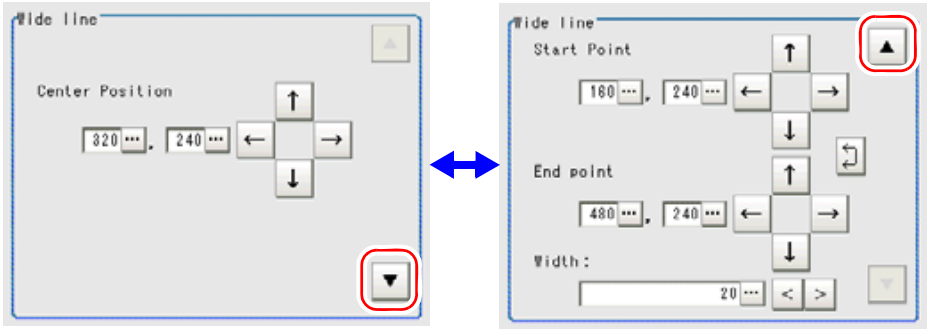
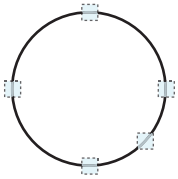


Table: Detail Setting (Line)

Item	Description
Center position (X, Y)	The X and Y coordinate values at the center of the line are displayed. To edit each value, tap the button to the right of the value, and specify a value in the window displayed.
Start point (X, Y)	The X and Y coordinate values at the initial point of the line are displayed. To edit each value, tap the button to the right of the value, and specify a value in the window displayed.
End point (X, Y)	The X and Y coordinate values at the terminal point of the line are displayed. To edit each value, tap the button to the right of the value, and specify a value in the window displayed.
Width	The line width (thickness) is displayed. To edit each value, tap the button to the right of the value, and specify a value in the window displayed.

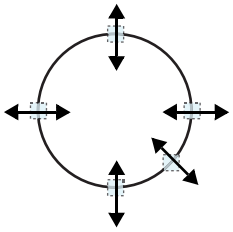
Circle/Ellipse

- Image selected

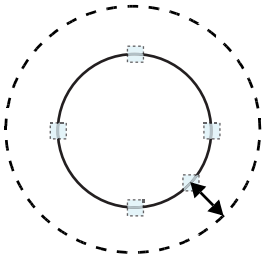


Points are displayed on the top, bottom, left, right, and lower right of the circle.

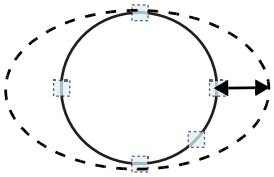
- Dimension Adjust
  Drag one of the points.



  - Example) When circle is Zoom
    Drag the point on the lower right of the circle.



  - Example) To transform the circle into a horizontally long ellipse
    Drag the point on the right of the circle to the right.



- Setting Item

  Setting items can be switched by tapping [▲] or [▼].

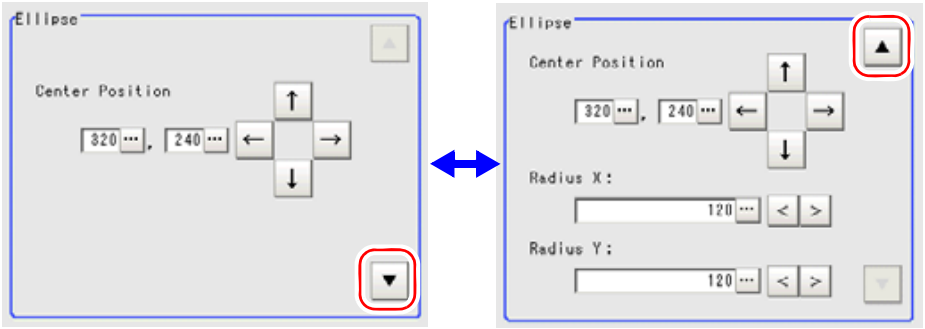
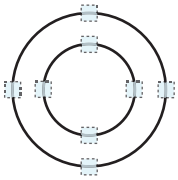


Table: Detail Setting (Circle)

Item	Description
Center position (X, Y)	The values of the coordinates (X, Y) at the center of the circle are displayed. To edit each value, tap the button to the right of the value, and specify a value in the window displayed.
Radius X	The radius of the circle in the X-axis direction is displayed. To edit each value, tap the button to the right of the value, and specify a value in the window displayed.
Radius Y	The radius of the circle in the Y-axis direction is displayed. To edit each value, tap the button to the right of the value, and specify a value in the window displayed.

Circumference

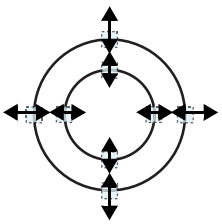
- Image selected



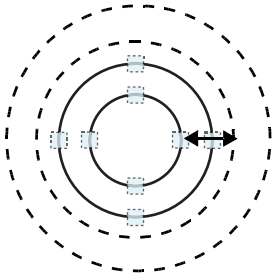
Points are displayed on the top, bottom, left, and right of both the inner and outer circles.

- Dimension Adjust

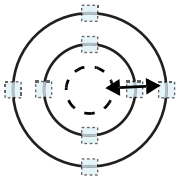
  Drag one of the points.



- Example) To enlarge the entire circumference
  Drag a point on the outer circle.



- Example) When adjusting the width of circumference
  Drag a point on the inner circle.



- Setting Item

  Setting items can be switched by tapping [▲] or [▼].

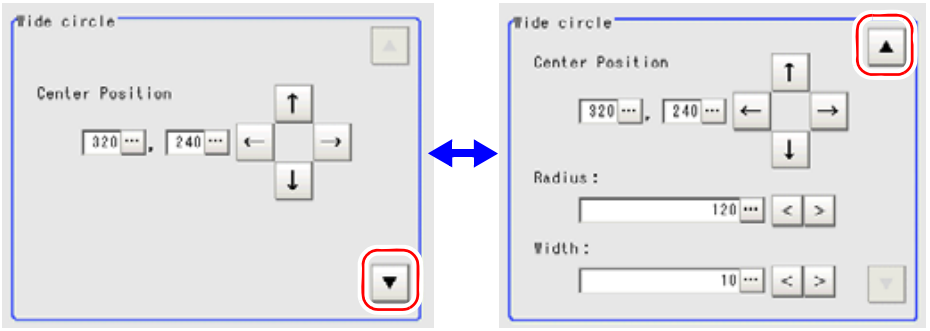
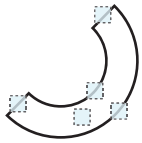


Table: Detail Setting (Circumference)

Item	Description
Center position (X, Y)	The values of the coordinates (X, Y) at the center of the circle are displayed. To edit each value, tap the button to the right of the value, and specify a value in the window displayed.
Radius	The radius of the circle is displayed. To edit each value, tap the button to the right of the value, and specify a value in the window displayed.
Width	The width of the circumference is displayed. To edit each value, tap the button to the right of the value, and specify a value in the window displayed.

Arc

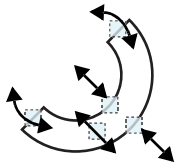
- Image selected



Points are displayed on two lines at both ends of the arcs, on the inner arc, on the outer arc, and inside the closed arc shape.

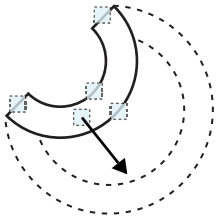
- Dimension Adjust

Drag one of the points.



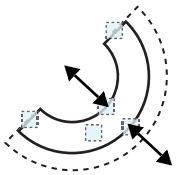
  - Example) When arc is Zoom

    Drag the point inside the arc in the outward direction.



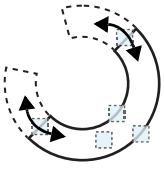
  - Example) When adjusting the width of arc

    Drag the point on the inner or outer arc inward or outward.



  - Example) When changing the Angle of arc (partially open)

    Drag one of the points at the end of the arc.



- Setting Item

  Setting items can be switched by tapping [▲] or [▼].

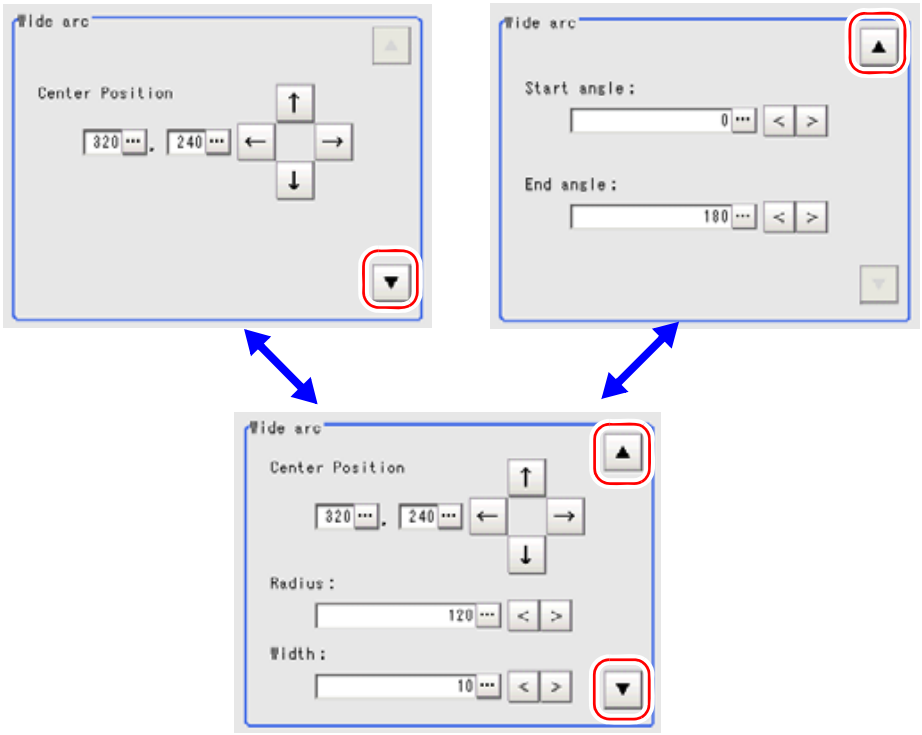


Table: Detail Setting (Arc)

Item	Description
Center Position (X, Y)	The values of the coordinates (X, Y) at the center of the circle are displayed. To edit each value, tap the button to the right of the value, and specify a value in the window displayed.
Radius	The radius of the circle is displayed. To edit each value, tap the button to the right of the value, and specify a value in the window displayed.
Width	The width of the arc is displayed. To edit each value, tap the button to the right of the value, and specify a value in the window displayed.
Start angle	The value of the start angle is displayed. To edit each value, tap the button to the right of the value, and specify a value in the window displayed.
End angle	The value of the end angle is displayed. To edit each value, tap the button to the right of the value, and specify a value in the window displayed.

Cursor

- Image selected

Overall image selected.

- Setting Item

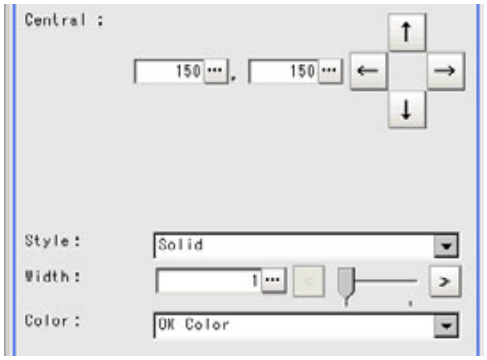
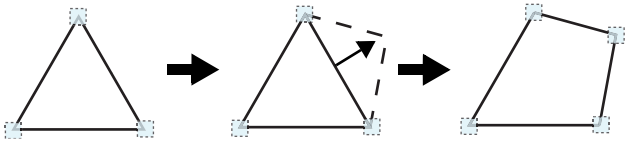


Table: Detail Setting (Cross)

Item	Description
Central coordinate (X, Y)	The values of the coordinates (X, Y) at the center of the cross are displayed. To edit each value, tap the button to the right of the value, and specify a value in the window displayed.
Style	The style of the line for the cross is displayed. To change the style, tap [▼] and select one.
Width	The width of the line for the cross is displayed. To change the value, tap the button to the right and specify a value in the window displayed.
Color	The color of the line for the cross is displayed. To change the color, tap [▼] and select one. Options are "OK color", "NG color", "Judgment", and "RGB".

Polygon (Triangle to Decagon)

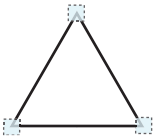
- How to draw a polygon (e.g. a quadrilateral)



1. When [Polygon] is specified, a triangle is drawn at first.
2. If you drag one of the sides and drop it at the point you want to make a new vertex, a new vertex will be created.

If the number of climaxes is not within 3 to 10, the image isn't deemed as a polygon.

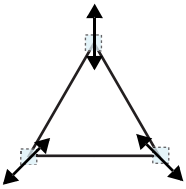
- Image selected



Climax view point of images.

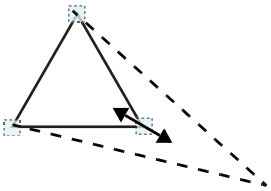
- Dimension Adjust

Drag one of the points.



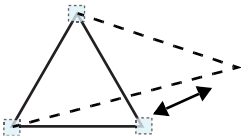
- Example) When changing the Angle of one point

Drag points (randomly).



- Example) When changing area

Drag points (randomly).



- Setting Item

  Setting items can be switched by tapping [▲] or [▼].

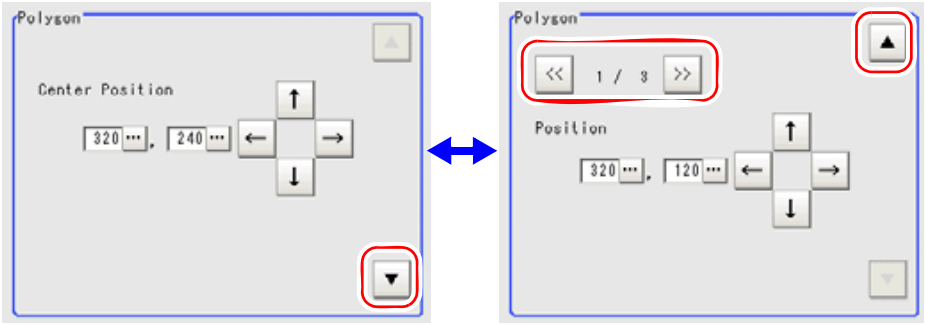


Table: Detail Setting (Polygon)

Item	Description
Center Position (X, Y)	The X and Y coordinate values at the center of the polygon are displayed. To change the value, tap the button to the right and specify a value in the window displayed.
Position (X, Y) for each vertex	The X and Y coordinate values of each vertex of the polygon are displayed. To edit a value, select a vertex by tapping [<<] and/or [>>], tap the button to the right of each coordinate, and specify a value in the window displayed.

Text

- Image selected

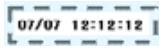
Overall image selected.

POINT

- "Text" can be only used in [Result display] processing item.
  See "7.1 Result Display" (→pg.1), of "Processing Items List Manual".

Time

- Image selected



Overall image selected.

POINT

- "Time" can be only used in [Result display] processing item.
  See "7.1 Result Display" (→pg.1), of "Processing Items List Manual".

1.9.3 OR Setting/NOT Setting

OR setting/NOT setting is used to combine multiple images.
The figures that can be combined are different depending on the processing item. For details, see the Processing Items List Manual.

When inserting a new figure, it is handled as an OR image. At this time, when [OR/NOT] (OR/NOT) is tapped, the image is handled as a NOT image. Each time [OR/NOT] (OR/NOT) is tapped, the setting of the selected figure toggles between OR and NOT.

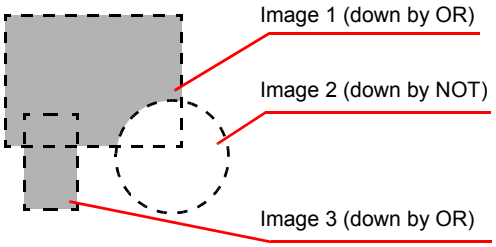
Important

- It's not allowed to draw only the images with NOT setting.

Table: Note of OR Setting/NOT Setting

Item	Description
OR/NOT(OR/NOT)	Used when drawing a model or a region The setting toggles between OR and NOT each time the button is tapped. ・OR The selected figure is displayed with a dotted line in the OK color (OR Image). When drawing multiple figures, the entire area is registered as a region. ・NOT The selected figure is displayed with a dotted line in the NG color (NOT image). The area outside of the NOT image is registered as a region.

Example) Grey parts are measurement region.



Complex area can be drawn through image combination, or unnecessary parts are removed from the measurement region.

1.9.4 Drawing Procedures

This section describes how to register models, draw figure in measurement region and specify the measurement region.

1 Display the "Figure setting" area by one of the following methods.

- For "Model registration" in Processing item setting

The number and type of the objects you can register are different depending on the processing item.
Or drawn by using OR setting/NOT setting.
"1.9.3 OR Setting/NOT Setting" (→pg.38).

- For "Region setting" in Processing item setting
  Objects to be registered may differ from the Processing item.
  "11.6 Corresponding Image List of Processing Items" (→pg.20)
- For figure setting in Processing item "Result Display"
  "7.1 Result Display" (→pg.1), of "Processing Items List Manual"

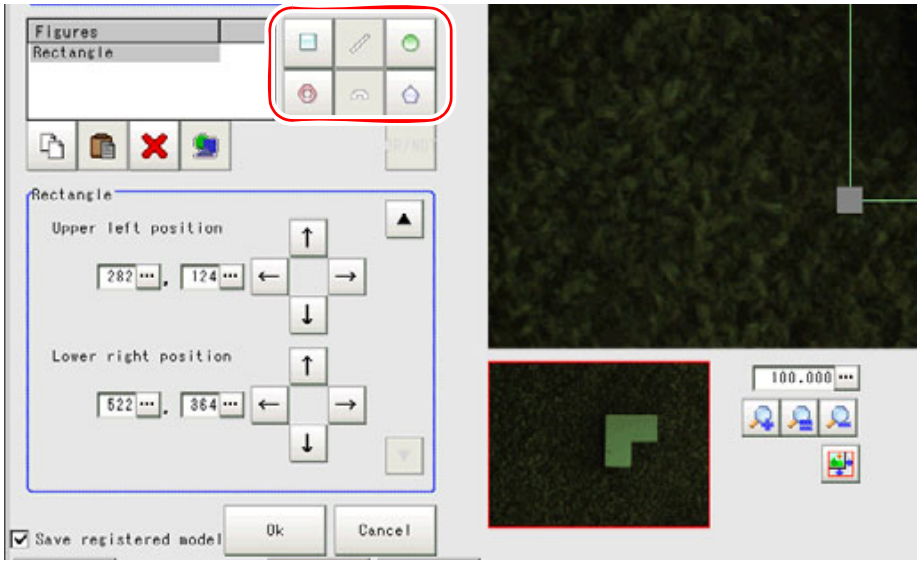
Important

- In the "Figure setting" area, the type and the number of the objects that you can set vary depending on which function they are displayed from or which processing item they are used by.
  For details, see every Processing item and "11.6 Corresponding Image List of Processing Items" (→pg.20).

2 Tap the object button to be drawn from Image Tool button.

For OR/NOT setting, see "1.9.3 OR Setting/NOT Setting" (→pg.38).

3 Draw the objects.



The objects are registered.

POINT

To enlarge

- Use the Zoom function to enlarge the displayed image.
  "1.8 Using Zoom Function" (→pg.24)

To check the drawn objects

- The type and the consecutive number of drawn objects are displayed on the left of the "Figure setting" area.
  "1.9.1 "Figure Setting" Area" (→pg.25)

4 Objects can be added by tapping Image Tool button.

POINT

- Object can be deleted by tapping the objects to be deleted and [Delete] ( ).
  To delete all the drawn objects, tap [Select all] ( ) and then tap [Delete] ( ).

5 Repeat 2. to 4., draw figure.

6 Tap [OK] when drawing is over.
The settings are registered.

1.9.5 Available Operations in Drawing Area

This section explains the editing operations available in the "Figure setting" area. For details about the "Figure setting" area, see also "1.9.1 "Figure Setting" Area" (→pg.25).

Moving a Object in View Area

1 Tap the objects to be moved from the "Image display" area to object list. All objects can be moved by tapping "Select All" ( ).
The objects are selected.

2 Tap the arrow button of the direction to which you want to move the object.
The selected object moves 1 pixel every time.

POINT

- Dragging allows images moving in the "Image display" area.
  Bigger locations are more easily shifted.

Copying/Pasting

1 Tap the objects to be copied from object list.
The objects are selected.

2 Tap [Copy] ( ).

3 Tap [Paste] ( ).
The copied objects are Pasted to the location. The pasted object is appended at the bottom of the object list.

Deleting objects

1. Tap the objects to be deleted from object list. Or, tap [Select all] ( ).
   The objects are selected.

2. Tap [Delete] ( ).
   A window will be viewed for your confirmation.

Using Expressions

When tapping [...] for each value displayed in the Detail window, the Setting Expression window is displayed to set a value. However, the available features in the Setting Expression window vary depending on the situation. For the operation of the Setting Expression window, see "4.1.4 Structure and Creation of Expression" (→pg.5), of "Processing Items List Manual".

1.10 Saving Settings and Powering Off

Before turning off the power of the controller, perform the following operations to save the scene data that you have set. Scene data of Scene Group 0 will be Saved into the built-in flash memory of controller. If USB memory is inserted, the setting data of Scene Group 1 to 31 will be Saved into USB memory.
Whenever starting up, the controller loads the scene data from the flash memory. Therefore, if you turn off the power without saving the data to the flash memory, the changes made will not be retained.

Important

- Logged images in the controller and images/data saved on the RAM Disk are deleted when the power is turned off, since they cannot be saved in the flash memory. If you want to keep these images or data, perform either of the following procedures.
  - In "Logging setting", set the Destination folder to the USB memory.
    "7.2 Setting up Logging Condition [Logging setting]" (→pg.7)
  - In "Save to file", copy the data saved to the RAM Disk to the USB memory.
    "8.1.4 Copying/Moving File [Save to file]" (→pg.9)

1 On the Main screen (the ADJUST window), tap [Data save] in the Toolbar to save the set data.
For details on this operation, see "8.1.1 Saving Setting Data in the Controller's Memory [Data save]" (→pg.6).

2 Exit after powering off controller.

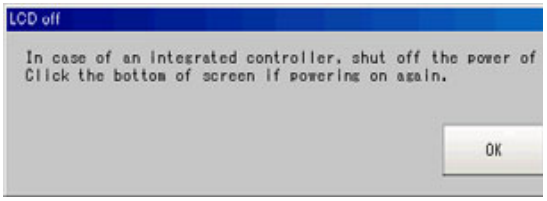
1.10.1 Powering Off LCD

Just Power off LCD, not the controller.

1 Open the measurement manager bar at the bottom right of the Main screen and tap [LCD Off].

A confirmation message is displayed.

2 Tap [OK].



LCD is switched off.

POINT

- This window cannot be captured.

Powering On LCD Again

Tap the lower part of view.
Then, LCD will be switched on.

2

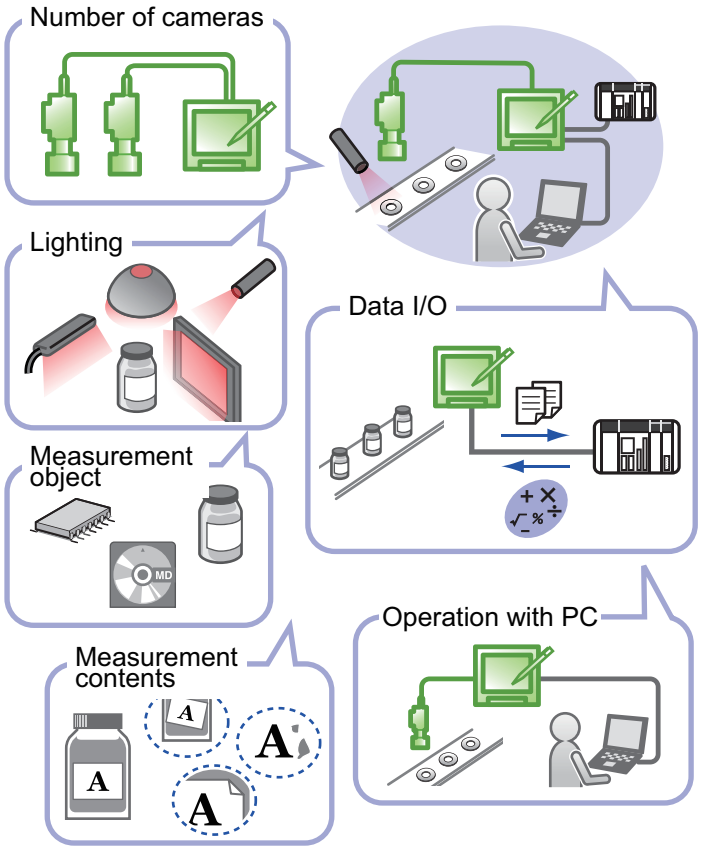
Chapter 2 - Design

Measurement environment/Processing item shall be necessarily designed prior to measurement.

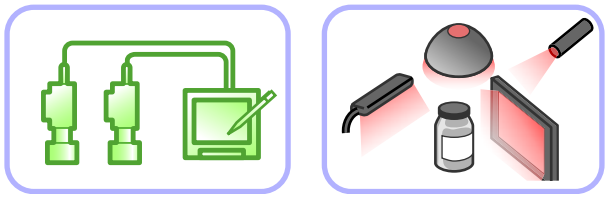
2.1 Connections Required for Measurement 2
2.2 Design Measurement Contents 4

2.1 Connections Required for Measurement

Please check the connections of equipments prior to measurement, which shall be set up where necessary.



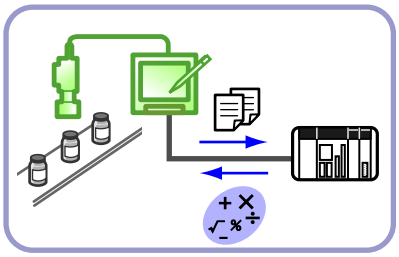
Number of Cameras and Lighting Method



The cameras, lightings and lighting methods may vary depending upon different measurement objects. The cameras and lighting methods optimally suited for measurement shall be discussed here.

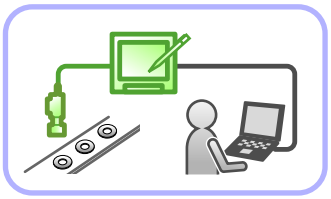
"3.3 Adjusting Camera" (→pg.5)
"11.1 CCTV Lens" (→pg.2)

Data I/O



When using measurement results, it's required to input measurement command from external devices, or set up I/O. Different external devices require different connections. For details, see "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1).

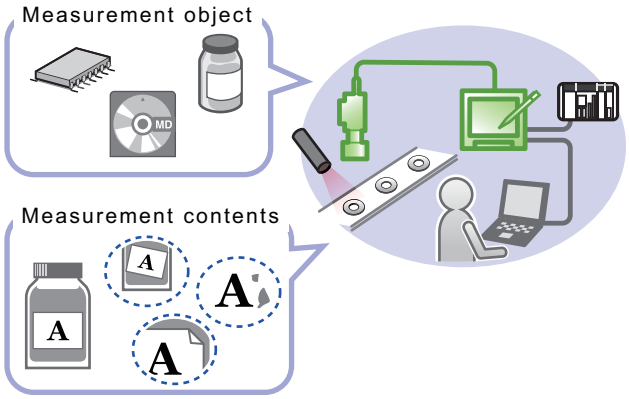
Operation with PC



PC connection and setting shall be required when inputting measurement commands or using measurement results.
For details, see "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1).

2.2 Design Measurement Contents

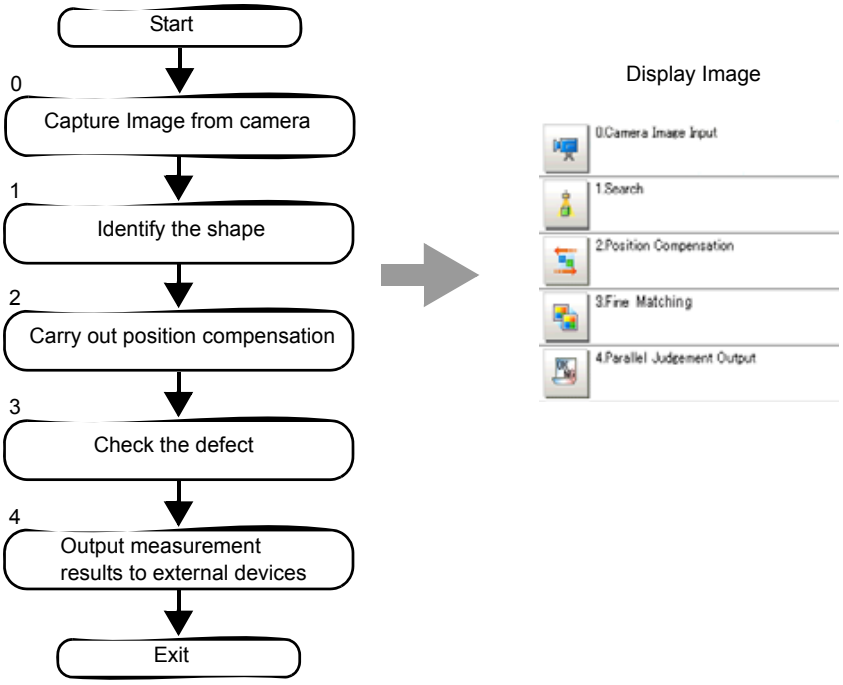
A wide range of measurement objects and corresponding Processing items are available in this product. By combining these Processing items, measurement for different purposes can be implemented.
This combinations of Processing items are called as "Scene". You can prepare many scenes beforehand, so as to toggle between scenes easily and change measurement contents.



Contents of Scene

You can create a scene by combining Processing items like a flow diagram.
A processing item registered in a scene is called a "processing unit", and processing units in a scene are sequentially numbered (processing unit No.) from zero in the order of registration. When executing measurement, the processing items that have been set are executed in the sequence of processing unit. No.

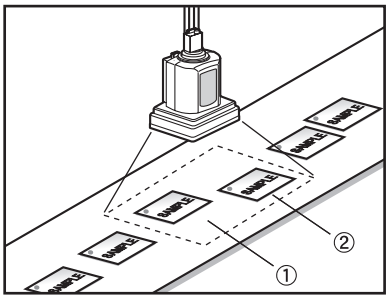
For details, see"4.5 Selecting a Processing Item" (→pg.21).

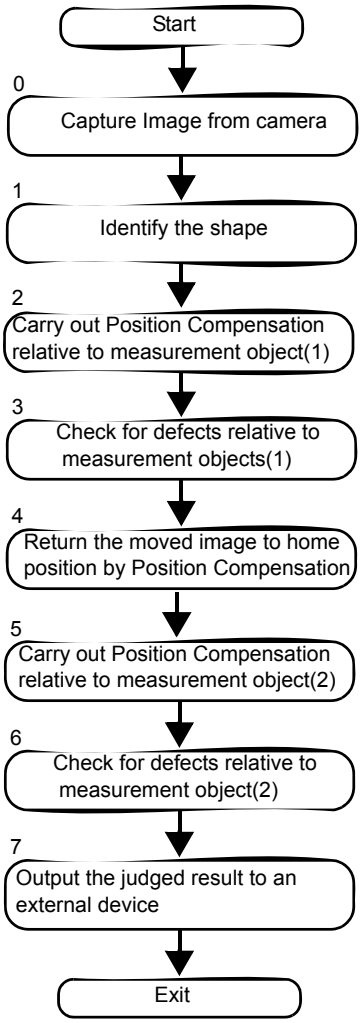


POINT

- By default, Unit 0 has a processing item [Camera image input], which corresponds to the dimension.
  - For the FZ2 series, [Camera Image Input]
  - For the FZD series, [3D Camera Image Input]

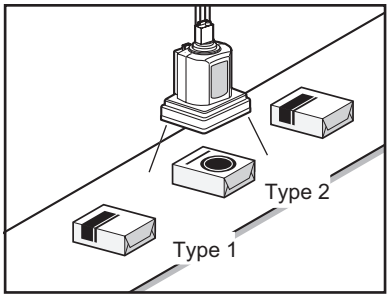
Example) When adding Position Compensation for two measurement objects in the same Sight

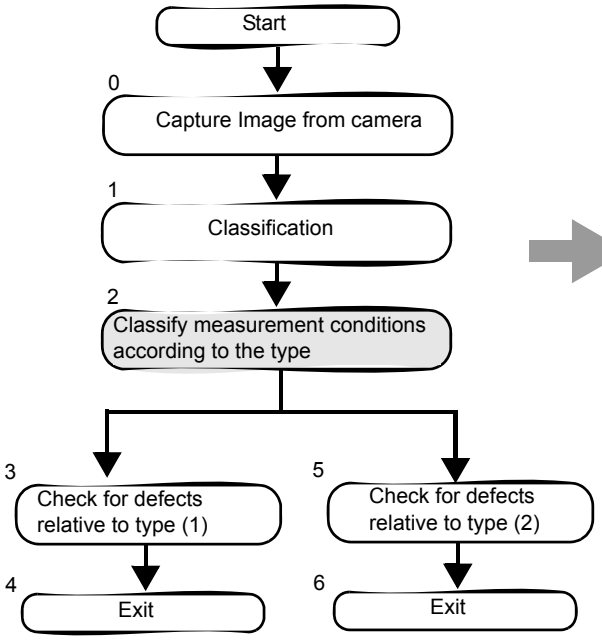




Display Image

Example) When judging the type and classifying measurement conditions according to images (branch processing)





Display Image

3

Chapter 3 - Preparation

This chapter describes the preparations prior to fine-tuning of camera, etc.

3.1 Verifying Items 2
3.2 Preparing Controllers 4
3.3 Adjusting Camera 5

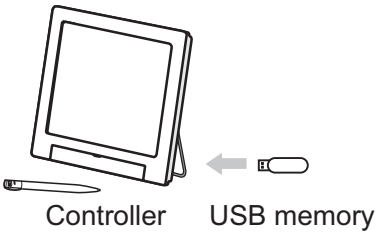
3.1 Verifying Items

This product can operate with a single controller, or is connected to external devices.

3.1.1 Verifying Configurations

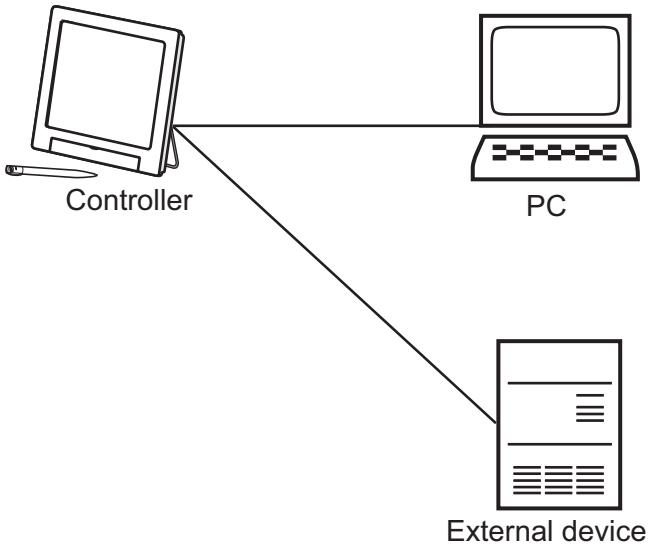
Configuration 1: Used on 1 Controller

USB memory is used to Save back-up data into PC.



Configuration 2: Connect Controller and External Devices

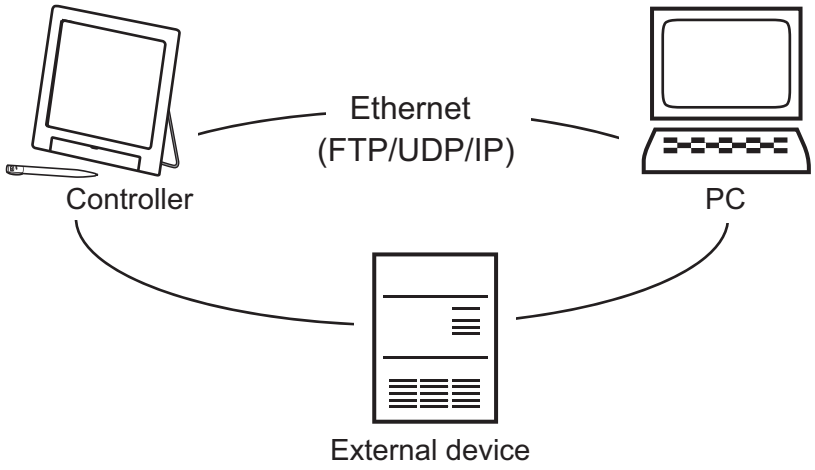
PC is connected to external devices via RS-232C/422 or parallel cables.
External devices allow measurement command input, or measurement results acquisition.
For details, see "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1).



Configuration 3: Connect Controller and External Devices to Ethernet

Where LAN is available, one controller and more than one PC can be connected to LAN.

Measurement commands can also be input from external devices.
In this case, setup should be made to the network.
For details, see "10.2 Ethernet Connection" (→pg.3).



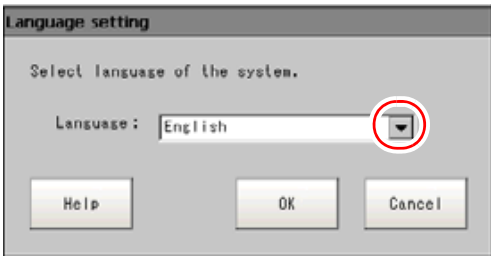
3.2 Preparing Controllers

No special preparation is required since some Processing items are preinstalled into this product. Please check if controller is switched on, and the Main screen is displayed.
For the details, see the User's Manual.

3.2.1 Language Selection

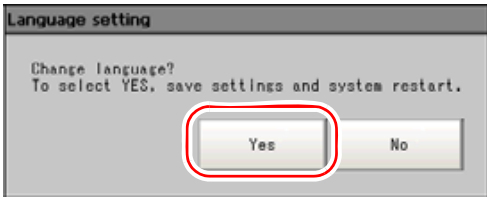
When a controller with factory defaults starts up, the Language Setting window is displayed. Information about the application software will be displayed in your selected language. Either "Japanese" or "English" can be selected.

1 In the Language Setting window, tap [▼] for "Language" and select a language.



2 Tap [OK].

3 Tap [Yes].



POINT

- The Language Setting window is displayed also when restarting after executing "System initialization".
- After changing the language setting, the system restarts automatically using the selected language. The message displayed immediately before the restart is in the language before the change.
- When starting up the controller first time, if a warning message, such as battery shortage and fan problem, appears before displaying the Language Setting window, the message is in Japanese.

3.3 Adjusting Camera

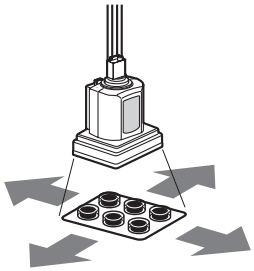
Confirm which images are taken.
Adjust the position of measurement objects and focal distance of lens.

1 In "Image view setting" of the "Control" area on the Main screen, tap [▼] for "Image mode" to select [Through].
The whole images captured from camera are viewed in the "Image display" area.

POINT

- An alternative operation: tap [View] - [Image mode] - [Through].

2 Adjust the position of measurement objects so that these objects are located at center of monitor.



Adjust the positions of objects to be measurement

3 Adjust focal distance of lens.
When using an auto-focus camera or an intelligent camera, the Focus and Iris can be automatically adjusted.
If CCTV lens are integrated into camera, please adjust focal distance by rotating focusing ring of lens.
" Lens Setting (When Connecting an Intelligent Camera or an Auto-focus Camera)" (→pg.16), of "Processing Items List Manual"

POINT

- Adjust light intensity of intelligent camera from the controller.
" Lighting Control" (→pg.11), of "Processing Items List Manual"

3.3.1 Intelligent Camera (with Lighting Function)

Proper lighting is of crucial importance to vision sensor.
If an intelligent camera with lighting function is connected, lighting can be controlled from a controller.
Features of an intelligent camera with lighting function are as follows:

- A single camera enables to test the illumination in various Angles, so it's possible to shorten the lighting setting time and measurement test time.
- With the Help of controller, lighting can be adjusted depending upon the variants.
- Improve reproductivity of lighting settings.
- Settings can be modified without needing to change lighting.

"1.1.4 [Screen Adjust (Camera Image Input)]" (→pg.11), of "Processing Items List Manual"

3.3.2 When Performing 3D Measurement

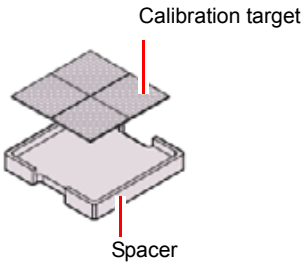
Coordinates from two cameras must be linked when performing 3D measurement. This operation is called "3D coordinate setting".

- When using all-in-one cameras
  When the distance between the measurement objects and the camera position is small (240 mm or less), the 3D measurement can be performed with all-in-one cameras. All-in-one cameras do not require specific settings since the 3D coordinate parameter was set at the factory.
  However, if the precision of measurement is not accurate, you may need to re-registrate the 3D coordinate parameter according to the installation environment.
- When using separate-type cameras
  When the distance between the measurement object and the camera position is big (more than 240 mm), use separate-type cameras. Separate-type cameras require the 3D coordinate setting.

3D Coordinate Registration

3D measurement is performed with a combination of two or three cameras. In order to accurately measure the height direction, the position of each camera must be accurately identified and the coordinates of two cameras must be linked. This procedure is referred to as "3D coordinate setting" and a custom calibration tool must be used. Please prepare a calibration tool beforehand.

Calibration tool



There are two methods for making a 3D coordinate setting:

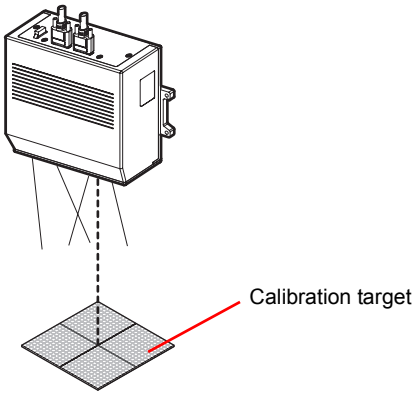
- Settings when the calibration target can be placed horizontally.
- Settings when the calibration target cannot be placed in horizontally.

Settings when the calibration target can be placed horizontally.

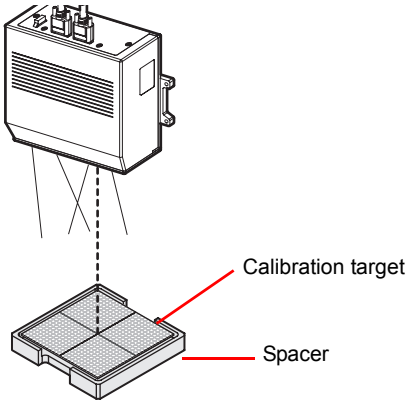
Take samples of the calibration target at 2 points, close and long distance from the camera. Set 3D coordinates by registering each position.

For the operations, see " Measurement when the Measured Object can be Placed Horizontally" (→pg.35), of "Processing Items List Manual".

Sampling an object far from the camera



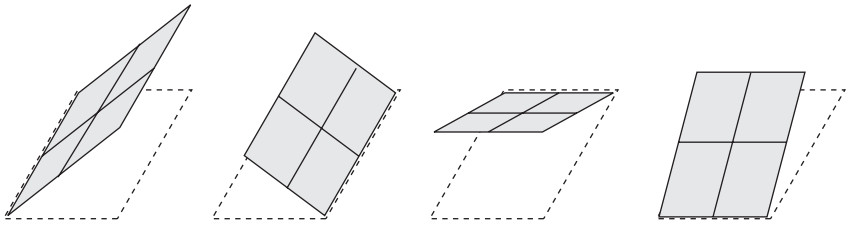
Sampling an object close to the camera



Settings when the calibration target cannot be placed horizontally.

Take samples at several points by moving the calibration targets up and down with different angles.
For the operations, see " Measurement when the Measured Object cannot be Placed Horizontally" (→pg.39), of "Processing Items List Manual".

Sampling with different angles



The dotted lines indicate the reference surface

4

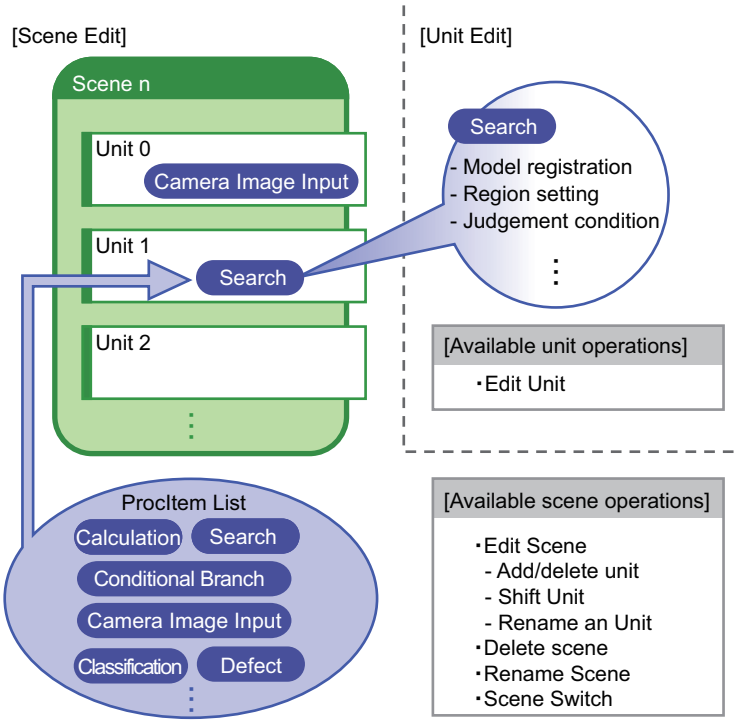
Chapter 4 - Setting up Scene (Measurement Flow)

A series of processes (measurement process) combined with Processing items are called as "Scene".

4.1	What is Scene	2
4.2	Creating a New Scene	4
4.3	Editing a Processing Unit in a Scene	7
4.4	Changing Steps (Scene Switch)	20
4.5	Selecting a Processing Item	21
4.6	Configuring Measurement	38
4.7	What is Scene Group	50
4.8	Edit Unit in a Scene Group	52
4.9	Editing Scene Group	57

4.1 What is Scene

It's required to create "scene" prior to measurement. This method enables to select Processing item from the prepared Processing item list and combine them like a flow chart.
For details, see "2.2 Design Measurement Contents" (→pg.4).



Scene

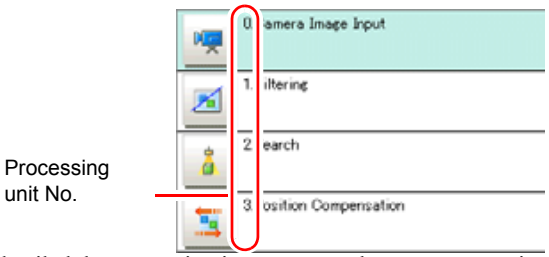
It's possible to create a scene after combining Processing item according to a flow chart. You also can create multiple scenes for switching.
E.g., "ABC" label is measurement with "Scene 0", "XYZ" label with "Scene 1". You can create scenes according to different measurement objects, only simple Scene switch is required when changing the measurement object.
In spite of variations of measurement objects and measurement contents, steps can be changed smoothly by scene switches simply.
Up to 32 scenes can be set. However, 32 scenes may not be fully employed due to insufficient memory. In case where over 32 scenes are required, they could be divided into some scene groups for management. For scene group, see "4.7 What is Scene Group" (→pg.50).

Processing Unit

The processing items registered to the scene are called "processing units".

Some Processing items are prepared in advance according to a variety of measurement objects and contents supported by this product. By combining Units freely according to measurement contents, scenes can be created for different purposes.

In the Edit Flow window to create a scene, a processing unit labeled "0. Camera Image Input" is displayed. The number at the beginning of processing unit is called a "processing unit No.". Whenever a processing unit is added to a scene, a new "processing unit No." is set.



The more detailed the processing items are set, the more appropriately the measurement is performed. The settings may differ from selected Processing items. For details, see " Processing Items List Manual" (→pg.1).

4.2 Creating a New Scene

This section describes how to create a new scene.
For how to edit scenes, see"4.3 Editing a Processing Unit in a Scene" (→pg.7). For the detailed settings of each processing unit added to a scene, see " Processing Items List Manual" (→pg.1).
This section explains how to add a new processing unit to a scene.

POINT

- There is a limit for the total number of [Camera Image Input] ([3D Camera Image Input]), [Camera Switching] ([3D Camera Switching]), [Position Compensation], [Filtering] and [Color Gray Filter] units. The available number of units varies depending on the combination of cameras. Use the following numbers as a reference:
  - FZ2-3xx Series
    FZ-SC: 22 units
    FZ-S: 68 units
  - FZ2-5xx Series
    FZ-SC2M: 13 units
    FZ-S2M: 39 units

  If the number exceeds the limit, measurement results in NG due to memory shortage.
  The number of [3D Camera Image Input] and [3D Camera Switching] are considered as the number of cameras to be used.
  Example) Using Camera 0+1 for [3D Camera Image Input] is equivalent to using 2 [Camera Image Input].
- For Unit 0, make sure to set one of the following:
  - [Camera Image Input]
  - [3D Camera Image Input] (only for FZD Series)

  *As for FZ2 Series, [Camera Image Input] is set in Unit 0 by default.

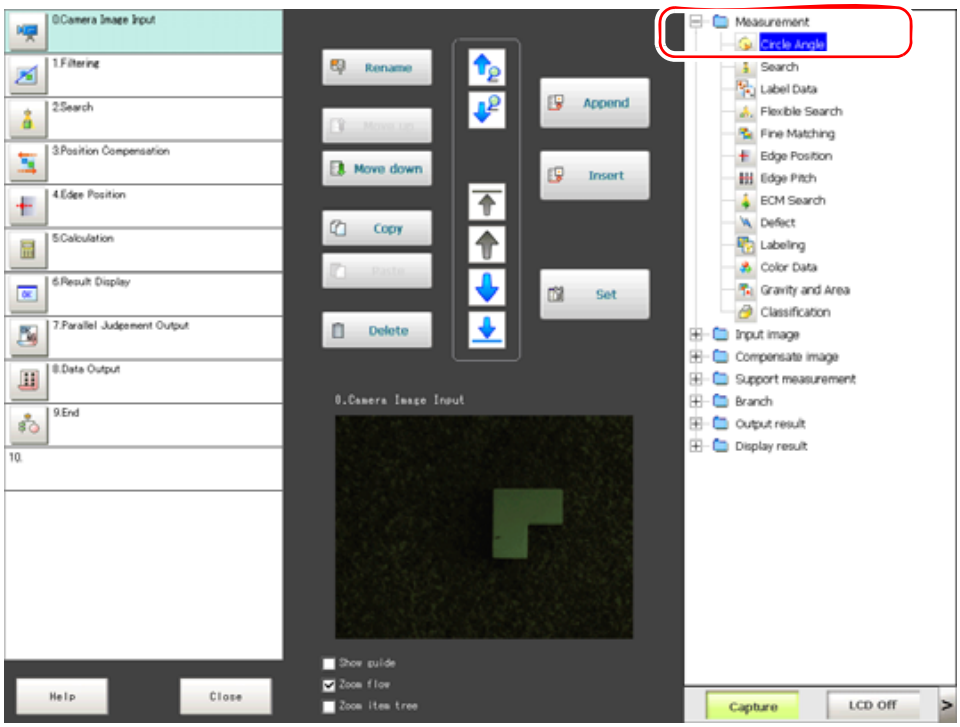
1 Display the scene to edit on the Main screen.
"4.4 Changing Steps (Scene Switch)" (→pg.20)

2 Tap "Edit flow" in Toolbar.

The Edit Flow window is displayed.
"1.2.3 Edit Flow Window" (→pg.9)

3 Select a processing item to be added from the processing item tree.

"1.2.3 Edit Flow Window" (→pg.9)



4 Tap [Append].

The selected processing item is appended at the bottom of the unit list (flow).

Important

When 2D and 3D measurement and used in a scene

- When 2D measurement and 3D measurement are performed within the same scene, insert a [camera switch] just before the processing item where the dimension changes.
  Example) When performing inspections using 3D Camera Image Input, 3D Edge Position, Defect, and 3D Height, create a flow as follows.
  0. 3D Camera Image Input (Camera 0+1)
  1. 3D Edge Position
  2. Camera Switching (Camera 0)
  3. Defect
  4. 3D Camera Switching (Camera 2+3)
  5. 3D Height

When three cameras are used for 3D measurement

- 3D measurement with three cameras does not allow 3D Camera Switching.
  Switch a camera (camera0) before the 3D measurement.
  Example) When performing inspections using 3D Camera Image Input (Using Camera 0+1+2), 3D Edge Position, Defect, and 3D Height, create a flow as follows.
  0. 3D Camera Image Input (Camera 0+1+2)
  1. 3D Edge Position
  2. Camera Switching (Camera 3)
  3. Defect
  4. 3D Camera Switching (Camera 0)
  5. 3D Height

5 Set details for the processing unit.

Select a processing unit to set and tap [Set].

ProcItem setting button

The ProcItem Setting window for the processing unit is displayed.

For details, see " Processing Items List Manual" (→pg.1).

POINT

- The ProcItem Setting window can also be displayed by tapping the ProcItem Setting button for the processing unit to be set.

6 Continue to add processing units. Repeat the steps after 3.

For moving, deleting, or copying processing units in a scene, see "4.3 Editing a Processing Unit in a Scene" (→pg.7) below.

4.3 Editing a Processing Unit in a Scene

This section explains how to rearrange the unit order or how to delete processing units in a scene in the Edit Flow window.

1 Display the scene to edit on the Main screen.

"4.4 Changing Steps (Scene Switch)" (→pg.20)

2 Tap [Edit flow] in the Toolbar.

The Edit Flow window is displayed.

"1.2.3 Edit Flow Window" (→pg.9)

3 Edit the processing unit.

- "4.3.1 Selecting the Processing Unit to Edit" (→pg.7)
- "4.3.2 Appending a Processing Unit at the Bottom" (→pg.11)
- "4.3.3 Inserting a Processing Unit" (→pg.12)
- "4.3.4 Renaming a Processing Unit" (→pg.14)
- "4.3.5 Setting Details of a Processing Unit" (→pg.15)
- "4.3.6 Moving a Processing Unit" (→pg.16)
- "4.3.7 Copying and Pasting a Processing Unit" (→pg.17)
- "4.3.8 Deleting a Unit" (→pg.18)

4.3.1 Selecting the Processing Unit to Edit

This section explains how to select a processing unit to edit from the unit list in the Edit Flow window.

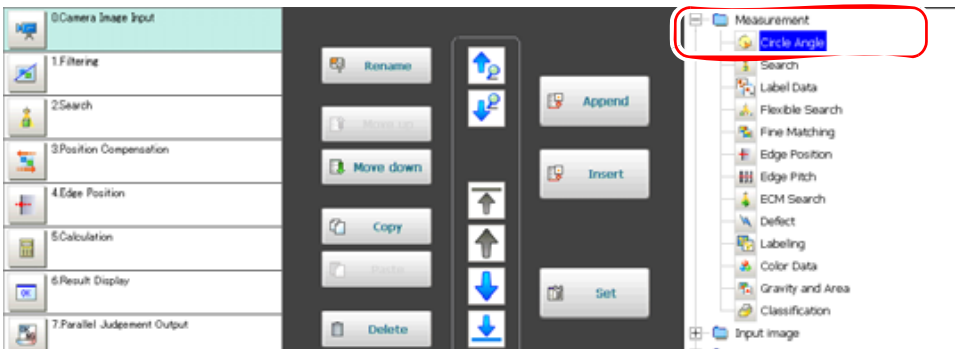
- When the needed processing unit is displayed in the list:
  Directly tap the desired processing unit. The tapped processing unit is selected and the background color of the processing unit name changes.
- When the needed processing unit is not displayed in the list:
  By using one of the following procedures, you can select a processing unit not displayed in the list.

  - " Selecting a Processing Unit by Searching for a Processing Item" (→pg.8)
  - " Selecting the Processing Unit at the Top or Bottom" (→pg.9)
  - " Selecting the Processing Unit above or below the Currently Selected Processing Unit" (→pg.10)

Selecting a Processing Unit by Searching for a Processing Item

You can search the unit list for a processing item of the same type as the one selected in the processing item tree.

1 Select a processing item you want to search from the processing item tree in the Edit Flow window.



2 Select any processing unit in the unit list, and tap [Search up] ( ) or [Search down] ( ).

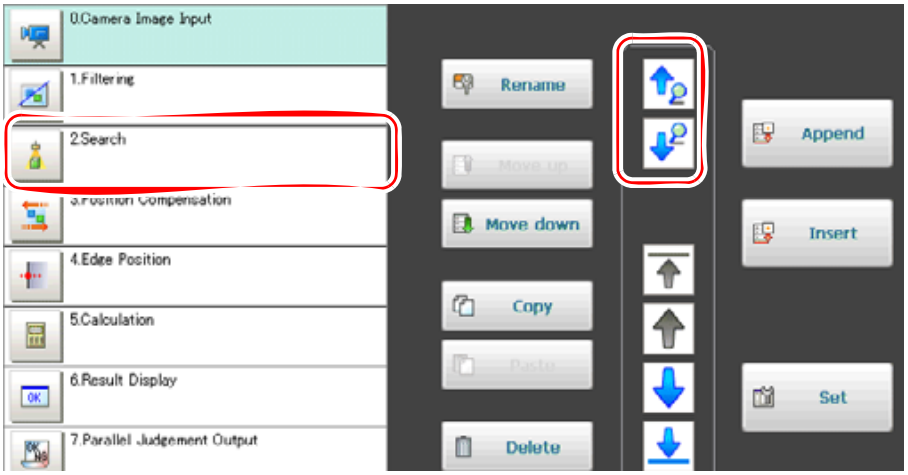


Table: Searching a Processing Unit

Button	Description
Search up ( )	Searches processing units above the position of the currently selected unit. If a processing unit contains the searched processing item, that processing unit is selected. If no units contain the item, the current unit remains selected.
Search down ( )	Searches processing units below the position of the currently selected unit. If a processing unit contains the searched processing item, that processing unit is selected. If no units contain the item, the current unit remains selected.

Selecting the Processing Unit at the Top or Bottom

Selects the processing unit at the top or bottom of the flow.

1 In the unit list, tap [Select top] ( ) or [Select bottom] ( ).

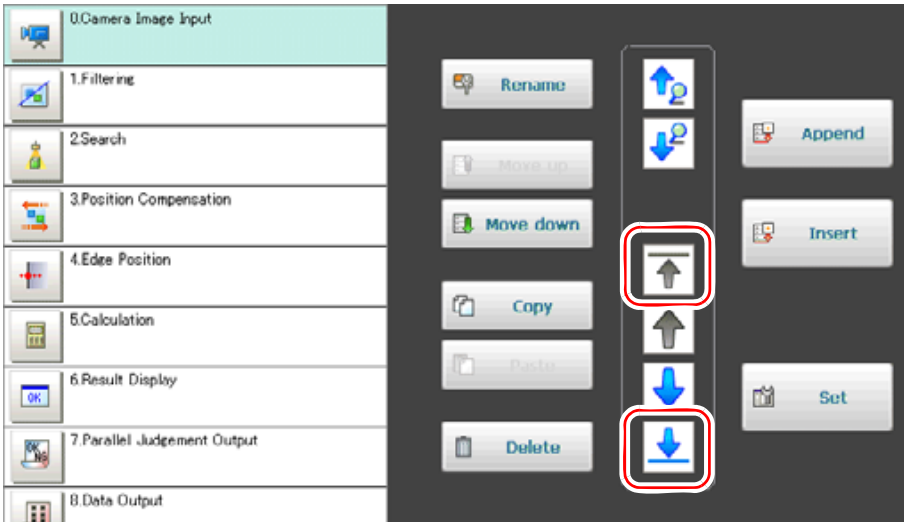


Table: Processing Unit Selection Buttons

Button	Description
Select top ( )	Selects the processing unit at the top of the unit list.
Select bottom ( )	Selects the processing unit at the bottom of the unit list.

Selecting the Processing Unit above or below the Currently Selected Processing Unit

Selects the processing unit located one above or one below the currently selected processing unit.

1 Tap any processing unit in the unit list, and then tap [Select above] ( ) or [Select below] ( ).

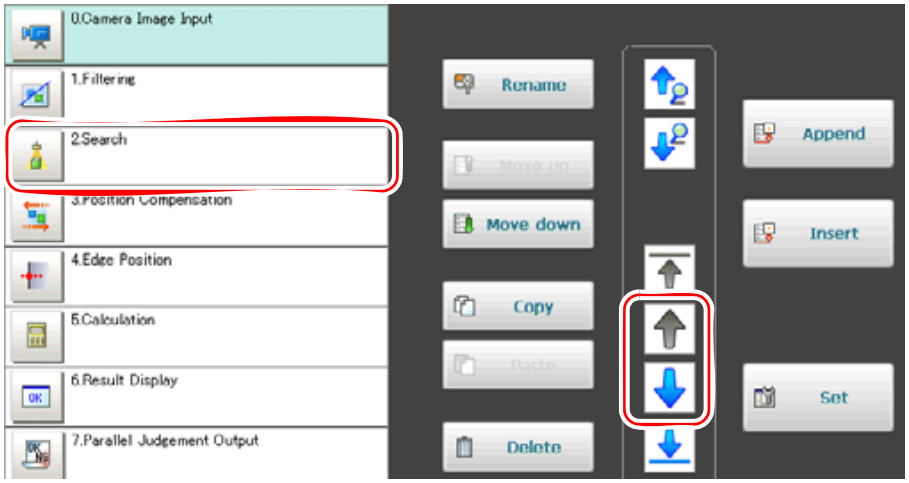


Table: Processing Unit Selection Buttons

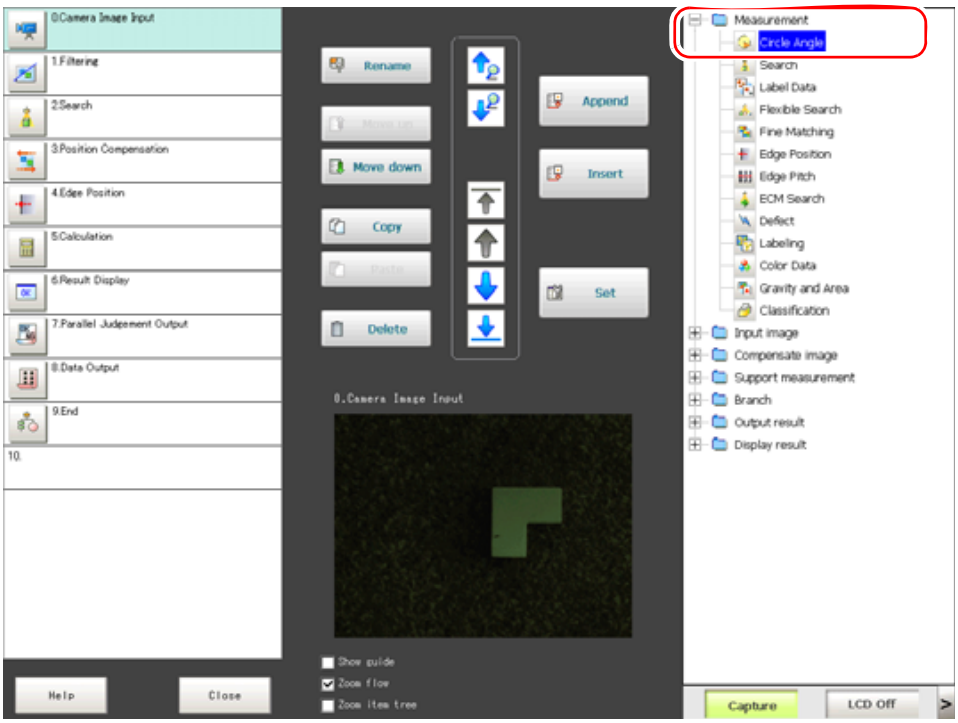
Button	Description
Select above ( )	Selects the processing unit one above the currently selected unit. For each tap, the selection moves upward by one unit. By holding the button down, the selection sequentially moves upward.
Select below ( )	Selects the processing unit one below the currently selected unit. For each tap, the selection moves downward by one unit. By holding the button down, the selection sequentially moves downward.

4.3.2 Appending a Processing Unit at the Bottom

You can append a processing unit at the bottom of the flow.

1 In the Edit Flow window, select a processing item to be added.

"1.2.3 Edit Flow Window" (→pg.9)



2 Tap [Append].

The selected processing item is appended at the bottom of the flow.

4.3.3 Inserting a Processing Unit

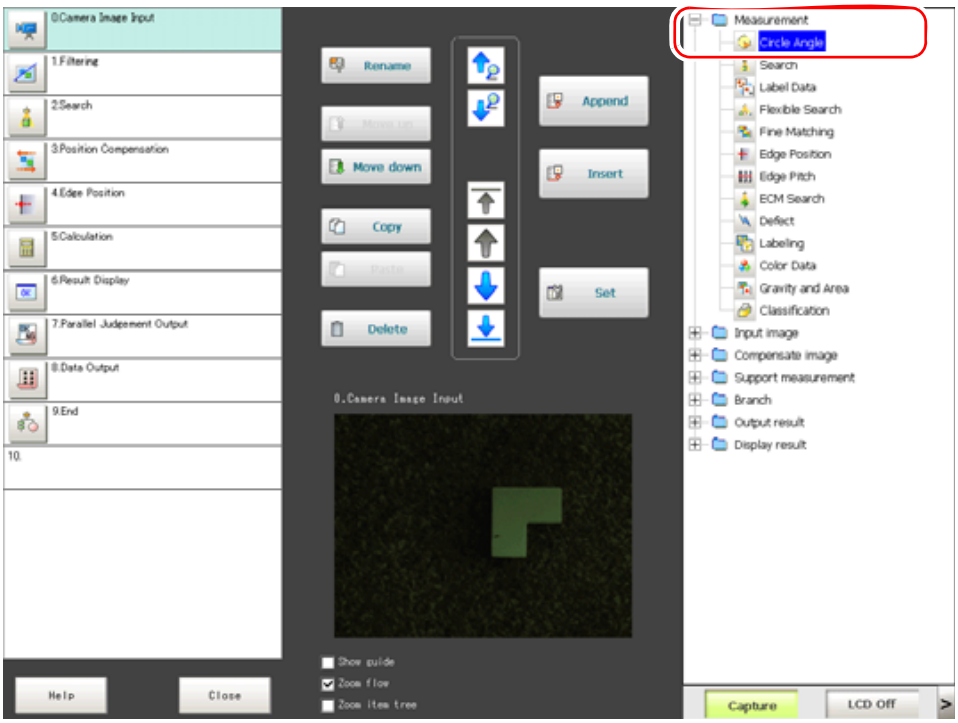
You can insert a processing unit at any position in a scene.

POINT

- If a processing unit is inserted, the number of the processing units below is incremented by one. The processing unit numbers, referred to in result-outputting or branch control processing items, are also incremented automatically.

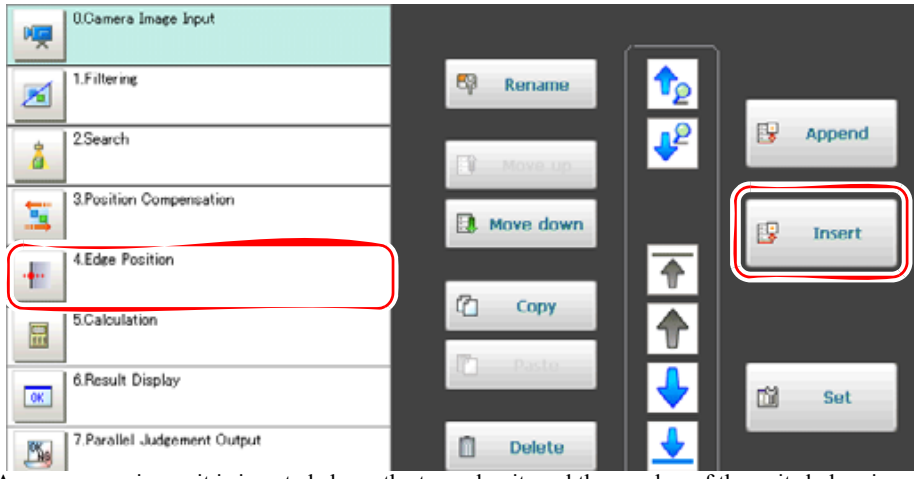
1 In the Edit Flow window, select a processing item to be added.

"1.2.3 Edit Flow Window" (→pg.9)

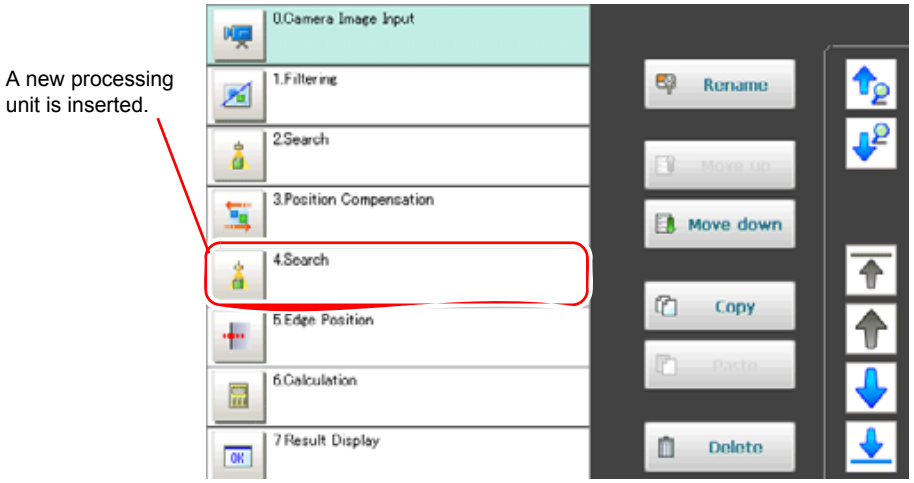


2 Tap the processing unit below the position you want to insert a processing item, and tap [Insert].

(When inserting between processing unit 3 and processing unit 4)



A new processing unit is inserted above the tapped unit, and the number of the units below is incremented by one.

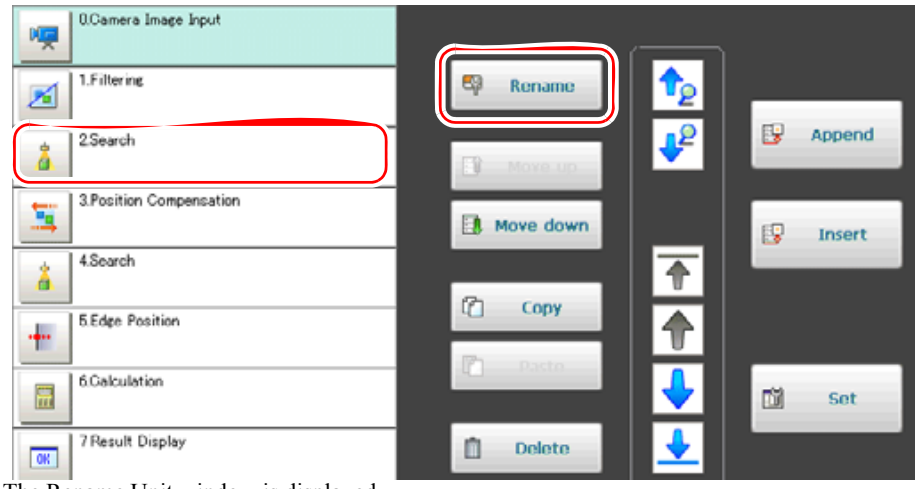


4.3.4 Renaming a Processing Unit

You can rename a processing unit with any name. By factory default, the processing unit's name is the same as the processing item's name.

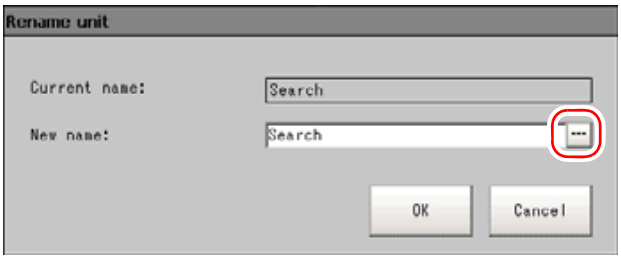
It is meaningful to rename a processing unit when there are multiple processing items of the same type in a scene. In addition, you can easily find a target processing unit when specifying the unit to be processed with items such as [Calculation] and [Get Unit Data].

1 In the Edit Flow window, select a processing unit you want to rename, and tap [Rename].



The Rename Unit window is displayed.

2 Tap [...] for "New name" and input any processing unit name.



The Soft keyboard is displayed.

Up to 31 letters can be used for a processing unit name.

How to input text: "1.5 Inputting a Text" (→pg.19)

3 Tap [OK].

The Rename Unit window closes and the processing unit is renamed.

4.3.5 Setting Details of a Processing Unit

You can set the details for processing units (the ProcItem setting).

1 In the Edit Flow window, select the processing unit to set the ProceItem settings and tap [Set].

ProcItem setting button

The ProcItem Setting window for the processing unit is displayed.

For details, see " Processing Items List Manual" (→pg.1).

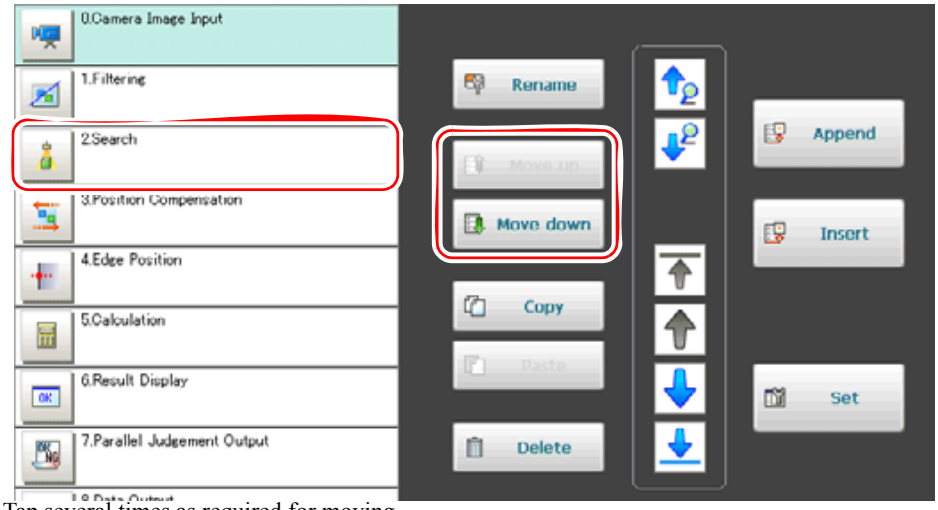
POINT

- The ProcItem Setting window can also be displayed by tapping the ProcItem Setting button for the processing unit to be set.

4.3.6 Moving a Processing Unit

You can change the running order of processing units.

1 Select a processing unit you want to move in the Edit Flow window and tap [Move up] or [Move down].



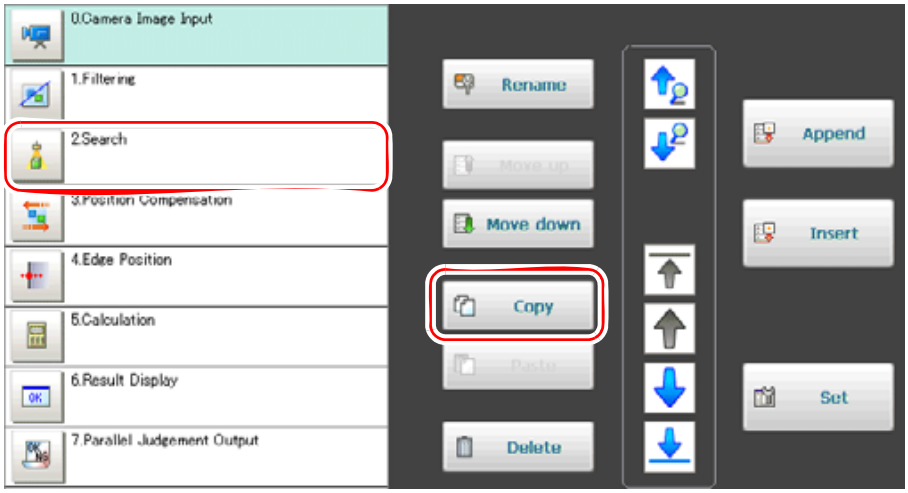
Tap several times as required for moving.

As the processing unit moves, its number also changes.

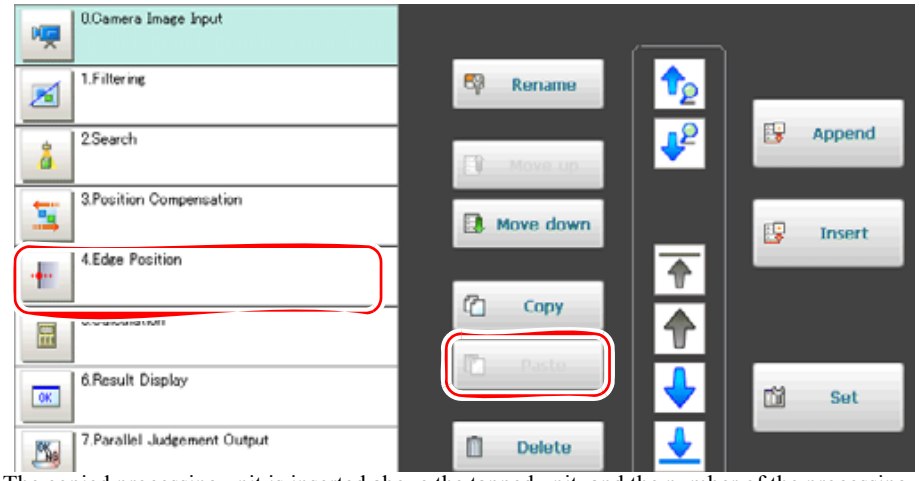
4.3.7 Copying and Pasting a Processing Unit

Since setting data can be maintained for copying, some of settings can be easily changed.

1 In the Edit Flow window, select a processing unit to be copied and tap [Copy].

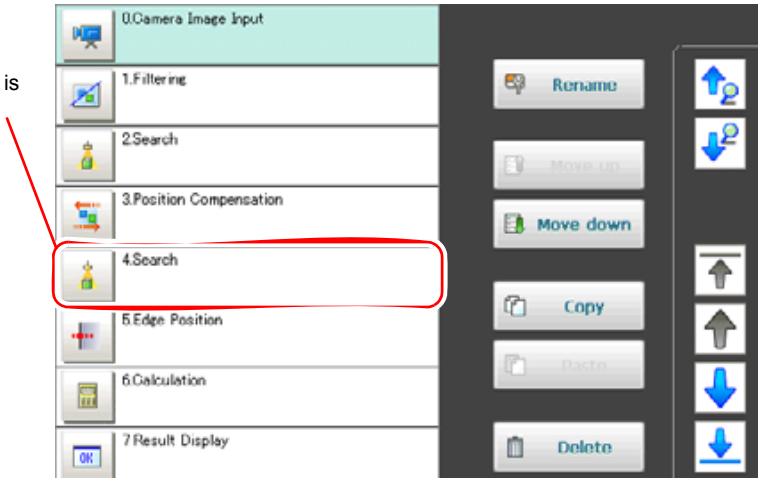


2 Tap the processing unit below the position you want to paste a unit and tap [Paste].



The copied processing unit is inserted above the tapped unit, and the number of the processing units below is incremented by one.

The copied processing unit is inserted.



POINT

- Repeat Step 2 to paste the unit continuously. However, if you tap a button other than [Paste], you cannot continue to repeat the pasting action at a later time.

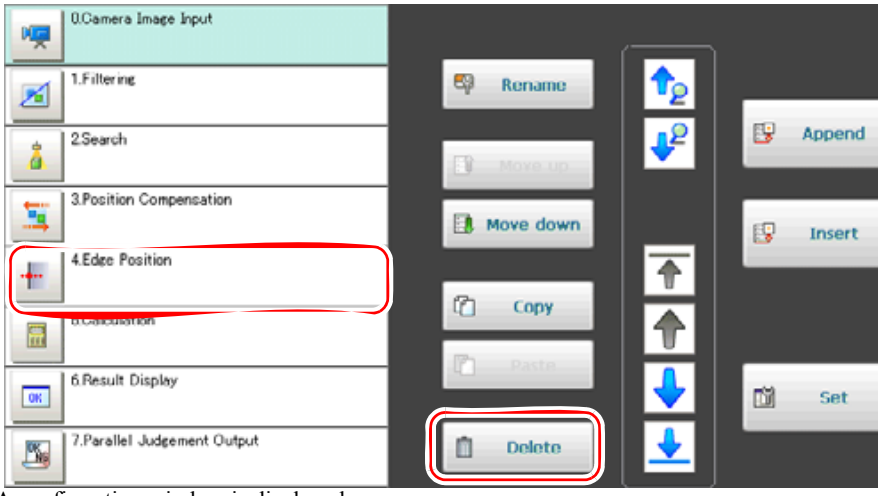
4.3.8 Deleting a Unit

Deletes any unit in a scene.

POINT

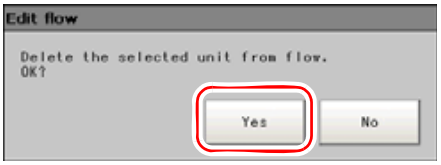
- If a processing unit is deleted, the number of the processing units below is decremented by one. The processing unit numbers, referred to in result-outputting or branch control processing items, are also decremented automatically.

1 Select a processing unit to be deleted in the Edit Flow window and tap [Delete].



A confirmation window is displayed.

2 Tap [Yes].



The selected processing unit is deleted, and the number of the processing units below is decremented by one.

4.4 Changing Steps (Scene Switch)

Change steps by scene switch. Factory setting is defaulted to View Scene 0 after switching on. In addition, it's possible to create multiple scenes (Scene 1 to 31).

Up to 1024 scenes can be set with scene group function.
You can also specify to switch scene group and scenes from external devices.
"Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1)

Important

When using scene group function

- This function can not be enabled until USB memory saved with scene group data is inserted.
- And this USB memory must be assigned with a Drive name "USBDisk".
  When any USB memories other than the USB memory with scene group data to be used have been inserted, remove them all. Then, only insert USB memory with scene group data, and execute the operation shown below.
  " About the Drive Name of USB Memory" (→pg.5)

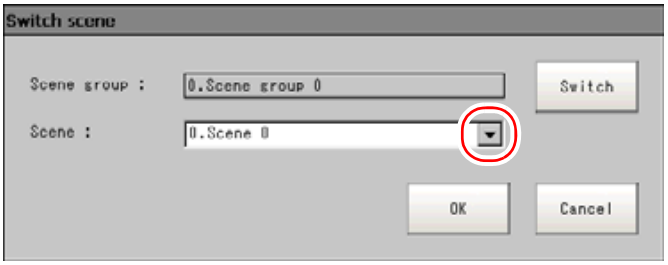
1 Tap "Scene Switch" in Toolbar on the Main screen.

The Switch Scene window is displayed.

POINT

- The same operation is available by tapping [Scene] menu - [Switch scene].

2 Tap [▼], select scenes to be replaced.



To switch the scene group, tap [Switch], then tap [▼] in the displayed window to select a scene group to be switched to.

3 Tap [OK].

The scene switches.

4.5 Selecting a Processing Item

Comprehensive Processing Items for measurement are available in this product. The application-oriented measurement can be configured by combining Processing Items or changing the settings of Processing Items.

This section describes Processing Items used for target measurement.

- "4.5.1 Selecting Measurement Processing Items with Chart" (→pg.21)
- "4.5.2 Selecting Measurement Processing Item by Measurement Way and Purpose" (→pg.31)
- "4.5.3 Selecting Measurement Processing Item from List" (→pg.36)

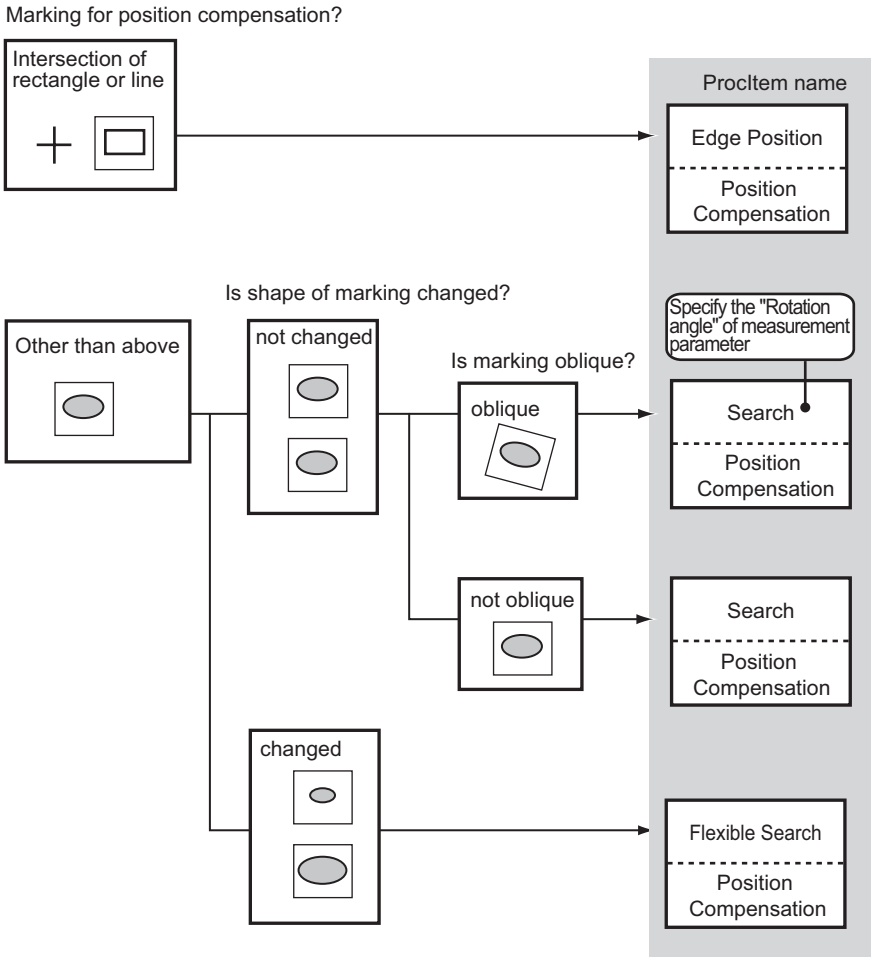
4.5.1 Selecting Measurement Processing Items with Chart

Select application-oriented Processing Items with a chart.

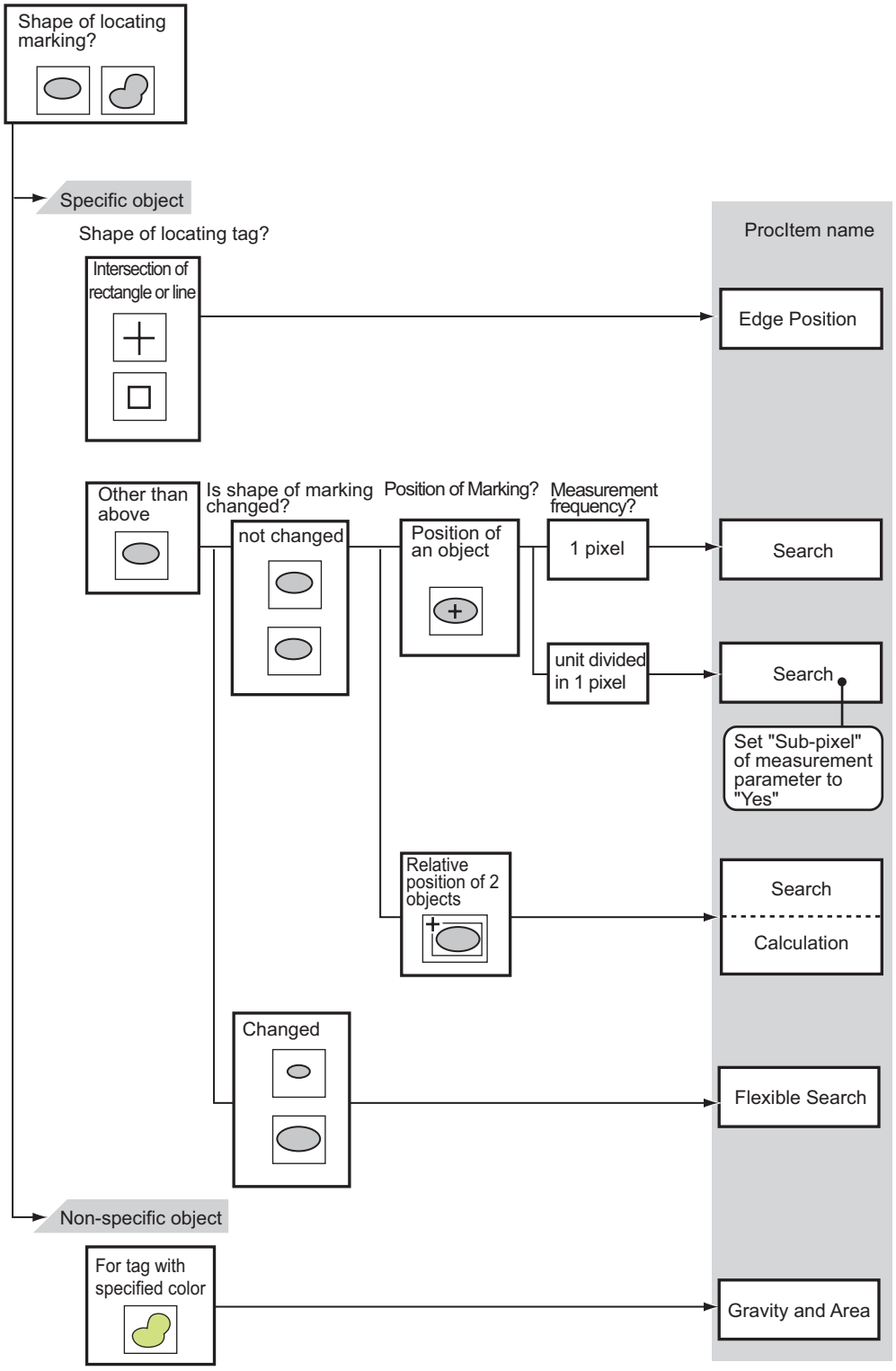
Table: Chart List

Item	see
Correct the position deflection of measurement objects	" Correct Position Deflection" (→pg.22)
Measure the location of measurement objects	" Locating (Measurement Objects Not Inclined)" (→pg.23) " Locating (Measurement Objects Inclined)" (→pg.24)
Measure the states of measurement objects	" Internal and External Measurement" (→pg.25) " Presence Measurement" (→pg.26) " Dimension Measurement/Measurement" (→pg.27) " Text Comparison/Measurement" (→pg.28) " Quantity Measurement/Measurement" (→pg.29)
Check for the NG products	" Defects Measurement" (→pg.29) " Burr Measurement" (→pg.27) " Mixing Measurement" (→pg.30)
Measure in 3D	" Measuring Height (3D)" (→pg.30) " Measuring Position of Holes (3D)" (→pg.31)

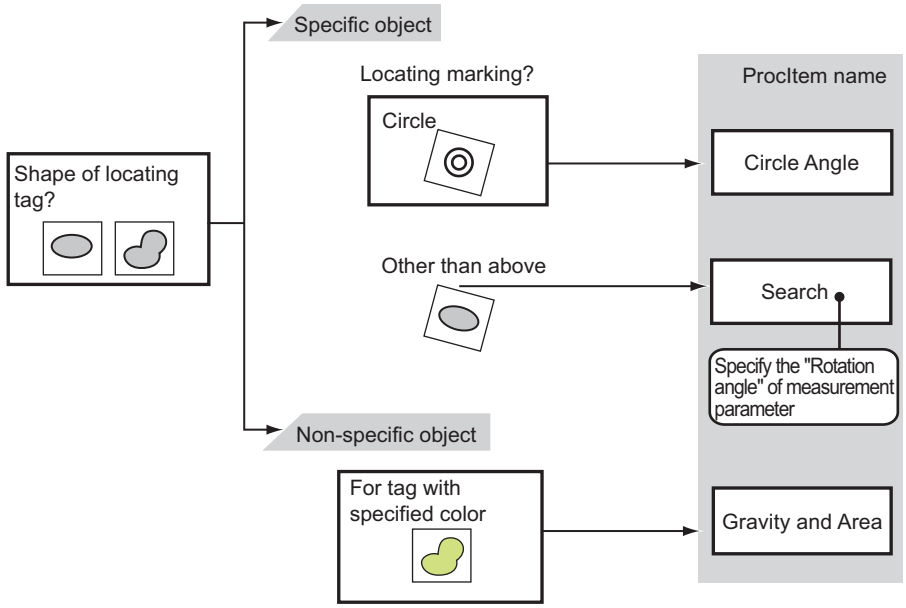
Correct Position Deflection



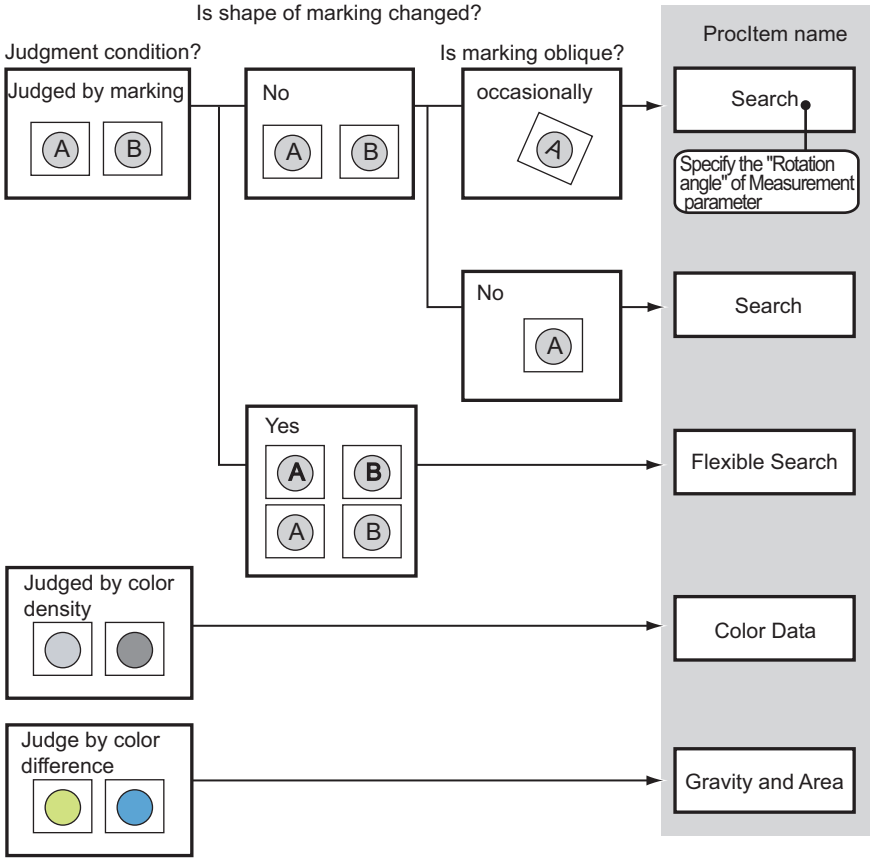
Locating (Measurement Objects Not Inclined)



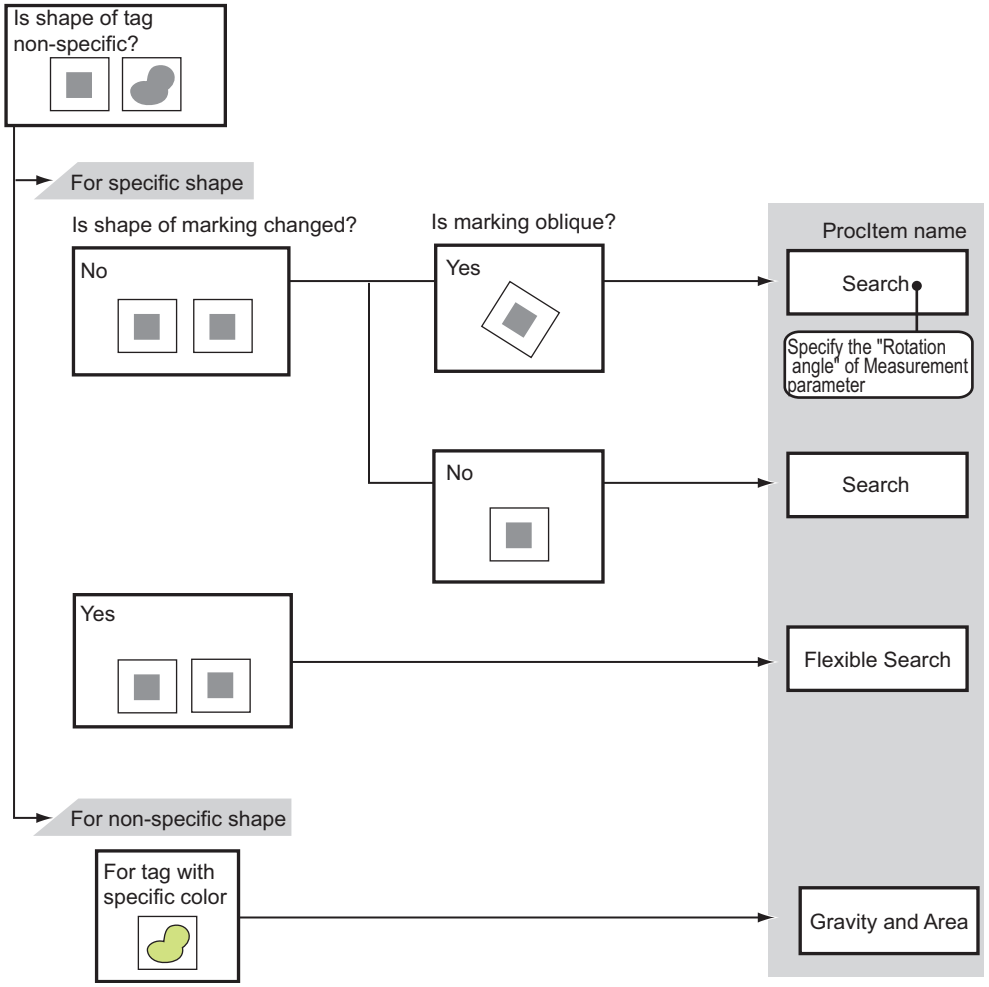
Locating (Measurement Objects Inclined)



Internal and External Measurement



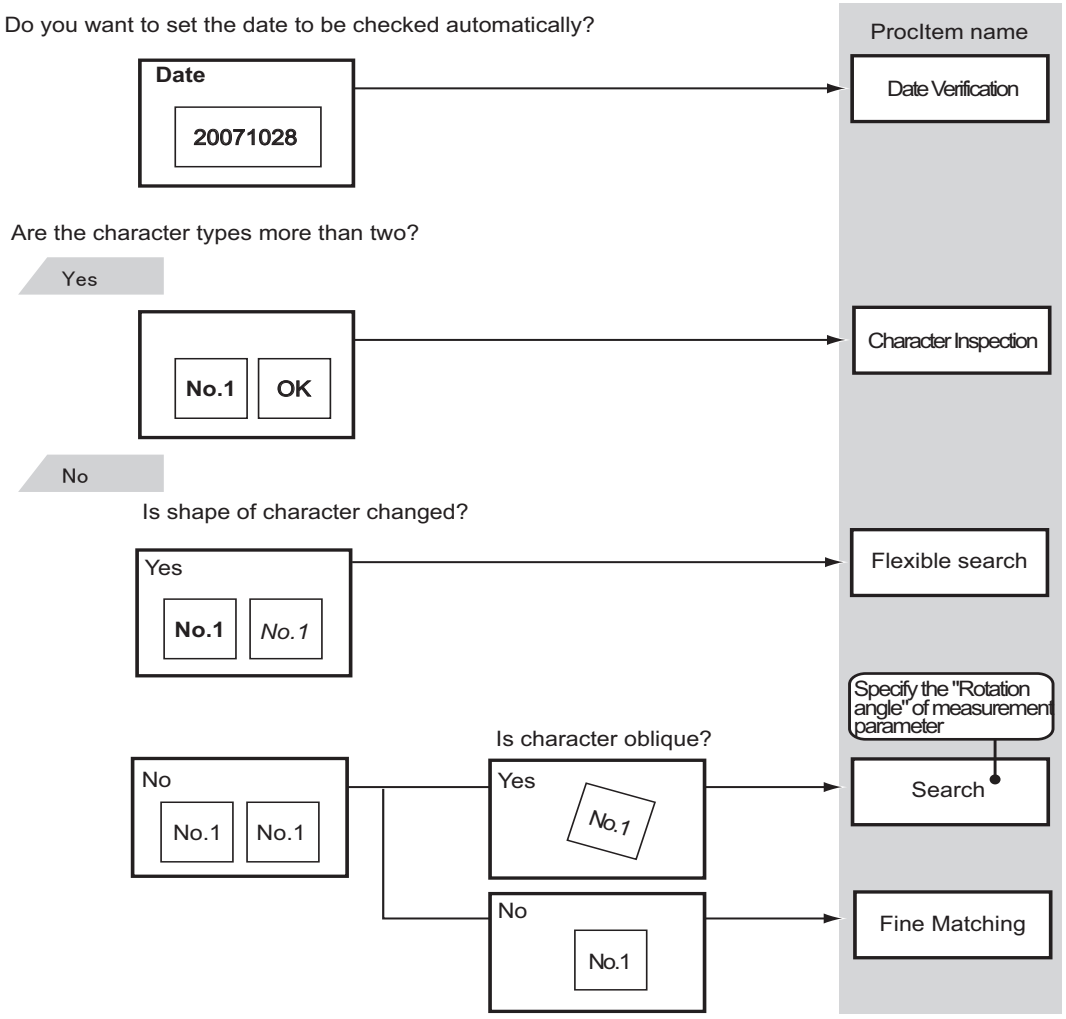
Presence Measurement



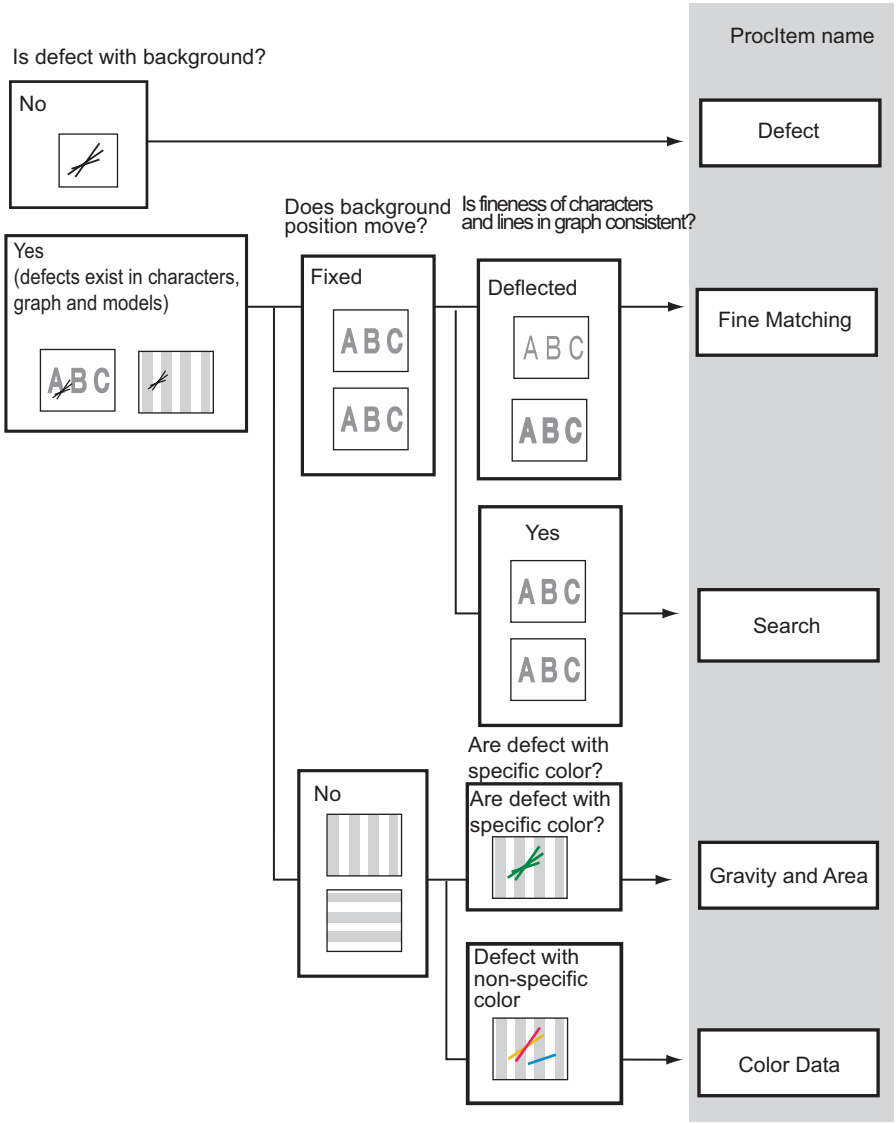
Dimension Measurement/Measurement

Burr Measurement

Text Comparison/Measurement

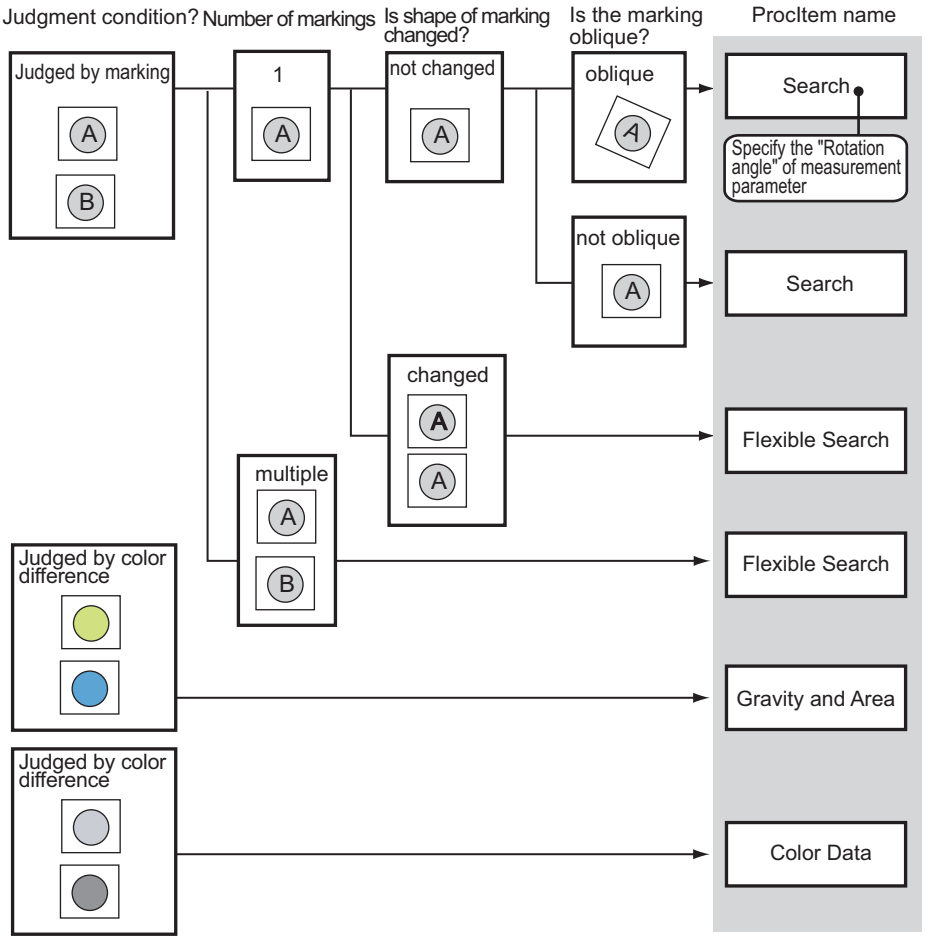


Defects Measurement

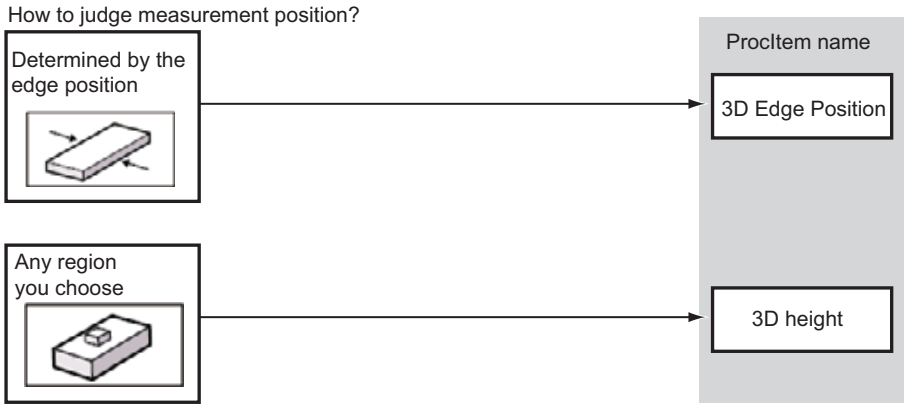


Quantity Measurement/Measurement

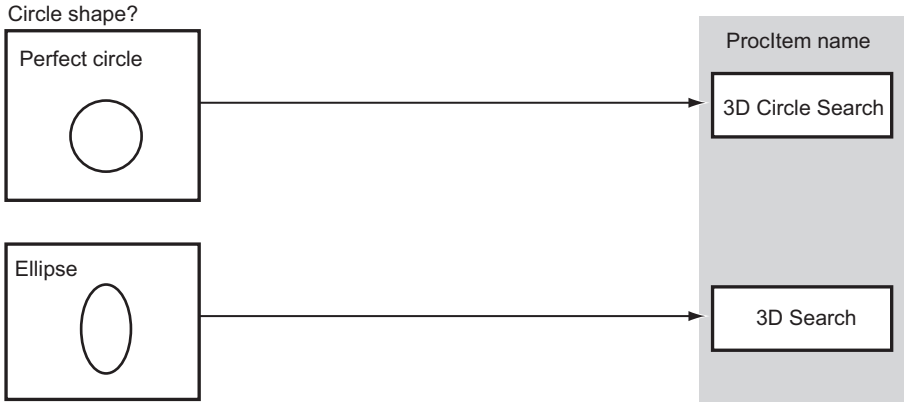
Mixing Measurement



Measuring Height (3D)



Measuring Position of Holes (3D)



4.5.2 Selecting Measurement Processing Item by Measurement Way and Purpose

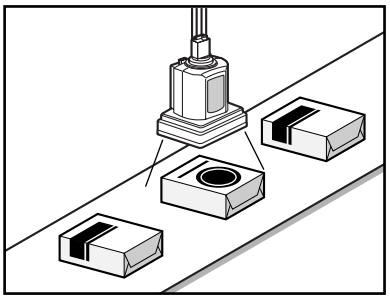
This section describes how to check the counted number, and verify if there is deformation and stain, etc, using proper methods.

- " Measure Position" (→pg.31)
- " Measuring Positions (3D)" (→pg.32)
- " Measure Defect and Foreign Materials" (→pg.32)
- " Count" (→pg.33)
- " Measure Size" (→pg.33)
- " Measure Folding of Paper and Sheet" (→pg.34)
- " Measure Interior/Exterior and Orientation" (→pg.34)
- " Measure Mixing of Variants" (→pg.35)
- " Measure Deformation" (→pg.35)
- " Inspecting Characters" (→pg.35)

Measure Position

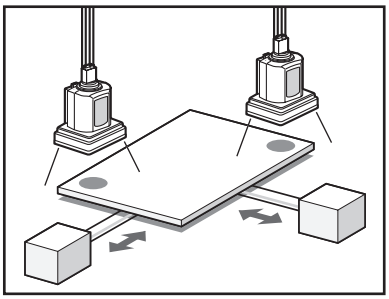
- Positioning of the objects with low contrast
  An [ECM Search] is an effective way to position the measured object with low contrast and vague difference in color inside the measured part (ex. LCD substrates, glass substrates, and sheets).
  "3.13 ECM Search" (→pg.60), of "Processing Items List Manual"
- Measure position of labels
  When measuring the deviation or absence of labels of bottles and tins, [Edge Position] is effective.
  "3.4 Edge Position" (→pg.1), of "Processing Items List Manual"
- Locate robot arms
  When measuring the oblique position of measurement objects with the robot arms, [Search] is effective.
  "3.2 Search" (→pg.1), of "Processing Items List Manual"

- Measure the position of uneven objects
  When measuring the oblique position of measurement objects with the robot arms, [Search] is effective.
  "3.3 Flexible Search" (→pg.1), of "Processing Items List Manual"



Position measurement

- Other locating
  If the shape and background of measurement objects are fixed, the searched Processing Items, similar to [Search] after pattern registration, is effective.
  "3.2 Search" (→pg.1), of "Processing Items List Manual"



Locating of reference mark of base plate

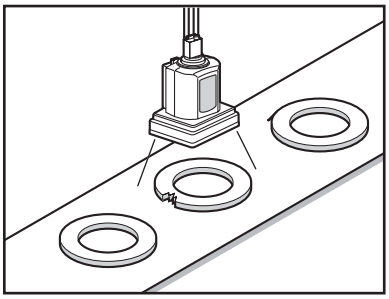
Measuring Positions (3D)

- Measuring door gaps or level difference
  When measuring the gap and level differences of assembled materials, [3D Edge Position] is effective.
  "3.19 3D Edge Position" (→pg.158), of "Processing Items List Manual"
- Detecting positions of holes
  When measuring the position of elliptical holes on mechanical components, [3D Search] is effective.
  "3.20 3D Search" (→pg.178), of "Processing Items List Manual"
- Measuring heights
  When measuring the heights of objects, [3D Height] is effective.
  "3.22 3D Height" (→pg.212), of "Processing Items List Manual"

Measure Defect and Foreign Materials

- Check the defect, stain and spot of plain measurement objects
  When measuring the defects and spots of plain background, [Defect] is effective.
  "3.6 Defect" (→pg.1), of "Processing Items List Manual"

- Scratch , burr
  When measuring the scratch and burr of parts, [Defect] is effective.
  "3.6 Defect" (→pg.1), of "Processing Items List Manual"

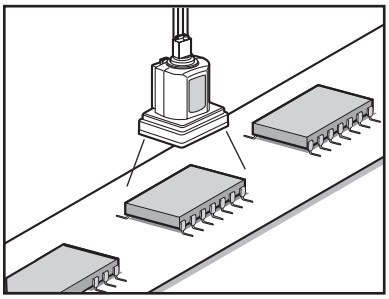


Defect/Burr measurement

- Measurement other than minor scratch, stain and plain background
  When measuring minor defect and stain of labels, etc, [Fine Matching] is effective.
  "3.7 Fine Matching" (→pg.1), of "Processing Items List Manual"

Count

- Measurement of the number of PIN
  When calculating number of pins of ICs and connectors, [Edge Pitch] is effective.
  "3.5 Edge Pitch" (→pg.1), of "Processing Items List Manual"



Measuring number of IC pins

Measure Size

- Measure width of objects
  When measuring width of objects, [Edge Position] is effective.
  "3.4 Edge Position" (→pg.1), of "Processing Items List Manual"
- Measure dimensions of finished products
  When measuring dimensions of finished products, combine [Edge Position] and [Expression].
  Use [Edge Position] to measure position, and [Expression] to calculate the spacing of positions and then the dimensions.
  "3.4 Edge Position" (→pg.1), of "Processing Items List Manual"

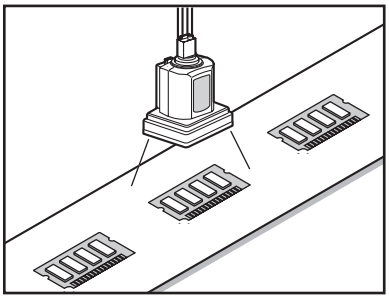
- Measure dimensions of circle and oblique parts
  When measuring the dimensions of circle work pieces and oblique objects, [Edge Position] is effective.
  Use this Processing Item to measure position, [Expression] to calculate the spacing of positions and then the dimensions.
  "3.4 Edge Position" (→pg.1), of "Processing Items List Manual"

Measure Folding of Paper and Sheet

- Measure folding of plain objects
  When measuring the folding of plain work pieces, [Defect] is effective.
  "3.6 Defect" (→pg.1), of "Processing Items List Manual"

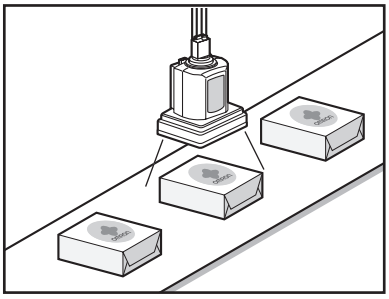
Measure Interior/Exterior and Orientation

- Measure interior/exterior and orientation according to the presence of markings
  When measuring orientation according to the presence of markings on objects, [Search] is effective.
  "3.2 Search" (→pg.1), of "Processing Items List Manual"



Measuring chip components

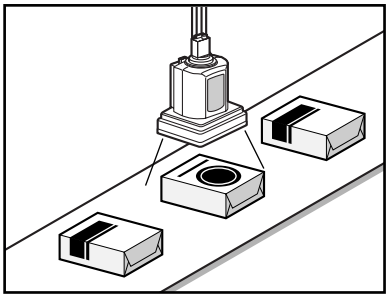
- When the size and position of markings are not even
  For this case, [Flexible Search] is effective.
  "3.3 Flexible Search" (→pg.1), of "Processing Items List Manual"
- When the marking shall be measurement accurately
  When there are decorations on background of markings, or complex shapes, or the markings shall be measurement accurately, [Fine Matching] is effective.
  "3.7 Fine Matching" (→pg.1), of "Processing Items List Manual"



Measuring LOG

Measure Mixing of Variants

- Measure mixing of variants into uneven measurement objects
  When measuring if the markings and uneven variants are mixed, [Flexible Search] is effective.
  "3.3 Flexible Search" (→pg.1), of "Processing Items List Manual"



Disparity judge

- Measure the mixing of variants with plain background
  When measuring the mixing of variants of complete equipments with plain background, [Search] is effective.
  "3.2 Search" (→pg.1), of "Processing Items List Manual"
- When mixing of variants shall be measurement accurately
  When mixing of variants other than nameplates and plain background shall be measurement accurately, [Fine Matching] is effective.
  "3.7 Fine Matching" (→pg.1), of "Processing Items List Manual"

Measure Deformation

- Deformation measurement for measurement objects with many OK shapes
  When measuring the deformation of objects with many OK shapes, [Flexible Search] is effective.
  "3.3 Flexible Search" (→pg.1), of "Processing Items List Manual"
- When measuring the shape more strictly
  When measuring the shape of work pieces with high precision, [Fine Matching] is effective.
  "3.7 Fine Matching" (→pg.1), of "Processing Items List Manual"

Inspecting Characters

- Inspecting date
  When inspecting character strings such as production date etc, [Date Verification] is effective. The date can be set automatically for verification.
  "3.16 Date Verification" (→pg.106), of "Processing Items List Manual"
- Inspecting character strings
  When inspecting arbitrary character strings, [Character Inspection] is effective.
  "3.14 Character Inspection" (→pg.82), of "Processing Items List Manual"
- Register character strings
  When inspecting character strings with [Date Verification] or [Character Inspection], the target character strings must be registered in [Model Dictionary].
  "3.15 Model Dictionary" (→pg.94), of "Processing Items List Manual"

4.5.3 Selecting Measurement Processing Item from List

Sets the details of the processing item registered in each processing unit.
For the settings and setting steps, see the description of Processing Items.

Table: Processing Item List

Classification	Processing Item Name (References)
Image Input	"1.1 Camera Image Input" (→pg.1)
	"1.2 Camera Switching" (→pg.1)
	"1.3 3D Camera Image Input" (→pg.3)
	"1.4 3D Camera Switching" (→pg.49)
Image Compensation	"2.1 Filtering" (→pg.2)
	"2.1 Position Compensation" (→pg.1)
	"2.2 Color Gray Filter" (→pg.8)
Measurement	"3.1 Color Data" (→pg.1)
	"3.2 Search" (→pg.1)
	"3.3 Flexible Search" (→pg.1)
	"3.4 Edge Position" (→pg.1)
	"3.5 Edge Pitch" (→pg.1)
	"3.6 Defect" (→pg.1)
	"3.7 Fine Matching" (→pg.1)
	"3.8 Circle Angle" (→pg.136)
	"3.9 Classification" (→pg.1)
	"3.10 Gravity and Area" (→pg.18)
	"3.11 Labeling" (→pg.34)
	"3.12 Label Data" (→pg.52)
	"3.13 ECM Search" (→pg.60)
	"3.14 Character Inspection" (→pg.82)
	"3.15 Model Dictionary" (→pg.94)
	"3.16 Date Verification" (→pg.106)
	"3.17 Scan Edge Position" (→pg.120)
	"3.18 Scan Edge Width" (→pg.142)
	"3.19 3D Edge Position" (→pg.158)
	"3.20 3D Search" (→pg.178)
	"3.21 3D Circle Search" (→pg.196)
	"3.22 3D Height" (→pg.212)

Table: Processing Item List

Classification	Processing Item Name (References)
Measurement Support	"4.1 Calculation" (→pg.1)
	"4.3 Set Unit Data" (→pg.1)
	"4.2 Get Unit Data" (→pg.1)
	"4.5 Elapsed Time" (→pg.1)
	"4.6 Wait" (→pg.1)
	"4.7 Trend Monitor" (→pg.1)
	"4.8 Data Logging" (→pg.15)
	"4.9 3D Calculation" (→pg.23)
Branch Control	"5.1 Conditional Branch" (→pg.1)
	"5.2 DI Branch" (→pg.1)
	"5.3 End" (→pg.1)
Result Output	"6.1 Parallel Judgement Output" (→pg.1)
	"6.2 Parallel Data Output" (→pg.1)
	"6.3 Data Output" (→pg.1)
Outputting Results on Screen	"7.1 Result Display" (→pg.1)
	"7.2 3D Result Display" (→pg.13)

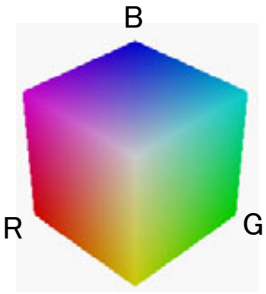
4.6 Configuring Measurement

This section describes how to configure the measurement according to the images acquired from cameras.

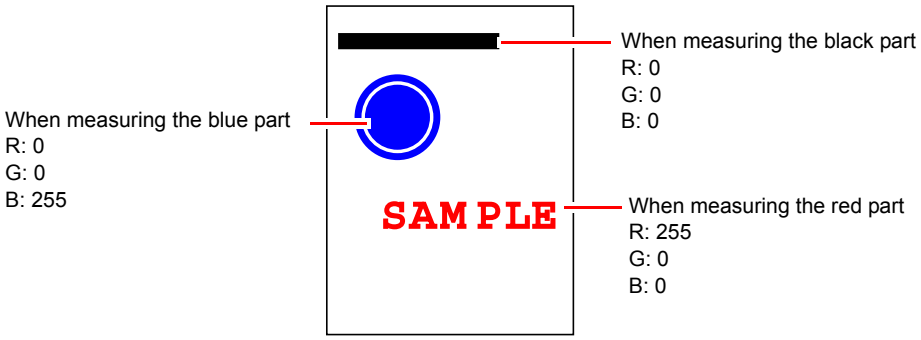
Comprehensive Processing Items for measurement are available in this product. Herein, the common configuration for various Processing Items is described.

4.6.1 Configuring Color Processing

The images acquired from cameras are available with color information such as R(Red)/G(Green)/ B(Blue). RGB images allow to adjusting color intensity within the range of 0 to 255, while 16.7 million colors are rendered on the screen.
It indicates black color in the case of RGB=0, or white color in the case of RGB=255.



During measurement of color images, many colors can be measurement by adjusting RGB.



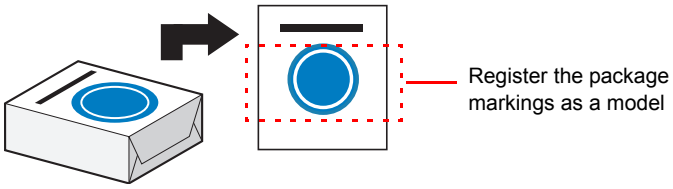
POINT

- For monochrome cameras, color processing is not performed.

4.6.2 Configuring Search

Reference image pattern can be registered as Model beforehand, and then the most similar part are found out from input images by search. Since the degree of similarity is represented by approximate value, scratch and mixing of variants can be checked.
Search is carried out in several times.

1 Register reference model.



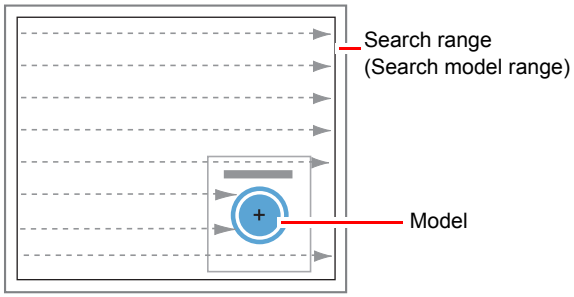
POINT

Model Status and Measurement

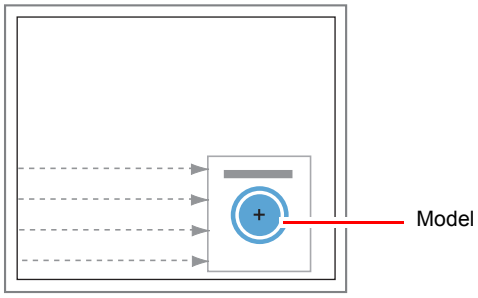
- The model state may affect the measurement time and accuracy as follows. Please select in-good-state (clean) measurement objects during Model Registration.
  - In the case of big or complicated model, processing time is prolonged.
  - In the case of extremely small model, or absence of features, search is unstable.

2 Rough search of overall measurement region.

Search and find models throughout overall measurement region.



3 Then, further search circumference of models.



Search Measurement Way

There are two measurement ways for search, i.e. Search by "Correlation (CR)" and by "Shape (PT)". Detection method can be selected by changing the "Rotation" settings for each processing unit.

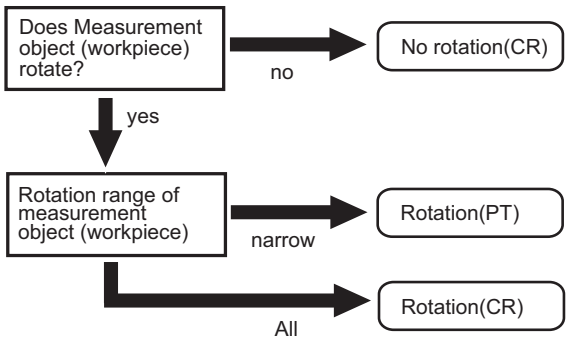
Correlation (CR)

Measure if there is a high degree of color similarity between input images and images for Model registration. Since intensity is specified for this operation, correct positions can be found out even if overall intensity changes.
During "Rotation", create the rotated model, search separately, and calculate the angle of maximum degree of similarity as measurement results.
In the case of narrow range of the rotation angle, this measurement can be faster than "shape" search.

Shape (PT)

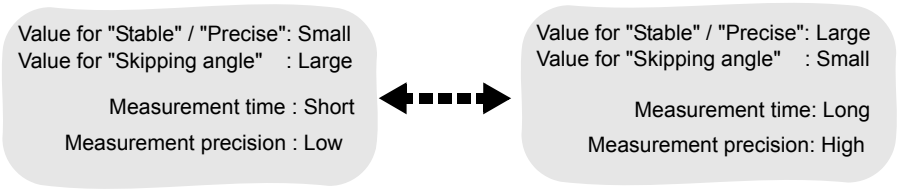
Measure if there is a high degree of shape similarity between input images and images for Model Registration. Since measurement is based on the consistency of shape (profile of model), positions can be measurement accurately even in the absence of some model images.
When the rotation angle range is wide, as is the case with any angle, the "PT" search works faster than the "CR" search. Note, however, that this method may be more unstable than a "CR" search if the image has low contrast or blurred edges.

Basic Selection Procedure



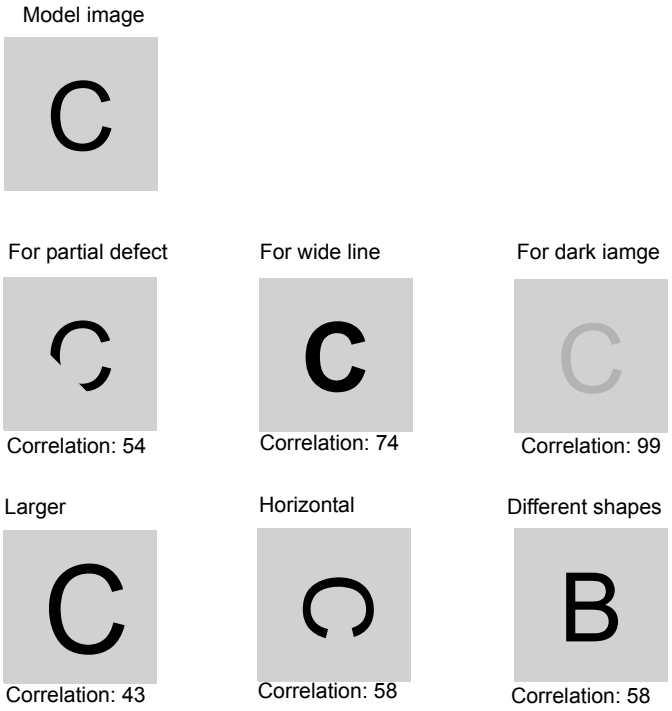
Search Speed

For "search" processing items, such as [Search] and [Classification], you can control the speed of the search by specifying the "Stable", "Precise", and/or "Skipping angle" item among the model parameters. If the value specified for "Stable" or "Precise" is small or if the value for "Skipping angle" is large, the processing speed is fast, since the amount of information on the models can be decreased during the search. On the contrary, if the value specified for "Stable" or "Precise" is large or if the value for "Skipping angle" is small, the processing speed is slow, the amount of information on the models cannot be decreased during the search. Specify appropriate values for "Stable", "Precise", and "Skipping angle" according to the situation of measurement.



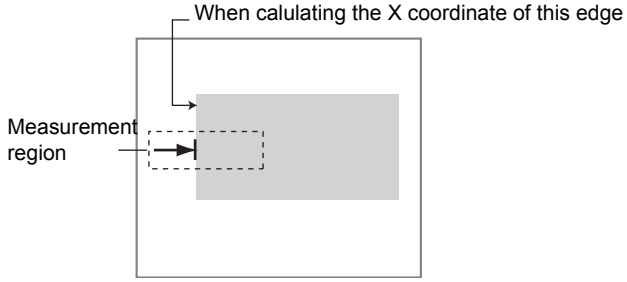
Correlation

Searched Processing Items are identified through correlation.
Correlation is used to check the consistency (degree of similarity) between actual measurement images and reference model images. Correlation becomes lower in the absence of some measurement images, or in the presence of different shapes.



4.6.3 Edge Measurement

This measurement method will extract the parts with color changed as edges, and find out edges according to color change in the measurement region.

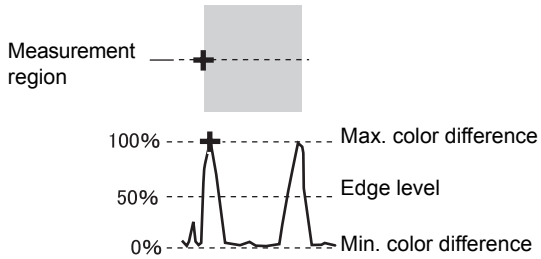


Edge Level

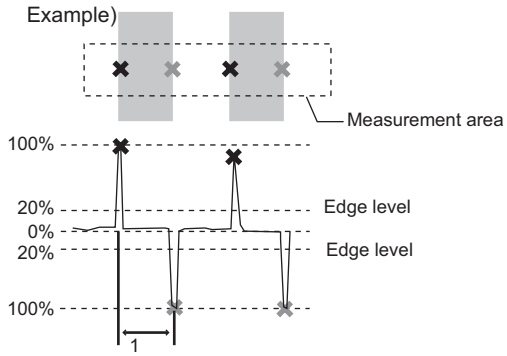
It indicates the color change level of edges (degree of color difference). This level shall be regulated in the case of failure to detect the edge.
The edges are detected using the following methods:

1. Calculate overall distribution of color difference in the measurement region.
2. Min. specified value of color difference: 0%; max. specified value: 100%.
3. Edge level with change of color difference is detected as edge.

Edge Position



Edge Pitch



The edge level shall be adjusted when edge cannot be found due to low color difference of background, or noise shall be removed.

POINT

- Edge level 0 to 100 represents "strength of edge", irrelative with color difference of original images.

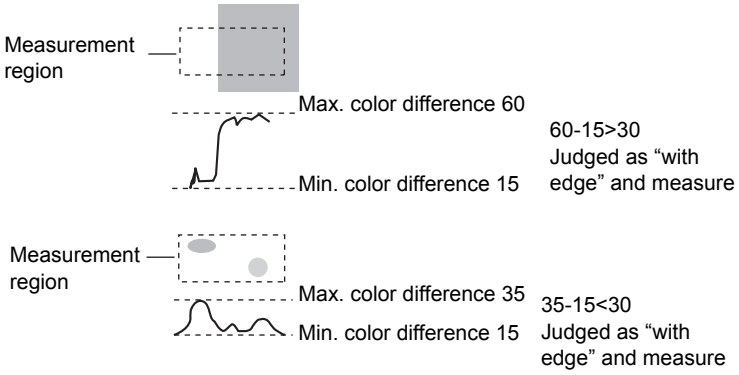
Noise Level

Used to judge the level of edge.
When calculating max. and min. value of color difference in the "Edge detection" area, no edge exists if the difference is less than noise level. When the detection is affected by noise, increase the value. (within area).

Maximum value of color difference - minimum value < Noise level → judging as absence of edge → measurement results: NG.

Maximum value of color difference - minimum value >= Noise level → judging as presence of edge → taken as measurement objects

Example: when noise level is set as 30

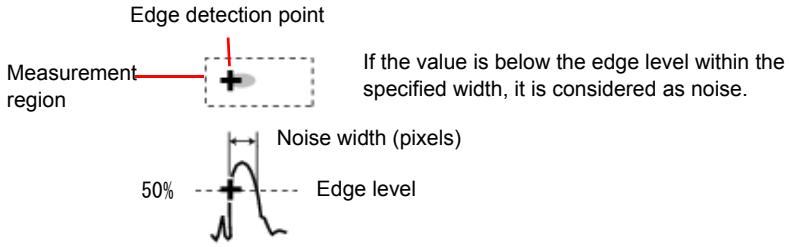


Noise Width

Set the width of noise.

- When no color is selected
  When the edge Error is detected again, within the range from the location of edge to noise width during first detection, the detected points are considered as noise.

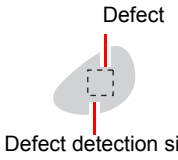
- When specifying color
  When the distribution of color difference is less than Edge level again, within the range from the location of edge to noise width during first detection, the detected points are considered as noise.



When the detection is affected by noise, increase the value.

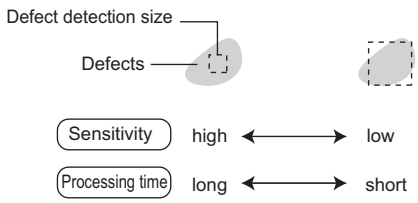
4.6.4 Defect Measurement

Find defect, stain and spots by changing the color within measurement region.
After drawing a measurement region, a rectangle is automatically formed in this area ("Defect detection" area). Move the "Defect detection" area, calculate separately the mean concentration, and obtain the detection difference with surrounding defect (referred to as defect level). Then, calculate defect level with all "Defect detection" areas. If the maximum value exceeds the criteria value, there are defect in measurement region.



Increasing "Defect detection size" allows to shortening processing time, but will reduce measurement accuracy.

Table: Defect Parameters

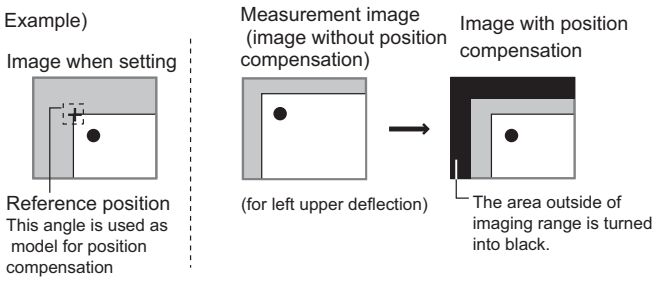
Option	Description
Upper Lower	Set the Upper and Lower limit of defect detection size based on the size of stain to be detected. The bigger the difference between Upper and Lower limits, the easier it is possible to detect the defect of various sizes. The bigger the defect detection size, the weaker the measurement sensitivity of Upper and Lower limits and the shorter the processing time. 

4.6.5 Configuring Coordinates

The processing items to measure positions have a setting item called "Output parameter" with which you can select how to handle coordinates.
In "Output parameter", you can set "Output coordinates" and "Calibration".

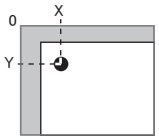
Output Coordinates

Selects Coordinate type to be output to external devices.



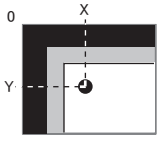
Before executing Position Compensation

Output Coordinate value prior to Position Compensation.



After executing Position Compensation (factory setting)

Output Coordinate value after Position Compensation.



Calibration

Select whether or not to verify when selecting output to external devices.
" Calibration" (→pg.13)

Calibration: ON

Calibration is performed during output, and measured values after calibration are output.

Calibration: OFF

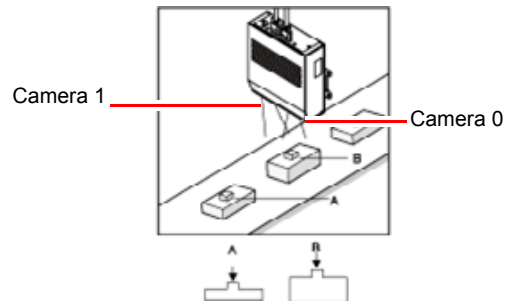
Calibration is not performed during output, and coordinate values from camera images are output.

4.6.6 Configuring 3D measurement

3D measurement is performed with a set of two cameras.

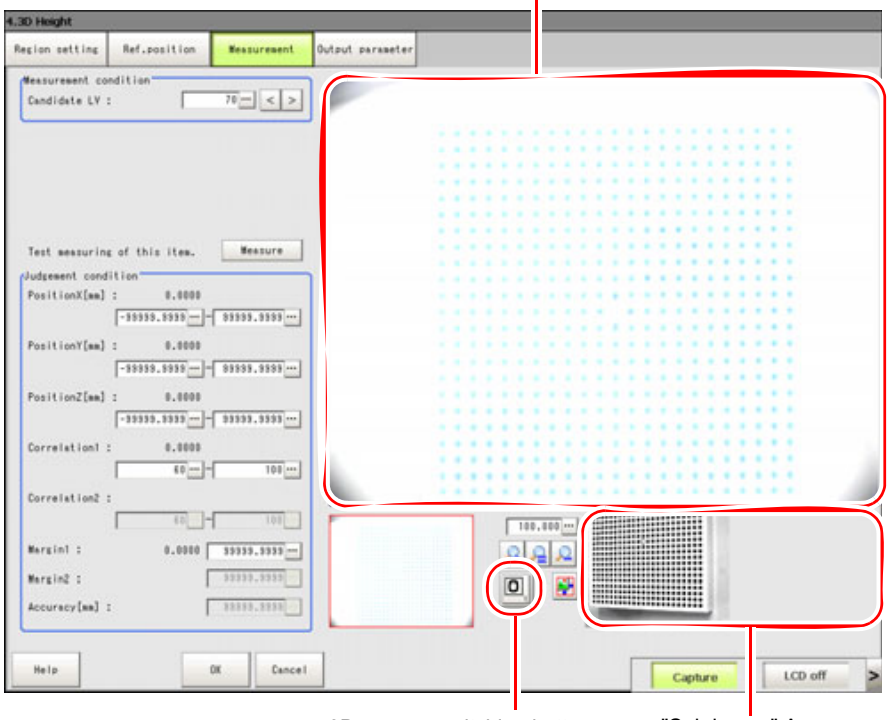
Settings such as the region setting or the model registration are made on the image of camera 0 (the perpendicular camera).
The registered measurement region is automatically applied to the image of camera1 (oblique camera) and the height of objects is measured.

Example) Judge by the height of components



Measurement display example

"Image display" area
Image of camera 0 (the perpendicular camera) is displayed.
Registration of model from the image in the specified region is made here.



3D camera switching button
The camera image to be displayed in the "Image display" area can be switched.

"Sub image" Area
Image of camera 1 (the oblique camera) is displayed.
Camera 1 searches registered models and measures the height of their parts.

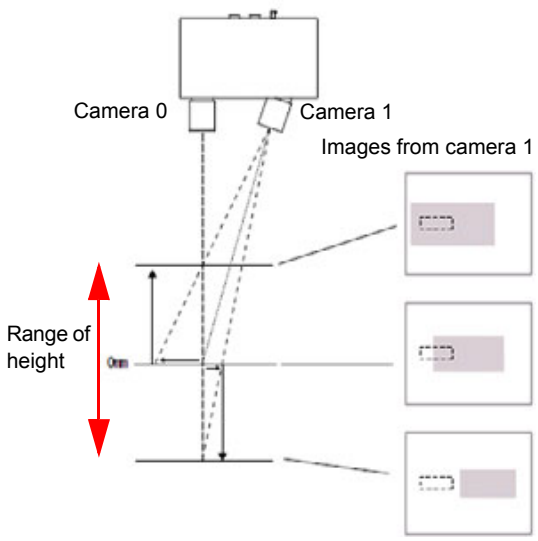
See " 3D Processing Item Window" (→pg.13) for how to view the screen display of 3D measurement when the measurement is performed.

To measure height accurately properly with 2 cameras, the coordinates of the cameras must be linked properly. To link the coordinates of two cameras is called [3D coordinate setting].
For how to make the settings for 3D coordinates, see " 3D Coordinate Registration" (→pg.6).

Range of Height Measurement

3D measurement uses the parallax of two cameras to measure the height direction.
To obtain the 3D height using 2D images from two cameras, register a measurement range of the height direction for each processing item used for 3D measurement.
When the height of measurement is changed, it reflects the image of camera1 (oblique camera). To enable measurement even when images shift, the size of measurement region changes laterally by the height measurement range.
Measurement region extends to the left when the upper limit of the height range is enlarged. The measurement region extends to the right when the lower limit of the height range is reduced. Adjust the height measurement range so that the measurement target is placed within a measurable range.

Adjustment of the height measurement range



: Measurement region
: Measured Objects

The image shifts to left when the measurement position moves up.
In case the image shifts and the edge of measurement object is off the measurable range, increase the upper bound value of height measurement range, and enlarge the measurement range to the left.

When the height of measurement position is in reference position (0), there is no gap with camera 0 image.

When the position moves down, the image shifts to the right.
When the image shifts and the measurement target is off the measurable range, reduce the lower bound value of the height measurement range, and extend the range to the right.

POINT

- On the actual screen, the measurement range is not displayed. Perform a test measurement to confirm whether the model is placed within a measurable range.

World Geometric Transformation

World geometric is actual coordinates in the entire space. Since the measured value is in local coordinates referenced to the position of measured objects, sharing the value with external devices (such as using a robot arm for the operation of measured objects), the value must be transformed into world coordinates. This operation is referred to as "World geometric transformation".

The parameters used for the world geometric transformation are produced by photographing the calibration targets with a camera and performing sampling measurement at several locations. For how to create a parameter for world geometric transformation, see "1.3.8 [3D Setting: World Coordinates (3D Camera Image)]" (→pg.42), of "Processing Items List Manual".
World geometric transformation corresponds to the calibration of 2D measurement. Similar to the setting of 2D measurement, which has an option whether to perform calibration at the time of output for each processing item, it is possible to make a setting for 3D measurement whether to perform world geometric transformation at the time of output.

World geometric transformation: ON

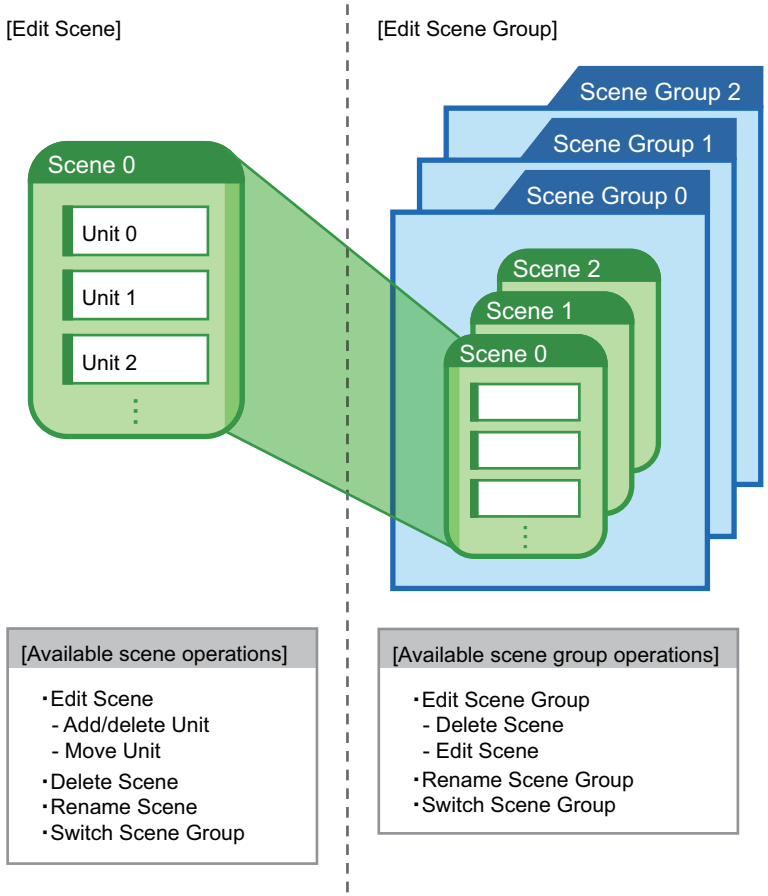
World geometric transformation is performed during output and the transformed values are output.

World geometric transformation: OFF

World geometric transformation is not performed during output and the coordinate values of the camera image are output.

4.7 What is Scene Group

Scene group consists of 32 scenes, enabling simple scene Classification management.



Important

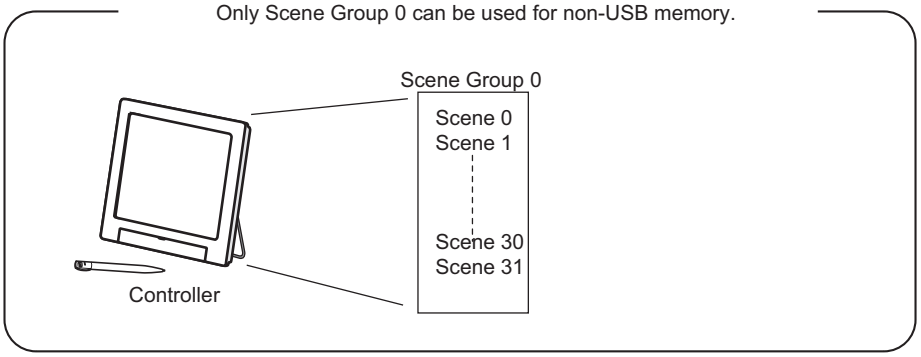
When using scene group function

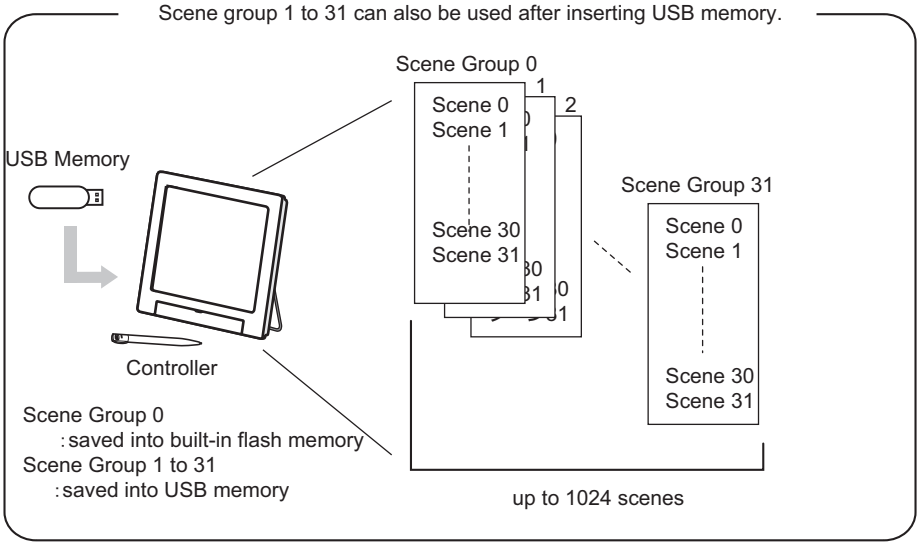
- This function can not be enabled until USB memory saved with scene group data is inserted.
- And this USB memory must be assigned with a Drive name "USBDisk".
  When any USB memories other than the USB memory with scene group data to be used have been inserted, remove them all. Then, only insert USB memory with scene group data, and execute the operation.
  " About the Drive Name of USB Memory" (→pg.5)

POINT

- Up to 1024 scenes can be added by inserting USB memory into controller.
  - 32 scenes are handled as a scene group, and up to 32 scene groups can be set. So, in total, up to 32 scenes x 32 scene groups = 1024 scene can be saved.

- Scene group 0 is saved into built-in flash memory, and Scene group 1 to 31 are saved into USB memory inserted in the controller.
- Since data size varies depending on the different scene settings, the scenes that can be set may be less than 1024 for insufficient USB memory.





4.8 Edit Unit in a Scene Group

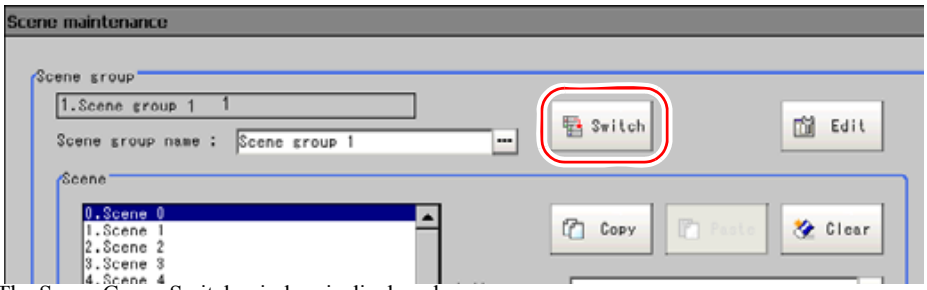
4.8.1 Switching the Scene Group

Switches to a scene group in which the scene to be edited is stored.

1 On the Main screen, tap [Scene] - [Scene maintenance].

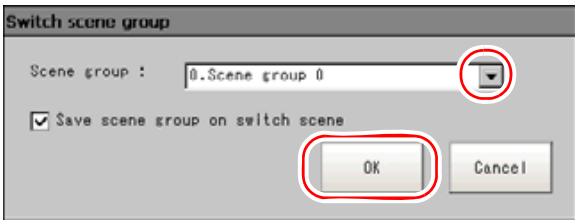
The Scene Maintenance window is displayed.

2 Tap [Switch] for the scene group.



The Scene Group Switch window is displayed.

3 Switch to the scene group to edit.



1. Tap [▼] and select the scene group to edit.
2. Specify whether the scene group should be saved when switching to another scene group.

Table: Switching the Scene Group

Setting Item	Set Value [Factory Default]	Description
Save scene group on switch scene	[Checked]	When the scene group is switched, the data of the scene group is saved.
	Unchecked	The scene group data is not saved when switching to another scene group. Therefore, the switching period can be compacted.

POINT

- The "Save scene group on switch scene" option is associated with the settings in the Measurement Setting window.
  "9.2 Setting for Measurement" (→pg.5)

3. Tap [OK].
   The scene group is switched and the screen returns to the Scene Maintenance window.

4.8.2 Copying a Scene

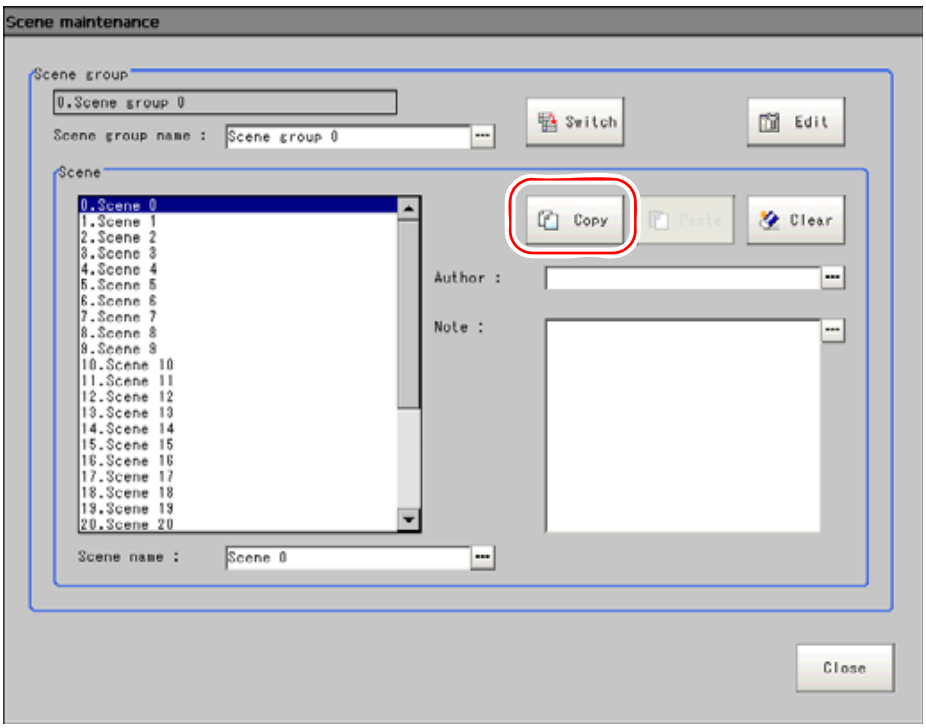
Copies and pastes scenes within a scene group.
You can use the created scenes conveniently with small efforts.

1 Tap [Scene] - [Scene maintenance] on the Main screen.
The Scene Maintenance window is displayed.

POINT

- If tapping [Switch], the scene group to edit can be switched.
  "4.8.1 Switching the Scene Group" (→pg.52)

2 In the scene list, tap the source scene to copy, and then tap [Copy].



3 In the scene list, tap the scene to which the copy should be pasted and then tap [Paste].
The confirmation window for overwriting is displayed.

4 Tap [Yes].
The data copied from the source scene is written over the scene selected as the destination.

5 Tap [Close].

4.8.3 Deleting a Scene

Delete the settings of a scene, and return to factory defaults. This section describes how to initialize measurement contents of scenes.

1 Tap [Scene] - [Scene maintenance] on the Main screen.

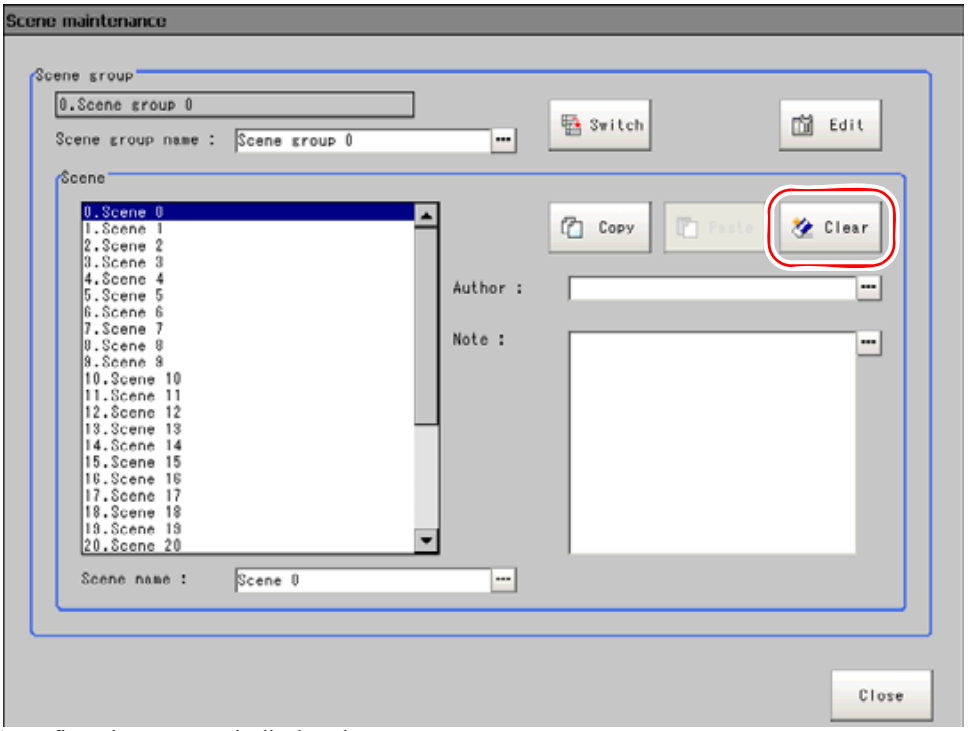
The Scene Maintenance window is displayed.

POINT

- If tapping [Switch], the scene group to edit can be switched.
  "4.8.1 Switching the Scene Group" (→pg.52)

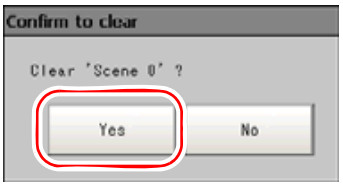
2 Tap the scene to be Deleted from scene list.

3 Tap "Clear".



A confirmation message is displayed.

4 Tap [Yes].



Scene data is deleted.

5 Tap [Close].

4.8.4 Renaming a Scene and Adding Description

A scene can be named arbitrarily, for ease to manage multiple scenes.

1 Tap [Scene] - [Scene maintenance] on the Main screen.

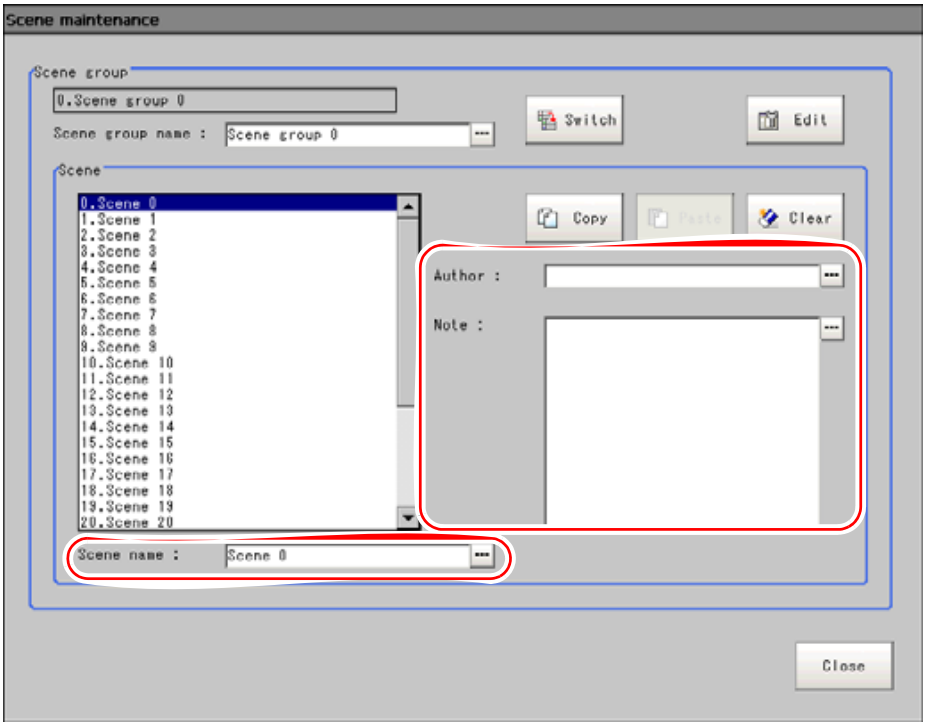
The Scene Maintenance window is displayed.

POINT

- If tapping [Switch], the scene group to edit can be switched.
  "4.8.1 Switching the Scene Group" (→pg.52)

2 Tap the scene to be renamed from scene list.

3 Set "Scene name", "Author" and "Note".



1. Tap [...] for each item.
   The Soft keyboard is displayed.
2. Set name and description.
   "Scene name" and "Author" can not be longer than 15 characters, "Note" not longer than 255 characters.
   How to input text: "1.5 Inputting a Text" (→pg.19)

POINT

- When writing "Note", enter a line-break after 32 single-byte characters or 17 double-byte characters. Without a line-break, the character strings are truncated.

4 Tap [Close].

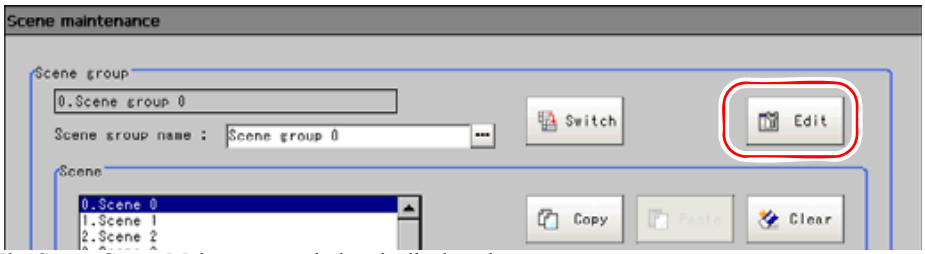
4.9 Editing Scene Group

You can Copy or Delete by scene group, or rename a scene group.
To do this, please insert USB memory in advance.

4.9.1 Copying a Scene Group

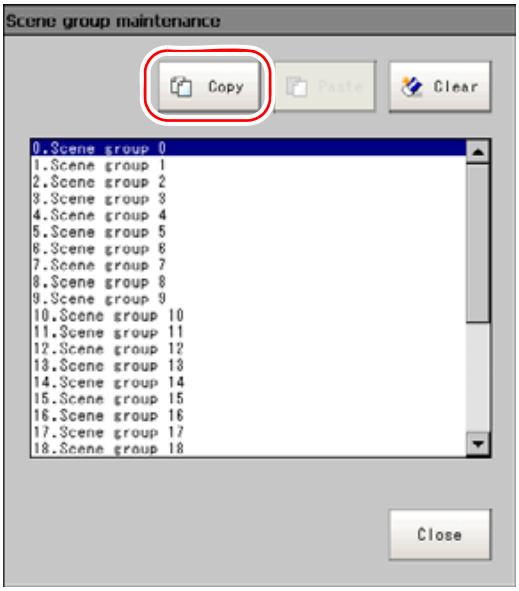
1 Tap [Scene] - [Scene maintenance] on the Main screen.
The Scene Maintenance window is displayed.

2 Tap [Edit].



The Scene Group Maintenance window is displayed.

3 Select the scene group to copy and tap [Copy].



4 Select the scene group to which the copy is to be pasted, and tap [Paste].
The confirmation window for overwriting is displayed.

5 Tap [Yes].

The data copied from the source scene group is written over the scene group selected as the destination.

6 Tap [Close].

4.9.2 Deleting a Scene Group

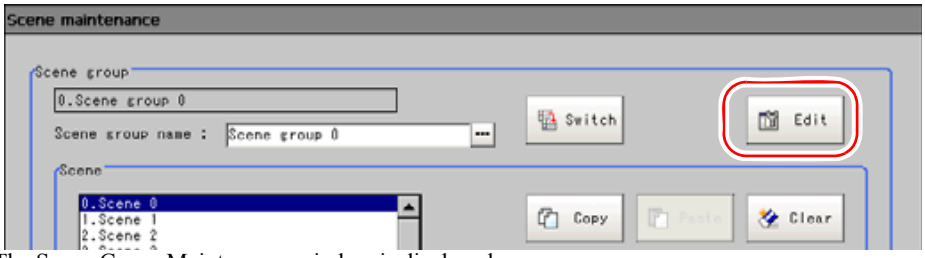
Delete the data of a scene group. The data to be deleted is shown as follows.

- Names selected for a scene group
- All the data of scenes within a scene group

1 Tap [Scene] - [Scene maintenance] on the Main screen.

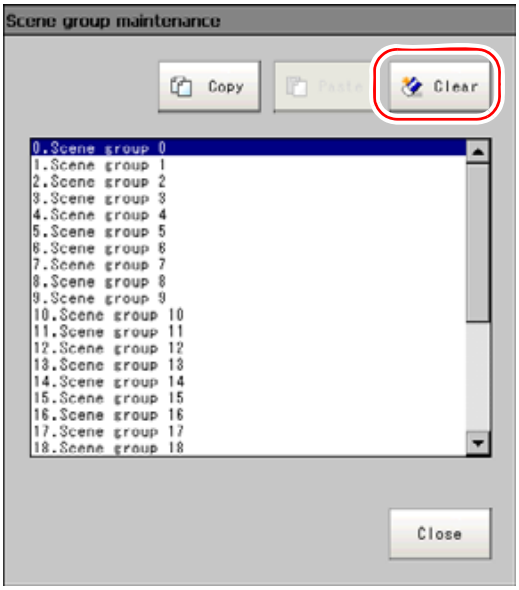
The Scene Maintenance window is displayed.

2 Tap [Edit].



The Scene Group Maintenance window is displayed.

3 Select the scene group to delete and tap [Clear].



A confirmation message is displayed.

4 Tap [Yes].

Scene group data is deleted.

5 Tap [Close].

4.9.3 Renaming a Scene Group

A scene can be named arbitrarily. This is convenient for managing more than one scene group.

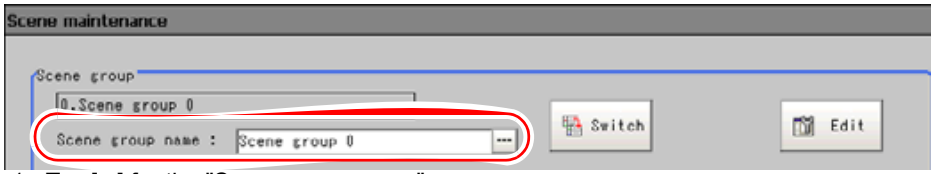
1 Tap [Scene] - [Scene maintenance] on the Main screen.

The Scene Maintenance window is displayed.

POINT

- If tapping [Switch], the scene group to edit can be switched.
  "4.8.1 Switching the Scene Group" (→pg.52)

2 Set "Scenegroup name".



1. Tap [...] for the "Scene group name".
   The Soft keyboard is displayed.
2. Enter a new name.
   Input words up to 15.
   How to input text: "1.5 Inputting a Text" (→pg.19)

3 Tap [Close].

5

Chapter 5 - Test Measurement/Re-measurement/ Adjustment

This chapter explains how to test whether measurement can be correctly performed under the specified conditions, how to perform re-measurement for saved images, how to adjust the setting values for processing units, and the key points of adjustment.

5.1 Test Measurement before Actual Operation 2
5.2 Re-measuring Saved Images (Re-measurement) 5
5.3 Confirming the Measurement Results and Adjusting Processing Unit Settings 9
5.4 Points on Adjustment 11
5.5 Clearing Measurement Results 17
5.6 Clearing Logging Images 18

5.1 Test Measurement before Actual Operation

After editing the flow and setting processing items for each processing unit, perform a test measurement to confirm whether the measurement is performed as intended with the settings. Repeat test measurements for confirmation and, depending on the test results, adjust the ProcItem settings for each processing unit.
Measure using the conditions set in a scene. You can specify whether or not to output the test measurement results to an external device.
For external devices, see "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1).

POINT

- If "Only NG" or "All" is selected for "Image logging" in [Logging setting], images can be saved to the memory/RAM disk of the controller, or to USB memory. When saving to the controller's memory, if the number of the saved images exceeds the limit, images are overwritten sequentially starting with the oldest one.
  "7.2 Setting up Logging Condition [Logging setting]" (→pg.7)
  A saved image can be used for measurement.
  "5.2 Re-measuring Saved Images (Re-measurement)" (→pg.5)
- To reset the number of measurements, which is counted in a specified expression, clear the measurement results.
  "5.5 Clearing Measurement Results" (→pg.17)

1 In the "Control" area of the Main screen, tap [Test measurement setting].

2 Specify each of the following items.

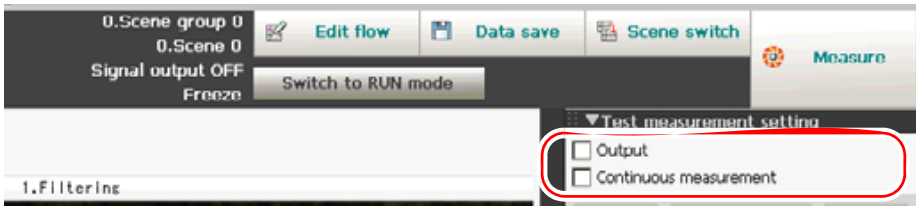


Table: Test measurement

Setting Item	Description	
Output	Specifies whether or not to output the measurement results to an external device during the measurement.	
	Checked	Outputs the measurement results to an external device during the measurement.
	Unchecked	Does not output the measurement results to an external device during the measurement.

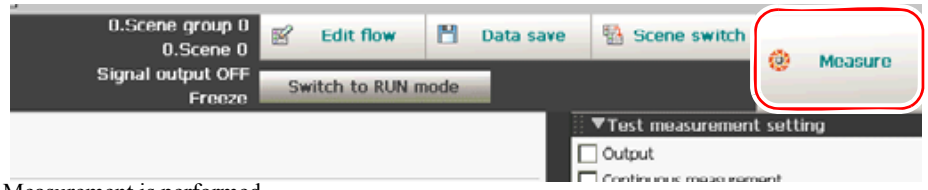
Table: Test measurement

Setting Item	Description	
Continuous measurement	Specifies whether or not to perform continuous measurements. In continuous measurements, saved images or measured images are measured continuously.	
	Checked	Performs continuous measurements during the measurement.
	Unchecked	Does not perform continuous measurements during the measurement.

POINT

- When measurement is performed in the RUN window, measurement results are output to an external device regardless of the "Output" setting.
- Whenever switching from the RUN window to the ADJUST window, "Output" is unchecked.

3 Tap [Measure] in the Toolbar.



Measurement is performed.

POINT

- An alternative operation: tap [Measure] - [Test meas.].
- In continuous measurements, the [Measure] button changes to the [Stop meas.] button during the measurement. To stop the continuous measurements, tap [Stop meas.].

4 Verify measurement results.

For instructions on how to check the measurement results, see "5.3.1 Confirming the Measurement Results (ADJUST window)" (→pg.9).

5 If necessary, adjust setting values for each processing item again.

When tapping a button (icon) for any processing units listed in the flow on the Main screen or in the Edit Flow window, the ProcItem Setting window is displayed.
"b ProcItem setting button" (→pg.10)
For details, see "5.3 Confirming the Measurement Results and Adjusting Processing Unit Settings" (→pg.9).
For property setting of Processing Item, see" Processing item List" (→pg.1).

POINT

- The ProcItem Setting window can also be displayed by tapping the ProcItem setting button in the "Image display" area.
  "1. ProcItem setting button" (→pg.8)

6 Measurement test should be carried out again with corrected contents.

For instructions on how to re-measure images that have been once test-measured, without obtaining any images from the camera, see "5.2 Re-measuring Saved Images (Re-measurement)" (→pg.5).

5.2 Re-measuring Saved Images (Re-measurement)

After a test measurement or a measurement, saved images can be re-measured.
The following images can be re-measured.

- The measured images saved in the controller
- The images saved in the USB memory

Measuring the testing of NG images can confirm if the correction is correct.
Like testing measurement, re-measurement is performed using the condition setting in scene.
"Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1)

Important

- When performing re-measurement, set the image mode to "Freeze".
  "6.3.1 Image Display Setting" (→pg.5)
- Only the image files which are named with one-byte alphanumeric characters can become the object of re-measure.

1 In the "Control" area of the Main screen, tap [Test measurement setting].

2 Specify each of the following items.

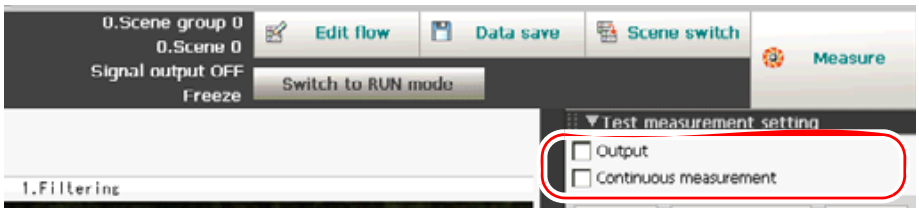


Table: Test measurement

Setting Item	Description	
Output	Specifies whether or not to output the measurement results to an external device during the measurement.	
	Checked	Outputs the measurement results to an external device during the measurement.
	Unchecked	Does not output the measurement results to an external device during the measurement.
Continuous measurement	Specifies whether or not to perform continuous measurements.	
	Checked	Performs continuous measurements during the measurement.
	Unchecked	Does not perform continuous measurements during the measurement.

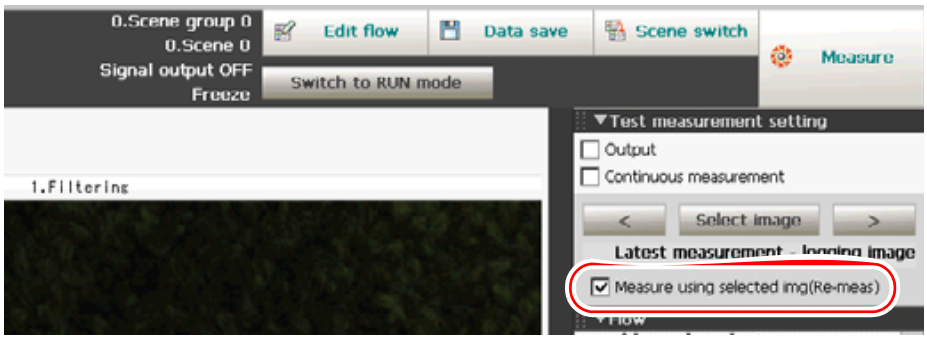
POINT

- When measurement is performed in the RUN window, measurement results are output to an external device regardless of the "Output" setting.

3 Specify and display the image file to be re-measured.

For how to specify an image file, see "5.2.1 Displaying Saved Images" (→pg.7).

4 Check "Measure using selected img (Re-meas.)".



5 Tap [Measure] in the Toolbar on the Main screen.

The measurement on the selected image is performed.

POINT

- An alternative operation: tap [Measure] - [Measure].
- In continuous measurements, the [Measure] button changes to the [Stop meas.] button during the measurement. To stop the continuous measurements, tap [Stop meas.].

6 To re-measure another image continuously, either tap [Select image] again, or tap one of [<] and [>] on each side to display the file name of another image.

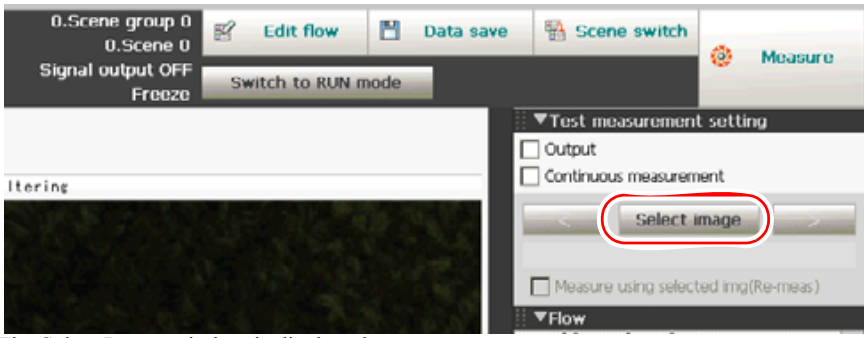
"5.2.1 Displaying Saved Images" (→pg.7)

7 Tap [Measure] in the Toolbar on the Main screen.

The measurement on the selected image is performed.

5.2.1 Displaying Saved Images

1 In [Image display setting] of the "Control" area on the Main screen, tap [Select image].



The Select Image window is displayed.

POINT

- An alternative operation: tap [View] - [Image selection] - [Select image].

2 Tap [...] and select the file to display.

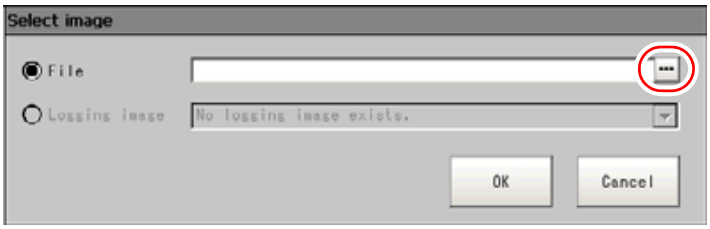


Table: Select image

Setting Item	Description
File	Specifies an image file saved in the USB memory or in the controller.
Logging image	Specify an image file that is logged in the controller.

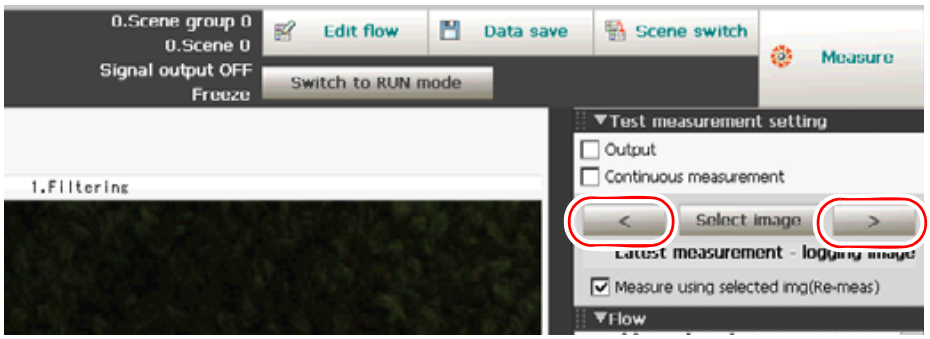
3 Tap [OK].

The selected image is displayed in the "Image display" area. The path and file name of the image are displayed under [Select image].

4 To display another image continuously, either tap [Select image] again, or tap one of [<] and [>] on each side to display the file name of another image.

Each time you tap [<], an older image file is displayed, and each time you tap [>], a newer image file is displayed.

If you tap [>] when the newest image file is displayed, the oldest image file in the saved image files is displayed.



POINT

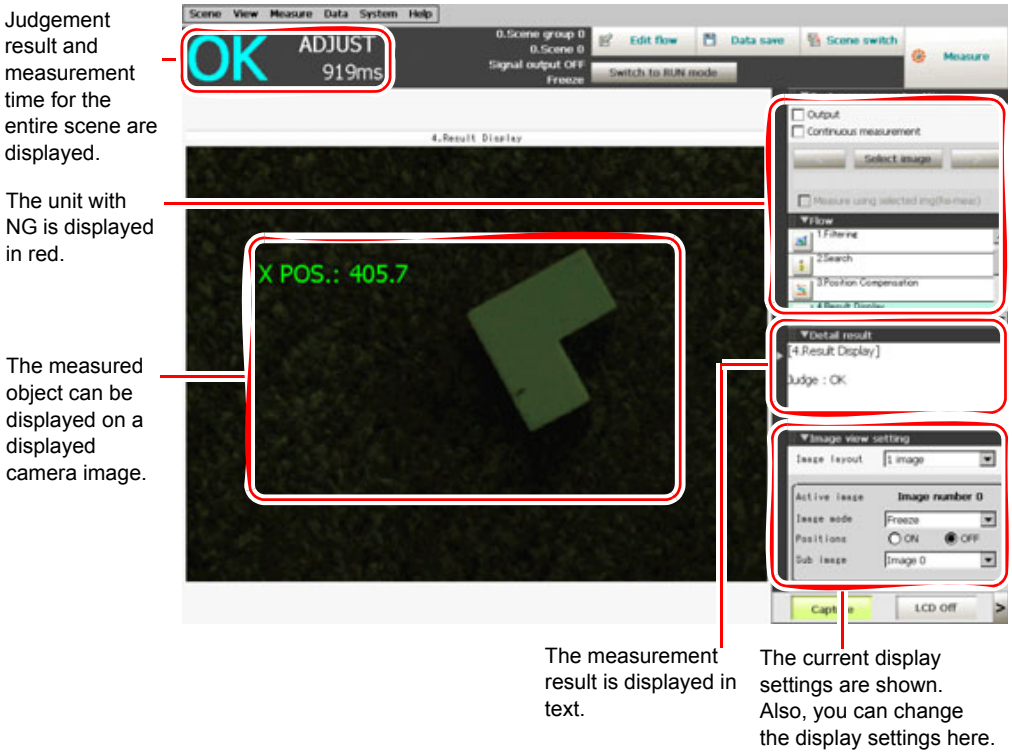
- An alternative operation: tap [View] - [Image selection] - [Previous image]/[Next image].

5.3 Confirming the Measurement Results and Adjusting Processing Unit Settings

After a test measurement or a re-measurement, confirm the test results.
If there is a problem, adjust the settings for the processing items in the processing unit.

5.3.1 Confirming the Measurement Results (ADJUST window)

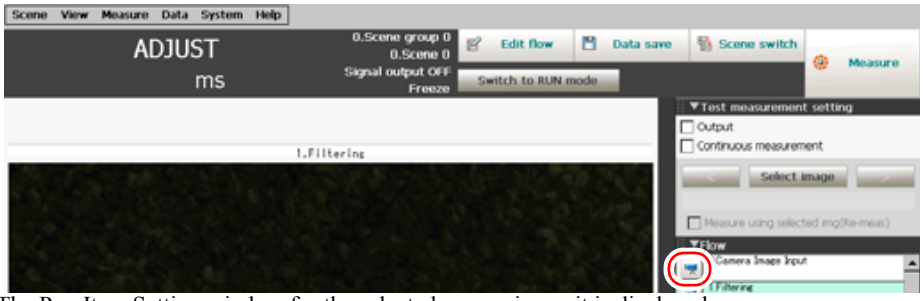
Confirm the measurement results to check if there is any NG judgement and, if so, in which processing unit the NG occurred. The processing unit with NG can easily be located, since the icon of this processing unit is displayed in red.
You can check the measurement results along with the measured values, so that you can find the cause of NG and adjust measurement settings.
When a process is taking a long time, it is necessary to check processing items and setting values. The time required for the measurement is also displayed in the "Measurement information display" area as a reference.
"5.4.2 How to Shorten Measurement Time" (→pg.11)



5.3.2 Adjusting Setting Values

This section explains how to adjust the setting values for the processing unit in which NG occurred.
The explanation here assumes that the "Control" area is displayed on the Main screen.
For how to display the "Control" area, see "6.3.2 Displaying Flow and Detail Result" (→pg.12).

1 In [Flow] of the Main screen, tap the icon of the processing unit for which the detailed settings need to be confirmed.



The ProcItem Setting window for the selected processing unit is displayed.

POINT

- The ProcItem Setting window can also be displayed by tapping the ProcItem setting button in the "Image display" area.
  "1. ProcItem setting button" (→pg.8)

2 Change each setting value for the processing unit.

" Processing Items List Manual" (→pg.1)
After editing the processing unit, return to the Main screen.

3 Perform a test measurement or a re-measurement.

"5.1 Test Measurement before Actual Operation" (→pg.2)
"5.2 Re-measuring Saved Images (Re-measurement)" (→pg.5)
Check the results and, if necessary, adjust setting values for each unit again.
To edit the flow, tap [Edit Flow].
"4.3 Editing a Processing Unit in a Scene" (→pg.7)

5.4 Points on Adjustment

5.4.1 Basic Considerations of Measuring Accuracy

Measurement accuracy depends much upon pixels (resolution) of camera, Inspection and measurement objects, etc.
This section explains how to perform measurement and how the inspection object influences the precision of the measurement.

inspection

The measurement precision varies depending on the processing unit.
"Fine Matching" indicates the Processing Items with higher measurement accuracy. However, the higher the measurement accuracy, the longer the measurement time. When selecting Processing Items, particular attentions shall be paid to measurement accuracy, measurement time and measurement objects.
" Shortening Measurement Time by Setting Processing Item" (→pg.11)

Measurement Objects

Measurement accuracy differs from different measurement objects.
High-precision measurement is impossible when using low-contrast images, or the background has patterns during defect measurement. In such case, measurement accuracy could be improved by processing the measurement images in advance.
"5.4.3 Filtering Required for Stable Measurement" (→pg.13)

5.4.2 How to Shorten Measurement Time

The measurement time using optical sensors varies depending on the processing unit. However, it is more affected by the image processing speed. To decrease the measurement time, it is important to select appropriate processing items and to perform appropriate image processing.
This section introduces a method to review processing item selection, image processing, and image logging, as to decrease the measurement time.

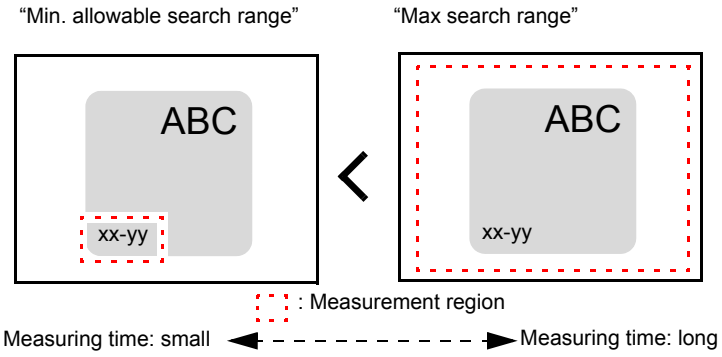
Shortening Measurement Time by Setting Processing Item

The load of image processing is bigger. So, it often takes a longer image processing time if excessive search range is set.
Herein, methods of re-setting the search range and shortening measurement time are described.

Set Search Range

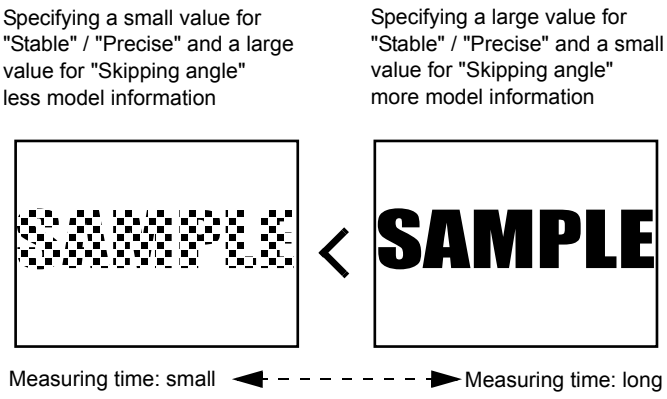
For such Processing Items as "Search" and "Flexible Search", measurement region is set as "Search Range".

Since searching is conducted in a given measurement region, a bigger area means a longer measurement time.
Therefore, measurement region as search range shall be set as the minimum possible range.
Among other Processing Items, the measurement region shall also be set as the minimum possible range.



Set Search Speed

For "search" processing items, such as [Search] and [Classification], you can specify the speed of search using the "Stable", "Precise", "Skipping angle", and "Candidate LV" items of Model parameter.
If the values set for "Stable" and "Precise" are small or that for "Skipping angle" is large, the processing speed becomes faster, since the information on the models is decreased and "Rough search" (rough positioning) is performed.
Note, however, that if you decrease the information too much, the processing speed may become slower, since candidate points may increase for "Rough search" or calculation may increase for "Detail search" (calculation on coordinates). In such a case, you can make the processing speed faster by increasing "Candidate LV" or by making the values of "Stable" and "Skipping angle" closer to the factory default.
On the contrary, if the value specified for "Stable" or "Precise" is large or if the value for "Skipping angle" is small, the processing speed is slow, the amount of information on the models cannot be decreased during the search.
Set appropriate "Stable", "Precise", "Skipping angle", and "Candidate LV" according to the situation of measurement.

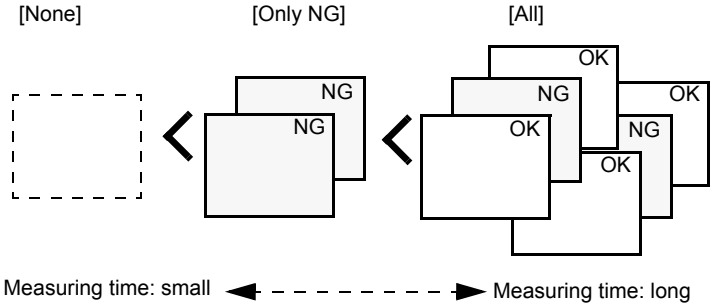


For details, see"4.6.2 Configuring Search" (→pg.39).

Shortening Measurement Time through Image Logging

Image logging is a function to save the measured images to the controller's memory, controller's RAM disk, or USB memory.
With Image logging, you can select one of "All", "Only NG", and "None".

- None
  No measurement images are Saved.
- Only NG
  Measurement images are Saved only when the Judgement result is NG.
- All
  All measurement images are Saved, in spite of the Judgement result.



Selecting "All" may influence the measurement time.
Unless it is necessary, set the image logging setting to "None" or "Only NG". For the setting method, see "7.2 Setting up Logging Condition [Logging setting]" (→pg.7).

5.4.3 Filtering Required for Stable Measurement

Owing to the noise, non-uniformity and lower contrast of camera images, the images shall be processed in advance, into measurement images in the case of unstable measurement.
This section describes the types and conditions for efficient Filtering.

Search Unstable Conditions

If measurement images are non-uniform and searching and locating are unstable, "Weak smoothing", "Strong smoothing" and "Median" are effective.

"Weak smoothing" and "Strong smoothing" are used to fuzzily the images such that non-uniformity is processed obscurely. As compared to smoothing, "Median" enables non-uniformity to become obscure without needing to fuzzily the edges.

[Weak smoothing]

Before filtering

After filtering

When Measured Images Have Noise, or Measurement Is Unstable

In case where measurement images have noise and measurement is unstable, "Dilate" and "Erosion" are effective.
"Dilate" is used to remove dark noise, "Erosion" used to remove bright noise. Thus, "Dilate" is required if white objects have black noise, or "Erosion" is required if black objects have white noise.

[Zoom in]

Before filtering

After filtering

When Defect Detection Is Unstable

When measurement images have a lower contrast, and defects, etc, are extracted unstably, "Extract vertical edges", "Extract horizontal edges" and "Extract edges" are effective.
"Extract vertical edges" is used to extract vertical image edges, "Extract horizontal edges" is used to extract horizontal image edges, and "Extract edges" is used to extract edges in all directions.

[Extract vertical edges]

Before filtering

After filtering

When Unidentifiable Shapes Present

When measurement images have a lower contrast, and shape is unidentifiable, "Extract edges" is effective.
"Extract edges" is used to make profile clearer and shape identifiable.

[Extract edges]

Before filtering

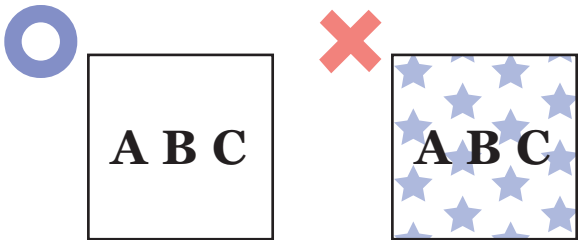
After filtering

5.4.4 Identifiable Printing Methods

When measuring labels and lots, the printing state, character spacing and contrast will influence the reading accuracy.
This section describes identifiable printing conditions.

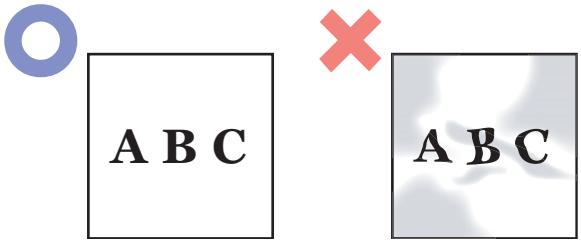
Plain Printing Surface

Printing surface with patterns is difficult to identify.



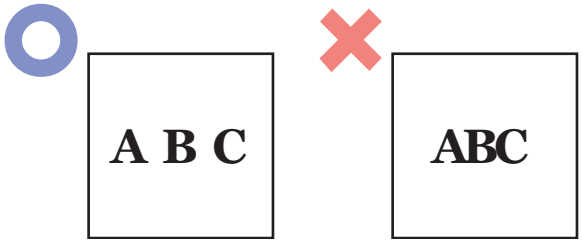
Flat Printing Surface

Printing surface with concave convex is difficult to identify.



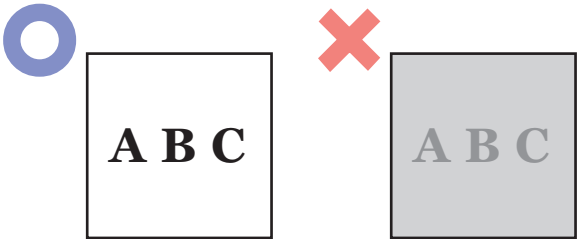
Character Spacing

Narrow character spacing is difficult to identify.



Contrast

A proper contrast shall be required to ensure correct reading.
Ensure appropriate contrast, if necessary, by extracting edges in "Filtering".
"2.1 Filtering" (→pg.2), of "Processing Items List Manual"

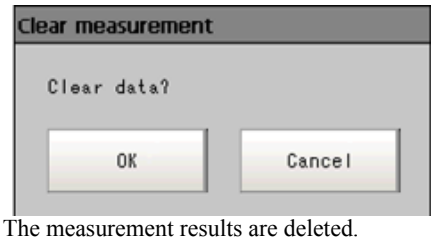


5.5 Clearing Measurement Results

Clear currently shown Measured value of all scenes.
This function is used to set the expression of accumulative number of measurements, and reset the number.

1 On the Main screen, tap [Measure] - [Clear measurement].
The confirmation window is displayed.

2 Tap [OK].



The measurement results are deleted.

5.6 Clearing Logging Images

Clears all images that are currently logged in the controller.

1 On the Main screen, tap [Measure] - [Clear logging image].
The confirmation window is displayed.

2 Tap [OK].

POINT

- If you want to keep the logged images as files, save the logged images to the USB memory by tapping [Data] - [Save to file] - [Logging image] before clearing them.
"8.1.3 Saving Logging Image Data [Save to file]" (→pg.8)

6

Chapter 6 - Starting Operation

Now, you can go to the RUN window and start measurement. This chapter describes the method to switch the window displayed and the functions useful during operations.

6.1 The Flow before Starting the Operation 2
6.2 Display of the RUN Window 3
6.3 Changing Display on the Main Screen 5
6.4 Changing Judgement Condition of a Unit during Measurement . . . 15
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6.6 Capturing a Screen [Capture] 24

6.1 The Flow before Starting the Operation

After creating scenes on the ADJUST window and performing test measurements, switch to the RUN window and perform measurements.

1 In the ADJUST window, create a scene (measurement flow).
"4.2 Creating a New Scene" (→pg.4)

2 Perform test measurements in the ADJUST window and adjust the parameters of processing items.
"5.1 Test Measurement before Actual Operation" (→pg.2)

3 Perform test measurement by checking "Output" in the ADJUST window, and confirm the interface between output signal and external device.
"5.1 Test Measurement before Actual Operation" (→pg.2)

4 Tap [Switch to RUN mode] in the ADJUST window.

The window switches to the RUN window. About the content of the display in the RUN window, see "6.2 Display of the RUN Window" (→pg.3).

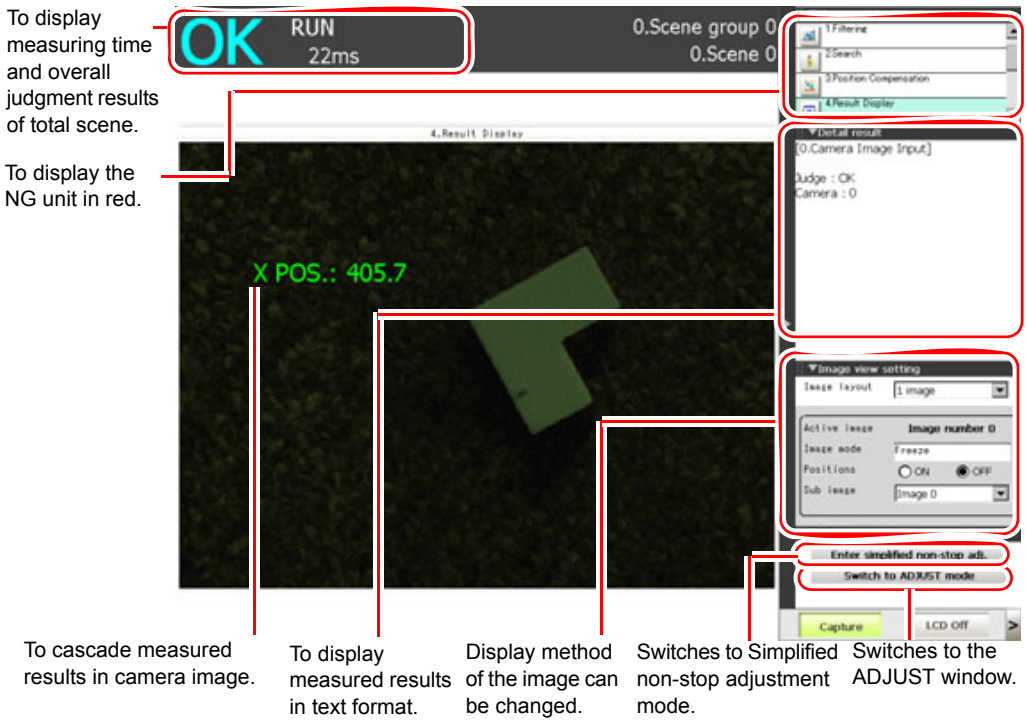
POINT

- You can set to show the RUN window whenever the power of controller is turned on.
  "9.3.4 Setting the Status at the Startup [Startup setting]" (→pg.9)
- Lighting gets darker gradually if it is used for a long time, so adjust judgement conditions periodically.
- Without stopping a measurement in operation, you can change judgement conditions of a processing unit that is set in a scene.
  "6.4 Changing Judgement Condition of a Unit during Measurement" (→pg.15)

6.2 Display of the RUN Window

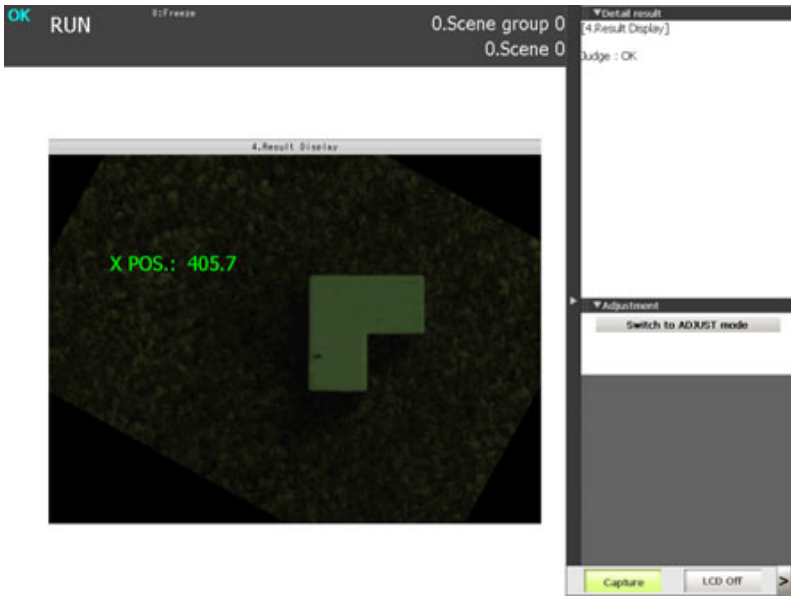
During an operation, you can check the measurement result by displaying it in the RUN window.
You can confirm the measurement results to check if there is any NG judgement and, if so, in which processing unit the NG occurred. You can confirm not only judgement result (OK/NG) but also the measured values as detailed results. Therefore, they can be used to find the cause of NG and to adjust measurement.
There are two types of RUN window, i.e. Normal mode and Fast view mode.

RUN window - Normal mode



When a process is taking a long time, it is necessary to check processing items and setting values. The time took for measurement is also displayed in the measurement result so that you can refer to it.
"5.4.2 How to Shorten Measurement Time" (→pg.11)

RUN window - Fast View Mode



POINT

- For how to switch between the Normal mode and the Fast view mode of the RUN window, see "9.3.5 Setting the Mode of the RUN window [Select RUN mode]" (→pg.11).

6.3 Changing Display on the Main Screen

You can arrange the display on the Main screen so as to display only necessary information during an operation.

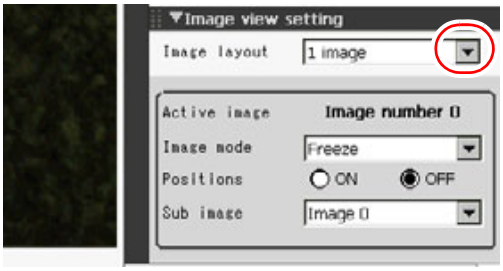
6.3.1 Image Display Setting

- " Displaying Multiple Images in the Window" (→pg.5)
- " Listing Measurement Results" (→pg.7)
- " Changing the Camera Image Mode (ADJUST Window Only)" (→pg.11)

Displaying Multiple Images in the Window

Multiple images can be displayed side by side in the "Image display" area.

1 In [Image view setting] in the "Control" area of the Main screen, tap [▼] for "Image layout" and select the number of images to display.
The displayed images in the "Image display" area change according to the selection.



POINT

- An alternative operation: tap [View] - [Image layout].

There are following four patterns of image display.

Table: Image display pattern

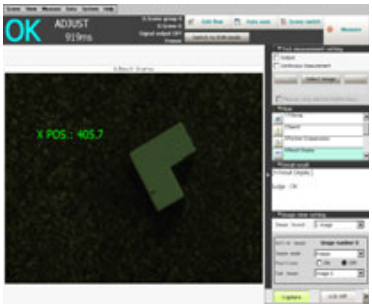
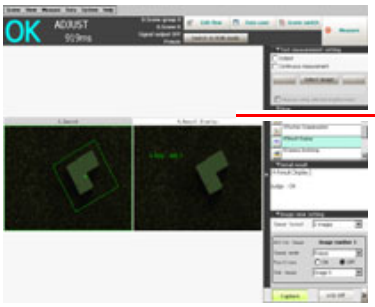
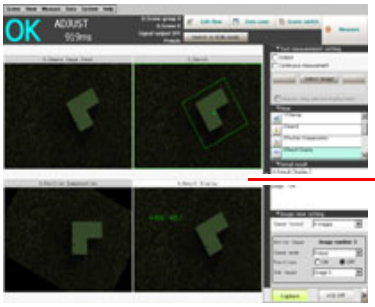
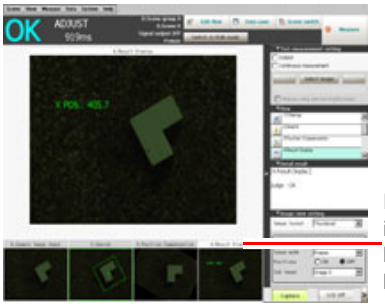
Item	Description
1 image	1 image. Since images are Zooming, it is ideal for you to see the Details. The image of the processing unit selected in the measurement flow is displayed. 
2 images	2 images are viewed side by side. Suitable for connecting two cameras whereby images can be checked side by side.  For the selected image, the color of button turns lighter.
4 images	4 images are viewed together with each one at the left, right, upper, and lower position. Suitable for connecting 4 cameras whereby images are checked at one time.  For the selected image, the color of button turns lighter.

Table: Image display pattern

Item	Description
Thumbnail	Shows four small images on the bottom, and one bigger image above of the one selected from the four. This view is preferable when you wish to check details of a certain image when connecting four cameras. Thumbnail is not available with "RUN - fast view mode". When displaying with Thumbnail in the ADJUST window, if you switch to RUN - fast view mode, the display will change to 4 images.  For the selected image, the color of button turns lighter.

Important

- When displaying multiple images, the processing unit of measurement flow can be displayed with each image. By selecting an image by pointing and then tapping the processing unit of measurement flow, the Unit No. of the processing unit is set.
  When switching from one image display to multiple image display, if Unit No. for each image is not set, Unit No. 0 (default) is selected.

POINT

The available options for the case whereby more than one image is viewed

- The color of ProcItem setting button turns to white.
- While displaying flow information or detailed information, if image selection is changed in the "Image display" area, the following contents will change according to the selected image.
  - Selected processing unit in the measurement flow (the processing unit with blue background color)
  - Displayed content of detailed information
- While selecting images in the "Image display" area, if the selection of processing unit is changed in the measurement flow, the image selected in the "Image display" area switches according to the reselected processing unit in the measurement flow. However, other images in the "Image display" area do not change.

View the Saved images

- After switching the selection from camera images to saved images, if you delete a saved image, the display of the location where the image was shown becomes black.

Listing Measurement Results

By using "Positions", you can display the positions of measurements of multiple processing units in the "Measured image" area. Listing positions makes it easier to know the situation of entire inspection.

POINT

- An alternative operation: tap [View] - [Positions].

1 Set each item in [Image view setting] of the "Control" area.

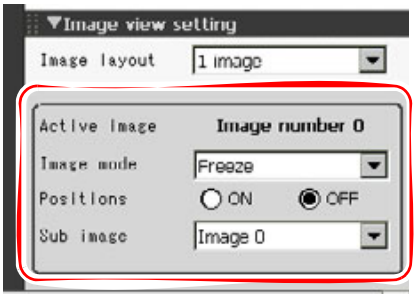


Table: Image display

Item	Description
Active image	The number of currently selected image (0 to 3) is displayed. When the "Detail result" area is active, the string "Detail result" is displayed.
Image mode	This item changes the camera image mode. " Changing the Camera Image Mode (ADJUST Window Only)" (→pg.11)
Positions	Set ON/OFF of Positions. While "Positions" is "ON", the processing unit you can select is one of Camera Image Input, Camera Switching, and Position Compensation. If you switch "OFF" to "ON", Camera Image Input, Camera Switching, and Position Compensation above the currently selected Unit No. will be selected automatically. Switching "Positions" to "ON" with Position Compensation selected will display Positions that combines all the units after the Position Compensation. The regions of the units before the Position Compensation will not be displayed.
Sub image	By changing the "Sub image", you can switch the content of the measurement results to be displayed. Number of displayed Sub images differs depending on processing item. For the Sub image number of each processing item, see "Table: List of Sub image number" (→pg.10). For processing items not listed in the list of the Sub image number, the same measurement result is displayed regardless of the setting of the Sub image number.

Table: List of Sub image number

Classification	Processing Item Name	Sub image number and display
2D measurement	Position Compensation	0: After 1: Before
	Edge Position	0: Measured image 1: Profile display
	Gravity and Area	0: Measured image 1: Extracted image
	Edges	0: Measured image 1: Profile display
	Labeling	0: Measured image 1: Extracted image
	Fine matching	0: Measured image 1: Difference image
	ECM search	0: Measured image 1: Measured image together with matched edges
	Defect	0: Measured image 1: Defect profile [with area measurement]
	Scan Edge Position	0: Measured image 1: Scanning region
	Scan Edge Width	0: Measured image 1: Scanning region
3D measurement	3D Camera Image Input 3D Height 3D Search 3D Circle Search	Depending on the 3D setting and camera setting, displayed images change. 0: Measured image from camera 0 or camera 2 1: Measured image from camera 1 or camera 3 2: Measured image from camera 2 [Note 1]
	3D Camera Switching	0: Measured image from camera 0 or camera 2 1: Measured image from camera 1 or camera 3
	3D Edge Position	0: Measured image from camera 0 or camera 2 1: Display of image profile from camera 0 or camera 2 2: Measured image from camera 1 or camera 3 [Note 2] 3: Display of image profile from camera 1 or camera 3 [Note 2] 4: Measured image from camera 2 [Note 2] 5: Display of image profile from camera 2 [Note 2]

[Note 1]: When measuring with camera 0+1+2

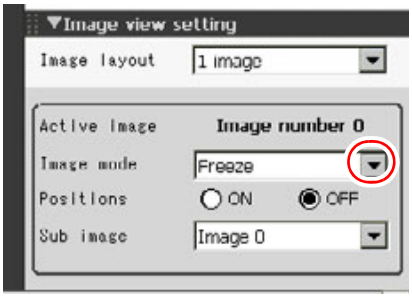
[Note 2]: When the measured coordinates, measurement region, and profile display of sub image 2 to 5 is measured by 3D edge measurement with camera 0+1+2, camera 0+1 and camera 0+2 are switched automatically inside. Therefore, the number displayed changes depending on whether the measurement is performed with camera 0+1 or camera 0+2.
The outline of switching camera 0+1 and camera 0+2 is as follows:
With camera 0+1, the edge along the horizontal direction is measured. The edge along the vertical direction cannot be measured.
With camera 0+2, the edge along the vertical direction is measured. The edge along the horizontal direction cannot be extracted.

The displayed images in the "Image display" area change according to the selection.

Changing the Camera Image Mode (ADJUST Window Only)

Select the type of camera images shown in "Image display" area.

1 In [Image view setting] in the "Control" area, tap [▼] for "Image mode" and select a mode for camera images.



POINT

- An alternative operation: tap [View] - [Image mode].

Table: Type of Camera Images

Item	Description
Through	The latest images are always captured from cameras and displayed in image view area. The following operations are not available with Through. ・Re-measurement ・Display Saved images
Freeze	Display the images acquired during the last measurements. These imaged can be updated at all times.
Last NG	Display Last NG images according to the overall judgement result. The latest measurement results are always shown in overall judgement and measurement time. In such case, the overall judgement result and measurement time may conflict with camera images.

Switch camera image view in the "Image display" area according to the selected contents.

POINT

- When displaying the Last NG and making it active, if you tap the "Image display" area or a flow, the screen is cleared. To capture the Last NG, do it before performing another operation.
- With the status of multiple inputs or when a measurement trigger is entered immediately after BUSY is turned OFF, the Last NG cannot be displayed.
- During continuous measurement, the Last NG image can not be displayed.

6.3.2 Displaying Flow and Detail Result

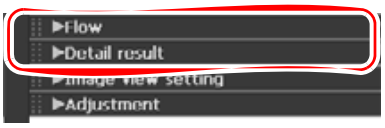
Displaying Flow and Detail Result

Toggles on/off of display of [Flow] and [Detail Result] in the "Control" area.

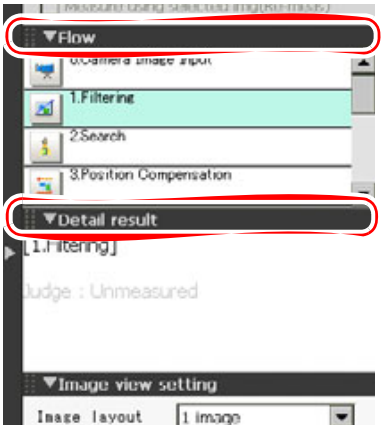
POINT

- An alternative operation: tap [View] - [Flow] or [Detail result].

1 Tap [Flow] or [Detail result] in the "Control" area.



Flow or Detail result is displayed. If tapping it again, the display restores to the original state.



2 When displaying both flow and detail result, you can change the size of the display area of the flow and the detail result by dragging [Detail result].

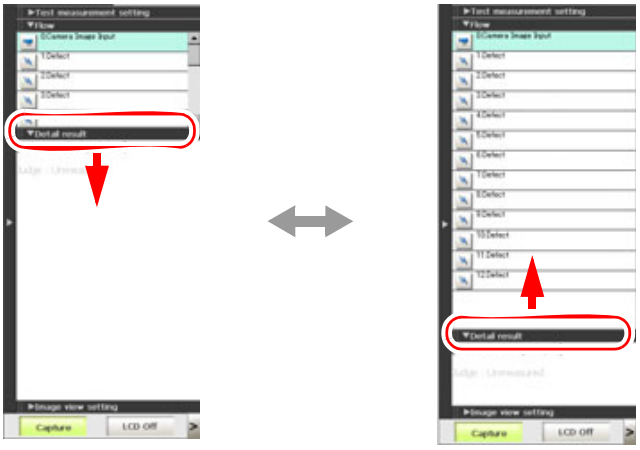


Table: Content of display

Item	Description
Flow	The background color of the selected processing unit is blue. The color of icon of the processing unit that has NG after measurement is red.

Table: Content of display

Item	Description
Detail result	Displays detail result of the processing unit selected in the flow. If tapping the "Detail result" area, the Detail result becomes active. When the Detail result is active, if you tap a flow, you can switch the No. of the processing unit you wish to display only detail result. What are displayed are the measurement results that are defined in each processing item. One item is displayed on one line. The contents are as follows. ・ Line 1 Name of the Unit Format: <X. name of Unit> (X: code number of Unit) ・ Line 2 Judgement for each processing unit Format: judge: judgement result (judgement result: OK/NG) ・ Starting from Line 3 The measurement results of each Processing Item When the judgement result is OK, black text will be viewed; when NG, red text will be viewed.

6.4 Changing Judgement Condition of a Unit during Measurement

If you use Simplified non-stop adjustment function in the RUN window (Normal mode), you can change the judgement condition of the processing unit of the displayed scene without stopping the measurement in operation.

POINT

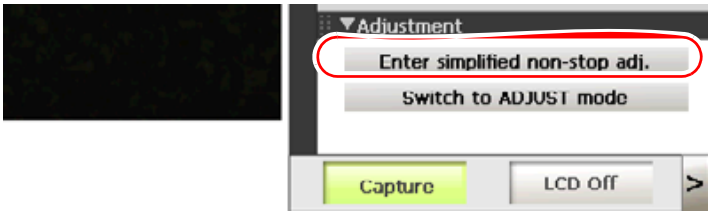
- Simplified non-stop adjustment cannot be performed in the ADJUST window and in the RUN window (RUN - fast view mode).

1 In the "Control" area of the Main screen (RUN window), tap [Adjustment].

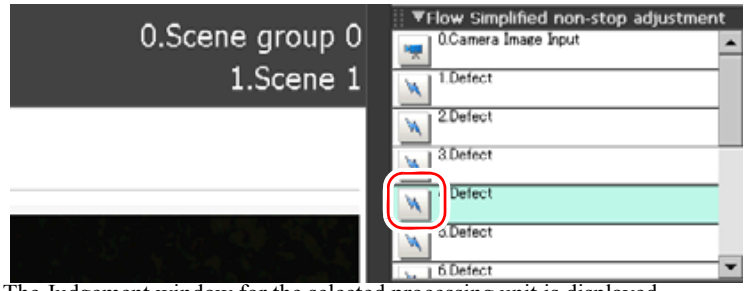
2 Tap [Enter simplified non-stop adj.].

Switch to Simple non-stop mode. [Enter simplified non-stop adj.] is switched to [Quit simplified non-stop adj.] and [Simplified non-stop adjustment] is displayed at the top of the flow in the "Control" area.

Measurement will continue in this process.



3 In the flow on the right of the Main screen, tap the icon of the processing unit you wish to edit.



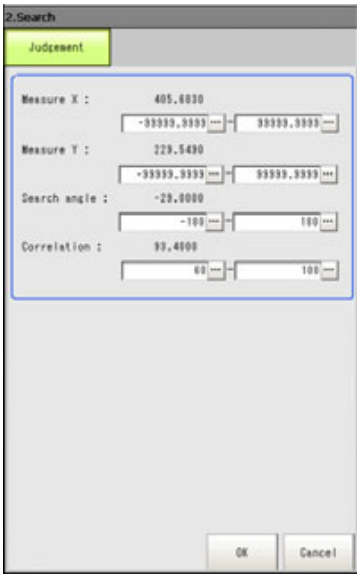
The Judgement window for the selected processing unit is displayed.

If you tap the icon of the processing unit that does not have setting item of "Judgement condition", a Judgement window is not displayed.

POINT

- If measurement flow is not displayed in the "Control" area of the Main screen, tap [Flow Simplified non-stop adjustment].
  "6.3.2 Displaying Flow and Detail Result" (→pg.12)

4 Change the Judgement conditions of each processing unit.

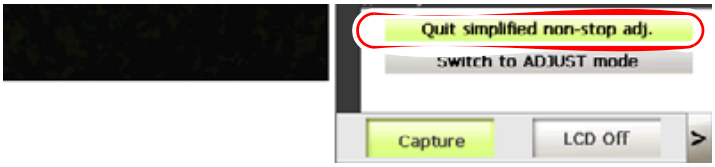


For details, see "Judgement condition" for each processing unit in " Processing Items List Manual" (→pg.1).

5 Tap [OK].

Judgement window closes, and the screen returns to the Main screen.
The changed contents are shown in the scene.
To change the judgement conditions for multiple processing units, repeat Steps 3 to 5.

6 In the "Control" area of the Main screen, tap [Quit simplified non-stop adj.].



Exit form Simple non-stop mode.

POINT

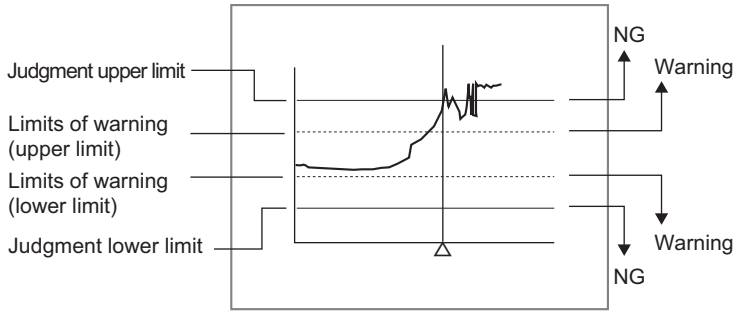
- If tapping [Switch to ADJUST mode] while executing Simplified non-stop adjustment, the Simplified non-stop adjustment mode automatically quits and the screen switches to the ADJUST window.

6.5 Trend Monitor

After setting "Trend monitor" of Processing Item, the trend of Value shall be observed to avoid NG products and Help analyze the reason. This section describes the key setting and viewing methods of "Trend Monitor".
This section describes the key setting and viewing methods of "Trend Monitor".
For actual settings, see"4.1 What is Scene" (→pg.2) and "4.7 Trend Monitor" (→pg.1), of "Processing Items List Manual".

6.5.1 Setting up Warning Range for Avoiding NG

It's used to set the conditions of OK or NG of inspected results, as well as alarming range against NG.



POINT

- If the Value is within alarming range, "Warning" is shown in the screen.
- Result output-related Processing Item enables the alarms to be output to external devices.

6.5.2 Verification Charts

The Value and occurrence time of NG can be visualized from measurement results logged by trend monitor. Up to 35 Last NG results can be visualized. This is Helpful for analyzing the occurrence time and reasons of NG.

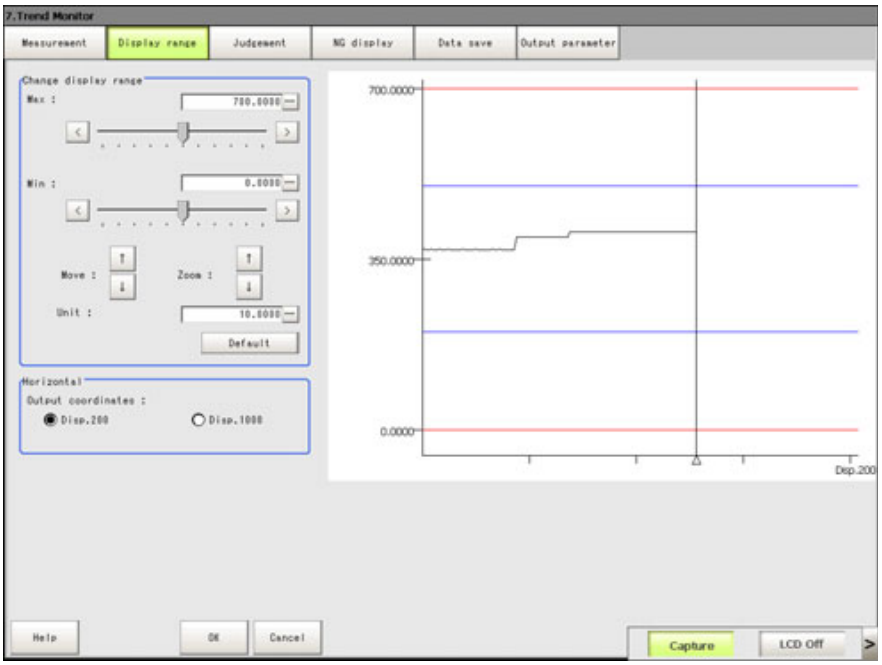
POINT

- For the trend monitor to save only measurement images that judged to be NG, set up all processing units except [Trend Monitor] so that their results should be OK.

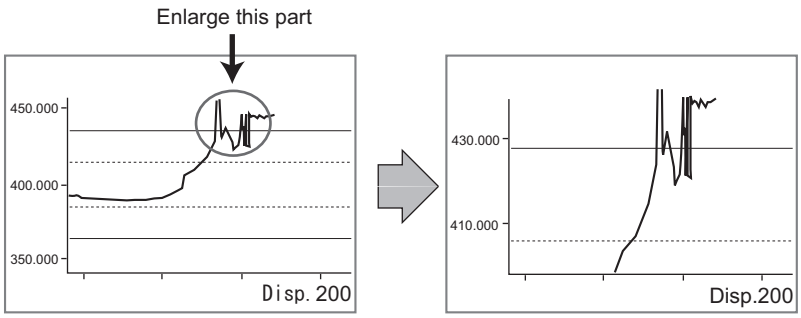
1 In the [Flow] of the "Control" area of the Main screen, tap the icon of [Trend Monitor].
The ProcItem Setting window is displayed.

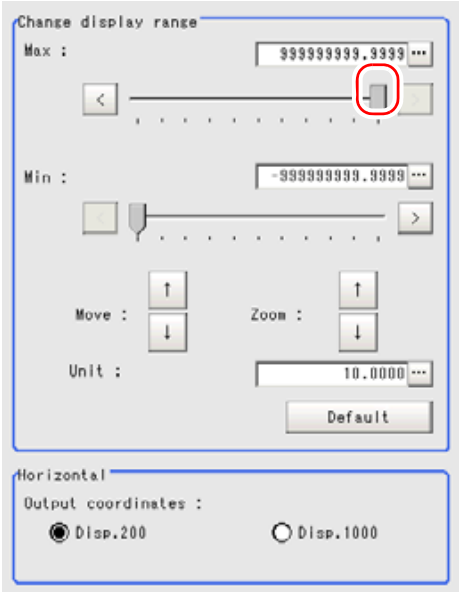
2 Tap [Display range] of the "Item tab" area in the ProcItem Setting window.

Figures are shown in the "Image display" area.



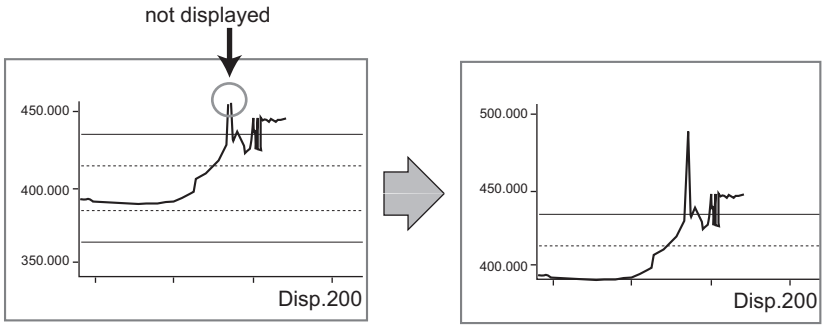
Specifying the top (Max) and the bottom (Min) of the graph to change the displayed range

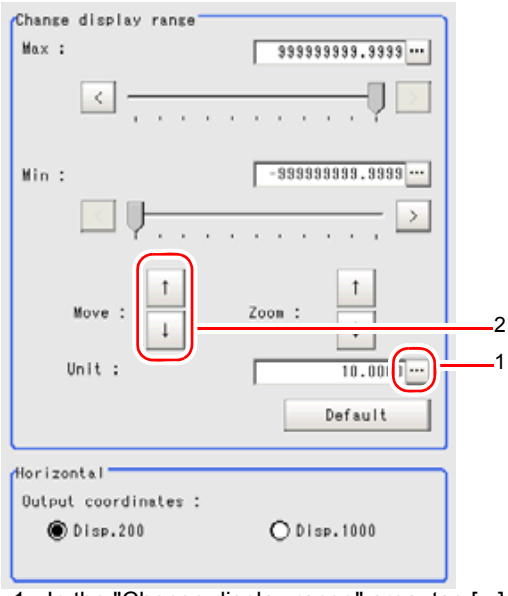




1. In the "Change display range" area, drag the slider for [Max] to a preferred value.
   The value can also be specified by tapping one of the buttons at both ends of the slider or tapping [...].
   For how to input value, see"1.4 Inputting a Value" (→pg.18).
   The max value that you set up will be located above the figure.
2. Specify the "Min." value in the same way as the "Max." value.

Moving up and down the graph itself





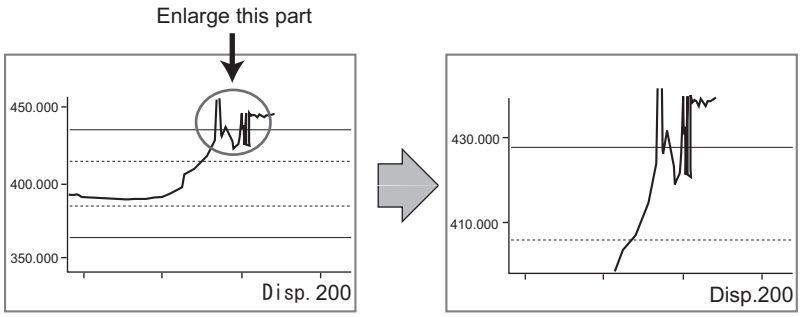
1. In the "Change display range" area, tap [...] for [Unit] and specify how many units per tap when moving the graph.
2. In the "Change display range" area, tap one of the arrow buttons of "Move" to move the graph.

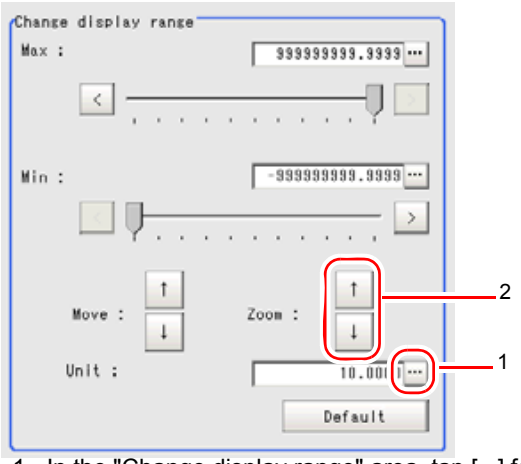
   The diagrams in the "Image display" area will be moved.

   The scale will also change as the graph moves.

Zooming in/out the graph

Example) Enlarging a part where measurement results were unstable:



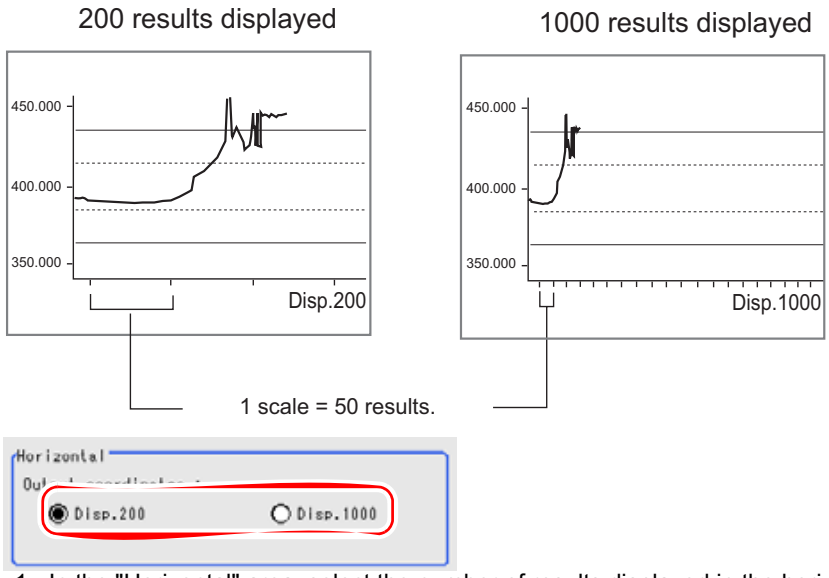


1. In the "Change display range" area, tap [...] for "Unit" and specify how many units per tap when enlarging the graph.
2. In the "Change display range" area, tap an arrow of "Zoom:" to zoom in/out the graph.
   The figure in the "Image display" area will be Zooming.
   The scale will change with the moving of figure.

Setting the optimum range automatically

1. In the "Change display range" area, tap [Default].
   The optimum range including the maximum and minimum values of the input data is displayed.
   If two or more data inputs are not available, a message that prompts for input will appear.
   Tap [Default] after performing measurement twice or more.

When changing horizontal view (number of pieces)



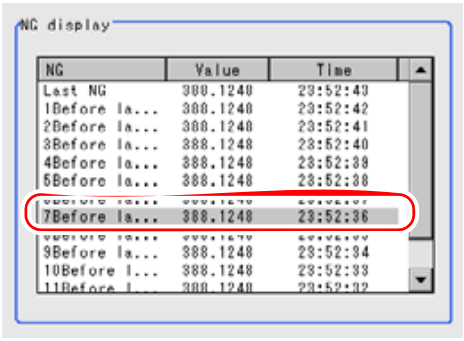
1. In the "Horizontal" area, select the number of results displayed in the horizontal direction.
   View figure according to the set number of pieces.

Verifying NG view

1 In the [Flow] of the "Control" area of the Main screen, tap the icon of [Trend Monitor].
The ProcItem Setting window is displayed.

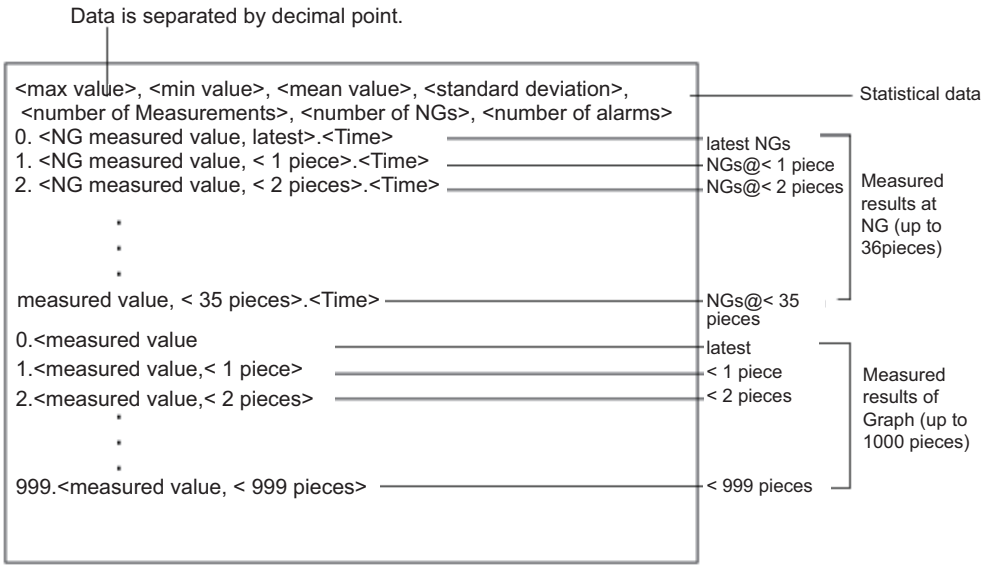
2 In the ProcItem Setting window, tap [NG display] in the "Item tab" area.

3 In the "NG display" area, tap an NG result to be displayed.



The measurement values and time are displayed.
In the "Image display" area, longitudinal line at NG position overlapped with figure shows where NG occurs.

Measured Data (CSV Format)



6.6 Capturing a Screen [Capture]

If opening the Measurement Manager bar on the lower right of the Main screen and tapping at [Capture], you can capture the content displayed on the monitor. After being read into PC, the Saved images are Pasted into files.

Important

- It takes a few seconds to capture images, during which no measurement is possible.

Screen capture can be performed from the Measurement Manager bar on the lower right of the screen.

1 Open the Measurement Manager bar on the lower right of the Main screen and tap [Capture].

POINT

- An alternative operation: tap [System] - [Screen capture] - [Screen capture].

Important

- The following windows cannot be captured.
  - The window to select a file or a folder
  - The Confirmation window which is displayed when the LCD's power is OFF.

Capture Images

After capturing, the captured images are saved into specified destination. You can specify where to save capture images in [Screen capture setting]. "9.5 Setting the Destination to Save Capture Image [Screen capture setting]" (→pg.17)

Table: Image Capture

File Name	Description
YYYY-MM-DD_HH-MM-SS-MS.BMP	Save the image viewed in monitor screen in BMP format. Image File name is set as "capture time: year(4 digits of western calendar) -month- date_ hour- minute- second- millisecond". Example) Capture time: 11:25:30.500 am, March 10th, 2007. Image file: "2007-03-10_11-25-30-500.BMP".

7

Chapter 7 - Utilizing/Analyzing Measured Data

This chapter describes how to Save measured data into PC and analyze the data.

7.1 Analyzing Measured Data with PC 2
7.2 Setting up Logging Condition [Logging setting] 7

7.1 Analyzing Measured Data with PC

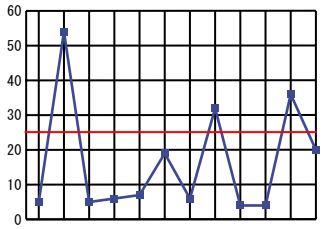
This section describes how to analyze the measured data with PC.

7.1.1 Using Logging Functions

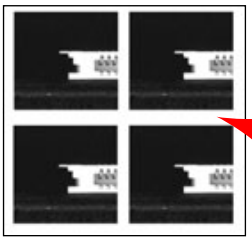
The results of measurement on images and Procesing items (hereinafter referred to as "Measurement data") can be saved to USB memory, so it is useful for the following adjustments.

- Comparing the NG image with the data to resolve the cause of NG
- Inspecting a threshold value to identify the right value
- Statistically analyzing the measured data

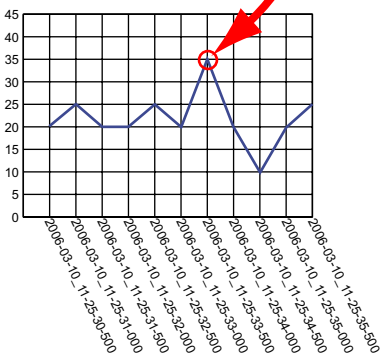
Here, the examples of setting method and usage of logging are described



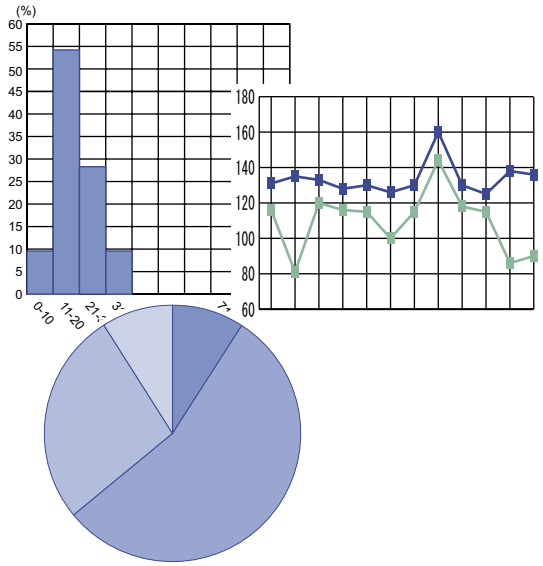
Optimization of thresholds



Verify measured data and NG images



Statistical analysis via Excel



Setting for Logging Functions

The following preparations shall be required when using logging functions.

- Set the condition for logging as "Only NG" or "All".
  "7.2 Setting up Logging Condition [Logging setting]" (→pg.7).
- Set the processing item "Data logging" in the flow of the scene for logging.
  "4.8 Data Logging" (→pg.15), of "Processing Items List Manual".

Setting When Reading Data via PC

In the case of data access via PC, the save directory must be specified in advance as USB memory in the logging setting.
"7.2 Setting up Logging Condition [Logging setting]" (→pg.7).

Analyzing Data

Analyze the settings by viewing or processing the acquired data. Please refer to the related pages.

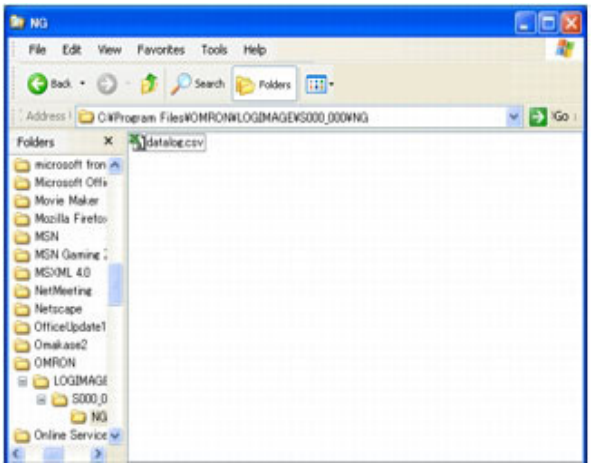
- Verify Logging Images
  Verify the Details of NG images on the controller, or compare OK with NG images.
  "5.2.1 Displaying Saved Images" (→pg.7)
- Verify Recorded Data
  " Verifying Logging Data" (→pg.3)
- Analyze Logging Data
  Analyze data and calculate optimum critical value using Excel functions.
  " Analyzing Logging Data" (→pg.4)
  " Comparing Logging Data and Images" (→pg.5)

7.1.2 Analyzing Data

Verifying Logging Data

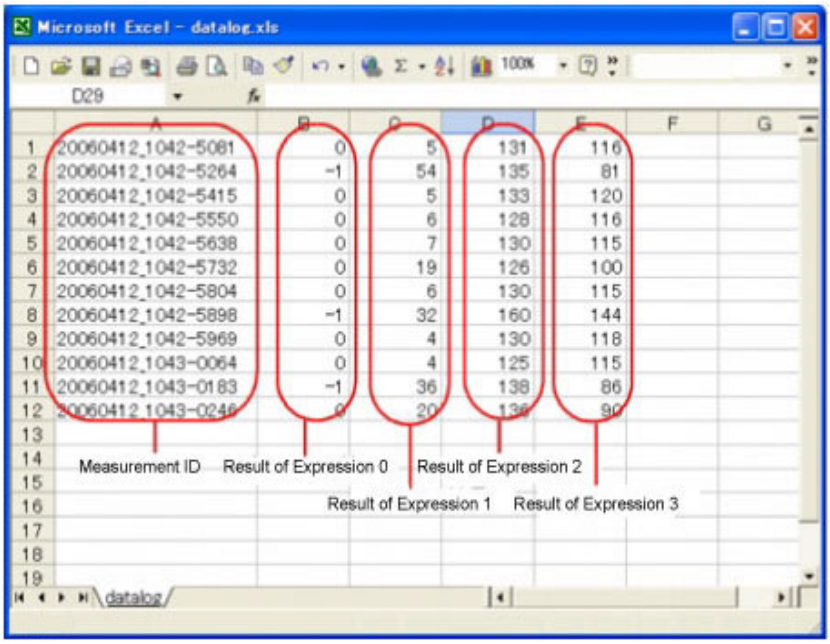
1. Measure and logging the measured data.
   "7.2 Setting up Logging Condition [Logging setting]" (→pg.7)
2. Copy the data saved in USB memory into PC.

3 Open folder with copied data.



4 Open and logged data using extension name-related applications.

Here, examples of CSV files shown in Excel are described.

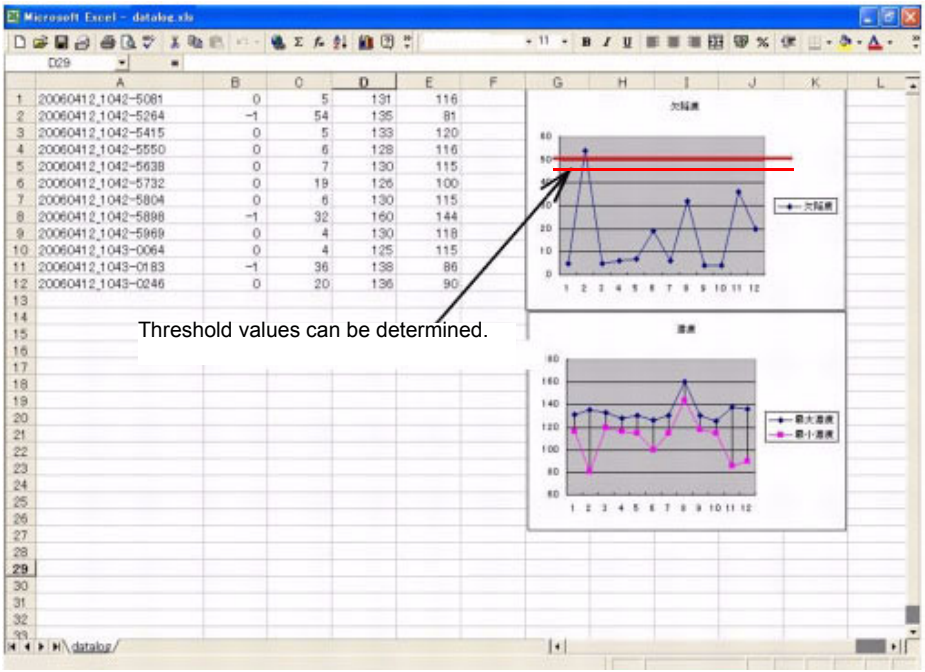


Analyzing Logging Data

Analyze data and calculate optimum critical value using Excel functions.

1 View data according to the steps of "Verify Logging Data".

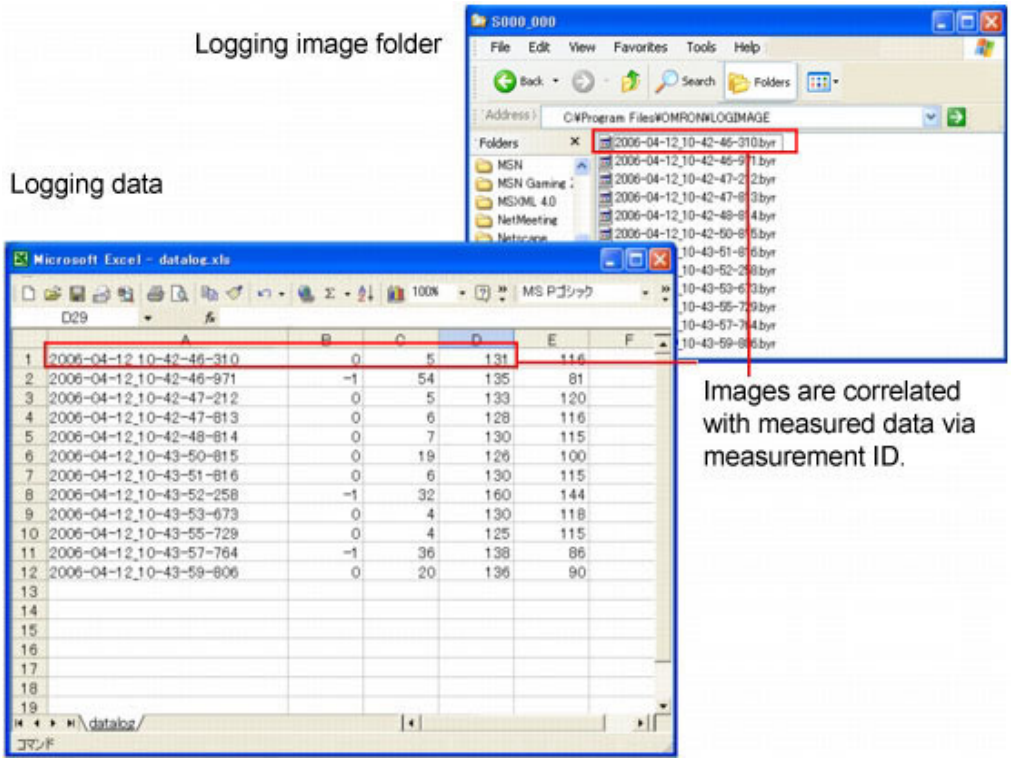
2 Analyze data and calculate optimum critical value using Excel functions.



Comparing Logging Data and Images

Analyze the trend of NG by comparing and verifying images and measured data.
The measured data saved by logging functions are correlated image data via time-dependent measurement ID.
In such way, measured data always correspond to image data.

Compare data according to measurement ID.



	A	B	C	D	E	F
1	2006-04-12_10-42-46-310	0	5	131	116	
2	2006-04-12_10-42-46-971	-1	54	135	81	
3	2006-04-12_10-42-47-212	0	5	133	120	
4	2006-04-12_10-42-47-813	0	6	128	116	
5	2006-04-12_10-42-48-814	0	7	130	115	
6	2006-04-12_10-43-50-815	0	19	126	100	
7	2006-04-12_10-43-51-816	0	6	130	115	
8	2006-04-12_10-43-52-258	-1	32	160	144	
9	2006-04-12_10-43-53-673	0	4	130	118	
10	2006-04-12_10-43-55-729	0	4	125	115	
11	2006-04-12_10-43-57-764	-1	36	138	86	
12	2006-04-12_10-43-59-806	0	20	136	90	
13						
14						
15						
16						
17						
18						
19						

7.2 Setting up Logging Condition [Logging setting]

Logging is a function to automatically save camera images and measurement results when performing measurement.
In "Logging setting", set the target of logging and the destination to save logging images and logging data.

Important

- To perform logging of measured data, set the processing unit [Data logging] in the flow.
  "4.8 Data Logging" (→pg.15), of "Processing Items List Manual"
- When image logging failed due to insufficient capacity of the destination for saving or for some other reason, "Logging error" is displayed in red in the "Measurement information display" area. The display of "Logging error" disappears if one of the Setting windows is displayed.
- When logging is done on the memory of the controller, if the number of saved images exceeds the limit, images are overwritten sequentially from the oldest one.
- The number of images that can be saved differs depending on the following conditions of capacity.
  - Camera's resolution
  - Controller's memory capacity when selecting a RAM disk
  - USB disk capacity when selecting a USB disk
- In addition to the free space, there are the following restrictions for the number of images that can be saved.
  - File Format (FAT)
    In the FAT file format, there is a limit for the number of files that can be saved under the root directory (directly under \\USBDisk). If you specify the saving destination as root directory and save image logging files only, up to about 126 files can be saved. This limit depends on the length of file names. If the files with short names only are saved, up to 512 files can be saved. If there is a file other than image logging file, the number of image logging files that can be saved becomes smaller. This restriction does not apply when saving files in subdirectories, such as \USBDisk\SUB.
  - FZ series
    Up to 999 image files can be saved in one folder. In different folders, up to 999 image files can be saved in each folder.
- The data saved in the memory of the controller or in the RAM Disk is deleted when controller is restarted.

POINT

About image logging

- It's also allowed to re-measure the logged images.
  "5.2 Re-measuring Saved Images (Re-measurement)" (→pg.5)
- When files in saving object folder are increased, the time of saving images will become longer.
- It may influence on measurement time depending on the conditions.
  " Shortening Measurement Time through Image Logging" (→pg.13)
- If [Camera Image Input] is used several times in a flow, the image by the last [Camera Image Input] is saved.

1 On the Main screen, tap [Measure] - [Logging setting].

The Logging Setting window is displayed.

2 Set the method for saving logging images.

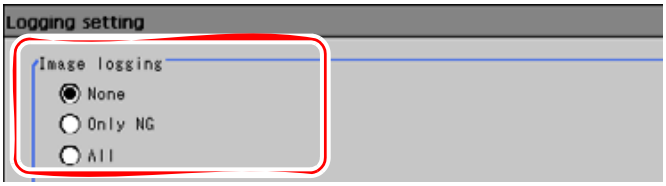


Table: Setting Items of Logging Functions

Setting Options	Set Value [Factory defaults]	Description
Image logging	Select what images are Saved.	
	[None]	Does not save images.
	Only NG	Saves the images only if NG.
	All	Saves all the measured images. Note, however, that some may not be saved if "Measurement" is selected in the "Logging priority" in Step 4.

POINT

- If "Only NG" is selected, even if an NG occurred after the processing unit for Data logging, image logging is not executed. Set Data logging as later as possible in a scene.
- When a Logging error occurs, "Logging error" is displayed in red for 10 seconds in the "Measurement information display" area.

3 Set the destination to save logging images.

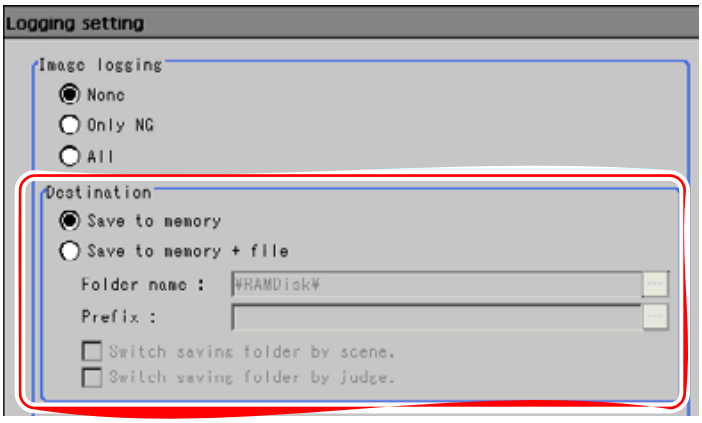


Table: Logging setting - Destination for logging image

Setting Item	Set Value [Factory Default]	Description
Destination	[Save to memory]	Saves in the memory of the controller.
	Save to memory + file	Creates image file and saves it in the specified destination folder. It is possible to create a folder for each scene group or for each scene and save image files by classifying them.
Folder name	・[RAMDisk] ・USBDisk	Specifies destination (RAM Disk or USB memory) to save image file. Logging image is saved in the specified destination folder.
Prefix	Sets prefix of saving file name. The set character string is added at the beginning of the name of the saving file.	
Switch saving folder by scene	・Checked ・[Unchecked]	If checked, image files are saved after being classified by scene.
Switch saving folder by judge	・Checked ・[Unchecked]	If checked, image files are saved after being classified by overall judgement.

When selecting "Save to memory + file"

1. Tap [...] of "Folder name" and specify destination folder to save logging image.
2. Tap [...] of "Prefix" and enter the prefix of saving file name.
3. Check "Switch saving folder by scene" or "Switch saving folder by judge" if necessary.

Example of setting and destination for "Save to memory + file"

Table: Logging setting - Destination to save logging image - Example of setting

Example of setting	Destination
・Folder name: USBDisk ・Prefix: image_ ・"Switch saving folder by scene": Checked ・"Switch saving folder by judge": Checked	For this example of setting, logging image is saved as follows. ・OK image is saved in: \USBDisk\S000-000\OK\image_(Measurement ID).IFZ ・NG image is saved in: \USBDisk\S000-002\NG\image_(Measurement ID).IFZ

4 Set Logging mode of Logging image.

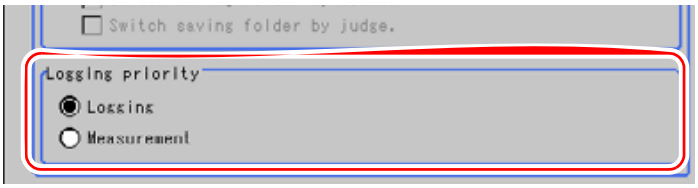


Table: Logging setting

Setting Item	Set Value [Factory Default]	Description
Logging priority	If "Save to memory + file" is selected for the destination to save image logging, the logging image of a measurement is saved in the memory of the controller first and then the saved file is transferred to a specified folder. The timing for the following measurement differs depending on the mode. Since the writing speed of RAM disk or USB disk is slower than the controller, the situation with no free space occurs temporarily on the controller's memory. Specify the mode for the case the controller's memory have no free space.	
	[Logging]	When the controller's memory have no free space, logging has priority to measurement interval (input time interval of measurement triggers). Until free space becomes available in the controller's memory, next measurement is not accepted. Image logging of all the images to be measured are executed, but measurement intervals become longer.
	Measurement	When the controller's memory have no free space, measurement interval (input time interval of measurement triggers) has priority to logging. Until free space becomes available in the controller's memory, new logging is not executed. Measurement interval is kept. Since measurement interval has priority, logging for some measurements are not executed.

5 Set how to save logging data.

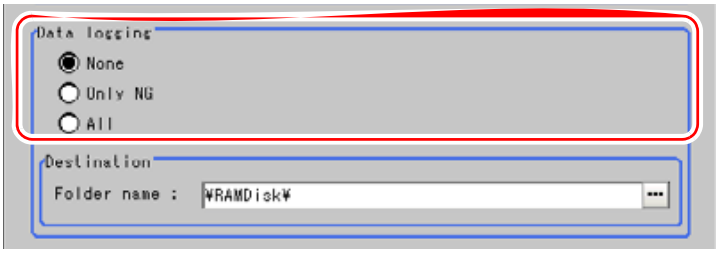


Table: Logging setting

Setting Item	Set Value [Factory Default]	Description
Data logging	Selects which data is to be saved. Output format of saved data can be set in the [Data logging] processing item.	
	[None]	Does not save the measured data.
	Only NG	Saves the measured data only if NG.
	All	Saves all the measured data.

6 Set the destination to save logging data.

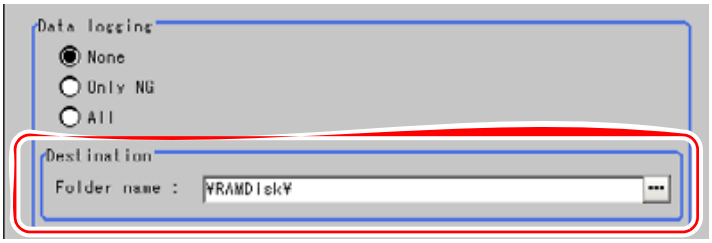


Table: Logging setting

Setting Item		Set Value [Factory Default]	Description
Destination		Specifies the destination to save logging data.	
	Folder name	・[RAMDisk] ・USBDisk	Saves the data in the specified destination folder (RAM disk or USB disk).

1. Tap [...] of "Folder name" and specify destination folder to save logging data.

POINT

About the destination to save logging data

- The setting of the factory default is to store logging data in the controller's RAM Disk. To save logging images in a PC, specify the USB disk as the save destination. Images can be, first, saved to the controller's RAM disk, and then copied from the RAM disk to the USB disk using "Copy files" in "Save to file".

7 Tap [OK].

The settings are determined and the Logging Setting window closes.

Environment Setting Part

This part describes environment settings during measurement.

Chapter 8 -Data Operation 1
Chapter 9 -Change System Environment 1
Chapter 10 -How To Connect & Communicate With External Devices 1
Chapter 11 -Appendixes 1

8

Chapter 8 - Data Operation

This chapter explains the method to save the setting data and image data of the controller to the controller itself or USB memory.
It also explains the method to reload the data saved to USB memory into the controller.

8.1 Saving/Loading Data 2

8.1 Saving/Loading Data

Scene data, scene group data, setting data such as setting values of each item of [System] menu, and logging image data can be saved.
There are two methods for saving.

- Saving in the controller's flash memory
- Saving as files in the specified destination (RAM Disk or USB memory)

POINT

- RAM Disk is the storage space (folder) created on the memory of the controller.

Important

During a data transfer, do not turn off the power.

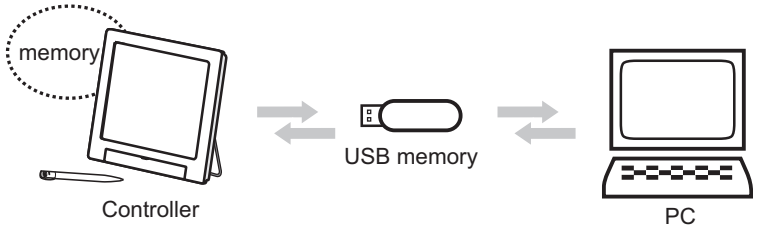
- When a message that a process, such as saving or loading, is in progress is displayed, do not restart the machine or do not turn off the power. Data will be corrupt and the system will not work properly at the next startup.
- During an execution of saving or loading, do not remove the USB memory. The controller's operation may damage data or the USB memory.
- Do not change the extension of the saved files. If changed, the file cannot be loaded as the setting data. In addition, if the setting data of the file of which extension was changed is loaded, the system may not work properly later.

Saving/Loading Setting Data

Setting data can be saved to the controller's flash memory/RAM disk or USB memory.

- To save data on the controller's flash memory, use "Data save". To save a setting data file to the RAM disk or USB memory, use "Save to file". For each operation, see each of the followings.
  - "8.1.1 Saving Setting Data in the Controller's Memory [Data save]" (→pg.6)
  - "8.1.2 Saving Setting Data to the RAM Disk/USB Memory [Save to file]" (→pg.7)
- The data saved on the RAM Disk can be sent to/received from an external device by FTP function. "10.2.4 Data Transfer via FTP" (→pg.6)
- A file that is once saved to the RAM Disk or the USB memory can be copied or moved. The data saved on the RAM Disk is deleted when the power of the controller is turned off. If you wish to keep these data, copy them on a USB memory.
  "8.1.4 Copying/Moving File [Save to file]" (→pg.9)
- The setting data saved to USB memory can be used after moving to another controller or another PC. We recommended you to save setting data to USB memory just in case of data damage or machine failure.

- For instructions on how to load the data saved in an external device onto the controller, see the following section:
  "8.1.5 Loading the Setting Data to the Controller [Load from file]" (→pg.11)



Setting Data That Can Be Saved/Loaded

Table: About Savable Data

Data	Description	"Data save"		"Save to file"	
				Create file and save	Copy/move the file to save
		Flash memory of the controller	USB memory	Controller's RAM disk/ USB memory	Controller's RAM disk/ USB memory
Setting data					
System Data (*.ini)	The contents of the settings for [System] menu and the setting data of [Image mode].	OK	-	OK	OK
Scene Data (*.scn)	Data of a scene. Classification sequence and set value of Unit in various scene.	OK	-	OK	OK
Scene Group Data (*.sgp)	The data of scene group with 32 scenes in it. The destination to save data when executing [Data save] differs between Scene Group 0 and other scene groups.			OK	OK
	Scene Group 0	OK	-		
	Scene Group 1 to 31	-	OK		
System data + data of scene groups (*.bkd)	The combined data with the system data and the data from Scene Group 0 together.	OK	-	OK	OK

OK: Possible
- : Impossible

POINT

- When executing "Save to file" or "Load from file", the data to be saved is also saved in the controller (except Scene Group Data 1 to 31).

Saving Images/Logging Data

Logging image

Logging images can be saved to the controller's RAM Disk and USB memory by using "Save to file". (You cannot save them using "Data save".)
"8.1.3 Saving Logging Image Data [Save to file]" (→pg.8)
A file that is once saved to the RAM Disk or the USB memory can be copied or moved. The data saved on the RAM Disk is deleted when the power of the controller is turned off. If you wish to keep these data, copy them on a USB memory.
"8.1.4 Copying/Moving File [Save to file]" (→pg.9)

Capturing image

Capture image is automatically saved in the destination specified in the Screen capture setting. (You cannot save them using "Data save" or "Save to file".)
However, if the destination is set as RAM Disk in the Screen capture setting, you can save them to USB memory using "Save to file". The data saved on the RAM Disk is deleted when the power of the controller is turned off. If you wish to keep these data, copy them on a USB memory.

- "9.5 Setting the Destination to Save Capture Image [Screen capture setting]" (→pg.17)
- "8.1.4 Copying/Moving File [Save to file]" (→pg.9)

Logging data

To save logging data, set the Data to be saved and the Destination in the Logging setting. (You cannot save them using "Data save" or "Save to file".)
However, if the destination is set as RAM Disk in the Logging setting, you can copy them to USB memory using "Save to file". The data saved on the RAM Disk is deleted when the power of the controller is turned off. If you wish to keep these data, copy them on a USB memory.

- "7.2 Setting up Logging Condition [Logging setting]" (→pg.7)
- "8.1.4 Copying/Moving File [Save to file]" (→pg.9)

Images/Logging data that can be saved

Table: Images/Logging data that can be saved

Data	Description	"Save to file"	
		Create file and save	Copy/move the file to save
		Controller's RAM disk/ USB memory	Controller's RAM disk/ USB memory
Image data	Image data that was created by the screen capture function or logging function (File extension is bmp or ifz.)		
Logging image (*.ifz)	Logging image during measurement. You can save it using "Save to file". You can also set to automatically save it in the Logging setting.	OK	OK
Capture image (*.bmp)	The captured image of the screen displayed on the monitor. It is automatically saved in the destination specified in the Screen capture setting. You can copy the capture image saved in the RAM Disk to USB memory using "Save to file".	-	OK
Logging data (*.csv, *.dat, etc.)	Logging data during measurement. If you set to save it in the Logging setting, it is automatically saved according to the setting. You can copy the logging data saved in the RAM Disk to USB memory using "Save to file".	-	OK

OK: Possible
- : Impossible

About the Drive Name of USB Memory

A controller is equipped with 4 USB interfaces. If multiple USB memory devices are plugged in, specify the USB memory drive that is to be the destination.
The Drive name of USB memory is called USBDisk, USBDisk2, USBDisk3 and USBDisk4, according to the sequence of inserting controller.
If the controller is started with more than one USB memory being inserted, however, Drive names will be assigned based on the ports to which USB memories are inserted. The following sequence will be used to identify the USB memories and assign the Drive names based on different controller types.

- The type which is integrated with the panel
  1: Left side of the front → 2: right side of the front → 3: front of the side face → 4: back of the side face
- BOX
  1: Lower left of the front → 2: lower right of the front → 3: upper left of the front → 4: upper right of the front

Important

The case whereby the BOX controller is used

- If USB memory is separately connected to adjacent USB interfaces, the contact between USB memories will possibly lead to failure and damage.

POINT

- Depending on the setting, saving may fail due to the insufficient USB memory. When saving failed and the error message "Please check." appeared, check to see if there is unnecessary data on the USB memory, delete it if there is, and save the data.

8.1.1 Saving Setting Data in the Controller's Memory [Data save]

Saves system data and scene group data on the controller's flash memory.

Important

- When the message to tell that saving is in operation is displayed, do not restart or turn off the power. Otherwise, it will lead to data loss and failure of operation.
- During a data transfer to USB memory, do not remove the USB memory until the transfer is completed. Data and/or the USB memory may corrupt.

POINT

- When using Scene Group 1 to 31, what can be saved in the controller's flash memory is only the system data. Note, however, that if a USB memory device is plugged in, scene group data can be saved to the USB memory.

When Using Scene Group 0

1 On the Main screen, tap [Data save] in the Toolbar.

A confirmation message is displayed.

POINT

- An alternative operation: tap [Data] - [Data save].

2 Tap [Yes].

System data and scene group data are saved on the controller's flash memory.

When Using Scene Group 1 to 31

1 Plug a USB memory device into the controller.

2 On the Main screen, tap [Data save] in the Toolbar.

A confirmation message is displayed.

POINT

- An alternative operation: tap [Data] - [Data save].

3 Tap [Yes].

System data is saved to the controller's flash memory and scene group data is saved to the USB memory respectively.

POINT

- If a USB memory device is not plugged in, the message to check it is displayed.
  If you tap [Yes], only system data is saved on the controller's flash memory.
  If you tap [No], the operation is interrupted and the display returns to the Main screen.

8.1.2 Saving Setting Data to the RAM Disk/USB Memory [Save to file]

Saves the setting data file to the RAM Disk or USB memory.

POINT

- When executing "Save to file", the data to save is also saved in the controller (except Scene Group Data 1 to 31).

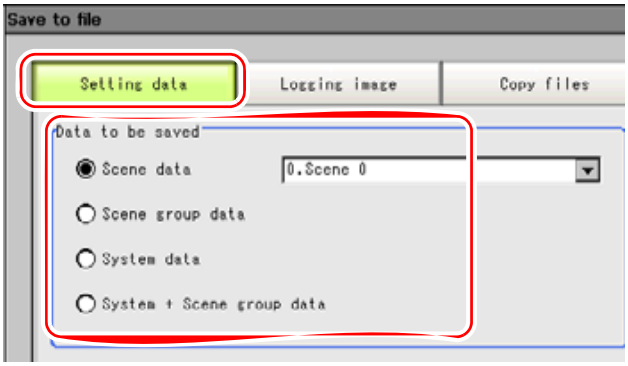
1 When saving to USB memory, plug a USB memory device into the controller.

2 On the Main screen, tap [Data] - [Save to file].

The Save to File window is displayed.

3 Tap [Setting data] and select the data to save.

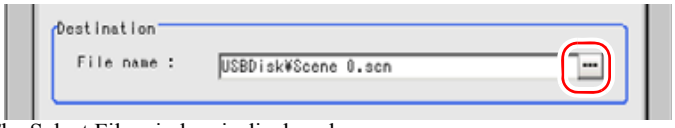
For the explanation on each data, see " Saving/Loading Setting Data" (→pg.2).



4 When selecting a scene data, tap [▼] and select the scene number to save.

5 Specify the destination.

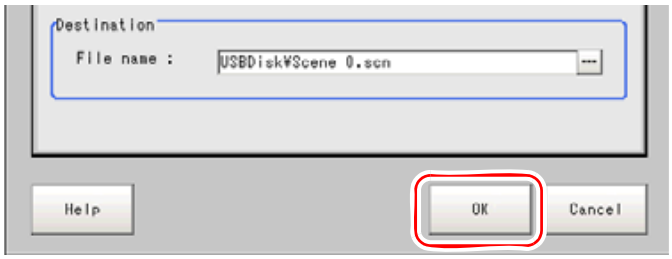
1. Tap [...] of "File name".



The Select File window is displayed.

2. Specify the destination folder and file name, and tap [OK].
"1.6 Selecting Files and Folders" (→pg.20)

6 Tap [OK].



The window to show the status of transfer is displayed, and the data is sent to the destination.

8.1.3 Saving Logging Image Data [Save to file]

Saves image data created by the logging function to the controller's RAM Disk or USB memory.

1 When saving to USB memory, plug a USB memory device into the controller.

2 On the Main screen, tap [Data] - [Save to file].

The Save to File window is displayed.

3 Tap [Logging image] and select the file to save.

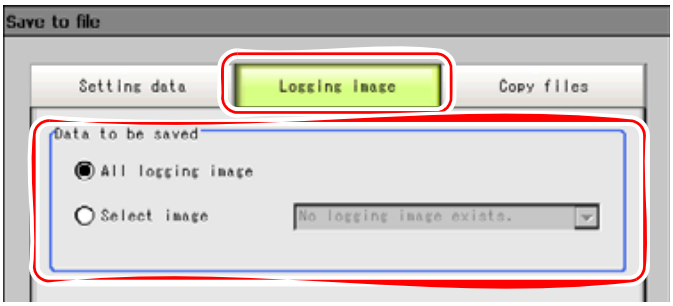


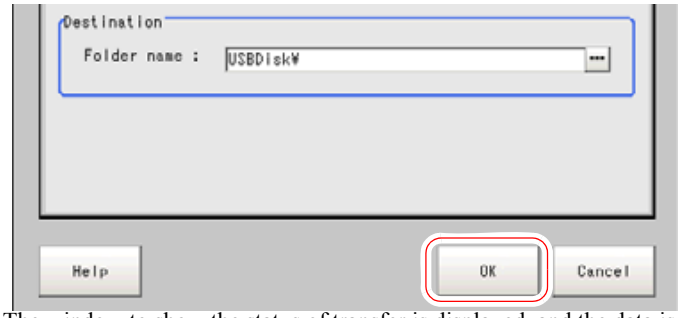
Table: Data to be saved/logging data

Setting Item	Setting value [Factory default]	Description
Data to be saved	[All logging image]	Saves all the logging images.
	Selects image	Saves the selected logging image. Tap [▼] and select the image to save.

4 Specify the destination folder.

1. Tap [...] of [Folder name].
   The Select Folder window is displayed.
2. Specify the destination folder and tap [OK].

5 Tap [OK].



The window to show the status of transfer is displayed, and the data is sent to the destination.

8.1.4 Copying/Moving File [Save to file]

Files can be copied or moved between the controller's RAM Disk and USB memory.
Images and data saved on the RAM Disk are deleted if you turn off the power. If you wish to keep these data, copy or move them to the USB memory.

1 Insert USB memory into controller.

2 On the Main screen, tap [Data] - [Save to file].
The Save to File window is displayed.

3 Tap [Copy files] and select the file or folder to copy or move.

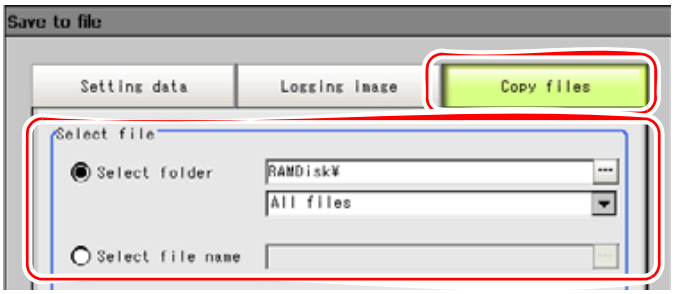
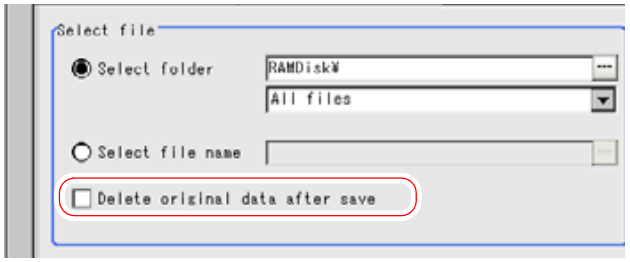


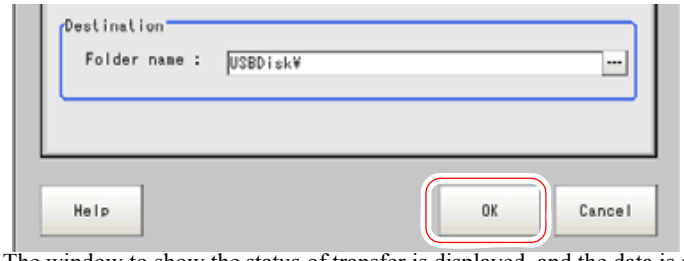
Table: Data to be saved/logging data

Setting Item	Setting value [Factory default]	Description
Select file	[Select folder]	Copies or moves multiple files in a folder. ・ Tap [...] and specify the source folder to copy/move. ・ Tap [▼] and select the file format. If selecting [All files], you can copy or move all files in the folder. If selecting one of the file formats, you can specify the type of files (extension) in the folder to copy or move.
	Select file name	Copies or moves the selected file. Tap [...] and specify a file name.

4 If you wish to delete the source file after saving it to USB memory, check "Delete original data after save".



5 Tap [OK].



The window to show the status of transfer is displayed, and the data is sent to the destination.

8.1.5 Loading the Setting Data to the Controller [Load from file]

Loads the setting data saved in an external device to the controller. The name of the loaded scene or scene group is displayed in the "Measurement information display" area.

POINT

- When executing "Load from file", the data to load is also saved in the controller (except Scene Group Data 1 to 31).

1 Do either of the followings.

- Plug the USB memory device storing data to be loaded into the controller.

Important

About USB memory

- Setting data must be stored on the USB memory.

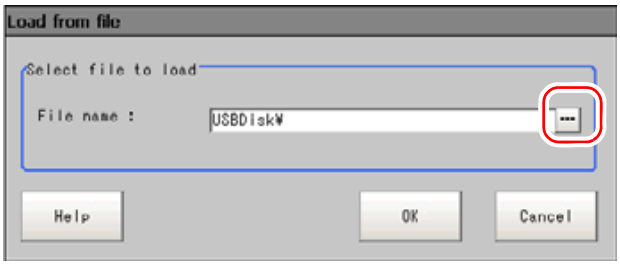
- Send setting data to the controller's RAM Disk via FTP.

2 On the Main screen, tap [Data] - [Load from file].

The Load from File window is displayed.

3 Select the file to load.

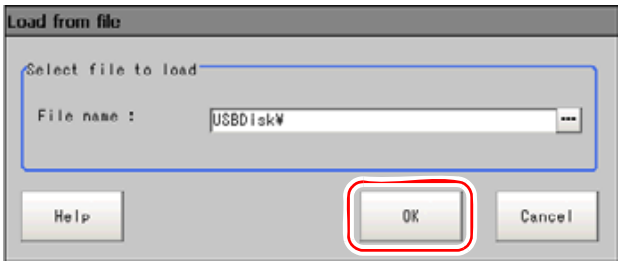
1. Tap [...] of "File name".



The Select File window is displayed.

2. Specify the file to load.
   For folder, RAM Disk and USB memory can be referred to.
   For file, only the file for setting data can be specified.
   " Setting Data That Can Be Saved/Loaded" (→pg.3)
3. Tap [OK].

4 Tap [OK].



The window to show the status of transfer is displayed, and the data is sent.

9

Chapter 9 - Change System Environment

This chapter describes the settings related to controller's system environment. For "Communication Specification", see "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1).

9.1 Setting the Conditions for Using Camera [Camera] 2
9.2 Setting for Measurement 5
9.3 Setting System Operation Environment/Checking System Information [Controller] 7
9.4 Initializing/Restarting the System [Controller] 15
9.5 Setting the Destination to Save Capture Image [Screen capture setting] 17

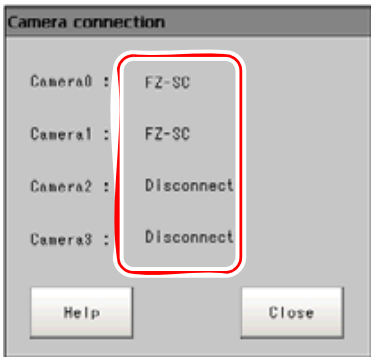
9.1 Setting the Conditions for Using Camera [Camera]

9.1.1 Checking Camera Connection [Camera connection]

Verify whether or not camera has been connected. There is no special setting here.

1 On the Main screen, tap [System] - [Camera] - [Camera connection].
The Camera Connection window is displayed.

2 Verify the connection status.



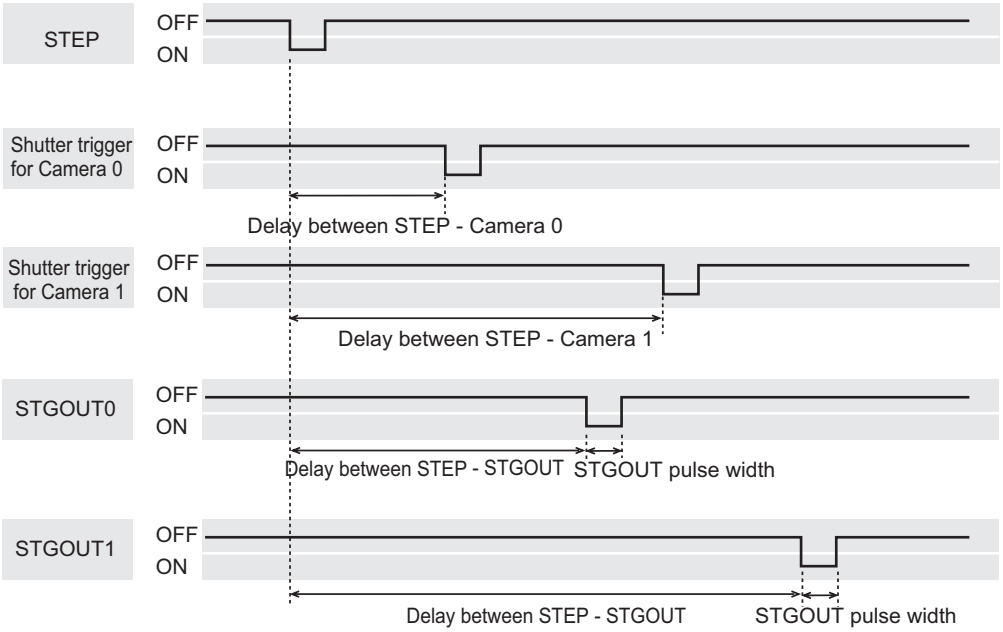
3 Tap [Close].

9.1.2 Setting for Trigger Delay [Inter-camera setting]

In the case of many cameras, the delay from receiving STEP signal to input to shutter trigger shall be set.

POINT

- Set the STGOUT width in "Electronic flash setting" of the [Camera Image Input] processing item.
  " Electronic Flash Setting" (→pg.10), of "Processing Items List Manual"



1 On the Main screen, tap [System] - [Camera] - [Inter-camera setting].

The Inter-camera Setting window is displayed.

2 Tap [...] of each item and set values.

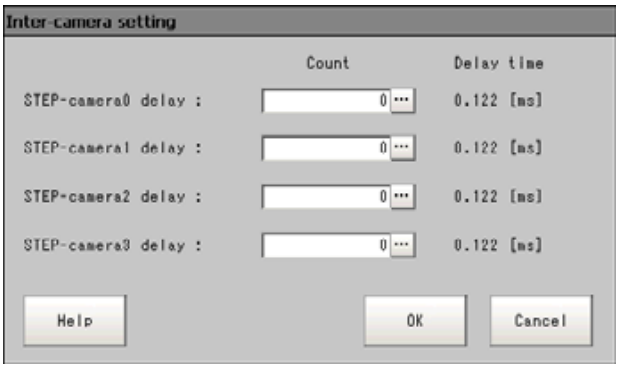


Table: STEP - Camera Delay Setting List

Item	Set Value [Factory defaults]	Description
STEP- camera 0 delay	[0] to 511 (1 count/30µs) max. 15ms	Set up the delay from the receiving of the STEP signal to the beginning of the exposure of the camera. Delay time = counts x 30µs+122µs
STEP- camera 1 delay		
STEP- camera 2 delay		
STEP- camera 3 delay		

3 Tap [OK].

The settings are determined and the Inter-camera Setting window closes.

9.2 Setting for Measurement

The following items can be changed for the operation during measurement.

- Signal output linked with the input during measurement
- Scene group saving at the time of scene group switch

1 On the Main screen, tap [Measure] - [Measure setting].

The Measurement Setting window is displayed.

2 Set each necessary item.

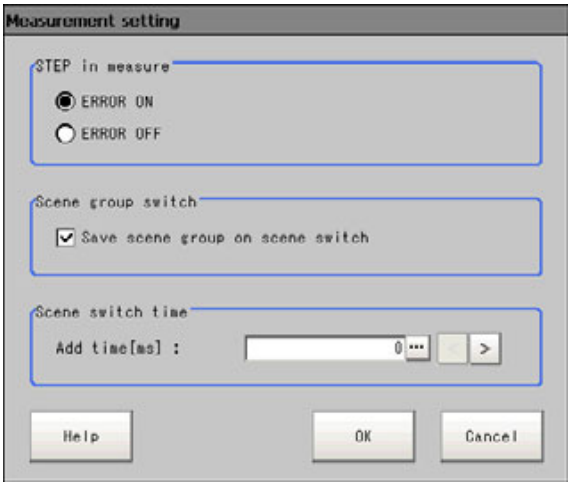


Table: Measurement setting

Item	Set Value [Factory defaults]	Description
STEP in measure		Specifies whether or not to turn ON the ERROR signal output when STEP signal is received during measurement.
	ERROR ON	Turns ERROR signal output ON when STEP signal is received during measurement.
	ERROR OFF	Turns ERROR signal output OFF when STEP signal is received during measurement.
Scene group switch		Specifies the operation when switching the scene group.

Table: Measurement setting

Item			Set Value [Factory defaults]	Description
	Save scene group on scene switch			Specifies whether or not to save the scene group when switching the scene group.
			Checked	The scene group data is saved when switching to another scene group.
			Unchecked	The scene group data is not saved when switching to another scene group. Therefore, the switching period can be compacted.
Scene switch time				Sets scene swiching time.
	Add time [ms]		[0] to 1000	Sets time to be added at scene switching. Tapping [<] or [>] allows you to set the time in 5ms from the displayed values.

POINT

- The setting of "Save scene group on scene switch" is linked with the settings of the Switch Scene Group window.
  "4.8.1 Switching the Scene Group" (→pg.52)

3 Tap [OK].

The display returns to the Main screen.

9.3 Setting System Operation Environment/ Checking System Information [Controller]

Sets controller's operation environment. The following settings are available.

- "9.3.1 Setting Date and Time [Date-time setting]" (→pg.7)
- "9.3.2 Setting the Language [Language setting]" (→pg.8)
- "9.3.3 Setting the rotation speed of the controller fan [Fan control setting]" (→pg.8)
- "9.3.4 Setting the Status at the Startup [Startup setting]" (→pg.9)
- "9.3.5 Setting the Mode of the RUN window [Select RUN mode]" (→pg.11)
- "9.3.6 Setting Password on the RUN window [Password setting]" (→pg.12)

In addition, the model of controller and the version of measurement application can be checked.

- "9.3.7 Checking System Information [System information]" (→pg.14)

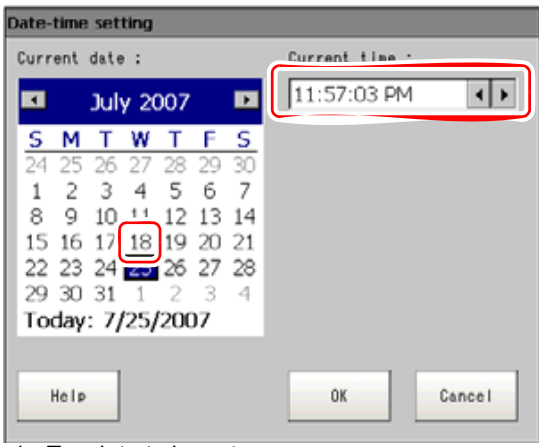
9.3.1 Setting Date and Time [Date-time setting]

Verify if date and time of embedded calendar is correct. If not, please set it correctly.
Set date/time of log data accordingly.

1 On the Main screen, tap [System] - [Controller] - [Date-time setting].

The Date-Time Setting window is displayed.

2 Set date and time.



1. Tap date to be set.
   Switch month by tapping [<] / [>] nearby year and month.
2. Set time.

3 Tap [OK].

The Date-Time Setting window closes.

9.3.2 Setting the Language [Language setting]

Sets the language used for the characters displayed on the screen. You can choose either Japanese or English.

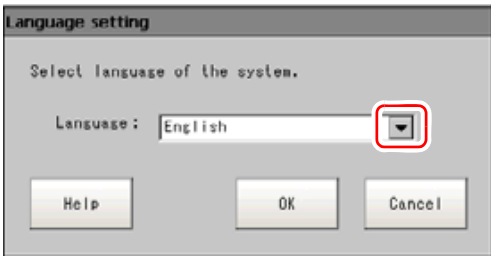
POINT

- To change the language, you need to restart the system.

1 On the Main screen, tap [System] - [Controller] - [Language setting].

The Language Setting window is displayed.

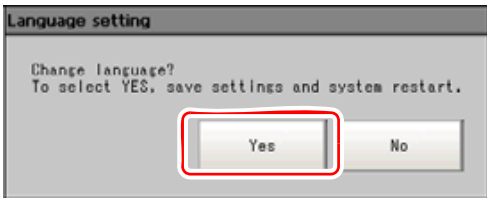
2 Tap [▼] and select a language.



3 Tap [OK].

When switching the language, a confirmation message is displayed.

4 Tap [Yes].



The setting is saved on the controller and the system automatically restarts.

After the restart, the language is switched to the selected one.

9.3.3 Setting the rotation speed of the controller fan [Fan control setting]

Sets the rotation speed of the controller fan.

1 On the Main screen, tap [System] - [Controller] - [Fan control setting].

The Fan Control Setting window is displayed.

2 Select a fan setting.

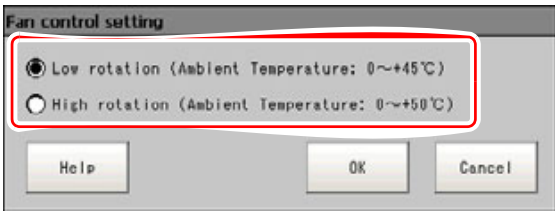


Table: Fan Control Setting

Set Value [Factory default]	Description
・[Low rotation (Ambient Temperature: 0 to +45 ℃)] ・High rotation (Ambient Temperature: 0 to +50 ℃)	Select a fan speed.

3 Tap [OK].

The fan speed is set.

Important

- For the FZ2-3xx series, the fan control setting is fixed to a low speed. You can not change it to high speed. (High-speed can be selected on the screen, however, the setting is not applied.)

9.3.4 Setting the Status at the Startup [Startup setting]

The switching-on state is set here.
If Scene No. is set for previous scene settings, it's possible to measure immediately after switching-on.
In addition, you can set not to display the Camera Setting window at a startup, which is supposed to be displayed.

1 On the Main screen, tap [System] - [Controller] - [Startup setting].

The Startup Setting window is displayed.

2 Change the settings.

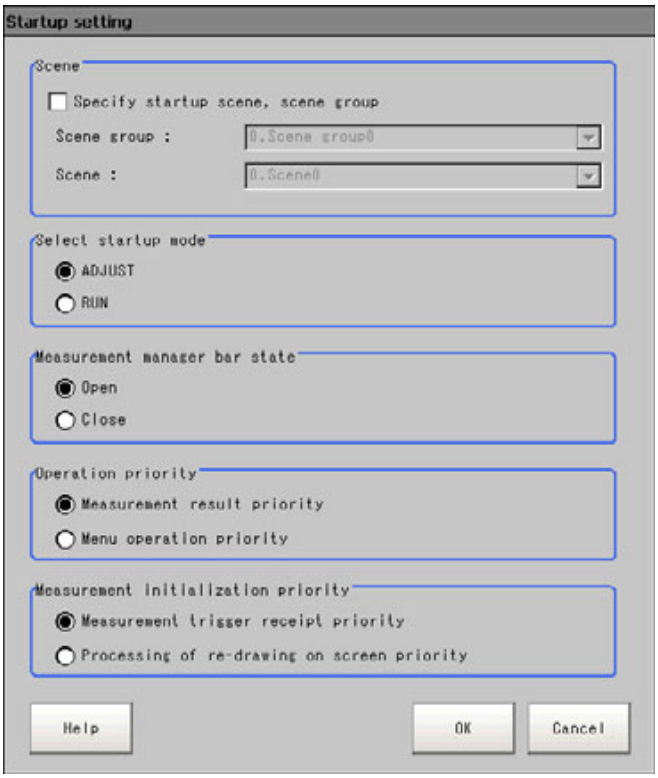


Table: Startup setting

Item	Set Value [Factory Default]	Description
Scene		
Specify startup scene, scenegroup	Checked	The selected scene/scene group will be the scene/scene group at startup.
	[Unchecked]	The scene/scene group set in the controller when "Data save" is executed will be the scene/ scene group at startup.
Scene group	Scene group 0 to 31 [Scene group 0]	Selects the scene group displayed at startup.
Scene	Scene 0 to 31 [Scene 0]	Selects the scene displayed at startup.
Select startup mode	・[ADJUST] ・RUN	Selects either the ADJUST window or the RUN window is displayed at startup.
Measurement manager bar state	・[Open] ・Close	Select whether to display the Measurement Manager bar when the system is executed.

Table: Startup setting

Item	Set Value [Factory Default]	Description
Operation priority		Specify which to have the priority, measurement result or menu operation.
	[Measurement result priority]	Measurement result has the priority over menu operation. Menu operation becomes harder to be performed due to the lowered priority.
	Menu operation priority	Menu operation has the priority. Measurement result may be displayed incompletely.
Measurement initialization priority		Measurement initialization is performed immediately after switching scene or editing flow. You can specify which to have the priority, measurement trigger receipt or processing of re-drawing on screen, during measurement initialization.
	[Measurement trigger receipt priority]	Measurement trigger has the priority even during measurement. Incomplete screen may be displayed for processing of re-drawing on screen due to its lowered priority in measurement.
	Processing of re-drawing on screen priority	Processing of re-drawing on screen has the priority. Until processing of re-drawing on screen is complete, measurement trigger will not be received.

3 Tap [OK].

The settings are determined and the Startup window closes.

9.3.5 Setting the Mode of the RUN window [Select RUN mode]

Switches the mode for the RUN window.
The RUN window has normal mode and fast view mode.
With the Fast View mode, display and operation are limited compared to those of Normal mode, but its display is faster.

1 On the Main screen, tap [System] - [Controller] - [Select RUN mode].

The Select RUN Mode window is displayed.

2 Tap [▼] and select a mode.

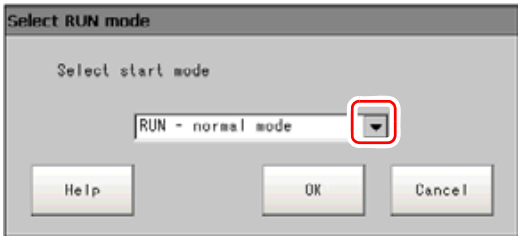


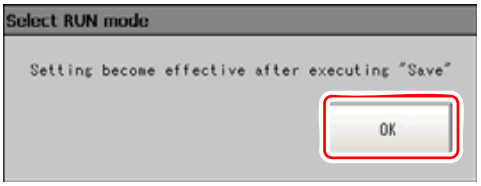
Table: Select RUN Mode Window

Set Value [Factory Default]	Description
・[RUN - normal mode] ・RUN- fast view mode	Selects which mode is used to display the RUN window.

3 Tap [OK].

A confirmation message is displayed.

4 Tap [OK].



The Select RUN Mode window closes.

9.3.6 Setting Password on the RUN window [Password setting]

Operation on the RUN window can be locked with a password.

You can lock an operation when:

- Switching from the RUN window to Adjust window
- Performing simplified non-stop adjustment on the RUN window
- Changing screen structure on the RUN window

1 On the Main screen, tap [System]-[Controller]-[Password setting].

The Password Setting window is displayed.

2 Specify each of the following items.

Table: Password Setting Window

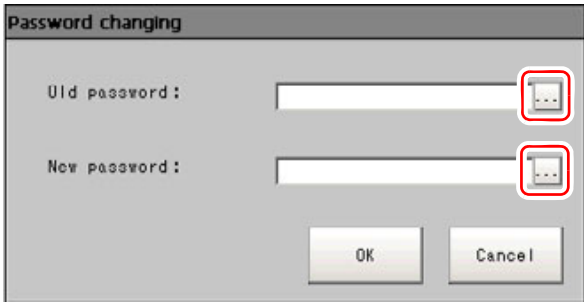
Set Value [Factory Default]	Description
[Do not use a password]	You do not need a password when changing the RUN window.
Use a password	You need a password when changing the RUN window. Select an item/items you want to set a password. ・ Switch to ADJUST mode ・ Simplified non-stop adjustment ・ Control area operation
Password changing	Tapping this button displays the Password Changing window.

POINT

- No passwords are set by default. For the first time, tap [Password changing] and set a password.

Setting or changing a password

1. On the Password Setting window, tap [Password changing].
2. Tap [...].



The software keyboard is displayed.

3. Set "Old password" and "New password".

Up to 16 letters can be used for a password.

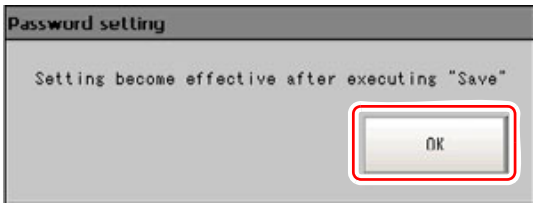
How to input text:"1.5 Inputting a Text" (→pg.19)

4. Tap [OK].
   The display returns to the Password Setting window.

3 Tap [OK].

A confirmation message is displayed.

4 Tap [OK].



The Password Setting window closes.

9.3.7 Checking System Information [System information]

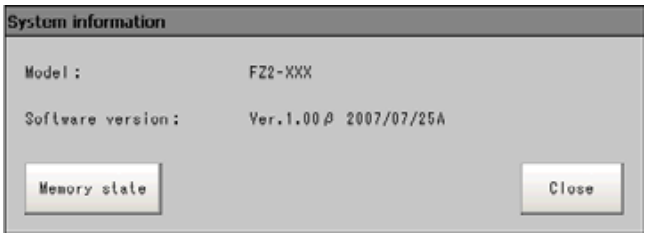
It's used to confirm the format of controller and version of measurement procedure.

1 On the Main screen, tap [System] - [Controller] - [System information].

The System Information window is displayed.

2 Confirm the information.

The model of controller and the version of measurement application can be confirmed.



3 Tap [Memory state].

You can confirm the following information.

- Available application memory (memory space available for application)
- Available data memory (memory space available for unit data and for setting data of each unit)

4 Tap [Close].

The System Information window closes.

9.4 Initializing/Restarting the System [Controller]

All settings of the controller can be restored to factory default (initialization).
In addition, the controller can be restarted.

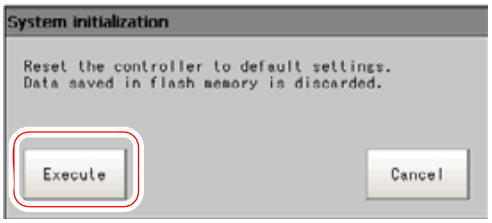
- "9.4.1 Initializing Controller [System initialization]." (→pg.15)
- "9.4.2 Restarting the Controller [System restart]" (→pg.16)

9.4.1 Initializing Controller [System initialization].

Restores the controller to factory default. Before initialization, back up the necessary data such as scene data and system data.
"8.1 Saving/Loading Data" (→pg.2)

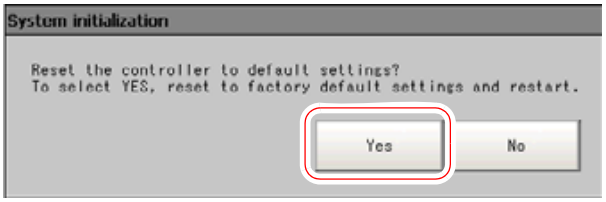
1 On the Main screen, tap [System] - [Controller] - [System initialization].
The System Initialization window is displayed.

2 Tap [Execute].



A window will be displayed for your confirmation.

3 Tap [Yes].



The controller is initialized and restarted.

POINT

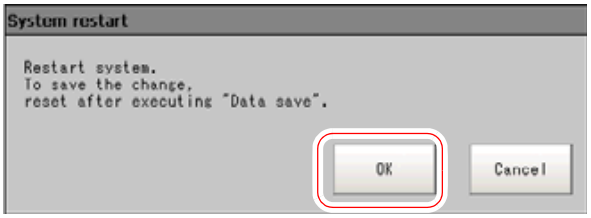
- The Language Setting window is displayed also when restarting after executing "System initialization".
- When starting up the controller first time, if a warning message, such as battery shortage and fan problem, appears before displaying the Language Setting window, the message is in Japanese.

9.4.2 Restarting the Controller [System restart]

Restart the controller. Before restarting, save the necessary data such as scene data and system data.
"8.1 Saving/Loading Data" (→pg.2)

1 On the Main screen, tap [System] - [Controller] - [System restart].
The System Restart window is displayed.

2 Tap [OK].



The controller is restarted.

9.5 Setting the Destination to Save Capture Image [Screen capture setting]

Sets the destination to save the image captured by the screen capture function.

1 On the Main screen, tap [System] - [Screen capture] - [Screen capture setting].

The Screen Capture Setting window is displayed.

2 Specify Save address of captured images.

1. Tap [...] of "Save folder".

The Select Folder window is displayed.

2. Specify the Save target folder of captured images.
3. Tap [OK].

POINT

- If the destination is not changed, capture image is saved on the RAM Disk.
  When loading capture image to USB memory, set the USB Disk as the destination of output.

3 Tap [OK].

The settings are determined and the Screen Capture Setting window closes.

10

Chapter 10 - How To Connect & Communicate With External Devices

This chapter describes the communications with external devices such as PC and programmable controllers, etc.

10.1 Connecting with External Devices 2
10.2 Ethernet Connection 3
10.3 Serial Interface 7
10.4 Parallel Interface 28

10.1 Connecting with External Devices

After controller is connected with external devices such as PCs and robots, the measurement results on controller are available.

Connecting Mode (Interface)

The following interfaces are available for connecting external devices.

- Ethernet Connection
- Serial Interface
- Parallel Interface

Communication Methods

The following communication methods are available. Prior to communication, some necessary connections shall be set to match the communication methods between devices.

- "10.2 Ethernet Connection" (→pg.3)
- "10.3 Serial Interface" (→pg.7)
- "10.4 Parallel Interface" (→pg.28)

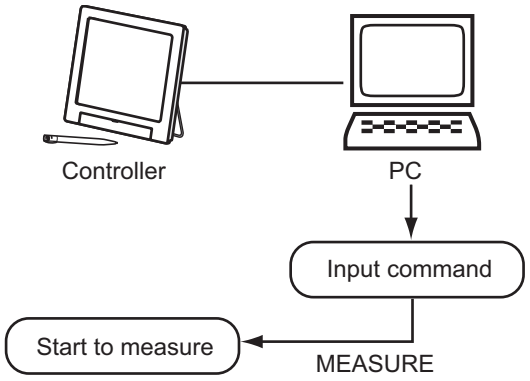
10.2 Ethernet Connection

Deal with how to set up necessary communication protocols and input formats when Ethernet (UDP/IP) is connected to the external devices.

10.2.1 Communication Processing Flow (Ethernet Connection)

The procedure to connect Ethernet.

(Example) Input measurement command



10.2.2 Setting Communication Specifications (Ethernet Connection)

Set up the IP address and communication protocols such as DNS.
In addition, the input format also needs to be set up.

Important

- Use the same communication specification settings for the controller as the external device.

1. On the Main screen, tap [System] - [Communication] - [Ethernet].
   The Ethernet window is displayed.

2 Set up the following items.

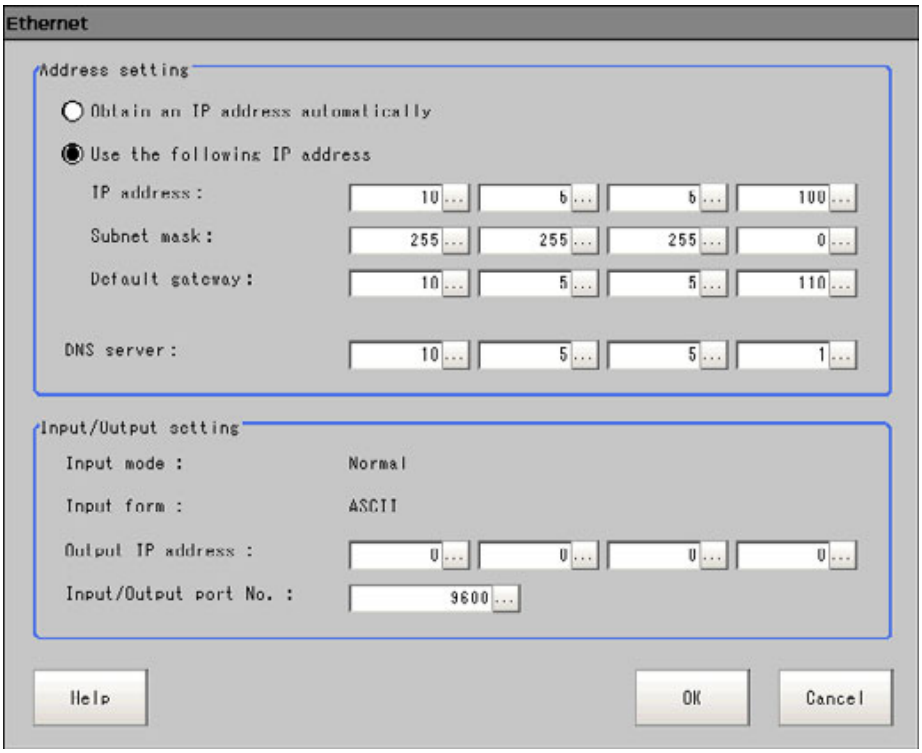


Table: Communication specifications (Ethernet connection)

Item	Set Value [Factory defaults]	Description
Address setting		

Table: Communication specifications (Ethernet connection)

Item	Set Value [Factory defaults]	Description
・Obtain an IP address automatically ・[Use the following IP address]		Set up the IP address of the controller. When the "Obtain an IP address automatically" option is selected, the IP address of the controller will be automatically obtained. After selecting the "Use the following IP address", set up the IP address, sub-net mask, and defaulted routing address.
IP address	a.b.c.d a : 1 to 223 b : 0 to 255 c : 0 to 255 d : 0 to 255 [10.5.5.100]	Enter the IP address of the controller.
Subnet mask	0.0.0.0 to 255.255.255.255 [255.255.255.255]	Enter the sub-net mask address.
Default gateway	0.0.0.1 to 255.255.255.254 [10.5.5.110]	Enter defaulted routing address.
DNS server	a.b.c.d a : 1 to 223 b : 0 to 255 c : 0 to 255 d : 0 to 255 [10.5.5.1]	Enter the DNS server address.
I/O setting		
Input mode	[Normal]	This item cannot be changed.
Input form	[ASCII]	This item cannot be changed.
Output IP address	a.b.c.d a : 1 to 223 b : 0 to 255 c : 0 to 255 d : 0 to 255 [0.0.0.0]	Enter the IP address of the output target.
I/O port No.	0 to 65535 [9600]	Set the number of the port to be used to input/output data from/to a controller.

3 Tap [OK].

The settings are determined and the Ethernet window closes.

10.2.3 Instruction Specification (Ethernet Connection)

This section describes the examples of command input format in the Ethernet normal method.
Communication specifications will be decided based on "10.2.2 Setting Communication Specifications (Ethernet Connection)" (→pg.3).
The input format and serial port are basically the same.

But no delimiter is needed at the end of the commands with the no-order mode of the Ethernet connection.
For continuous data transmission, the space (0x20) is used to separate two adjacent data, which is used as a packet to transfer.

(Example) using DISPCOND to retrieve the view state.

Command	:	DISPCOND
Response	:	View State OK

"10.3.4 Instruction Specification (Serial Interface)" (→pg.11)

Important

- With Data Output (setting for Ethernet output), up to 128 units can be registered. Note, however, that all the data may not be received depending on the environment you use (network environment, PC's performance, software to receive data, etc.).

10.2.4 Data Transfer via FTP

Using FTP function, you can get various data files from the controller, which are saved to the controller's RAM Disk or USB memory.
In addition, the files edited outside can be transferred to the controller by using FTP function.
The data that can be sent and received by using FTP function are as follows:

- System data (*.ini)
- Scene data (*.scn)
- Scene group data (*.sgp)
- System + Scene group data (*.bkd)
- Logging image (*.ifz)
- Logging data (*.csv, *.dat, etc.)

POINT

- When sending or receiving files by using FTP function, make sure to use one-byte alphanumeric characters for file names.

10.3 Serial Interface

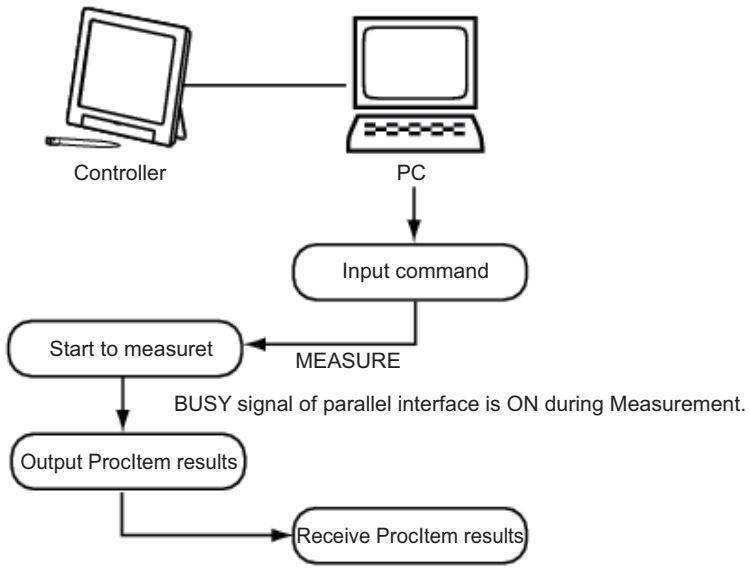
This section describes how to set communication specifications with external devices via serial interface (RS-232C/422 link) with No-order commands, as well as I/O format.

10.3.1 Communication Processing Flow (Serial Interface)

This section describes how to connect via RS-232C/422.

1:1 connection

Example) Input measurement command and acquire the results



* When "Flow Control" is set to "Xon/Xoff".
If a PC has no response within preset overtime, line breakage or PC malfunction maybe occur, signalling an overtime error.
Error message will displayed in the window of controller and ERR signal of parallel interface is ON.

10.3.2 Setting Communication Specifications (Serial Interface)

It describes how to set communication specifications such as communication speed and data length. Including setup for flow control and multipoint link.

Important

- Use the same communication specification settings for the controller as the external device.

POINT

- While setting communication specifications, Input is not adjusted. However, input status can be checked using [Confirmation].
  "10.3.3 Checking the Communication Status (Serial Interface)" (→pg.10)
- When data is output via serial communication, output is suspended while setting communication specifications.

1 On the Main screen, tap [System] - [Communication] - [Serial].

The Serial window is displayed.

2 Tap [Setting] to set communication specifications.

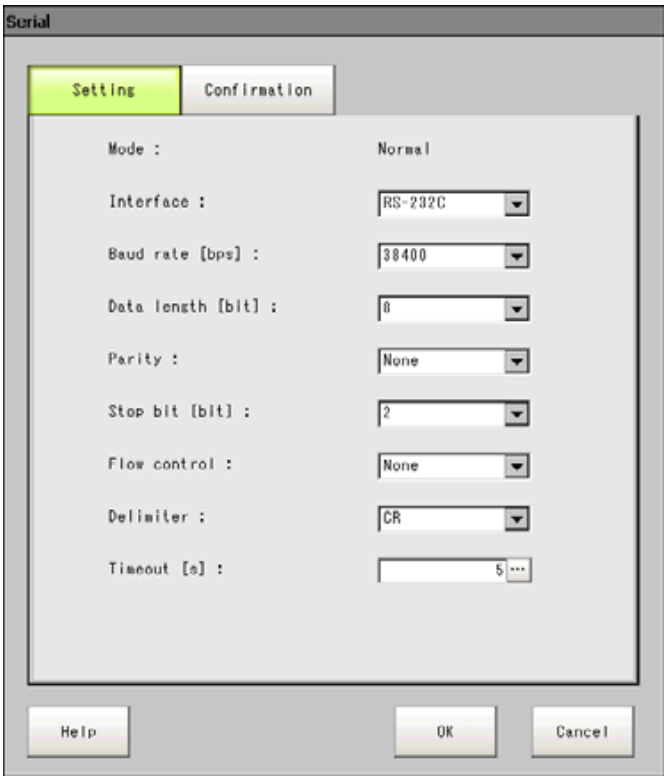


Table: Communications Specifications (Serial Interface)

Item	Set Value [Factory defaults]	Description
Interface	・[RS-232C] ・RS-422	Make consistent with communication specifications of the PC.
Baud rate [bps] [Note 1]	・2400 ・4800 ・9600 ・19200 ・[38400] ・57600 ・115200	Consistent with communication specifications of computers.
Data length [bit]	・7 ・[8]	Consistent with communication specifications of computers.
Parity	・[None] ・Odd ・Even	
Stop bit [bit]	・1 ・[2]	

Table: Communications Specifications (Serial Interface)

Item	Set Value [Factory defaults]	Description
Flow control	[None]	Do process control without software. If no response can be received from peripherals in excess of overtime setting time, overtime Error will occur, and Error information will be viewed. ERROR signal of parallel interface is also ON.
	Xon/Xoff	Flow control with software. Data are sent according to Xon/Xoff code from peripherals.
Delimiter	・[CR] ・LF ・CR+LF	Consistent with communication specifications of computers.
Timeout [s]	1 to 120 [5]	Set the time of overtime Error at second unit.

[Note 1]: Communication speed over 20kbps isn't defined in RS-232C, so, normal communication couldn't be always guaranteed if communication speed over 38400bps is selected according to different cable length. In such case, set communication speed below 19200bps.

3 Tap [OK].

The settings are determined and the Serial window closes.

10.3.3 Checking the Communication Status (Serial Interface)

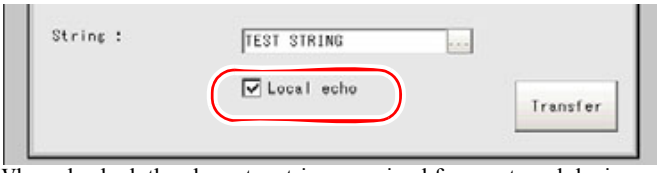
Check the communication status with the external devices that are connected by serial interface. You can check whether wiring and communication settings are done properly.

1 On the Main screen, tap [System] - [Communication] - [Serial].

The Serial window is displayed.

2 Tap [Confirmation] to check I/O status.

3 Check or uncheck the "Local echo" check box.



When checked, the character strings received from external devices can be sent directly.

4 You can input any character when editing and testing the character strings to be sent.

1. Tap the [...] button on the right side of the "String".

The soft keyboard is displayed.

2. Input character strings within 12 characters.
   How to input text: "1.5 Inputting a Text" (→pg.19)

5 Tap [Transfer].

Contents of "Send String" are displayed on the window. Please verify it.

Table: About Display Contents on Screen

Display	Description
[Send]	Display character strings sent to external devices.
[Receive]	Display character strings received from external devices.

6 Tap [OK].
The Serial window closes.

10.3.4 Instruction Specification (Serial Interface)

This section explains an example of the command input format that is used in the Serial Normal method. Communication specifications will be decided based on "10.3.2 Setting Communication Specifications (Serial Interface)" (→pg.7).

Example of Input Format (SCENE Command)

SCENE<Scene No.> delimiter

- Set up the parameter value in < >.
- Parameters are separated by space. (not required before delimiter)
- Delimiters must be input at the end of commands.
- The following are Errors. When Errors occur, the system will be quitted.
  - When non-existing commands are used
  - The number of parameters is incorrect
  - The scope of parameters is incorrect
  - The content of parameters is incorrect
  - Can not quit correctly when executing the action commands

Important

- Commands can be inputted and measurement results can be outputted only when the Main screen is at the foremost front. Cannot react to commands when setup windows or the Edit flow windows are displayed (not including "Serial" - "Confirmation"). In the Main screen, the output data after measurement will not be interrupted to the last one, even when the Main screen is switched to the Edit Flow window, etc. Can not react to commands when windows other than the Main screen are displayed.

10.3.5 Instruction List (Serial Interface)

This section explains input format of each command used in the Serial Normal method.
Commands can be input in ASCII code, case-insensitive.

Table: Command List

Command	Abbreviation	Function	Please see
CLRMEAS	No	Empties all the Value of the current scenes	" CLRMEAS -CLeaR MEASurement value-" (→pg.13)
BKDLOAD	No	Loads System + Scene group 0 data	" BKDLOAD" (→pg.13)
BKDSAVE	No	Saves System + Scene Group 0 data in a file	" BKDSAVE" (→pg.14)
DATASAVE	No	Saves System + Scene group data in the controller's memory	" DATASAVE" (→pg.14)
DATE	No	Sets up/obtain the current date/time	" DATE" (→pg.15)
DISPCOND	No	Acquires current view state of images	" DISPCOND - DISPlay CONDition -" (→pg.15)
		Changes the view state of images	
IMGSAVE	No	Saves the image data	" IMGSAVE - IMaGe SAVE -" (→pg.16)
MEASURE	M	Performs 1 measurement	" MEASURE or M" (→pg.17)
RESET	No	Restarts the controller	" RESET" (→pg.18)
SCENE	S	Acquires in-use Scene No.	" SCENE or S" (→pg.18)
		Scene Switch No.	
SCNGROUP	SG	Acquires in-use scene group No.	" SCNGROUP or SG - SceNe GROUP -" (→pg.18)
		Switch scene group No.	
SCNLOAD	No	Loads the Scene data	" SCNLOAD - SCeNe LOAD -" (→pg.19)
SCNSAVE	No	Saves the Scene data	" SCNSAVE - SCeNe SAVE -" (→pg.20)
SCRSWITCH	No	Switches ADJUST window/RUN window	" SCRSWITCH - SCReen SWITCH -" (→pg.20)
SGRLOAD	No	Loads the scene group data	" SGRLOAD - Scene GRoup LOAD -" (→pg.21)

Table: Command List

Command	Abbreviation	Function	Please see
SGRSAVE	No	Saves the scene group data	" SGRSAVE - Scene GRoup SAVE -" (→pg.21)
SYSDATA	No	Gets current system data	" SYSDATA - SYStem DATA -" (→pg.22)
		Sets system data	
SYSLOAD	No	Loads system data	" SYSLOAD - SYStem LOAD -" (→pg.23)
SYSSAVE	No	Saves system data	" SYSSAVE - SYStem SAVE -" (→pg.24)
UNITDATA	UD	Gets the parameters and/or measurement values of specified processing unit	" UNITDATA or UD" (→pg.24)
		Sets the parameters of specified processing unit	
VERGET	No	Acquires system version information	" VERGET - VERsion GET -" (→pg.25)

CLRMEAS -CLeaR MEASurement value-

Function ... Empties all the Value of the scenes that are being used.

Command CLRMEAS delimiter

Response Performed correctly :OK delimiter

Failure to perform :ER delimiter

The values after emptying are as follows.

Table: View State of Screens

Item	Description
Judgement result	Unmeasured (0)
Value	0
Character string	Text

BKDLOAD

Function ... Loads System + Scene group 0 data

Command BKDLOAD <File name of System + Scene group data> delimiter

Specifies <System + Scene group data file name> using an absolute path like \USBDisk\abc.bkd.

Response When executed properly: OK delimiter

When not executed properly: ER delimiter

POINT

- The following cases result in failure.
  - When a file with a different extension (other than "***.BKD") is specified:

- When a file that does not exist is specified.

▶ Do not turn off the power of the controller until a response is returned.

(Example)

Command	:	BKDLOAD \USBDisk2\IMG01\LABEL1.BKD delimiter Loads "LABEL.KBD" in the "IMG01" folder of the USB memory drive labeled "USBDisk2" onto the controller.
Response	:	OK delimiter

BKDSAVE

Function ... Saves in a file the System + Scene Group 0 data, which is currently used in the controller

Command	BKDSAVE <File name of System + Scene group data> delimiter Specifies <System + Scene group data file name> using an absolute path like \USBDisk\abc.bkd.
Response	When executed properly: OK delimiter When not executed properly: ER delimiter

POINT

▶ The following cases result in failure.
- When a file with a different extension (other than "***.BKD") is specified:

▶ Do not turn off the power of the controller until a response is returned.

(Example)

Command	:	BKDSAVE \USBDisk2\IMG01\LABEL1.BKD delimiter Saves the currently used System + Scene Group 0 data to a file named "LABEL1.BKD" in the "IMG01" folder of the USB memory drive "USBDisk2".
Response	:	OK delimiter

DATASAVE

Function ... Saves system data and scene group data on the controller's flash memory

Command	DATASAVE delimiter Saves system data and scene group data on the controller's flash memory.	
Response	Performed correctly	:OK delimiter
	Failure to perform	:ER delimiter

POINT

▶ When using Scene Group 1 to 31, if you execute DATASAVE command, system data is saved on the controller's flash memory and scene group data is saved to the USB memory. If a USB memory device is not plugged in, ER is returned.

▶ Do not turn off the power of the controller until a response is returned.

(Example)

Command	:	DATASAVE delimiter Saves a System + Scene group data of System + Scene group No. 3 with the file name "LABEL1.BKD" in the "IMG01" folder of the USB memory drive labeled "USBDisk2".
Response	:	OK delimiter

DATE

Function 1 ... Obtains the current date/time

Command	DATE delimiter	
Response	Performed correctly	:Year/month/day/hour/minute/second delimiter OK delimiter
	Failure to perform	:ER delimiter

(Example)

Command	:	DATE delimiter
Response	:	20070830123000 Delimiter OK delimiter 30.08.07/12h/30min/00s

Function 2 ... Sets the date/time

Command	<Western calendar 4 digits> <month 2 digits><day 2 digits><hour 2 digits> <minute 2 digits><second 2 digits> delimiter	
Response	Performed correctly	:OK delimiter
	Failure to perform	:ER delimiter

POINT

- The <hour 2 digits><minute 2 digits><second 2 digits> can be omitted when setting up. They can not be updated when being omitted and the previous time will be kept unchanged.
  The available omitting options include "omitting <second> only", "omitting <hour><minute><second>," cannot "omit <hour> only" and "omit <minute> only."

(Example)

Command	:	DATE 20070830123000 delimiter Set to 8/30/2007 12:30:00 am.
Response	:	OK delimiter

DISPCOND - DISPlay CONDition -

Function 1 ... Acquires current view state of images

Command	DISPCOND delimiter

Response	Performed correctly	:View state delimiter :OK delimiter
	Failure to perform	:ER delimiter

View state is shown below.

Table: View State of Screens

View State	Description
0	Image mode is "Through".
1	Image mode is either "Freeze" or mixture of "Freeze" and "Last NG".
2	Image modes of all the windows are "Last NG".

(Example)

Command	:	DISPCOND delimiter
Response	:	0 Delimiter
		OK delimiter
		Current images are shown with full state.

Function 2 ... Changes the view state of images

Command DISPCOND <view image model No> delimiter

Select 0 to 2 from the Image Mode Number.
- 0: Changes the image modes of all the windows to "Through"
- 1: Changes the image modes of all the windows to "Freeze"
- 2: Changes the image modes of all the windows to "Last NG"

Response	Performed correctly	:OK delimiter
	Failure to perform	:ER delimiter

(Example)

Command	:	DISPCOND 2 delimiter
		Viewed images are changed to Last NG images.
Response	:	OK delimiter

IMGSAVE - IMaGe SAVE -

Function ... Saves image data into the external devices

Command IMGSAVE <Image Data Number> <Save to Destination Address> delimiter

For <Image data No.>, specify 0 to I_MAX. For I_MAX, see "11.8 Number of Logged Images" (→pg.24).
Select the following from the <Save to Destination Address>
- \USBDisk\...
  When the destination folder is in the USB memory, it will be Saved to the USB memory. The file extension is "***.IFZ".

Response	Executed correctly	:OK delimiter
	Executed correctly	:ER delimiter

POINT

- Cannot be executed correctly in case of the following.
  - When an extension other than "ifz" is specified for the name of the file to be saved
  - When a non-existing folder is selected in the destination address
- In the case the specified file name has existed, the existing file will be overwritten
- Do not cut off power of controller before the response.

(Example)

Command	:	IMGSAVE 3 \USBDisk2\IMG01\LABEL1.IFZ delimiter The image data of the No.3 image, namely the "LABEL1.IFZ" file, will be Saved into the "IMG01" folder in the USB memory of the "USBDisk2" drive.
Response	:	OK delimiter

MEASURE or M

Function 1 ... Performs a measurement

Command	MEASURE delimiter	
	Performed correctly	:OK delimiter :Measurement Result
	Failure to perform	:ER delimiter

Function 2 ... Starts continuous measurement

Command	MEASURE /C delimiter	
	When executed properly	:OK delimiter :Measurement result :Measurement result :Measurement result
	When not executed properly	:ER delimiter

Function 3 ... Stops continuous measurement

Command	MEASURE /E delimiter	
	When executed properly	:OK delimiter
	When not executed properly	:ER delimiter :Measurement result :Measurement result (Measurement continues.)

POINT

- To output the measurement result, insert a [Data Output] processing unit in the scene. When the scene does not have a [Data Output] processing units, only a response to the command is output.
  "10.3.6 Output Format (Serial Interface)" (→pg.26)
  "6.3 Data Output" (→pg.1), of "Processing Items List Manual"

RESET

Function ... Restarts the controller

Command	RESET delimiter	
Response	No	

SCENE or S

Function 1 ... Acquires in-use Scene No.

Command	SCENE delimiter	
Response	Performed correctly	:Scene No. delimiter :OK delimiter
	Failure to perform	:ER delimiter

(Example)

Command	:	SCENE delimiter
Response	:	0 Delimiter
		OK delimiter
		Scene 0 is being used

Function 2 ... Scene Switch No.

Command	SCENE <Scene No.> delimiter	
	Point at the code number 0 to 31.	
Response	Performed correctly	:OK delimiter
	Failure to perform	:ER delimiter

(Example)

Command	:	SCENE 2 delimiter
		Switches to scene 2
Response	:	OK delimiter

SCNGROUP or SG - SceNe GROUP -

Function 1 ... Acquires in-use scene group No.

Command	SCNGROUP delimiter	
Response	Performed correctly	:scene group No. delimiter :OK delimiter
	Failure to perform	:ER delimiter

(Example)

Command	:	SCNGROUP delimiter
Response	:	0 Delimiter
		OK delimiter
		Scene Group 0 is being used.

Function 2 ... Switches the scene group number

Command	SCNGROUP <scene group No.> delimiter	
	Scene group No. shall be set within 0 to 31.	
Response	Performed correctly	:OK delimiter
	Failure to perform	:ER delimiter

(Example)

Command	:	SCNGROUP 2 delimiter
	:	Switches to Scene Group 2.
Response		OK delimiter

Important

- When parallel continuous measuring is engaged and continuous STEP signal is inputted, switching of scene group should be avoided. To switch a scene group, uncheck "Save scene group when switching" by either of the following methods.
  - The Switch Scene Group window "4.8.1 Switching the Scene Group" (→pg.52)
  - [Measure setting] in the [Measure] menu "9.2 Setting for Measurement" (→pg.5)

SCNLOAD - SCeNe LOAD -

Function ... Loads the Scene data from the external devices

Command	SCNLOAD <Scene No.> <Load Resource> delimiter	
	Point at the <code number> 0 to 31. Select the following from the <Load Resource> ・\USBDisk\... When a file in the USB memory is selected, this file will be loaded. The file extension is "***.SCN".	
Response	Executed correctly	:OK delimiter
	Executed correctly	:ER delimiter

(Example)

Command	:	SCNLOAD 2 \USBDisk2\IMG01\LABEL.SCN delimiter
		Load the "LABEL.SCN" file, namely Scene 2, in the "IMG01" folder in the USB memory of the "USBDisk2" drive onto the controller.
Response	:	OK delimiter

POINT

- Cannot be executed correctly in case of the following.

- Select the files with other extension names (other than "***.SCN")
- When non-existing files are used
- When Japanese letters are in a file name.

▶ Please do not Cut off power of controller before the response.

SCNSAVE - SCeNe SAVE -

Function ... Saves a scene data into the external device

Command SCNSAVE <Scene No.> <Save to Destination Address> delimiter

Point at the code number 0 to 31.
Select the following from the <Save to Destination Address>
・\USBDisk\...
When the destination folder is in the USB memory, it will be Saved to the USB memory. The file extension is "***.SCN".

Response
Executed correctly :OK delimiter
Executed correctly :ER delimiter

POINT

▶ Cannot be executed correctly in case of the following.
- Select the files with other extension names (other than "***.SCN")
- When a non-existing folder is selected in the destination address
- In the case the specified file name has existed, the existing file will be overwritten

▶ Please do not Cut off power of controller before the response.

(Example)

Command	:	SCNSAVE 3 \USBDisk2\SCN01\LABEL.SCN delimiter The image data of the No.3 image, namely the "LABEL.SCN" file, will be Saved into the "SCN01" folder in the USB memory of the "USBDisk2" drive.
Response	:	OK delimiter

SCRSWITCH - SCReen SWITCH -

Function ... Switches ADJUST window/RUN window

Command SCRSWITCH delimiter

Response
When executed properly :OK delimiter
When not executed properly :ER delimiter

(Example)

Command	:	SCRSWITCH delimiter Swiches to the ADJUST window if the current window is the RUN window Swiches to the RUN window if the current window is the ADJUST window
Response	:	OK delimiter

SGRLOAD - Scene GRoup LOAD -

Function ... Loads the scene group data from the external devices

Command SGRLOAD<Scene No.> <Load Resource> delimiter

Scene group No. shall be set within 0 to 31.
Selects the following from the <Load Resource>
- \USBDisk\...
  When a file in the USB memory is selected, this file will be loaded. The file extension is "***.SGP".

Response Executed correctly :OK delimiter

Executed correctly :ER delimiter

POINT

- Cannot be executed correctly in case of the following.
  - Select the files with other extension names (other than "***.SGP")
  - When non-existing files are used
  - When Japanese letters are in a file name.
- Please do not Cut off power of controller before the response.

(Example)

Command	:	SGRLOAD 3 \USBDisk2\IMG01\LABEL.SGP delimiter The "LABEL.SGP" file, namely Scene Group 2, in the "IMG01" folder in the USB memory of the "USBDisk2" drive is loaded onto Scene Group 3.
Response	:	OK delimiter

POINT

- For more information about the drive of the USB memory, see "8.1 Saving/Loading Data" (→pg.2).

SGRSAVE - Scene GRoup SAVE -

Function ... Saves scene group data into the external devices

Command SGRSAVE<Scene No.><Save to Destination Address> delimiter

Scene group No. shall be set within 0 to 31.
Selects the following from the <Save to Destination Address>
- \USBDisk\...
  When the destination folder is in the USB memory, it will be Saved to the USB memory. The file extension is "***.SGP".

Response Executed correctly :OK delimiter

Executed correctly :ER delimiter

(Example)

Command	:	SGRSAVE 3 \USBDisk2\IMG01\LABEL.SGP delimiter The image data of the No.3 image, namely the "LABEL.SGP" file, will be Saved into the "IMG01" folder in the USB memory of the "USBDisk2" drive.
Response	:	OK delimiter

POINT

- Cannot be executed correctly in case of the following.
  - Select the files with other extension names (other than "***.SGP")
  - When a non-existing folder is selected in the destination address
  - In the case the specified file name has existed, the existing file will be overwritten
- Please do not Cut off power of controller before the response.

SYSDATA - SYStem DATA -

Function 1 ... Gets current system data

Command	SYSDATA <Identifier 0> <Identifier 1> delimiter	
Response	When executed properly	:Set Value delimiter :OK delimiter
	When not executed properly	:ER delimiter

Identifier 0 is "Logging".
Identifier 1 and values are as follows.

Table: Identifier 1 and values

Setting data	Identifier 1	Set Value
Image logging	imageLogging	・0: None ・1: Only NG ・2: All
Folder name as the destination to save image logging	imageLoggingDirectory	Folder name as the destination (one-byte alphanumeric character)
Prefix of image logging file name	imageLoggingHeader	Prefix of image logging file name (one-byte alphanumeric character)
Data logging	dataLogging	・0: None ・1: Only NG ・2: All
Name as the destination folder to save data logging	dataLoggingDirectory	Folder name as the destination (one-byte alphanumeric character)

(Example)

Command	:	SYSDATA Logging imageLogging delimiter Gets current image logging setting
Response	:	1 delimiter OK delimiter The current image logging setting is 1 (Only NG).

Function 2 ... Sets system data

Command	SYSDATA <Identifier 0> <Identifier 1> <Set Value> delimiter	
Response	When executed properly	:OK delimiter
	When not executed properly	:ER delimiter

Identifier 0 is "Logging".

Identifier 1 and values are as follows.

Table: Identifier 1 and values

Setting data	Identifier 1	Set Value
Image logging	imageLogging	・0: None ・1: Only NG ・2: All
Folder name as the destination to save image logging	imageLoggingDirectory	Folder name as the destination (one-byte alphanumeric character)
Prefix of image logging file name	imageLoggingHeader	Prefix of image logging file name (one-byte alphanumeric character)
Data logging	dataLogging	・0: None ・1: Only NG ・2: All
Name as the destination folder to save data logging	dataLoggingDirectory	Folder name as the destination (one-byte alphanumeric character)

(Example 1)

Command	:	SYSDATA Logging imageLogging 1 delimiter
		Sets image logging to be performed only if NG.
Response	:	OK delimiter

(Example 2)

Command	:	SYSDATA Logging imageLoggingDirectory \RAMDisk delimiter
		Sets RAM Disk as the destination to save image logging.
Response	:	OK delimiter

SYSLOAD - SYStem LOAD -

Function ... Loads system data from an external device

Command	SYSLOAD <Source data> delimiter	
	Specifies the content of the following location as the <Source data>. ・\USBDisk\... If specifying the files on USB memory as the source, those files are loaded. The file extension is "***.INI".	
Response	Performed correctly	:OK delimiter
	Failure to perform	:ER delimiter

POINT

- The following cases result in failure.

- When a file with extension other than "***.INI" is specified.
- When a file that does not exist is specified.

▶ Do not turn off the power of the controller until a response is returned.

(Example)

Command	:	SYSLOAD \USBDisk2\IMG01\LABEL.INI delimiter Loads "LABEL.INI" in the "IMG01" folder of the USB memory drive labeled "USBDisk2".
Response	:	OK delimiter

SYSSAVE - SYStem SAVE -

Function ... Saves system data to an external device

Command SYSSAVE <Destination> delimiter

Specifies the following location as the <Destination>.

- \USBDisk\...
  When the destination folder is in the USB memory, it will be Saved to the USB memory. The file extension is "***.INI".

Response

Perform correctly	:OK delimiter
Failure to perform	:ER delimiter

(Example)

Command	:	SYSSAVE \USBDisk2\IMG01\LABEL.INI delimiter The image data of the No.3 image, namely the "LABEL.INI" file, will be Saved into the "IMG01" folder in the USB memory of the "USBDisk2" drive.
Response	:	OK delimiter

POINT

▶ Cannot be executed correctly in case of the following.

- Select the files with other extension names (other than "***.INI")
- When a non-existing folder is selected in the destination address
- In the case the specified file name has existed, the existing file will be overwritten

▶ Please do not Cut off power of controller before the response.

UNITDATA or UD

Function 1 ... Obtains the parameters set in or the values measured by the processing unit that is set in the current scene.

Command UNITDATA <Processing Unit No.> <External Reference Table No.> delimiter

- Specifies 0 to 9999 for <processing unit No.>.
- <External Reference Table No.> varies depending on the specified processing unit items.
  For details, see the "External Reference Table" of the processing items registered in the processing unit.
  " Processing item List" (→pg.1)
- Only numerical data is available.

Response	Performed correctly	:value delimiter :OK delimiter
	Failure to perform	:ER delimiter

(Example)

Command	:	UNITDATA 5 0 delimiter
		Retrieves the judgement result of the Search in the sixth processing unit with its number "5" (the value of the external reference table is "0").
Response	:	0 Delimiter
		OK delimiter

Function 2 ... Set the parameters of the processing unit set in the current scene

Command UNITDATA <Processing Unit No.> <External Reference Table No.> <Data to Set> delimiter

- Specifies 0 to 9999 for <processing unit No.>.
- <External Reference Table No.> varies depending on the specified processing unit items. For details, see the "External Reference Table" of the processing items registered in the processing unit. " Processing item List" (→pg.1)
- Only value data can be set.

Response	Performed correctly	:OK delimiter
	Failure to perform	:ER delimiter

(Example)

Command	:	UNITDATA 5 124 10delimiter
		Sets "Skipping angle" (the external reference table value: "124") of "Search" to "10", which was set to the 6th processing unit (Unit No. "5") .
Response	:	OK delimiter

VERGET - VERsion GET -

Function ... Acquires system version information

Command	VERGET delimiter	
Response	Performed correctly	: version information YYYY/MM/DD delimiter :OK delimiter
	Failure to perform	:ER delimiter

(Example)

Command	:	VERGETdelimiter
		Obtains system information.
Response	:	FZ2-XXX Ver.1.00 2007/07/30 delimiter
	:	OK delimiter
		The controller type is "FZ2-XXX", the version is "1.00", and the date is "July 30th, 2007".

10.3.6 Output Format (Serial Interface)

If the processing unit of [Data Output] is set in a scene, measurement results are sequentially output from the smaller data No. set in [Setting] of [Data Output].
"6.3 Data Output" (→pg.1), of "Processing Items List Manual"

When Outputting ASCII Data

Set output format as "ASCII" in the [Setting] of the [Data Output] processing item.
The defaulted value is "ASCII".

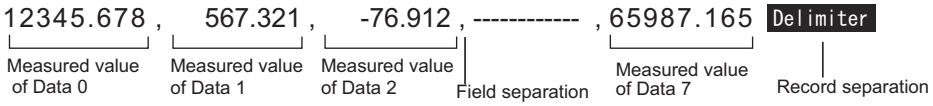
Output Format

<measured value of Data 0>,<measured value of Data 1>...<measured value of Data 7> delimiter

POINT

- Output form, digits and data separator can be changed if necessary.
  "6.3 Data Output" (→pg.1), of "Processing Items List Manual"

Example)



POINT

- Field separator is not output in the absence of next data.

The range of value to be output is as follows:
-999999999.9999 <= Measured value<= 999999999.9999
When Measured value< -999999999.9999, "-999999999.9999" is output.
When Measured value > 999999999.9999, "999999999.9999" is output.
When JG (Judge) is set, next value is output.
OK: 1
NG: -1

POINT

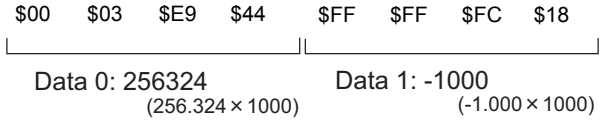
- Even if inspection is completed, data output will not stop until the last one. Please note, data output will not be interrupted.

When Outputting Binary Data

Set the output format as "Binary" in [Setting] of the [Data Output] processing item.

Output Format

The value is continuously output in 1 data/4 bytes after inspected data is Zooming by 1000 times.
Minus is output in 2's complement format.
For 2's complement, see "11.4 Terminology" (→pg.12).
Example) When Data 0 is "256.324", and data 1 "-1.000"



POINT

- Unlike ASCII output, binary output has no field separator and logging separator, etc. "6.3 Data Output" (→pg.1), of "Processing Items List Manual"

The range of value to be output is as follows:
-2147483.648 <= inspected value<= 2147483.647
when inspected value < -2147483.648, "-2147483.648" is output.
when inspected value > 2147483.647, "2147483.647" is output.
When JG (Judge) is set, next value is output.
OK: 1000 (1×1000)
NG: -1000 (-1×1000)

POINT

- Even if inspection is completed, data output will not stop until the last one. Please note, data output will not be interrupted.

10.4 Parallel Interface

This section describes how to set communication specification and I/O format required for the communication between parallel interface and external devices.

10.4.1 Setting Communication Specifications (Parallel Interface)

Set the communication specifications of controller. Use the same communication specification settings for the controller as the external device.

POINT

- While setting communication specifications, Input is not adjusted. However, input status can be checked using [Confirmation].
  "10.4.2 Checking the Communication Status (Parallel Interface)" (→pg.30)

1 On the Main screen, tap [System] - [Communication] - [Parallel].
The Parallel window is displayed.

2 Tap [Setting] to set communication specifications.

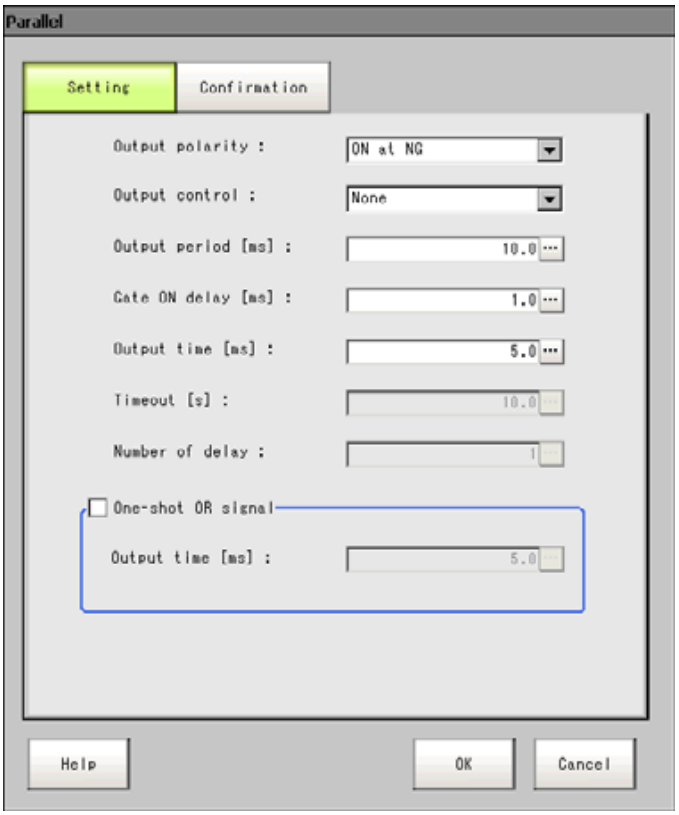


Table: Communication Specification(Parallel Interface)

Item	Set Value [Factory defaults]	Description
Output polarity	・[On at NG] ・On at OK	When the judgement result is either OK or NG, choose whether to activate OR and DO0 to 15.
Output control	[None]	Method to output measurement results asynchronous with peripherals. " When "Output control" Is Set to "None"" (→pg.35)
	Handshaking	Method to output measurement results synchronous with peripherals. " When "Output Control" Is Set to "Handshaking"" (→pg.38)
	Synchronization output	Method to output measurement results synchronous with processing time. STEP signal set in "Number of delay" is neglected, and measurement results are output when next STEP signal is ON. " When "Output Control" Is Set to "Synchronization output"" (→pg.39)
Output period	2.0 to 5,000.0ms [10.0ms]	Valid only When "Output control" is set to "No". Set the output circle of measurement results. Please set it as a value bigger than "Start time + output time" and smaller than the value of measurement interval. If it's bigger than measurement interval, output time will be delayed during re-measurement.

Table: Communication Specification(Parallel Interface)

Item	Set Value [Factory defaults]	Description
Gate ON delay	1.0 to 1,000.0ms [1.0ms]	Sets the time from when results are output to parallel interface to GATE signal ON. Waiting time prior to stable data output. Please set it as a value bigger than delay time of peripherals.
Output time	1.0 to 1,000.0ms [5.0ms]	Valid only when "Output Control" is set to "No" or "synchronous output". Set the time when GATE signal is ON. Please set the time required for peripherals to acquire measurement results.
Timeout	0.5 to 120.0s [10.0s]	Valid only when "Output control" is set to "Handshaking". Timeout Error is deemed when no response from peripherals is received during the setting time.
Number of delay	1 to 15 [1]	Valid only when "output control" is set as "Synchronization output". ON of STEP signal is neglected several times from setting STEP signal as ON to output measurement results.
One-shot OR signal	・ON ・[OFF]	Selects whether to always maintain the outputs of the OR signal.
Output time	1.0 to 1,000.0ms [5.0ms]	Specifies the time needed to output an OR signal. Only effective when "Output OR signal as one-shot" is set up. Sets smaller value than the value for the measurement time.

3 Tap [OK] to confirm the settings.

The settings are determined and the Parallel window closes.

10.4.2 Checking the Communication Status (Parallel Interface)

Check the communication status with the external devices that are connected with a parallel interface. You can check whether wiring and communication settings are done properly.

1 On the Main screen, tap [System] - [Communication] - [Parallel].

The Parallel window is displayed.

2 Tap [Confirmation] to check I/O status.

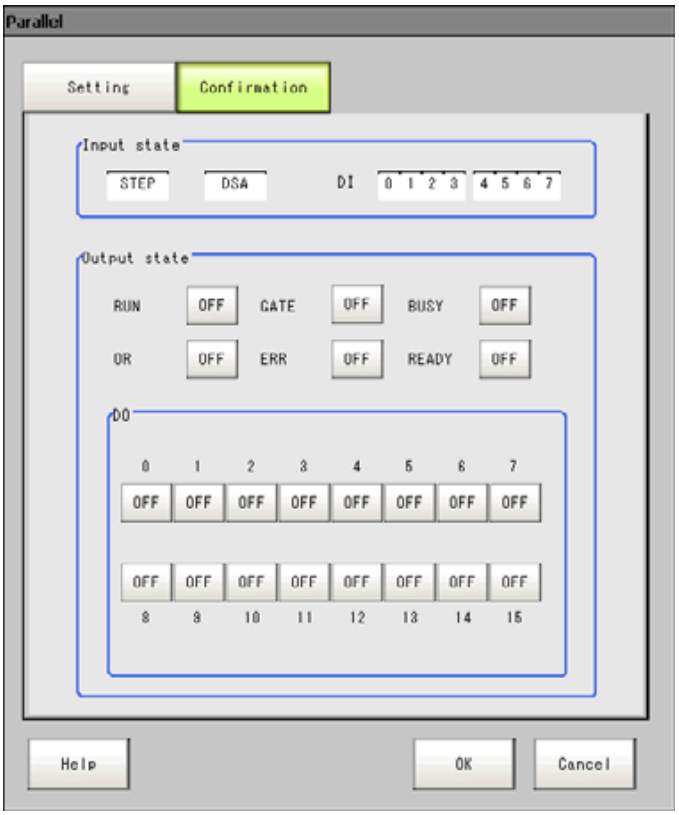
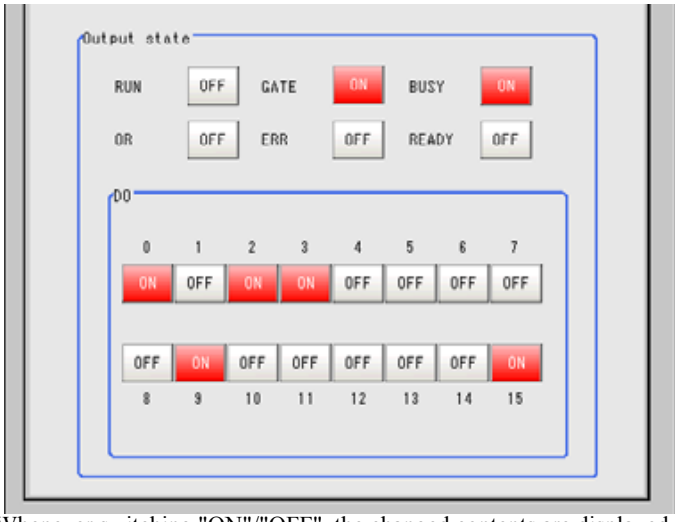


Table: About Displayed Contents on Screen

Display	Description
STEP	Input status of each signal from the external device to the controller is displayed. When a signal is input, the background color becomes red..
DSA	
DI	
RUN	Output status of each signal is displayed. When a signal is output, the background color becomes red. Specifies output states of signals from controller to external devices. Modification of ON, OFF, 0 and 1 can be simulated even if no inspection is conducted.
GATE	
BUSY	
OR	
ERR	
READY	
DO	

3 Change the contents to be sent.



Whenever switching "ON"/"OFF", the changed contents are displayed on monitors of external devices. Please verify it.

4 Tap [OK].

The Parallel window closes.

10.4.3 I/O Format (Parallel Interface)

Input Format

When the Main screen is viewed, the following commands are input:

- STEP signal
  Perform a measurement when STEP signal is ON.
- DSA signal
  This is a signal to inform that the external device is ready to receive data when "Output control" is set to "Handshaking".
  "10.4.1 Setting Communication Specifications (Parallel Interface)" (→pg.28)

- DI signal

  The commands are input in the following formats. DI signals can be set to "0" (OFF) or "1" (ON). Confirm commands and information, and turn DI7 (Perform) ON with an interval over 1ms.

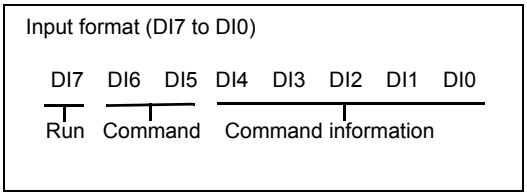


Table: Input Commands

Item	Description	Input format (DI7 to DI0)			Example for Input
		Perform (DI7)	Command (DI6 to DI5)	Command Information (DI4 to 0)	
Continuous measurement	Measure continuously during input of commands.	1	00	***** Controller doesn't view this signal, independently from setting of either 0 or 1.	Example for Input: 10000000
Scene switch	Switch measurement scenes.	1	01	Input "Scene No." in binary format.	Switches to scene 2. Example for Input: 10100010
Scenegroup switch	Switch measurement scene group.	1	11	Input "Scene Group No." in binary format.	Switches to scene group 2. Example for Input: 11100010

0: OFF 1: ON

POINT

- ERROR signal is ON if input command isn't received correctly.

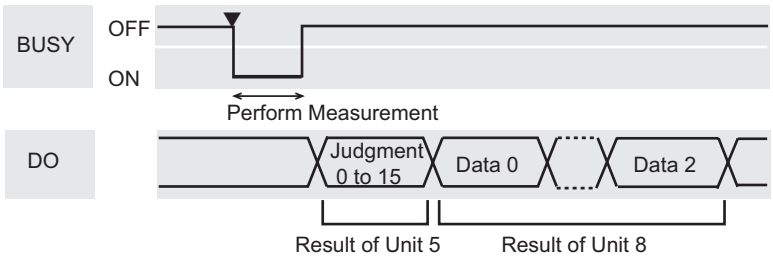
Important

- When parallel continuous measuring is engaged and continuous STEP signal is inputted, switching of scene group should be avoided. To switch a scene group, uncheck "Save scene group when switching" by either of the following methods.
  - The Switch Scene Group window "4.8.1 Switching the Scene Group" (→pg.52)
  - [Measure setting] in the [Measure] menu "9.2 Setting for Measurement" (→pg.5)

Output Format

Output the measurement results whenever performing measurement. The result is output only if "Output" of [Test Measurement setting] in the "Control" area is checked.
"9.2 Setting for Measurement" (→pg.5)
When judgemnet results are either OK or NG, it's possible to choose output ON. Ex-factory setting is "ON if NG".
"10.4.1 Setting Communication Specifications (Parallel Interface)" (→pg.28)

Table: Output Format (Parallel Interface)

Signal	Output Contents
OR Signal	Output comprehensive Judge
DO 0 to 15 signal	Parallel Judgement Output The results of Judge 0 to 15 set in [Parallel Judgement Output] are output to DO 0 to 15. "6.1 Parallel Judgement Output" (→pg.1), of "Processing Items List Manual"
	Parallel Data Out Value of Data 0 to 7 in [Parallel Data Out] are output in 16-digits format. "6.2 Parallel Data Output" (→pg.1), of "Processing Items List Manual" ・ Only integral part of a value can be output. Value shall be circled up. ・ The range of output value is as follows: Binary format: -32768 to +32768 BCD format: -999 to +999 The measurement value beyond the range is as follows: Binary: -32768 measurement value: Output -32767. Measurement value >+32768: output +32767. BCD: -999 measurement value: Output -999. Measurement value >+999: output +999. ・ For output format, 2's complement or BCD format are available. For 2's complement, see "11.4 Terminology" (→pg.12). ・ Output Sequence Measurement results are sequentially output from smaller processing unit No. Example) When [Parallel Judgement Output] in processing unit 5 and [Parallel Data Out] in processing unit 8 are set 

POINT

- After measurement, the data output to OR signal or DO signal shall be kept until next measurement. Please note, output state shall be maintained even if measurement is finished.
  When the Output "One-shot OR signal" "10.4.1 Setting Communication Specifications (Parallel Interface)" (→pg.28) is set to ON, however, the OR signal, after the set output time has lapsed, will turn to OFF.
- Ex-factory output is set OFF, and about 0.5s ON is maintained if switching-on. Due attention shall be paid to signal reading of external devices.

10.4.4 Time Chart

Here, I/O times of various commands are described.

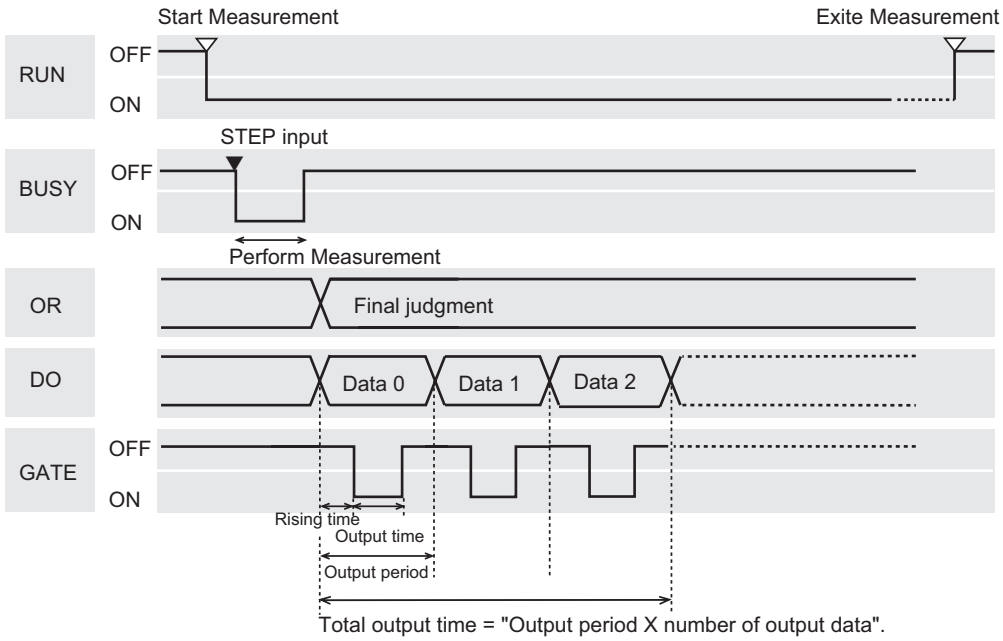
- " When "Output control" Is Set to "None"" (→pg.35)
- " When "Output Control" Is Set to "Handshaking"" (→pg.38)
- " When "Output Control" Is Set to "Synchronization output"" (→pg.39)
- " Scene/Scene Group Switch" (→pg.41)

When "Output control" Is Set to "None"

Output the measurement results if controller is not synchronous with external devices. After external devices detect GATE signal of controller, the measurement results are read during ON.

Input measurement trigger with in STEP signal range

Example) when 3 expressions are set in [Parallel Data Out] :



Output Signal

Table: Output Signal ("Output Control" set to "None")

Signal	Function
RUN	Turns ON when the controller is available for measurement and the RUN window is displayed. It is OFF with the ADJUST window, so switch to the RUN window during operation.
BUSY	Indicate that controller is under measurement or Scene switch. When BUSY signal is ON, don't input next command. Otherwise, on-going processing or input command isn't correctly performed.
OR	Output Reflect in overall judgement result. When judgemnet results are either OK or NG, it's required to select ON or not in the setting window of communication specification. "10.4.1 Setting Communication Specifications (Parallel Interface)" (→pg.28)
DO	Output the Expression results set in Processing Item [Parallel Judgement Output]/[Parallel Data Out]. When judgemnet results are either OK or NG, it's required to select ON or not in the setting window of communication specification."10.4.1 Setting Communication Specifications (Parallel Interface)" (→pg.28)
GATE	Used to control reading time of measurement results to external devices. It's ON within the time when external devices are required to access measurement results. To make total output time shorter than measurement interval (input interval of STEP signal), set output period. The GATE signal can be outputted only after the [Parallel Judgement Output] and [Parallel Data Out] are selected from the flowing process.
READY	ON when STEP signal can be input. When the through images are being viewed, the READY signal will turn to OFF, but cannot receive the STEP signal.

Input Signal

Table: Input Signal ("Output Control" is set to "None")

Signal	Function
STEP	Input measurement trigger from external devices such as optic switches, etc. Perform one measurement in synchronous with STEP signal ON (OFF → ON). At least 0.5ms ON of STEP signal shall be maintained.

POINT

- READY signal can be changed below.
  - Processing of ERROR signal when STEP signal is input during measurement
    "9.2 Setting for Measurement" (→pg.5)

Important

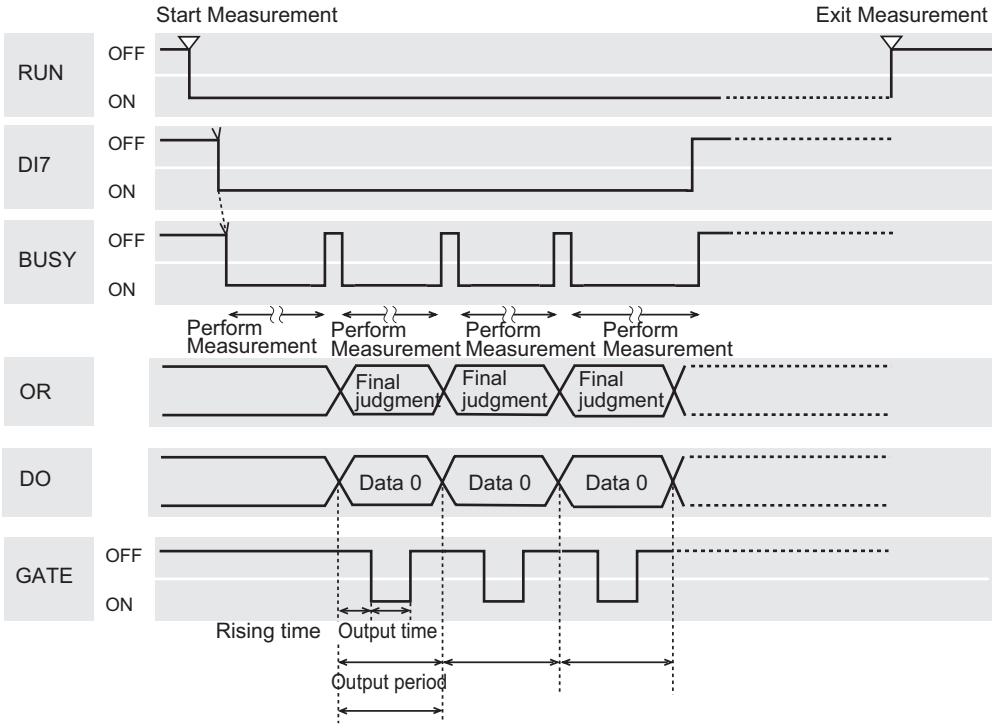
- When parallel continuous measuring is engaged and continuous STEP signal is inputted, switching of scene group should be avoided. To switch a scene group, uncheck "Save scene group when switching" by either of the following methods.
  - Using the Switch Scene Group window "4.8.1 Switching the Scene Group" (→pg.52)
  - Using [Measure] - [Measure setting] "9.2 Setting for Measurement" (→pg.5)

Continuous Measurement

Important

- Giving precedence to measurement when the input intervals of STEP signal is short, or while continuous measurement is being performed, display of measured results (overall judgment, image, judgment for each processing unit in the flow display, Detailed Results) may not be updated.
  When the continuous End, the measurement results of the last time measurement will be viewed.

Example) when 1 expression is set in [Parallel Data Out] :



Total output time = "Output period X number of output data".

POINT

- Output functions the same as when "Output Control" is set to "None".
  " When "Output control" Is Set to "None"" (→pg.35)

Input Signal

Table: Input(Continuous Measurement)

Signal	Function
DI0 to 6	OFF
DI7	Perform trigger. After DI0 to 6 is set, turn DI7 ON with an interval over 1ms.

POINT

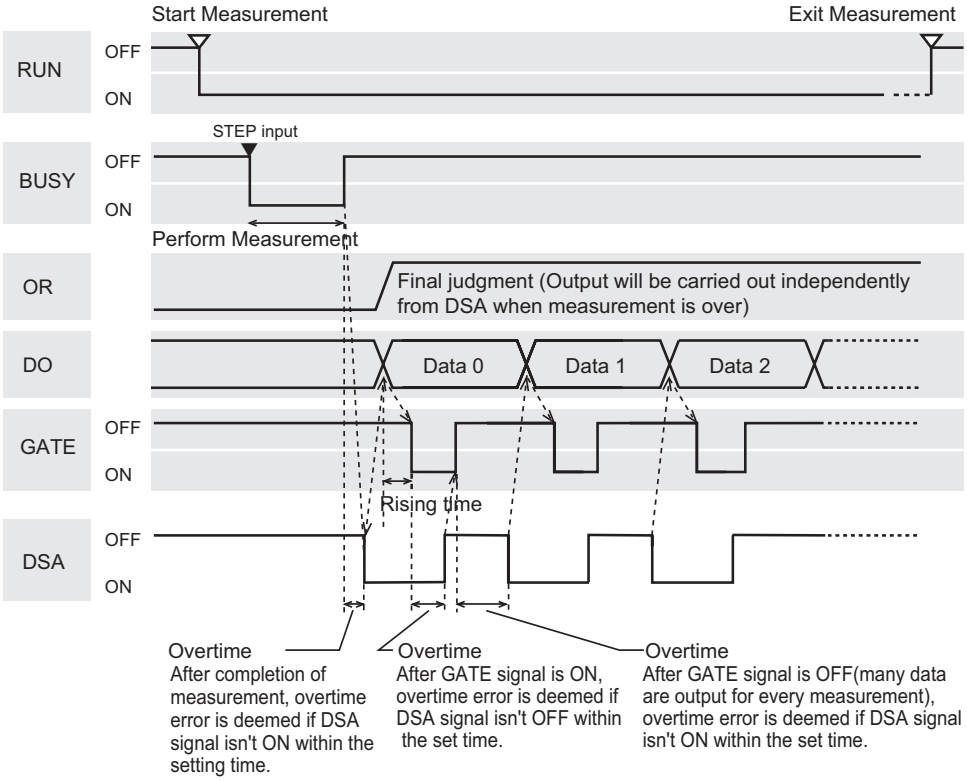
- ERROR signal is ON when input command isn't correctly performed.

When "Output Control" Is Set to "Handshaking"

Output the measurement results if controller is synchronous with external devices. This function enables to effectively transfer data when many measurement results are output in sequence.

Input measurement trigger with in STEP signal range

Example) when 3 expressions are set in [Parallel Data Out] :



POINT

- Output signal functions the same as when "Output Control" is set to "None".
  " When "Output control" Is Set to "None"" (→pg.35)

Input Signal

Table: Input Signal ("Output Control" is set to "Handshaking")

Signal	Function
DSA	This signal is used to request to send the following data from external devices. Before DSA signal is ON, the controller doesn't output data. Obtain DSA signal ON next time. ・ Complete receiving system of external devices ・ Measurement completed by controller BUSY signal is ON during measurement. Thus, finish time of measurement can be acquired if the state of BUSY signal is monitored.

When "Output Control" Is Set to "Synchronization output"

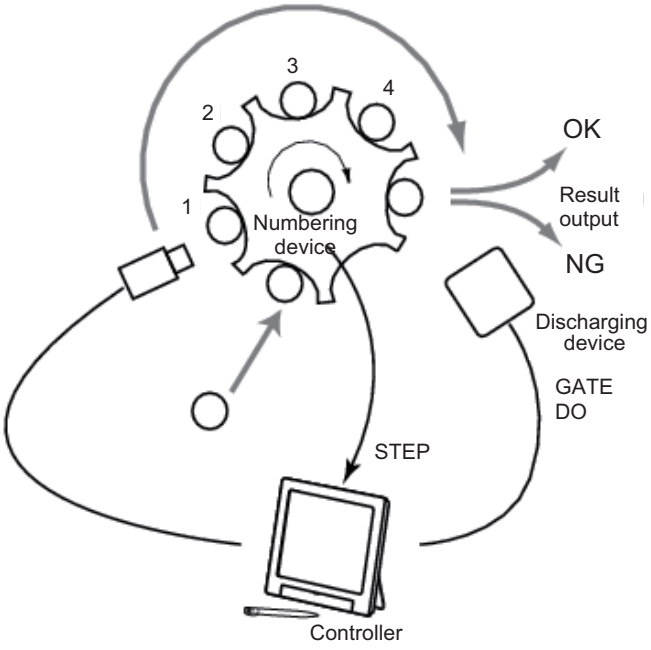
A method that enables processing time on the production line to Execute synchronously with result output time of controller. After STEP signal of "Number of delay" in communication specification is ON, measurement results will be output when STEP signal is ON next time.

POINT

- When "Output Control" of communication specification is set to "Synchronization output", the number of levels will be accumulated by ON times of STEP signal. So, it's advisable to set to one output for one measurement (1 unit for "Judgement Output", 1 data for "Data Output").
  "10.4.1 Setting Communication Specifications (Parallel Interface)" (→pg.28)
- Only STEP signal is input for measurement command.
  When serial command is used for measurement and continuous measurement, output time will mismatch, and the controller will lead to mis-operation.

Example) Staged Transmission Line with Star Wheel

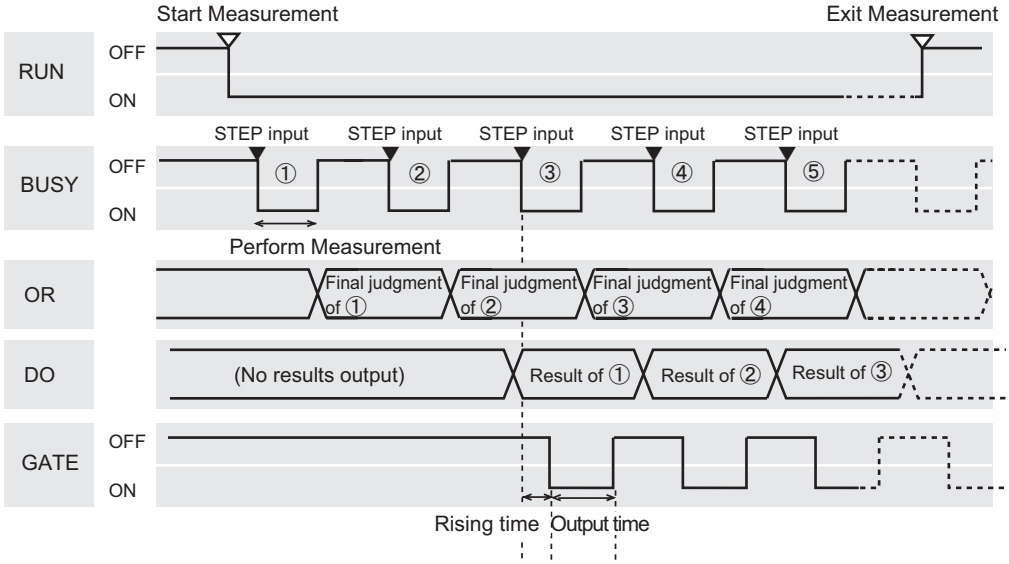
Discharge time for NG may Execute synchronously with output time of measurement results.



When "Number of delay" is set as "4",
measurement results are output after 4 delays.

Input measurement trigger with in STEP signal range

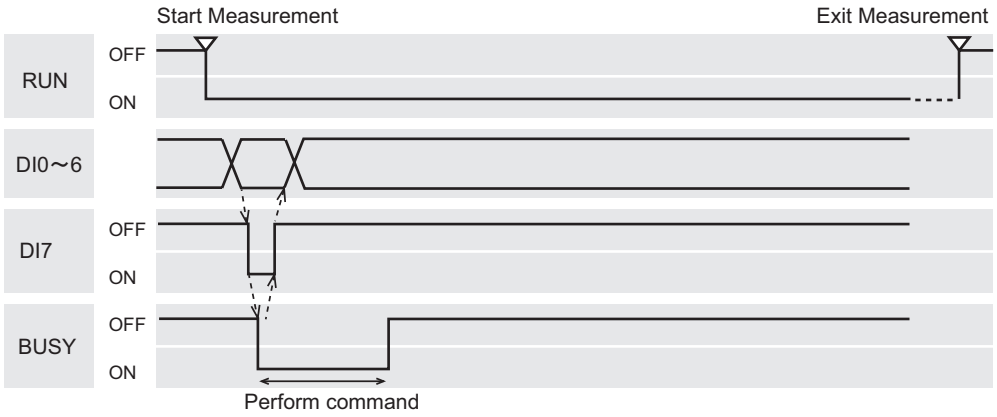
Example) When setting "2" for "Number of delay"



POINT

- Output functions the same as when "Output Control" is set to "None".
  " When "Output control" Is Set to "None"" (→pg.35)

Scene/Scene Group Switch



Output Signal

Table: Output Signal (Scene/Scene Group Switching)

Signal	Function
RUN	Turns ON when the controller is available for measurement and the Operation window is displayed. It is OFF with the Adjustment window, so switch to the Operation window during operation. "4.4 Changing Steps (Scene Switch)" (→pg.20)
BUSY	Indicate that controller is scene switches. When BUSY signal is ON, don't input next command. Otherwise, on-going processing or input command isn't correctly performed.

Input Signal (Scene Switching)

Table: Input Signal (Scene Switching)

Signal	Function
DI0 to 4	Set Scene No. (0 to 31).
DI5	ON
DI6	OFF
DI7	Perform trigger. After DI0 to 6 is set, turn DI7 ON with an interval over 1ms. BUSY signal is ON during implementation of commands. After BUSY signal is ON, turn DI7 OFF, and then DI0 to 6 OFF.

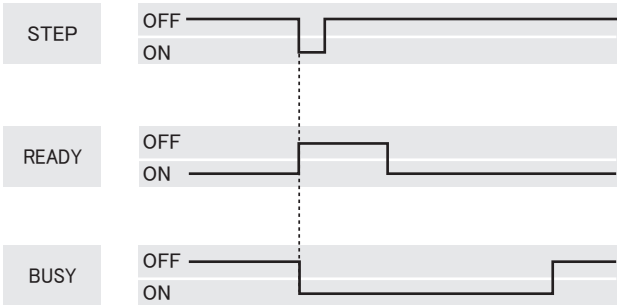
Input Signal (Scene Group Switching)

Table: Input Signal (Scene Group Switching)

Signal	Function
DI0 to 4	Set scene group No. (0 to 31).
DI5	ON
DI6	ON
DI7	Perform trigger. After DI0 to 6 is set, turn DI7 ON with an interval over 1ms. BUSY signal is ON during implementation of commands. After BUSY signal is ON, turn DI7 OFF, and then DI0 to 6 OFF.

READY Signal

When the image mode is "Freeze", the next STEP can be received if READY is ON. If READY is OFF and STEP is input, ERROR terminator is ON.



Important

- Perform the following when the image mode is "Through".
  - Accept STEP signal when READY is OFF.
  - When READY is OFF, the ERROR terminal will not turn ON, even if the STEP signal is input.

11

Chapter 11 - Appendixes

This chapter describes how to use product options and dispose Error information and questions. Please read as required.

11.1 CCTV Lens 2
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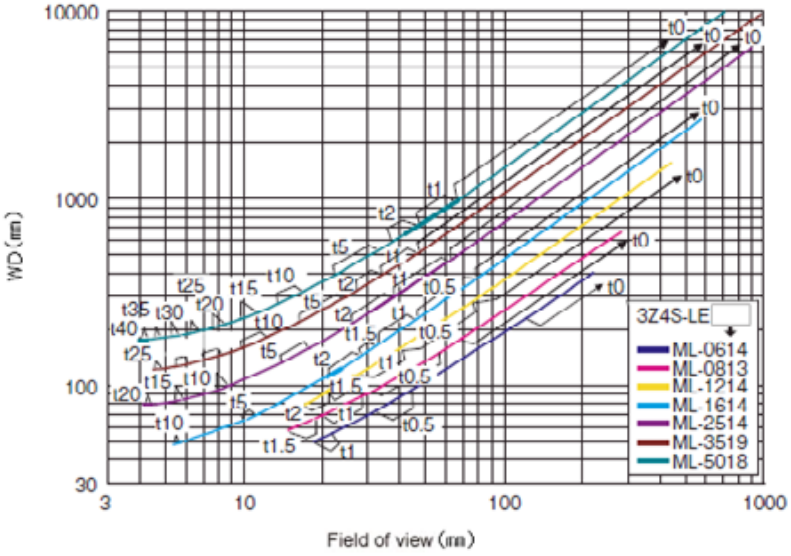
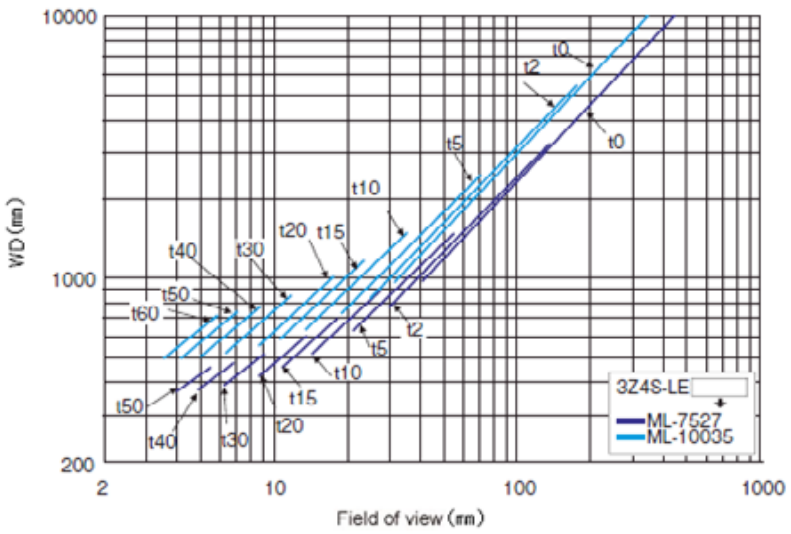
11.1 CCTV Lens

When using a camera (single) and pattern-lighting, refer to the following table to prepare the lens and macro-conversion ring. The lens may vary from the size of measurement objects and setting distance of camera.

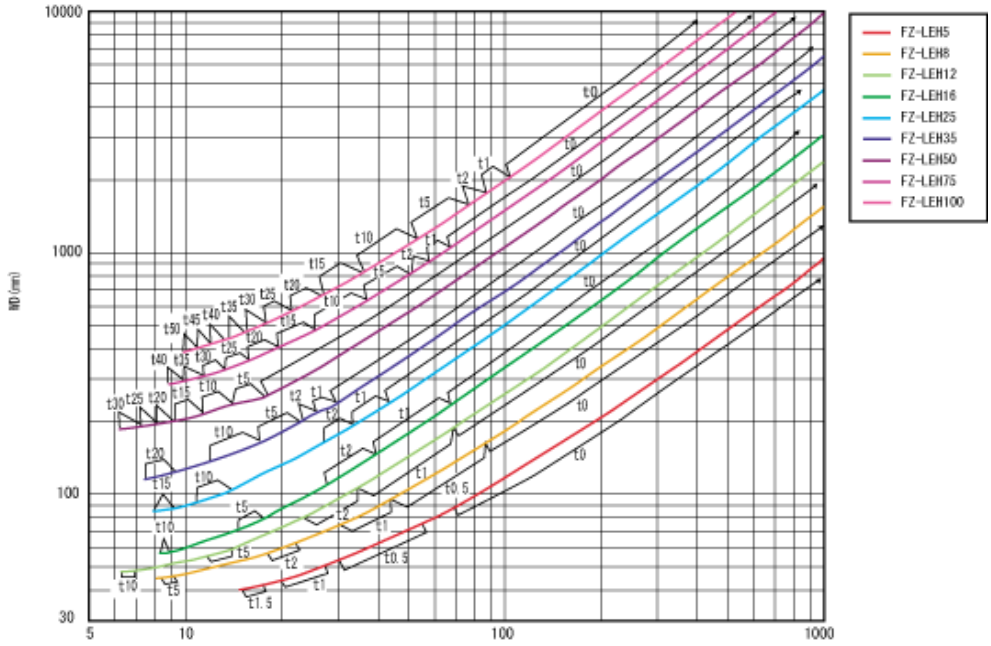
Optical Diagram

Digital camera (unit) 0.3 Mega pixels Model FZ-S



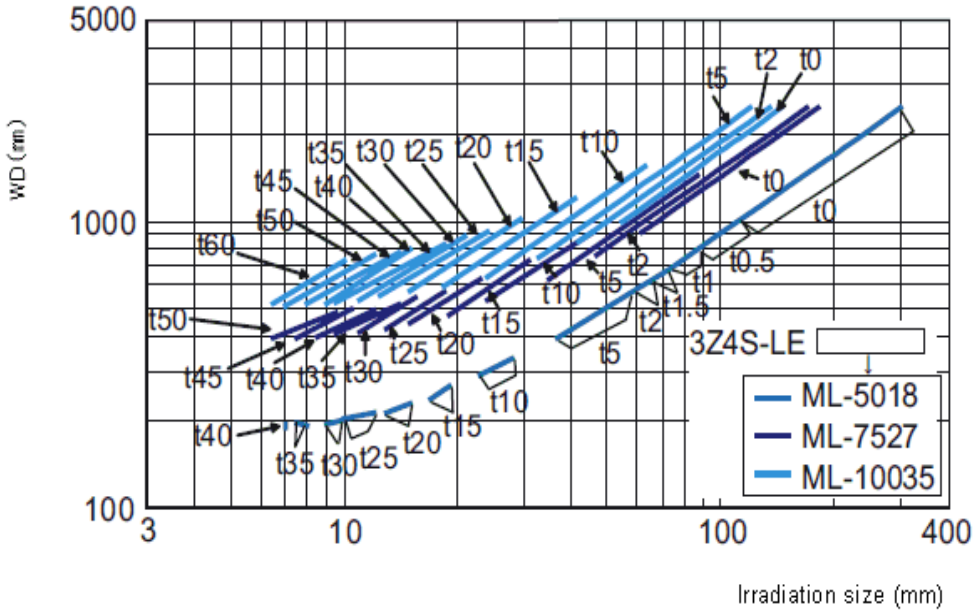


Digital camera (unit) 2Mega pixels Model FZ-S 2M



*Connecting 5 mm extension tube (Model 3Z4S-LE ML-EXR) for FZ-LEH25 is not possible.

For high-intensity pattern illumination Model FZD-LT series

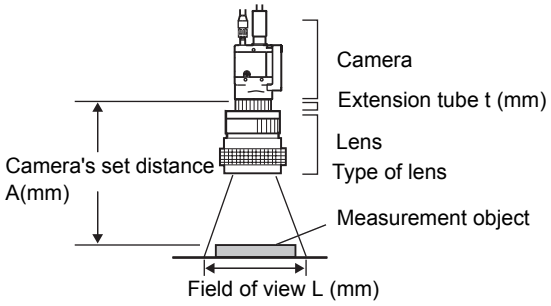


How to View Diagram

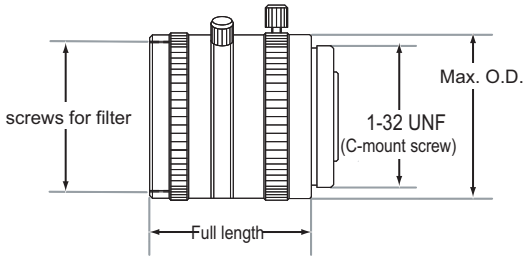
The horizontal axis of diagram indicates the Sight (L, in mm), and longitudinal axis indicates setting distance (A, in mm). This diagram shows the relationship between Sight for different types of CCTV lens and setting distance. Please verify the types and view diagram given the fact of different lens types. The length of extension tube corresponds to the point of "t5.0" on the diagram. This point is marked with "t0" if extension tube is not employed, and 5mm extension tube is marked with "t5.0".

(Example)

If Sight of measurement objects is 40mm, and 3Z4S-LE ML-5018 CCTV lens is used, the setting distance of camera is set as 500mm, and a 5mm extension tube is required.



Types and Dimensions of Lens



CCTV lens 3Z4S-LE ML series

Table: Types and Dimensions of Lens (CCTV lens 3Z4S-LE ML series)

Lens Type	Focal Distance	Brightness	Max. O.D.	Full length	Filter Size
Model 3Z4S-LE ML0614	6 mm	F1.4	Ø30 mm	30 mm	M27 P0.5
Model 3Z4S-LE ML0813	8 mm	F1.3	Ø30 mm	34.5 mm	M25.5 P0.5
Model 3Z4S-LE ML1214	12 mm	F1.4	Ø30 mm	34.5 mm	M27 P0.5
Model 3Z4S-LE ML1614	16 mm	F1.4	Ø30 mm	24.5 mm	M27 P0.5
Model 3Z4S-LE ML2514	25 mm	F1.4	Ø30 mm	24.5 mm	M27 P0.5
Model 3Z4S-LE ML3519	35 mm	F1.9	Ø30 mm	29 mm	M27 P0.5
Model 3Z4S-LE ML5018	50 mm	F1.8	Ø32 mm	37 mm	M30.5 P0.5
Model 3Z4S-LE ML7527	75 mm	F2.7	Ø32 mm	42.5 mm	M30.5 P0.5
Model 3Z4S-LE ML10035	100 mm	F3.5	Ø32 mm	43.9 mm	M30.5 P0.5

High resolution and low distortion lens Model FZ-LEH series

Table: Types and Dimensions of Lens (High resolution and low distortion lens Model FZ-LEH series)

Lens Type	Focal	Brightn	Max.	Full length	Filter Size
Model FZ-LEH5	5mm	F2.8	ϕ42mm	38.7mm	M40.5 P0.5
Model FZ-LEH8	8mm	F1.4	ϕ34mm	41.6mm	M27.0 P0.5
Model FZ-LEH12	12mm	F1.4	ϕ34mm	37.0mm	M27.0 P0.5
Model FZ-LEH16	16mm	F1.4	ϕ33mm	36.5mm	M27.0 P0.5
Model FZ-LEH25	25mm	F1.4	ϕ33mm	39.5mm	M27.0 P0.5
Model FZ-LEH35	35mm	F2	ϕ34mm	36.5mm	M27.0 P0.5
Model FZ-LEH50	50mm	F2.8	ϕ34mm	55.0mm	M27.0 P0.5
Model FZ-LEH75	75mm	F2.5	ϕ36mm	51.0mm	M34.0 P0.5
Model FZ-LEH100	100mm	F2.8	ϕ50mm	70.0mm	M40.5 P0.5

Extension Tube

Extension tube, installed between lens and camera, is used to adjust focal distance. Any length can be achieved by combination of 7 tubes.

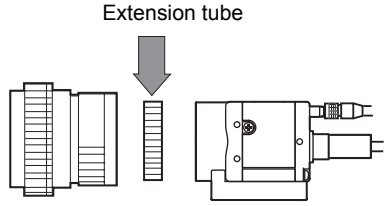


Table: Extension Tube(Model 3Z4S-LE ML-EXR)

Max. O.D.	Height
Ø30	Thickness:40mm 20mm 10mm 5mm 2mm 1mm 0.5mm 7sets

POINT

- 0.5 mm, 1.0 mm and 2.0 mm extension tubes shall not be overlapped.
  Since it's installed at spiral sections of lens and other extension tubes, overlapping of over 2 tubes will lead to unstable fixation.
- Extension exceeding 30 mm shall be enhanced according to different vibrating conditions.

11.2 Error Information and Troubleshooting

This section describes the Error messages and how to remedy.

ERR When information with this symbol is viewed, ERROR signal on parallel interface is ON.

Table: Error Information and Troubleshooting

Error tips		Remedy
	\/:*?""<>| cannot be used for the file name	Ensure to check if such characters as \ / , : ; * ? " < > | & . SPC (space) are used in the file name.
A	A camera outside the guarantee is connected.	An unsupported camera is connected to the controller currently used.
C	Camera connection is incorrect. ERR	Is camera connected with camera cable? Is camera cable disconnected? Does [Camera Option] of [Camera Image Input] and [Camera Switching] have any Error? Please verify the contents of [Image Mode], then switch off and restart. "9.1 Setting the Conditions for Using Camera [Camera]" (→pg.2)
	Cannot add object, Out of range of specified characters of expression.	Incompliant to the conditions of expression. Please verify the contents. " Precautions" (→pg.7), of "Processing Items List Manual"
	Cannot perform model registration	During searching, Classification and flexible searching ・ Please register higher-contrast images as models. ・ Please reduce the level of edge extraction.
		For fine matching With fine matching, 2 pixels on the edges of image cannot be registered as parts of a model.
	Communications timeout error. ERR	Switch off controller, verify the following contents and then restart. ・ Is cable connected correctly? ・ Does it comply with communication specifications of external devices? ・ Do external devices function normally? When troubleshooting is not possible, controller may be damaged. Please contact our regional branches or regional offices. "10.3.2 Setting Communication Specifications (Serial Interface)" (→pg.7)
E	Error input range. Please input correctly.	Please verify settable range for re-setting.

Table: Error Information and Troubleshooting

Error tips		Remedy
F	Fan/voltage error.	Switch off controller, and verify if fan is affected. If Error information is also shown after restart, the controller may be damaged. Please contact our regional branches and regional offices.
	Failed to clear scene group	Confirm that a USB disk is set to the controller and try again.
	Failed to save file Check the destination.	Check the following points. ・Is the capacity of the destination enough? ・Is the USB disk set to the controller, while the save destination is set to a folder on the USB disk? Or, the controller may not have detected the USB disk.
	Failed to start the window. Memory may be insufficient.	The memory necessary to start the window could not be secured, since available memory is not enough. Check the flow by adjusting the measured region of each processing unit and the sizes of the registered models.
	Failed to switch scene	Is a USB disk set to the controller? To load the scenes of Scene Group 1 and later, a USB disk is necessary.
	Failed to switch scene group or failed to save when switching scene group	The cause of the failure to switch or to save when switching may be that the USB disk was removed from the controller. Set a USB disk to the controller and try again.
I	Illegal expression	Are there the following Errors in settings of expression? ・Different number of left/right parentheses ・Connecting separately to TJG/Unit/value/function/operator/comma ・Operator is set at beginning or end of expression ・Insufficient or extreme function parameters
L	Low disk space. Please check.	・Please delete unnecessary scenes and ProUnits. ・Please use scene set function and reduce the number of scenes registered into a scene set.
N	No value set. Please set value.	This item must be set. Please set up value.
S	System date setting error. Built-in battery may be consumed.	Low battery (for the backup of date and time data) level. Need to be replaced with new batteries, please return the old batteries to our service offices.
	System error	Controller failure. Please contact our branches and regional offices.

Table: Error Information and Troubleshooting

Error tips		Remedy
T	The destination folder cannot be found. Check it.	Check the following points. ・Have you deleted the destination folder? ・Is the USB disk set to the controller, while the save destination is set to a folder on the USB disk? Or, has the USB disk been detected?
	The "Search" measurement result may be "NG (Insufficient memory)" with the current setting.	Insufficient memory may occur during measurement. Reset the model parameter. ・For [Search]: " When the judgement is NG (insufficient memory)" (→pg.18), of "Processing Items List Manual" ・For [Flexible Search]: " When the judgement is NG (insufficient memory)" (→pg.18), of "Processing Items List Manual" ・For [Classification]: " When the judgement is NG (insufficient memory)" (→pg.18), of "Processing Items List Manual"
	The selected file cannot be loaded. Check the selected file.	Check the following points. ・Have you removed the USB disk from the controller after selecting a file (files) of the USB disk? ・Have you deleted the selected file?(Such as the case when you selected the file on the RAM Disk and the file was deleted via FTP) In addition, the selected file may be corrupt.
	The system has a failure. 	The controller has a failure. Contact our office or our representative.
W	Warning range shall be set within the range from judgement lower limit to upper limit.	Please redefine the upper and lower alarming limits such that they are within the range between the upper evaluation limit and lower evaluation limit. "4.7.4 [Judgement Condition (Trend Monitor)]" (→pg.8), of "Processing Items List Manual"

11.3 FAQ

When Starting Up

POWER LCD not lit

- Is power supply connected correctly?
- Too low supply voltage (DC24V+10%,-15%)?

Monitor views nothing

- Is monitor ON?
- Is monitor cable connected correctly?
- Does monitor have any failure?
- Is power capacity enough (LCD)?
- Have you performed "Power off LCD"? If you have, the monitor will recover if you tap on the bottom of the monitor.

Confused monitor images

- Have power supply and cable generated electric noise?
- Is monitor cable connected correctly?

Can not input

- Are the cables of input devices (mouse, etc) connected correctly?
- Is Angle too big in the case of Touch pen?

Camera image is not displayed, or image is blurred

- Is lens cover open?
- Is camera cable connected correctly?
- Is lens diaphragm the biggest or smallest?
- Is camera's shutter speed correct?
- Is lighting method correct?

During Operation

Measurement results not viewed on monitor

- Are windows other than the Main screen (the Edit Flow window, etc) displayed?
- Is any setting window open?
  A setting window means a window that opens separately such as the Edit Flow window and the Scene Maintenance window.

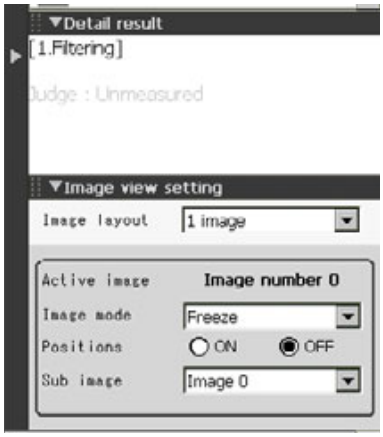
The touch screen responses slowly

- Is it necessary to tap the touch screen continuously and quickly? If yes, the response to operation will become slower.

"NG (Insufficient memory)" is displayed in the "Detail result" area

- Does a number of a certain processing item, such as Camera Image Input, exceed the limit?
  "4.2 Creating a New Scene" (→pg.4)

In the [Image view setting] of the "Control" area, "Image mode", "Positions" and "Sub image" can not be changed.



- Is the "Detail result" area active?
  " Listing Measurement Results" (→pg.7)

About Parallel Interface

Trigger signal (input) not accepted

- Are cables connected correctly?
- Signal cable disconnected?
  You can check the communication status in the Communication Check window.
  "10.4.2 Checking the Communication Status (Parallel Interface)" (→pg.30)
- Are the windows other than the Main screen (the Edit Flow window, etc) displayed?
- Is any setting window open?
  A setting window means a window that opens separately such as the Edit Flow window and the Scene Maintenance window.

Signals cannot be output to external devices

- Is trigger signal input?
- Are cables connected correctly?

- Signal cable disconnected?
  You can check the communication status in the Communication Check window.
  "10.4.2 Checking the Communication Status (Parallel Interface)" (→pg.30)
- Were the test and measurement performed or not?
  Signal cannot be output to external devices during testing measurement.

About Serial Interface (RS-232C/422)

No communication available

- Are cables connected correctly?
- Does communication specification of external devices comply with controller?
  You can check the communication status in the Communication Check window.
  "10.3.3 Checking the Communication Status (Serial Interface)" (→pg.10)

No response from controller after a period of operation

- Is buffer memory of PC fully filled?
  Please verify if data are correctly received according to current settings.

Data cannot be Saved

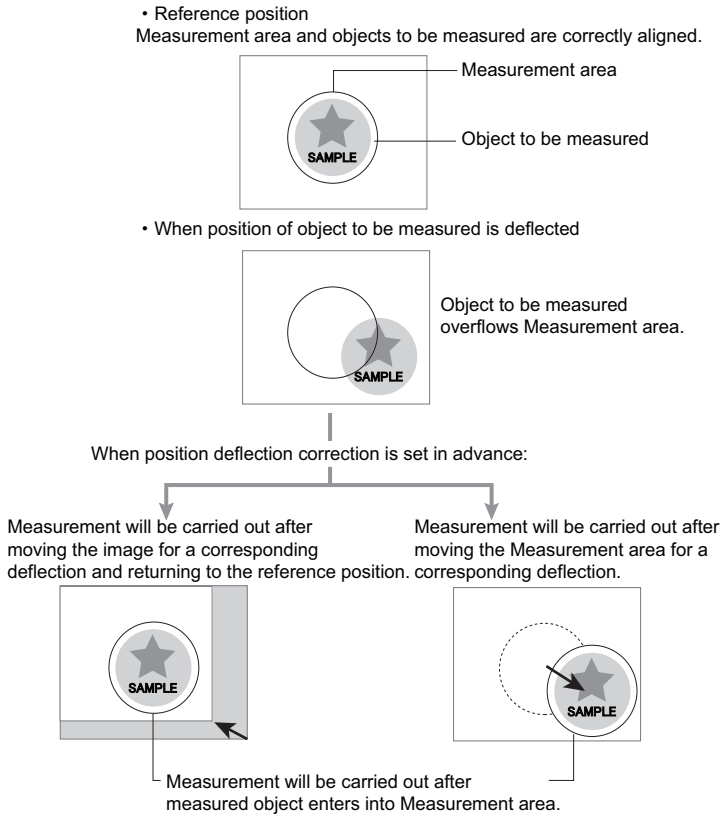
- Does communication specification of external devices comply with controller?
- Is "Flow Control" in communication specification set to "None"?
  To save data, set "Flow control" to "OFF".
  "10.3.2 Setting Communication Specifications (Serial Interface)" (→pg.7)

11.4 Terminology

This section gives descriptions of terms.

Position Compensation

Correct position deflection. When the location and direction of measurement objects are not fixed, the current location and displacement of reference shall be calculated and measured for compensation. Please select Processing Items matching measurement objects from those Processing Items related to position compensation.



Intelligent Camera (with Lighting Function)

A camera with a dome-shaped light can also be controlled by controller. It is effective for cases such as when outside diffusion must be avoided or when lighting setting period must be shortened.
For details, see "3.3.1 Intelligent Camera (with Lighting Function)" (→pg.5).

Epipolar line

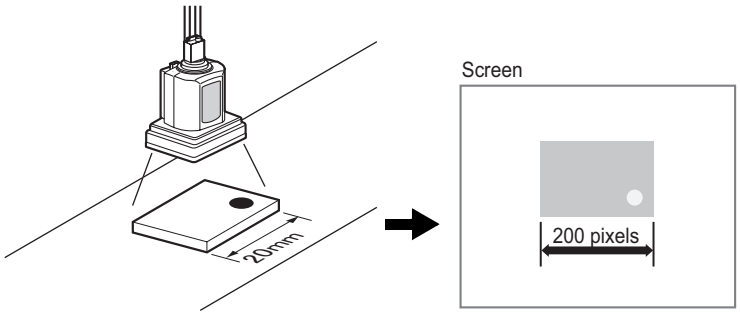
A point taken by a reference camera is projected to a straight line on an image taken by another camera. This straight line is called epipolar line.

Reference position

The point always treated as the reference. Default is the center of a model. If the location of the registered model is different from the basis, the setting should be changed in [Ref. position].

Calibration

The conversion of measured size from pixel unit to metric unit.
By setting the relationship between Actual and camera Coordinate, the measurement results in pixel unit can be converted into actual size. To output the measured value converted by the calibration, set "Calibration" in "Output parameter" of each unit to "ON".
For example, an object that measures 20 mm wide and has a 200-pixel width in the measured image, the calibration is done as follows.
20 (mm) / 200 (pixel) = 0.1 (mm/pixel)
In other words, 1 pixel (pix) of camera Coordinate corresponds to 0.1mm of actual size.



Measurement Flow

A series of measurement processes. You can combine Processing Items to create this measurement flow.

Detection point

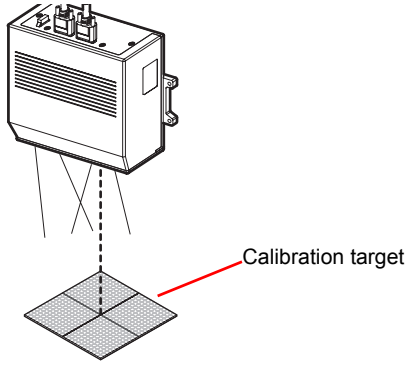
The point to specify which part of the model the coordinates are to be output, as a processing item of search and ECM search. Default is the center of a model.

Candidate

In the "search" processing items, such as Search, Flexible Search, ECM Search, Classification, 3D Search, 3D Height, Character Inspection, and Model Dictionary, "Rough search" searches the entire area of the measurement region and "Detail search" searches only the regions whose correlations were high during the Rough search. "Rough search" is to search entire measured region, and "Detail search" is to search the region of which correlation was high in the "Rough search". Candidate is the point to be the candidate for "Detail search". Candidate LV represents the correlation value for "Rough search". If stable search of a model is not possible, set the Candidate LV lower.

3D Coordinates Registration

The setting when applying the 3D process to convert a measured value into an actual size by matching the coordinates of two cameras.
The setting is made with a special calibration tool.



Scene

A combination of Units for measurement. A scene is created according to measurement objects or contents, used to switch measurement simply.
For details, see "4.1 What is Scene" (→pg.2).

Scene Group

32 Units are incorporated into a scene for sorted measurement. For details, see "4.7 What is Scene Group" (→pg.50).

Center of gravity

The images with white pixel are Cut into paper of a certain thickness, where a position is used to support the balance of paper. This position is called "Center of gravity". The gravity of circle object is the center of circle, the gravity of rectangle is the intersection of two diagonal lines.

Processing Item

A unit used for measurement. A scene (measurement flow) can be created after Processing Item is registered to Unit.

Processing Unit

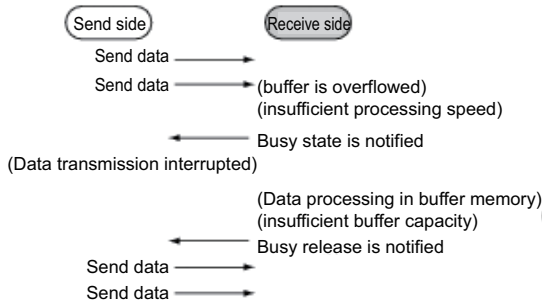
A unit of measurement processing constituent. Processing items can be set for a processing unit to create a Scene (measurement flow).
For details, see "4.1 What is Scene" (→pg.2).

Correlation

0 to 100 are used to represent the degree of similarity of finished products, namely, a higher value indicates a higher degree of similarity.

Flow control

If the processing speed of receiving side is slower than that of sending side, the receiving side will send interruption commands to sending side, or send re-admittance commands and then adjust the transmission speed.



There are two flow control methods, including "Hardware Flow Control" and "Software Flow Control". In this product, "Software Flow Control" is used to adjust transmission speed.

Model

An image model for measurement object. Images with some features are extracted for Model Registration.

World coordinates

This is a coordinate system to locate a position of an object in a specified space. The system is used to display or handle the movement of objects. On the other hand, the coordinate system that is used when processing the shape or deformation of an individual object is called local coordinate system.

Unit

" Processing Unit" (→pg.14)

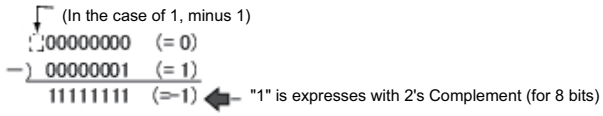
2's Complement

Binary number is generally used to represent a Minus.

"All digits of positive number are inversed bit wisely, and then added by 1" represent a Minus.

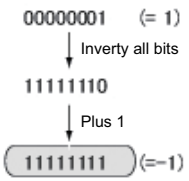
Example) "-1" is presented with 2's complement

"-1" can be calculated with "0-1"



Additionally, there are available with other simple computing methods.

Namely, "Minus = all digits of positive number inversed bit wisely plus 1".



The first digit is used to judge positive number or Minus.

- 0: positive number (or 0)
- 1: Minus

The benefit of 2's Complement is to allow for direct Expression of positive and Minus.

Example) When -1+10=9

```
  11111111(= -1)
+)00001010(= 10)
  00001001(=  9)
```

11.5 Menu List

11.5.1 Main Screen Menu

Table: Menu Hierarchy Chart

Menu 1	Menu 2	Menu 3	see
Scene	Edit flow	-	"4.1 What is Scene" (→pg.2) "4.2 Creating a New Scene" (→pg.4) "4.3 Editing a Processing Unit in a Scene" (→pg.7)
	Scene switch	-	"4.4 Changing Steps (Scene Switch)" (→pg.20)
	Scene maintenance	-	"4.1 What is Scene" (→pg.2) "4.7 What is Scene Group" (→pg.50) "4.8 Edit Unit in a Scene Group" (→pg.52) "4.9 Editing Scene Group" (→pg.57)
	Unit setting	-	" Processing Items List Manual" (→pg.1)

Table: Menu Hierarchy Chart

Menu 1	Menu 2	Menu 3	see
View	Control area	-	"1.2.1 Main Screen (ADJUST window)" (→pg.4) "1.2.2 Main Screen (RUN window)" (→pg.7)
	Test Measurement	-	"5.1 Test Measurement before Actual Operation" (→pg.2) "5.2 Re-measuring Saved Images (Re-measurement)" (→pg.5) "6.1 The Flow before Starting the Operation" (→pg.2)
	Flow	-	"6.3.2 Displaying Flow and Detail Result" (→pg.12)
	Detail result	-	
	Image display setting	-	
	Display the enlarged measurement flow	-	
	Positions	-	
	Image layout	1 image	"6.3.1 Image Display Setting" (→pg.5)
		2 image	
		4 image	
		Thumbnail	
	Image mode	Through	"6.3.1 Image Display Setting" (→pg.5)
		Freeze	
		Last NG	
	Image selection	Select image	"5.2 Re-measuring Saved Images (Re-measurement)" (→pg.5)
		Previous image	
		Next image	
Measure	Measure	-	"5.1 Test Measurement before Actual Operation" (→pg.2)
	Measure setting	-	"9.2 Setting for Measurement" (→pg.5)
	Logging setting	-	"7.2 Setting up Logging Condition [Logging setting]" (→pg.7)
	Clear measurement	-	"5.5 Clearing Measurement Results" (→pg.17)
	Clear logging image	-	"5.6 Clearing Logging Images" (→pg.18)

Table: Menu Hierarchy Chart

Menu 1	Menu 2	Menu 3	see
Data	Data save	-	"8.1.1 Saving Setting Data in the Controller's Memory [Data save]" (→pg.6)
	Save to file	-	"8.1.2 Saving Setting Data to the RAM Disk/USB Memory [Save to file]" (→pg.7) "8.1.3 Saving Logging Image Data [Save to file]" (→pg.8)
	Load from file	-	"8.1.5 Loading the Setting Data to the Controller [Load from file]" (→pg.11)
System	Camera	Camera connection	"9.1 Setting the Conditions for Using Camera [Camera]" (→pg.2)
		Inter-camera setting	"9.1.2 Setting for Trigger Delay [Inter-camera setting]" (→pg.2)
	Communication	Ethernet	"10.2.2 Setting Communication Specifications (Ethernet Connection)" (→pg.3)
		Serial	"10.3.2 Setting Communication Specifications (Serial Interface)" (→pg.7)
		Parallel	"10.4.1 Setting Communication Specifications (Parallel Interface)" (→pg.28)
	Controller	Date-time setting	"9.3.1 Setting Date and Time [Date-time setting]" (→pg.7)
		Language setting	"9.3.2 Setting the Language [Language setting]" (→pg.8)
		Fan Control Setting	"9.3.3 Setting the rotation speed of the controller fan [Fan control setting]" (→pg.8)
		Startup setting	"9.3.4 Setting the Status at the Startup [Startup setting]" (→pg.9)
		Switch to RUN mode	"9.3.5 Setting the Mode of the RUN window [Select RUN mode]" (→pg.11)
		System initialization	"9.4.1 Initializing Controller [System initialization]." (→pg.15)
		System restart	"9.4.2 Restarting the Controller [System restart]" (→pg.16)
		System information	"9.3.7 Checking System Information [System information]" (→pg.14)
	Screen capture	Screen capture	"9.5 Setting the Destination to Save Capture Image [Screen capture setting]" (→pg.17)
		Screen capture setting	

11.6 Corresponding Image List of Processing Items

In the "Figure setting" area, the objects that can be used and the number of objects that can be set vary depending on areas to be set.

Table: Corresponding Image List of Processing Items

Settable Objects	Rectangle	Line	Circle/ Oval	Circumference	Arc	Cursor	Polygon	Text	Time	Number of registration
When setting result display	P	P	P	P	P	P	-	O	O	100
When setting Model Registration										
3D Circle Search	-	-	-	O	-	-	-	-	-	1 units
Search	O	-	O	O	-	-	O	-	-	8
Flexible Search	O	-	O	O	-	-	O	-	-	
Fine Matching	O	-	O	O	O	-	O	-	-	
Classification	O	-	O	O	-	-	O	-	-	
Model Dictionary	O [Note 3]	-	O	O	-	-	O	-	-	
ECM search	O	-	-	-	-	-	-	-	-	
3D Search	O	-	O	O	-	-	O	-	-	

Table: Corresponding Image List of Processing Items

Settable Objects	Rectangle	Line	Circle/ Oval	Circumference	Arc	Cursor	Polygon	Text	Time	Number of registration
When setting up region setting										
Filtering	O	-	-	-	-	-	-	-	-	1
Position Compensation	O	-	-	-	-	-	-	-	-	
Edge Position	-	O [Note 1]	-	O	O	-	-	-	-	
Scan Edge Position	-	O [Note 1]	-	-	-	-	-	-	-	
Scan Edge Width	-	O [Note 1]	-	-	-	-	-	-	-	
Edge Pitch	-	O [Note 1]	-	O	O	-	-	-	-	
Search	O	-	-	-	-	-	-	-	-	
Flexible Search	O	-	-	-	-	-	-	-	-	
ECM Search	O	-	-	-	-	-	-	-	-	
Circle Angle	-	-	O [Note 2]	O	-	-	-	-	-	
Classification	O	-	-	-	-	-	-	-	-	
Character Inspection	O	-	-	-	-	-	-	-	-	
3D Camera Image	O	-	-	-	-	-	-	-	-	
3D Edge Position	-	O	-	-	-	-	-	-	-	
3D Circle Search	O	-	-	-	-	-	-	-	-	
3D Search	O	-	-	-	-	-	-	-	-	
3D Height	O	-	-	-	-	-	-	-	-	
Color Data	O	-	O	O	-	-	O	-	-	8
Defect	O	O	O	O	O	-	O	-	-	
Gravity and Area	O	-	O	O	-	-	O	-	-	
Labeling	O	-	O	O	-	-	O	-	-	
When specifying color										

Table: Corresponding Image List of Processing Items

Settable Objects	Rectangle	Line	Circle/ Oval	Circumference	Arc	Cursor	Polygon	Text	Time	Number of registration
Edge Position	O	-	-	-	-	-	-	-	-	1
Scan Edge Position	O	-	-	-	-	-	-	-	-	
Scan Edge Width	O	-	-	-	-	-	-	-	-	
Edge Pitch	O	-	-	-	-	-	-	-	-	
Labeling	O	-	-	-	-	-	-	-	-	
Gravity and Area	O	-	-	-	-	-	-	-	-	

P: Permanent images/calculated objects
O: Only for fixed figure
-: None
[Note 1]: Represented by arrow from start point to end point.
[Note 2]: Only set to a circle. Ellipse can not be set.
[Note 3]: Available for the rectangle setting only when Auto extract region is selected.

11.7 Selecting the Upper Limit of Processing Item Parameters

The Upper and Lower of the parameters used by the Processing Items are as follows.
Values of the parameters vary depending on the image size of the camera.

Table: The parameter value used by the processing items

Parameters	Description	For 0.3 Mega pixcel cameras:	For 2 Mega pixcel cameras:
X_MAX	The max value in the X axis orientation	639	1599
Y_MAX	The max value in the Y axis orientation	479	1199
W_MAX	Max magnitude value	239 (straight line W=319)	599 (straight line W = 799)
R_MAX	Max radius	239 (circle/eclipse R1=319)	599 (circle/ellipse R1=799)
A_MAX	Max area	(X_MAX+1) * (Y_MAX+1) = 307200	(X_MAX+1) * (Y_MAX+1) = 1920000
Y_PMAX	Max. scannable number of lines	479	1199

11.8 Number of Logged Images

The maximum number of logged images (I_MAX) that can be stored in the controller's memory varies depending on the type of the controller in use and the type and number of connected cameras.

For color cameras:

Table: Maximum Number of Logged Images (I_MAX) - Color Camera

Type of controller	0.3 Mega pixcel				2 Mega pixcel			
	1 camera	2 cameras	3 cameras	4 cameras	1 camera	2 cameras	3 cameras	4 cameras
FZ2-3xx	70	34	22	17	-	-	-	-
FZ2-5xx	242	120	80	59	38	18	12	8

0.3 Mega pixcel: 640 pixels x 480 pixels
2 Mega pixcel: 1600 pixels x 1200 pixels

For monochrome cameras:

Table: Maximum Number of Logged Images (I_MAX) - Monochrome Camera

Type of controller	0.3 Mega pixcel				2 Mega pixcel			
	1 camera	2 cameras	3 cameras	4 cameras	1 camera	2 cameras	3 cameras	4 cameras
FZ2-3xx	71	35	23	17	-	-	-	-
FZ2-5xx	244	121	80	60	38	18	12	8

0.3 Mega pixcel: 640 pixels x 480 pixels
2 Mega pixcel: 1600 pixels x 1200 pixels

POINT

- The available number of logged images is I_MAX+1. (Logging Image No.: 0 to I_MAX)

Processing Items List Manual

Processing Items List Manual decribes the Processing Items required for measurement. Processing Items can be classified as follows. Please select the required contents according to the measurement application.

"Chapter 1 - Image Input" (→pg.1)

This section describes how to process the images that you acquire from cameras as measurement objects.
Also include image processing captured from cameras to meet the measurement conditions.

"Chapter 2 - Image Compensation" (→pg.1)

This section describes how to correct the Position of measurement objects for further measurement.

"Chapter 3 - Inspection and Measurement" (→pg.1)

This section describes how to measure.
The measurement contents will differ depending upon the different purposes, such as "Position"/"Defect and foreign materials measurement"/"Counting"/"Reading string", etc.
You can select and combine Processing Items according to measurement.

"Chapter 4 - Measurement Support" (→pg.1)

For more efficient measurement, you also can combine with other Processing Items,including Value acquired from other Processing Items, other measurements and utilizing of measurement results.

"Chapter 5 - Branch Control" (→pg.1)

You can branch the sequent Processing Items according to the conditions of measurement conditions and classify them according to the different production lines.

"Chapter 6 - Result Output" (→pg.1)

After setting up a series of measurement, you can specify how to output the measurement results to external devices.

"Chapter 7 - Result Display" (→pg.1)

After completing a series of measurements, you aslo can set up how to result display to judge measurement results or indicate precautions on measurement.
It is easy to view measurement results by setting up result display.

Processing item List

Information about the Processing Items.

Chapter 1 -Image Input 1
Chapter 2 -Image Compensation 1
Chapter 3 -Inspection and Measurement 1
Chapter 4 -Measurement Support 1
Chapter 5 -Branch Control 1
Chapter 6 -Result Output 1
Chapter 7 -Result Display 1

1

Chapter 1 - Image Input

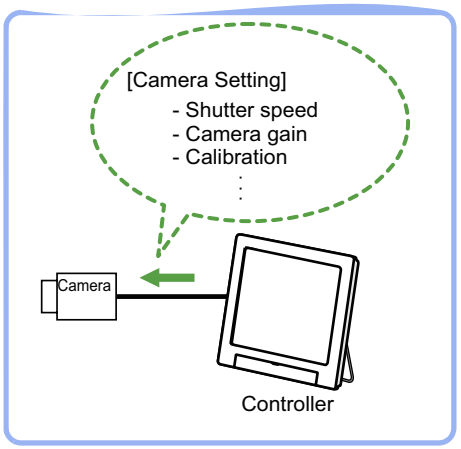
This chapter describes how to acquire images from cameras.

1.1 Camera Image Input 1
1.2 Camera Switching 1
1.3 3D Camera Image Input 3
1.4 3D Camera Switching 49

1.1 Camera Image Input

Used for the following case

- This processing item must be applied when measuring
  Specify the conditions for inputting images from the camera and for storing images of the measured objects.



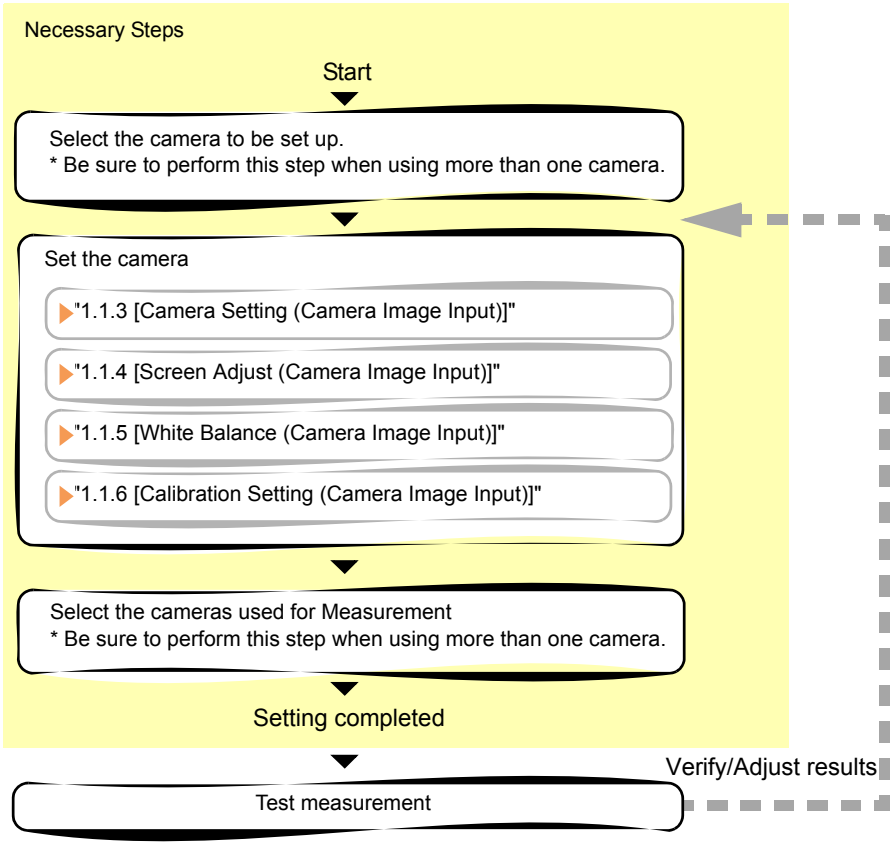
Important

- For Unit 0, make sure to set one of the following:
  - [Camera Image Input]
  - [3D Camera Image Input] (only for FZD Series)

  *As for FZ2 Series, [Camera Image Input] is set in Unit 0 by default.
- When switching from a monochrome camera to color camera, reconfigure the settings in the following units.

1.1.1 Setting up [Camera Image Input]

To set up Camera Image Input, follow the steps below.



POINT

Operations of the ProcItem Setting window

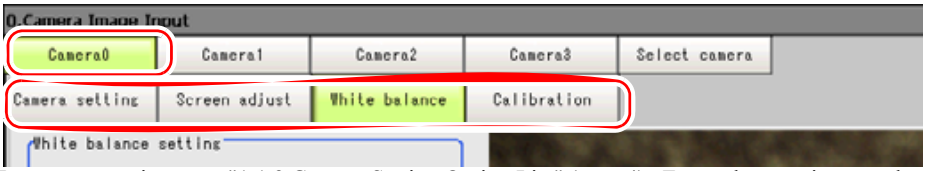
- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 In the Edit Flow window, tap [Camera Image Input].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area, tap [Camera N], where N is a Camera No., and configure imaging settings for that camera.



For camera settings, see "1.1.2 Camera Setting Option List" (→pg.4). For each operation, see the following:

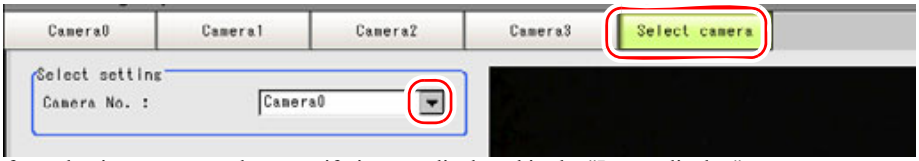
- "1.1.3 [Camera Setting (Camera Image Input)]" (→pg.5)
- "1.1.4 [Screen Adjust (Camera Image Input)]" (→pg.11)
- "1.1.5 [White Balance (Camera Image Input)]" (→pg.19)
- "1.1.6 [Calibration Setting (Camera Image Input)]" (→pg.21)

POINT

- When setting multiple cameras, repeat the procedure above for each camera.

3 Select a camera number for the measurement objects.

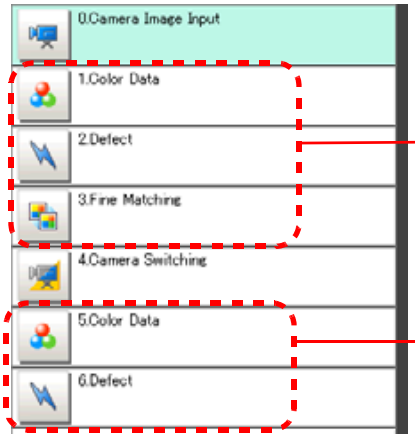
1. In the "Item tab" area, tap [Select camera].
2. In the "Select setting" area, tap [▼] for [Camera No.] and select a camera number.



After selecting cameras, please verify images displayed in the "Image display" area.

POINT

- The images from the camera selected in [Select camera] will be the object to be measured in the following units.
  If you need to switch the camera during the process, insert a [Camera Switching] unit in the scene and switch the image source.
  "1.2 Camera Switching" (→pg.1)



4 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

5 Perform a test measurement.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"
An image from the selected camera is displayed in the "Image display" area.

6 Adjust the image, as necessary, if the image cannot be input properly because it is out of focus or for some other reason.

1.1.2 Camera Setting Option List

You can perform detailed camera settings in [Camera Image Input]. The following items are available for camera settings. For details and settings of each item, see the respective reference page.

POINT

- The setting options differ depending on the camera type and lighting mode.
  "1.1.7 Camera/Lighting Combination and Available Functions" (→pg.32)

Table: Camera Setting Option List

Item	Description
Camera setting	Specify the camera settings such as the shutter speed or flashlight. "1.1.3 [Camera Setting (Camera Image Input)]" (→pg.5)

Table: Camera Setting Option List

Item			Description
	Camera settings		Specify the shutter speed and the camera gain. " Camera Settings" (→pg.6)
	Frame/Field		Select the unit to be treated as one image. This area is displayed only when a monochrome camera is used. " Frame/Field - for Monochrome Cameras Only" (→pg.7)
	Number of lines to be read		Narrow the image range to be scanned. " Number of Lines to be Read" (→pg.8)
	Electronic flash setting		Specify flashlight settings. " Electronic Flash Setting" (→pg.10)
Screen adjust			Adjust the lighting and the lens. "1.1.4 [Screen Adjust (Camera Image Input)]" (→pg.11)
	Lighting control		Adjust the amount of light (brightness) of the lighting. " Lighting Control" (→pg.11)
	Lens setting		Adjust the camera zoom, focus, and iris. " Lens Setting (When Connecting an Intelligent Camera or an Auto-focus Camera)" (→pg.16)
	Common setting for all cameras		Set the target area to apply the automatic setting for focus, iris, and white balance, and specify the iris base density. " Common Setting for All Cameras (When Connecting an Intelligent Camera or an Auto-focus Camera)" (→pg.18)
White Balance Setting			Adjust the white balance. "1.1.5 [White Balance (Camera Image Input)]" (→pg.19)
Calibration setting			Set when measurements (measurements in camera coordinates) are to be output in actual dimensions. Select the calibration setting method and generate the calibration parameters. "1.1.6 [Calibration Setting (Camera Image Input)]" (→pg.21)
	Calibration method		The following pattern generation methods are available. Select the appropriate method.
		Point defining	Specify a point in pixels to generate the calibration parameters. " Setting up by Specifying any Points (Point)" (→pg.21)
		Specify value	Specify a numeric value and generate the calibration parameters. " Setting up calibration by entering values (Parameter)" (→pg.24)
		Sampling	Perform a sampling measurement to generate the calibration parameters. " Setting up Calibration by Sampling Measurement (Sampling)" (→pg.27)
	Calibration parameter		Check the calibration settings. " View Calibration Parameters" (→pg.30)

1.1.3 [Camera Setting (Camera Image Input)]

The following items can be set up in Camera setting:

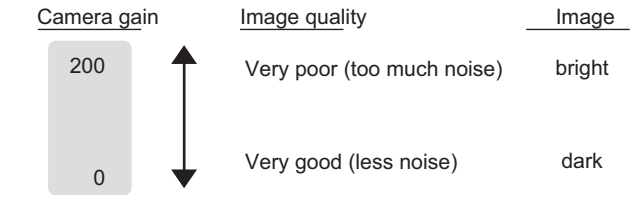
- " Camera Settings" (→pg.6)
- " Frame/Field - for Monochrome Cameras Only" (→pg.7)
- " Number of Lines to be Read" (→pg.8)
- " Electronic Flash Setting" (→pg.10)

POINT

- The displayed items differ depending on the camera type and lighting mode. Perform the following procedures as needed to suit the environment of your camera.
  "1.1.7 Camera/Lighting Combination and Available Functions" (→pg.32)

Camera Settings

Adjust the settings related to camera shutter speed and camera gain.
Select the shutter speed appropriate for the speed of the measured object. Choose faster shutter speed if the measured object is moving fast and the image is blurred.
Where the specific shutter speed, iris, and lighting condition cannot be used to brighten the image, the camera gain should be adjusted. Usually, the factory default value can be used.



[Factory defaults: 85]

1 In the "Item tab" area, tap [Camera setting].

The Camera Setting window is displayed.

2 In the "Camera settings" area, specify the shutter speed.

Select "Select typical value", and tap [▼] to select shutter speed.

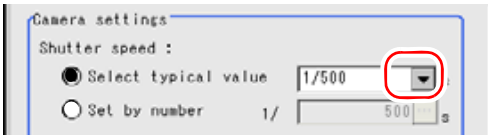


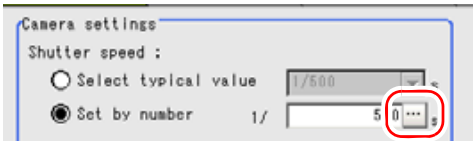
Table: Camera Setting (Camera Image Input) - Camera Settings

Item	Set Value [Factory defaults]	Description
Shutter speed	Options (examples) ・[1/120] (For 2 Mega pixcel cameras) ・1/200 ・[1/500] (For 0.3 Mega pixcel cameras) ・1/1000 ・1/2000 ・1/4000 ・1/8000 ・1/20000	Option values for the shutter speed differ depending on the camera type.

Specifying a value directly:

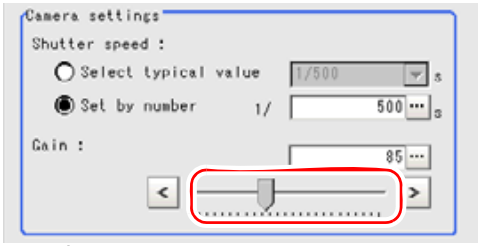
Select "Set by number", tap [...] and input value.

For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"



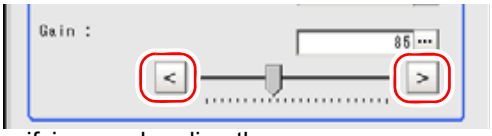
3 In the "Camera settings" area, specify the camera gain.

While verifying the camera-input image, adjust "Gain" by dragging the slider in the "Camera settings" area.



Fine-tuning

Tap the buttons at both ends of the slider.



Specifying a value directly:

Tap [...] in "Gain" and input a value.

For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"

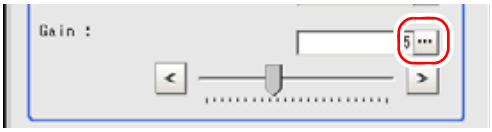


Table: Camera Setting (Camera Image Input) - Camera Settings

Item	Set Value [Factory defaults]	Description
Gain	0 to 230 [50] (for camera with more than 640 by 480 pixels) [85] (for camera with 640 by 480 pixels or less)	Adjust the camera gain when specific shutter speed, iris, and lighting condition cannot be used to brighten the image. Usually, the factory default value can be used.

For the following operations, see "1.1.1 Setting up [Camera Image Input]" (→pg.2)

Frame/Field - for Monochrome Cameras Only

Select the unit to be treated as one image.

POINT

- For frames and fields, see " About Frame Images and Field Images" (→pg.33).

1 In the "Item tab" area, tap [Camera setting].

The Camera Setting window is displayed.

2 In the "Frame/Field" area, select either "Frame" or "Field".

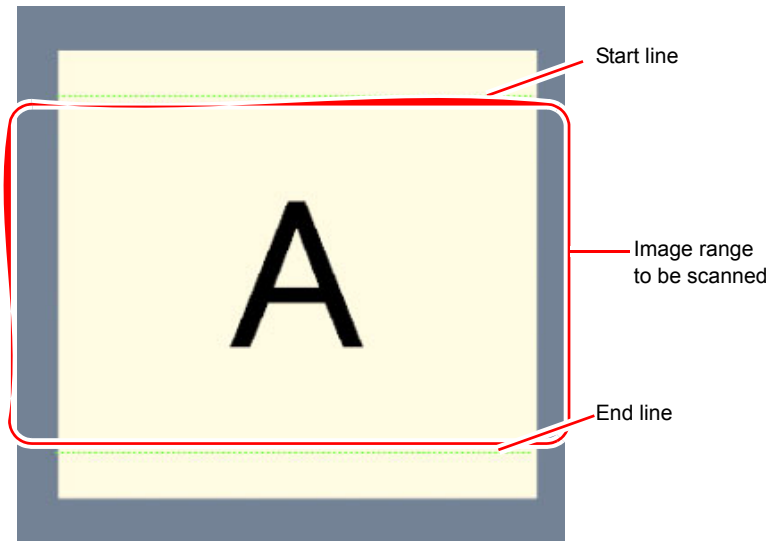
Table: Camera Setting (Camera Image Input) - Frame/Field

Item	Set Value [Factory defaults]	Description
Frame/Field	[Frame]	Measurements are made in units of frames.
	Field	Measurements are made in units of fields. Select "Field" when you prefer shorter image input time rather than higher accuracy. Processing becomes faster since each image is scanned while skipping one scan line per two consecutive lines, but the measurement accuracy lowers since the vertical resolution of images lowers.

For the following operations, see "1.1.1 Setting up [Camera Image Input]" (→pg.2)

Number of Lines to be Read

By narrowing the image range to be scanned, the image scan time can be shortened.
Set the range taking the offset of the measured object into consideration.
The part of the image narrowed down by the start line and the end line will be displayed in the "Image display" area of the ProcItem Setting window or of the Main screen.



POINT

About minimum lines

- The minimum lines (the minimum number of lines between the start and end lines) are 12 lines.

About coordinate values

- The coordinate values displayed as the measurement result are those values of the display position on the monitor.
- The coordinate values do not vary with the settings for the "Number of lines to be read".

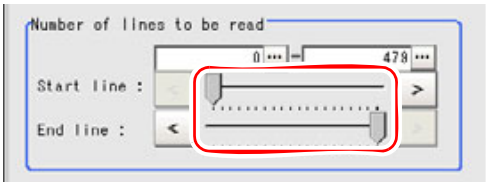
---

1 In the "Item tab" area, tap [Camera setting].

2 In the "Number of lines to be read" area, specify the start/end line.

When dragging the slider to change the start/end line

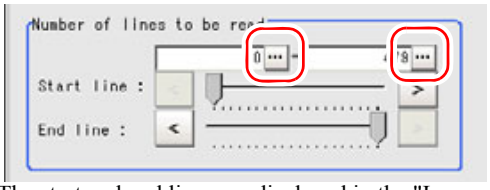
Drag the slider while verifying the image in the "Image display" area.



Specifying a value to change the start/end line:

In the "Number of lines to be read" area, tap [...] and input the coordinate values for the start/end line position.

For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"



The start and end lines are displayed in the "Image display" area.

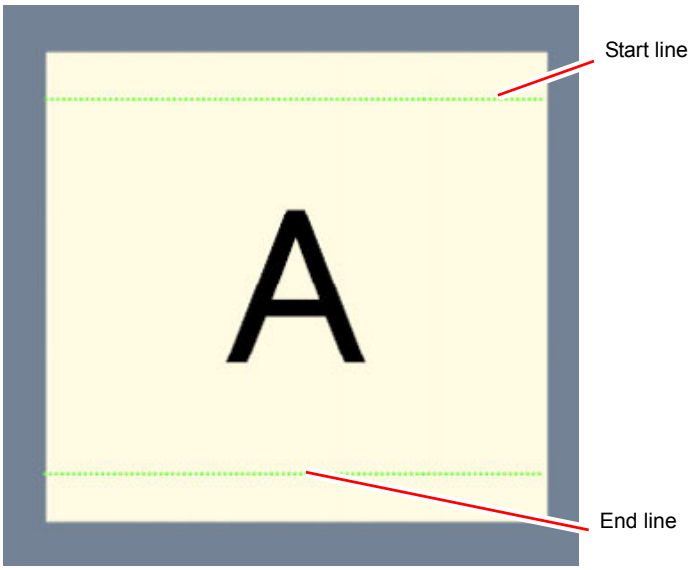


Table: Camera Setting (Camera Image Input) - Number of Lines to Be Read

Item	Set Value [Factory defaults]	Description
Start line	[0] to Y_PMAX	Specify the scan start position.
End line	0 to [Y_PMAX]	Specify the scan end position.

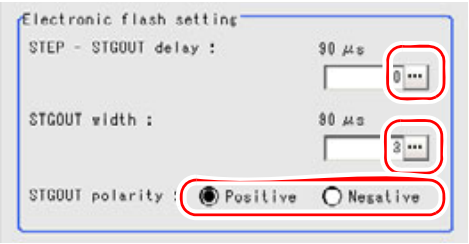
For the following operations, see "1.1.1 Setting up [Camera Image Input]" (→pg.2)

Electronic Flash Setting

1 In the "Item tab" area, tap [Camera setting].

The Camera Setting window is displayed.

2 In the "Electronic flash setting" area, specify each item.



1. Tap [...] for "STEP-STGOUT delay" and "STGOUT width" and input a value for each.
   For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"
2. Select the STGOUT polarity.

Table: Camera Setting (Camera Image Input) - Electronic Flash Setting

Item	Set Value [Factory Default]	Description
STEP-STGOUT delay	[0] to 511 (1 count 30µs)	Refer to the timing chart and set the Waiting Time from the time the STEP signal is input to the strobe trigger output signal becomes ON. Delay Time=Count x 30µs + 90µs
STGOUT width	1 to 63 [3] (1 count 30µs)	Specify the strobe trigger pulse width.
STGOUT polarity	・[Positive] ・Negative	Select the strobe trigger pulse polarity. Positive: Flashes when strobe trigger output signal changes from OFF to ON. Negative: Flashes when strobe trigger output signal changes from ON to OFF.

For the following operations, see "1.1.1 Setting up [Camera Image Input]" (→pg.2)

1.1.4 [Screen Adjust (Camera Image Input)]

The following items can be set up in the Screen adjustment option.

- " Lighting Control" (→pg.11)
- " Lens Setting (When Connecting an Intelligent Camera or an Auto-focus Camera)" (→pg.16)
- " Common Setting for All Cameras (When Connecting an Intelligent Camera or an Auto-focus Camera)" (→pg.18)

Lighting Control

The brightness of the lighting can be adjusted from the controller. You can choose to adjust the brightness for each part or select one of the preset patterns.

POINT

- Perform the lighting setting only when the camera being used has lighting equipment.
- When one scene contains two or more Camera Image Input units, lighting control can be performed only for the first Camera Image Input unit.

1 In the "Item tab" area, tap [Screen adjust].

2 In the "Lighting control" area, specify the brightness.

The displayed content depends on the connected camera.

When an intelligent camera is connected

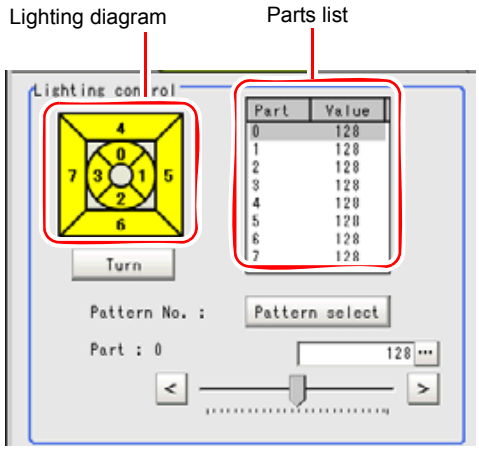
Set the brightness of parts 0 to 7 between the range of 0 and 255.

Brightness 0 indicates the lighting is OFF. The larger the number, the higher the brightness.

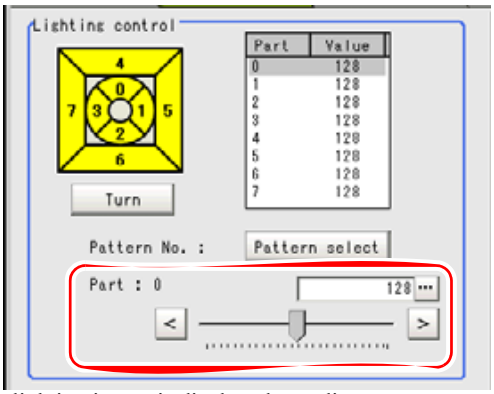
Important

- When model FZ-SLC15 is connected, only parts 0 to 3 are active. Changing parts 4 to 7 will not affect the brightness.

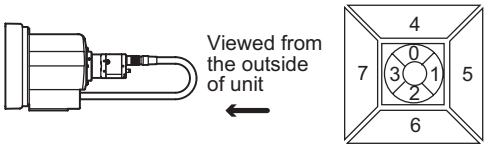
1. Check the part in the lighting diagram and tap the number of the part to set in the parts list.



2. While verifying the camera-input image in the "Image display" area, drag the slider to adjust the brightness.
   To fine-tune, tap the buttons at both ends of the slider.
   The "Value" for the selected part changes.



A lighting image is displayed as a diagram.



Capable to adjust light intensity of 8 positions

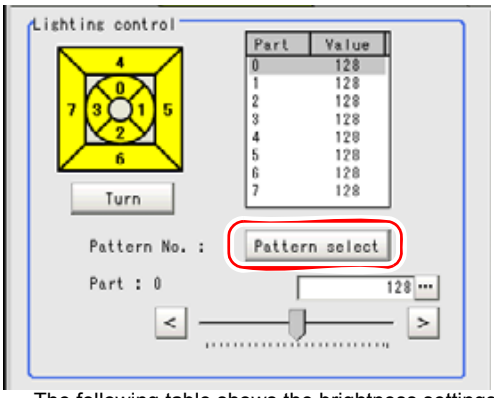
Table: Screen Adjust (Camera Image Input) - Lighting Setting

Item	Set Value [Factory Default]	Description
Brightness	[0] to 255 x 8ch	Adjustable in 256 steps

POINT

When selecting a preset lighting pattern:

- Tap [Pattern select] and select one of the preset lighting patterns. The selected pattern contains brightness settings to be applied to the respective parts.



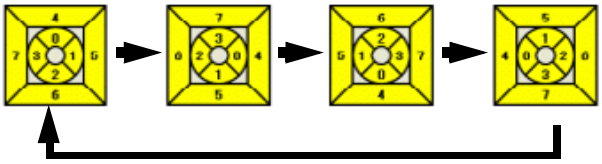
The following table shows the brightness settings in each pattern.

Table: Block Adjustment Pattern

Block Adjustment Pattern	Part 0	Part 1	Part 2	Part 3	Part 4	Part 5	Part 6	Part 7
Pattern 0	128	128	128	128	128	128	128	128
Pattern 1	255	255	255	255	255	255	255	255
Pattern 2	128	128	128	128	0	0	0	0
Pattern 3	255	255	255	255	0	0	0	0
Pattern 4	0	0	0	0	128	128	128	128
Pattern 5	0	0	0	0	255	255	255	255
Pattern 6	255	0	255	0	255	0	255	0
Pattern 7	0	255	0	255	0	255	0	255
Pattern 8	255	0	0	0	0	0	0	0
Pattern 9	0	255	0	0	0	0	0	0
Pattern 10	0	0	255	0	0	0	0	0
Pattern 11	0	0	0	255	0	0	0	0
Pattern 12	0	0	0	0	255	0	0	0
Pattern 13	0	0	0	0	0	255	0	0
Pattern 14	0	0	0	0	0	0	255	0
Pattern 15	0	0	0	0	0	0	0	255
Pattern 16	0	0	0	0	0	0	0	0

Change lighting number

- After the camera is installed, if the orientation of the camera does not match the orientation of the lighting parts, tap [Turn] under the lighting diagram. The lighting diagram rotates 90 degrees clockwise each time you tap [Turn], so that you can make the lighting part positions correspond to the actual lighting part positions.



For MG-WAVE connection:

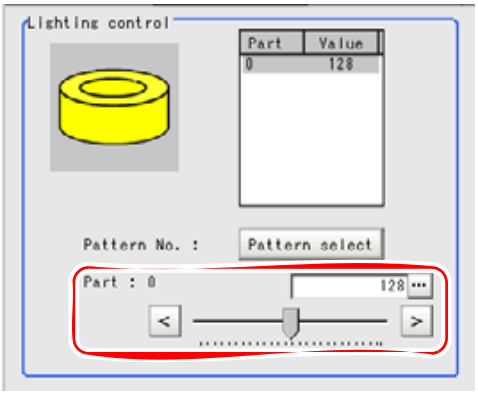
Set the brightness between the range of 0 and 255.

Brightness 0 indicates the lighting is OFF. The larger the number, the higher the brightness.

1. While verifying the camera-input image in the "Image display" area, drag the slider to adjust the brightness.

   To fine-tune, tap the buttons at both ends of the slider.

   The "Value" for the brightness changes.

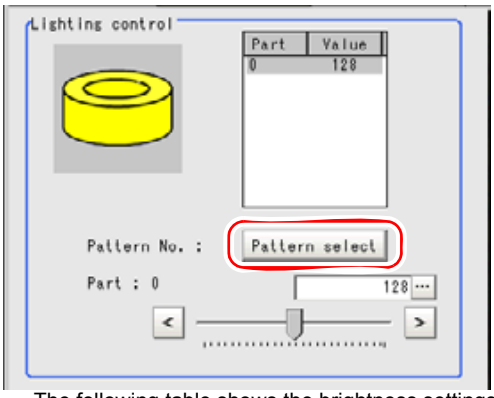


A lighting image is displayed as a diagram.

POINT

When selecting a preset lighting pattern:

- Each time you tap [Pattern select], the lighting pattern is switched to the next preset pattern.



The following table shows the brightness settings in each pattern.

Table: Adjustment Pattern

Adjustment Pattern	Part 0
Pattern 0	128
Pattern 1	255
Pattern 2	0

For other cameras

The brightness cannot be adjusted. The following message appears in the "Lighting control" area.

Lens Setting (When Connecting an Intelligent Camera or an Auto-focus Camera)

Adjust the lens of the camera.
The optimum value can be set automatically for focus and iris (auto focus, auto iris).
Depending on the focus setting, it may not be possible to set a large zoom value.

1 In the "Item tab" area, tap [Screen adjust].

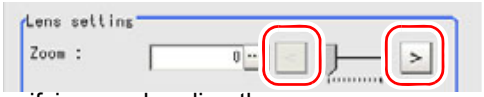
2 While verifying the image in the "Image display" area, drag the slider in the "Lens setting" area.

Table: Screen Adjust (Camera Image Input) - Lens Setting

Item	Set Value [Factory defaults]	Description
Zoom	[0] to 1023	Switches between wide and telephoto by enlarging the image and performing interpolation.

When fine-tuning

Tap the buttons at both ends of the slider.



Specifying a value directly:

Tap [...] for "Zoom" and input a value.

For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"

3 In the "Lens setting" area, specify values for "Focus" and "Iris".

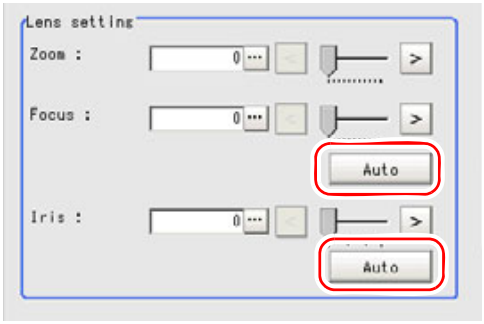
Table: Screen Adjust (Camera Image Input) - Lens Setting

Item	Set Value [Factory defaults]	Description
Focus	[0] to 1023	Adjust the focus.
Iris	[0] to 31	Adjust the amount of light that passes through the lens.

Setting optimum values calculated automatically:

Tap [Auto] at the right of each item.

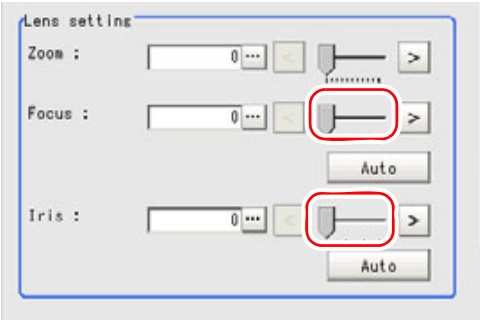
An appropriate value is calculated and set.



When adjusting the values manually

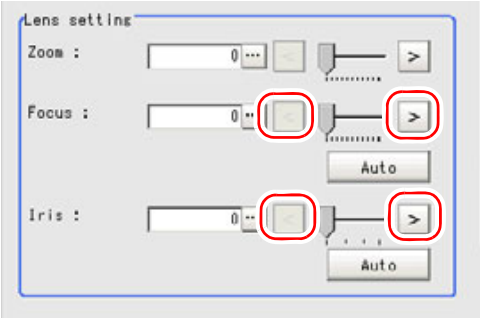
Drag the slider while verifying the image in the "Image display" area.

After the automatic setting, individual fine-tuning can still be performed.



Fine-tuning

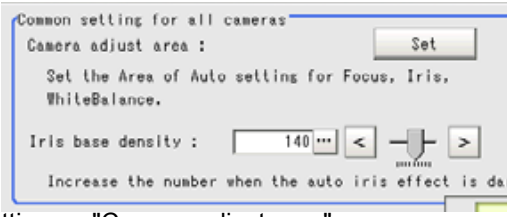
Tap the buttons at both ends of the slider.



Common Setting for All Cameras (When Connecting an Intelligent Camera or an Auto-focus Camera)

1 In the "Item tab" area, tap [Screen adjust].

2 In the "Common setting for all cameras" area, set up "Camera adjust area" and "Iris base density".

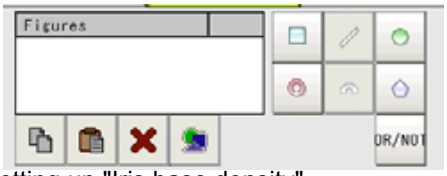


Setting up "Camera adjust area"

Specify the target area to apply automatic settings for focus, iris, and white balance.

1. Tap [Set] for "Camera adjust area".
   The "Figure setting" area is displayed.

2. Specify the target area using the Drawing Tools.
   "1.9 Setting Figures" (→pg.25), of "User's Manual"



When setting up "Iris base density"

Specify a larger value when the result with the automatic iris setting is dark.

1. Tap [...] for "Iris base density" and specify a value.
   For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"
   The value can be adjusted by dragging the slider or by tapping the buttons at both ends of the slider.

1.1.5 [White Balance (Camera Image Input)]

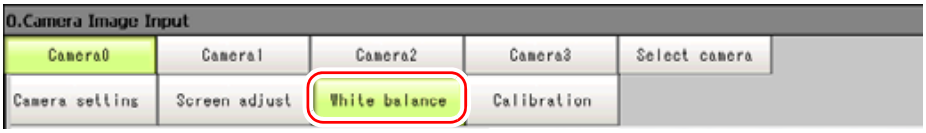
Set up the white balance to make white objects look white by calibrating the color of images scanned from cameras.
By adjusting the white balance, the white color can be appropriately reproduced under any lighting conditions
Appropriate value can also be set automatically.

POINT

- Perform the white balance setting only when a color camera is used.
- Be sure to perform the white balance setting in the following cases:
  - When a new system is installed
  - When a camera or lighting is changed

  Since measurement results may vary with changes of the white balance setting, be sure to verify the operation after it has changed.

1 In the "Item tab" area, tap [White balance].



2 In the "White balance setting" area, specify "R", "G", and "B" values.

Whiteness increases when the value of "R", "G", and "B" is increased.

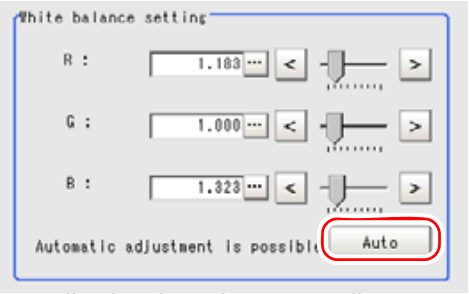
Table: White Balance Setting (Camera Image Input)

Item	Set Value [Factory defaults]	Description
White balance setting ・R ・G ・B	0.001 to 7.999 (for each of "R", "G", and "B") For FZ-SC connection: [R=1.183] [G=1.000] [B=1.323] For FZ-SC2M connection: [R=1.394] [G=1.000] [B=1.222]	Adjust the white balance.

Setting optimum values calculated automatically:

Display the white area in the center of the screen and tap [Auto].

The white color displayed in the center of the screen is identified as "white" and white balance is set automatically to match this.

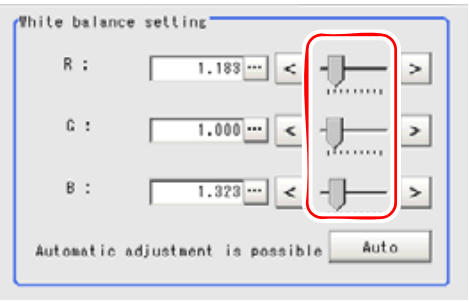


When adjusting the values manually

Specify the RGB values to be processed as white.

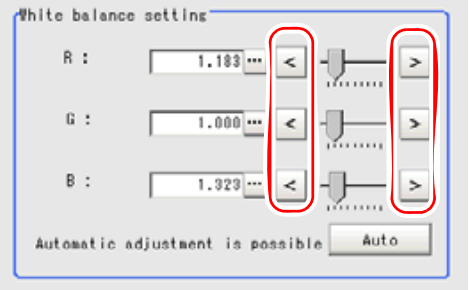
Drag the slider while verifying the image in the "Image display" area.

After the automatic setting, individual fine-tuning can still be performed.



Fine-tuning

Tap the buttons at both ends of the slider.



1.1.6 [Calibration Setting (Camera Image Input)]

By setting the calibration, the measurement result can be converted and output as actual dimensions.
Select your calibration method.
There are three calibration methods as shown below.

Table: Calibration (Camera Image Input)

Item	Description	See
Point	Set up calibration by specifying any preferable points (in pixels).	" Setting up by Specifying any Points (Point)" (→pg.21)
Parameter	Set up by inputting values directly.	" Setting up calibration by entering values (Parameter)" (→pg.24)
Sampling	Set by sampling measurement.	" Setting up Calibration by Sampling Measurement (Sampling)" (→pg.27)

You can check the contents of the set calibration data.
" View Calibration Parameters" (→pg.30)
For calibration, see "11.4 Terminology" (→pg.12), of "User's Manual"

POINT

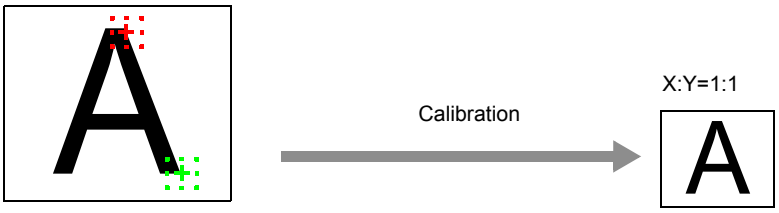
- When measurement results are to be output in actual dimension, set [Calibration] to "ON" in [Output parameter] for each unit. If [Calibration] is "OFF" (factory default), the coordinate values of the camera image are output as measurement results.

Setting up by Specifying any Points (Point)

This is a method to set calibration by specifying any points (in pixels).
The calibration parameter is calculated automatically when the actual coordinate of the specified location is entered. Up to 3 points can be specified.

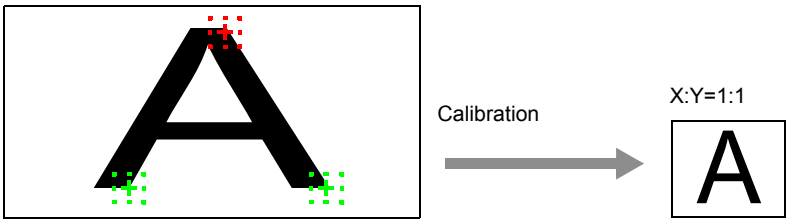
- When magnification is the same in X and Y directions
  Specify only 2 points.

X:Y=1:1



- When magnification is not the same in X and Y directions
  Specify 3 points.

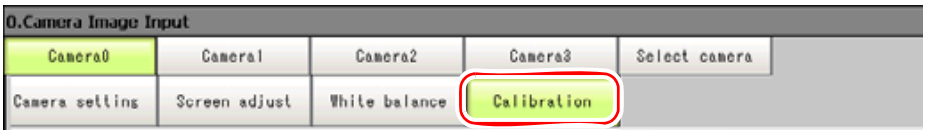
X:Y=5:3



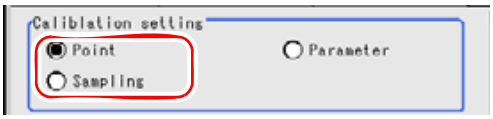
POINT

- When 2 points are specified, the coordinate system is set to left-handed system (forward in the clockwise direction). Specify 3 points to perform calibration including the coordinate system.

1 In the "Item tab" area, tap [Calibration].



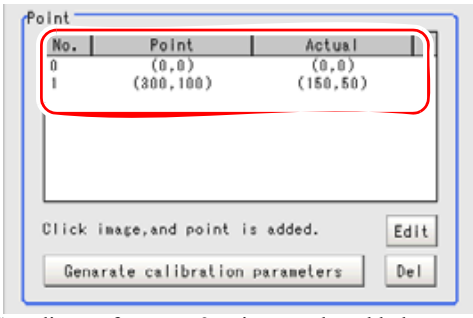
2 In the "Calibration setting" area, select "Point".



3 In the "Point" area, add a point coordinate pair.

Adding point coordinates

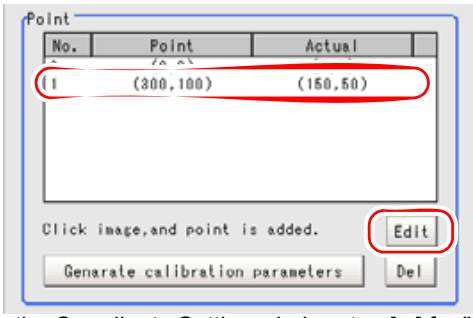
1. In the "Image display" area, tap a point whose position coordinates are to be added.
   The added point coordinates and the corresponding actual coordinates are reflected on the Point List.



Coordinates for up to 3 points can be added.

Editing coordinates

1. Select coordinates you want to edit on the Point List, and tap [Edit].



2. In the Coordinate Setting window, tap [...] for "Point" and "Actual" and specify the X and Y coordinate values for each of them.
   For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"

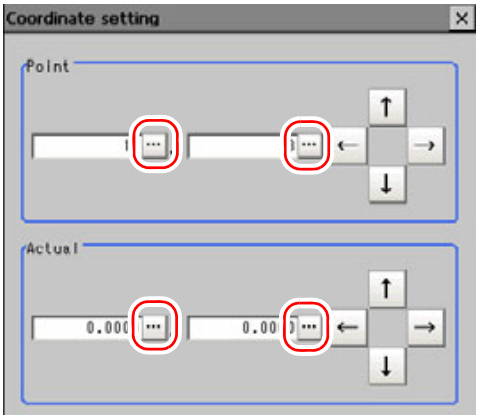


Table: Calibration Setting (Camera Image Input) - Point

Actual Coordinate	Set Value [Factory defaults]
Point coordinate X	0 to 9999 [Point you tapped in the window]

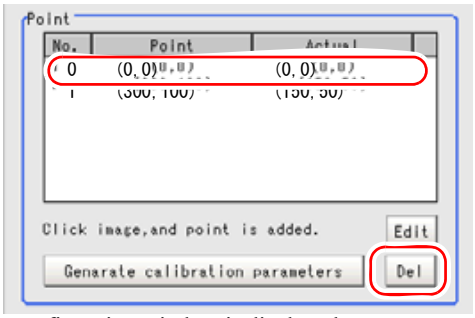
Table: Calibration Setting (Camera Image Input) - Point

Actual Coordinate	Set Value [Factory defaults]
Point coordinate Y	0 to 9999 [Point you tapped in the window]
Actual coordinate X	-99999.9999 to 99999.9999 [0]
Actual coordinate Y	-99999.9999 to 99999.9999 [0]

3. Tap [OK].
   The added point coordinates and the corresponding actual coordinates are reflected on the Point List.

Deleting Point Coordinates

1. Select the coordinates you want to delete on the Point List, and tap [Del].

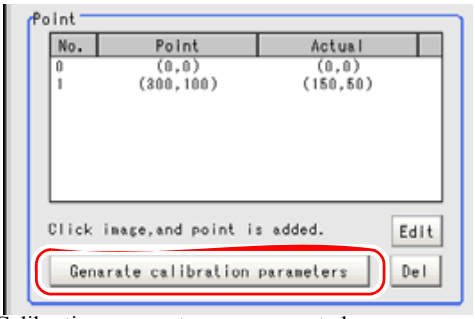


A confirmation window is displayed.

2. Tap [OK].

4 Repeat the Step 3 to add point coordinates.

5 Tap [Generate calibration parameters].



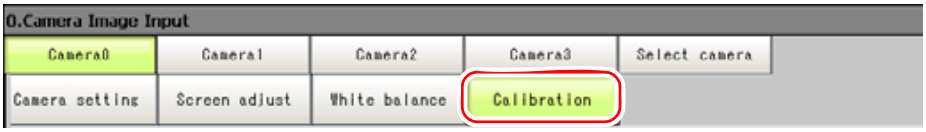
Calibration parameters are generated.

For the subsequent operations, see "1.1.1 Setting up [Camera Image Input]" (→pg.2)

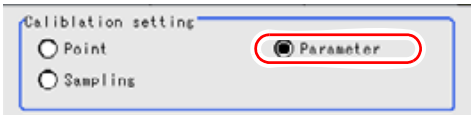
Setting up calibration by entering values (Parameter)

Directly enter values as calibration data.

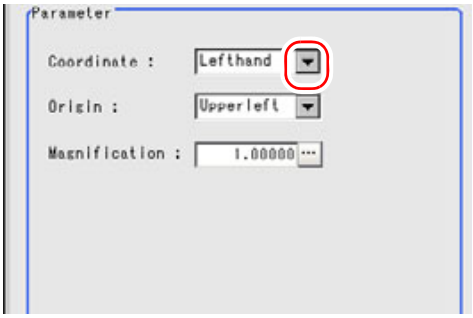
1 In the "Item tab" area, tap [Calibration].



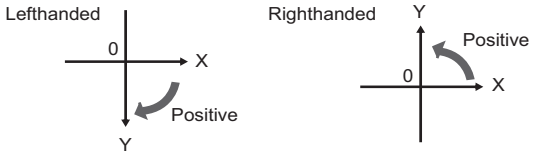
2 In the "Calibration setting" area, select "Parameter".



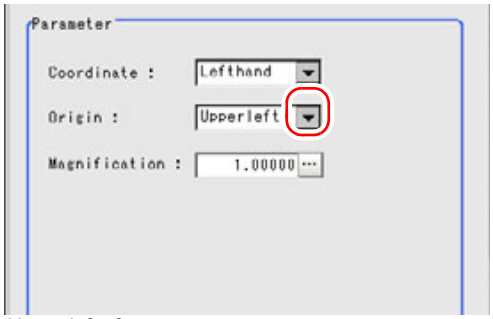
3 In the "Parameter" area, tap [▼] for "Coordinate" and select a coordinate system.



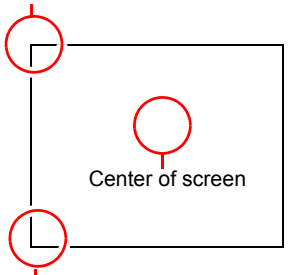
- Lefthand: Clockwise is forward when specifying the coordinate.
- Righthand: Counter-clockwise is forward when specifying the coordinate.



4 Tap [▼] for "Origin" and choose where to place the origin of the actual coordinates.



Upper left of screen

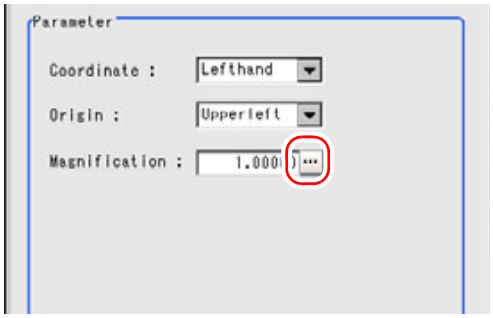


Lower left of screen

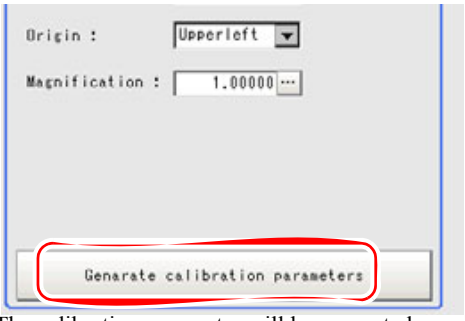
5 Tap [...] for "Magnification" and input a value of the actual size corresponding to one pixel.

Allowed range: 0.00001 to 9.99999

For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"



6 Tap [Generate calibration parameters].



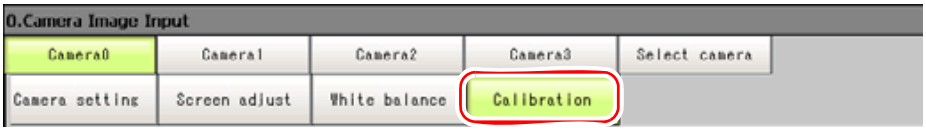
The calibration parameter will be generated.

For the following operations, see "1.1.1 Setting up [Camera Image Input]" (→pg.2)

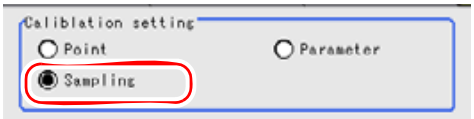
Setting up Calibration by Sampling Measurement (Sampling)

This is a method to set calibration based on measurement result.
Actual coordinates can be obtained by registering the model and searching the specified measurement area. Calibration parameters are calculated automatically from the obtained actual coordinates.

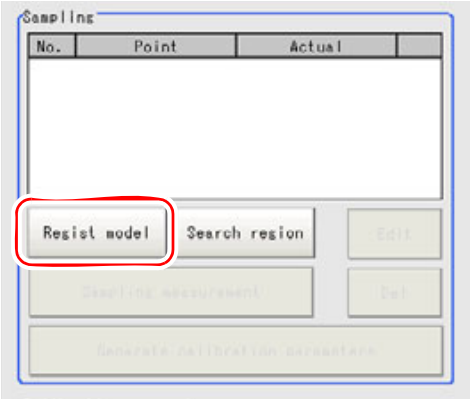
1 In the "Item tab" area, tap [Calibration].



2 In the "Calibration setting" area, select "Sampling" .

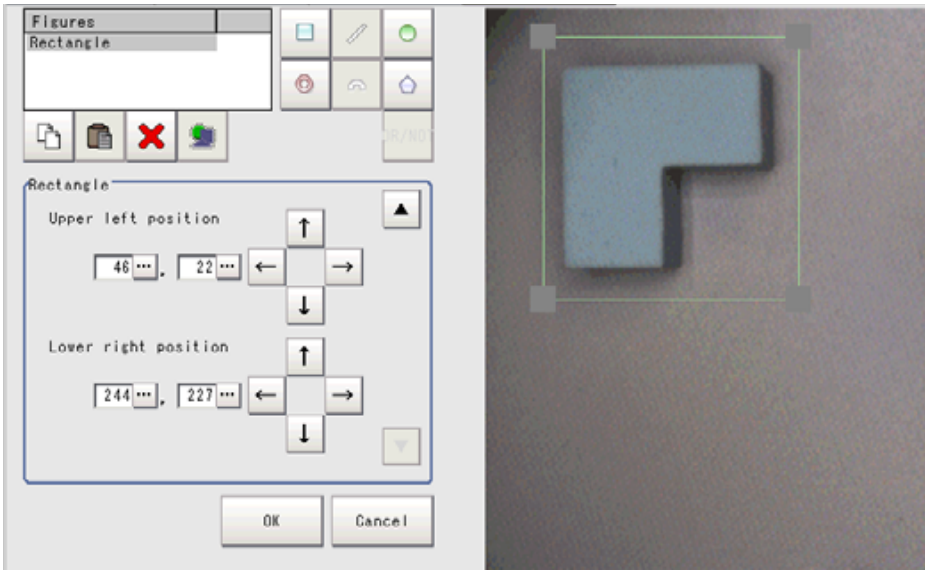


3 In the "Sampling" area, tap [Regist model].



4 Register a model using the drawing tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"



5 Set the search region as necessary.

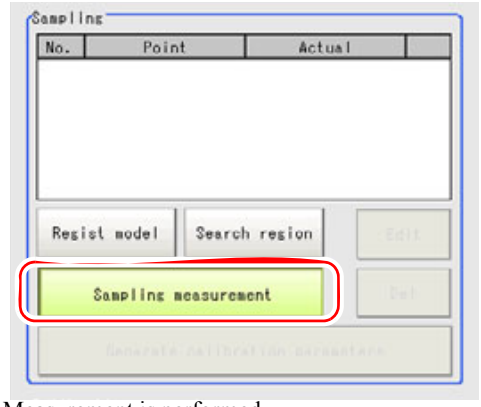
1. In the "Sampling" area, tap [Search region].

2. Set search region using the Drawing Tools.

   The default is the entire screen.

   "1.9 Setting Figures" (→pg.25), of "User's Manual"

6 Tap [Sampling measurement].



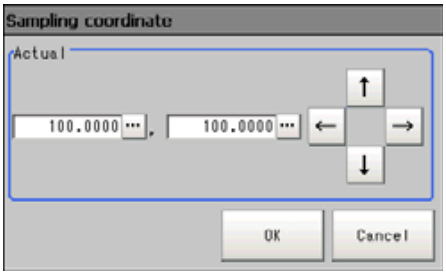
Measurement is performed.

The search result (cross-shaped cursor) is displayed in the "Image display" area, and the Sampling Coordinate window is displayed.

7 In the Sampling Coordinate window, tap [...] to enter the X and Y values.

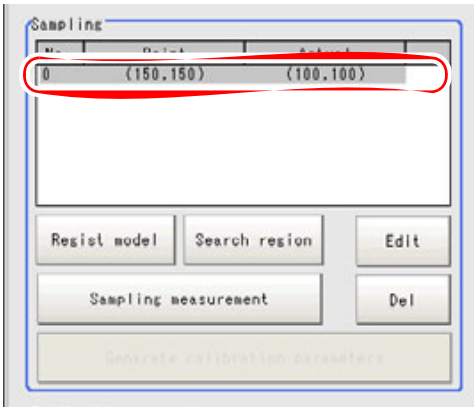
For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"

You can also use the arrow buttons to set the values.



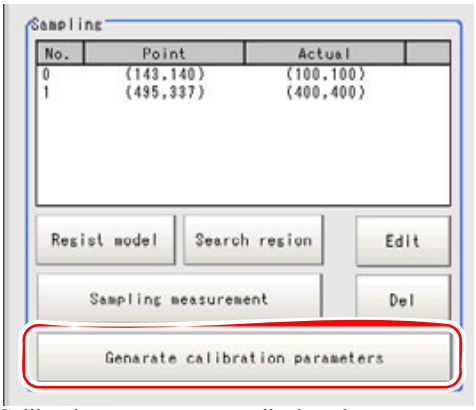
8 Tap [OK].

Point coordinates and actual coordinates are registered in the sampling area.

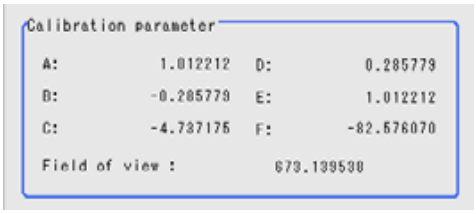


9 Move the object to be measured and repeat the Steps 3 to 8.

10 Tap [Generate calibration parameters].



Calibration parameters are displayed.



View Calibration Parameters

View the set calibration data.

1 In the "Item tab" area, tap [Calibration].

2 In the "Calibration parameter" area, confirm the calibration data.

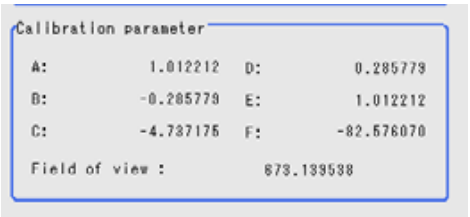


Table: Referenced Calibration Parameters

Item	Set Value [Factory defaults]	Description
A	Calculated value [1.000]	These are calibration conversion values. Camera coordinates are converted to actual coordinates based on these calibration conversion values. The conversion formulas to actual coordinates are as follows: ・(X, Y): Measurement point (camera coordinates), Unit: pix ・(X', Y'): Conversion point (actual coordinates) X'=A x X + B x Y + C Y'=D x X + E x Y + F
B	Calculated value [0.000]	
C	Calculated value [0.000]	
D	Calculated value [0.000]	
E	Calculated value [1.000]	
F	Calculated value [0.000]	
Field of view	Calculated value [640]	This is an actual dimension in the X direction.

1.1.7 Camera/Lighting Combination and Available Functions

The functions that can be set in [Camera Image Input] differ depending on the combination of your camera and lighting.

Table: Camera/Lighting Combination and Available Functions

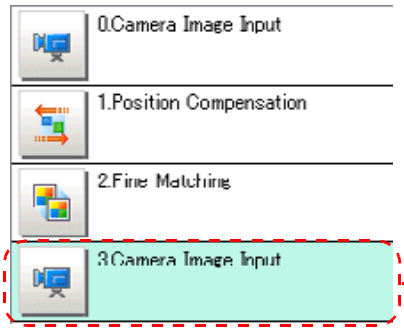
Camera and Lighting		Available Functions				
cameraNo	Peripheral	Camera setting		Screen adjustment		
		Shutter, gain	STGOUT	White balance	Lens	Lighting
FZ-SC	-	OK	OK	OK		
	Flashlight unit	OK	OK	OK		OK
FZ-SZC15 FZ-SZC100	-	OK	OK	OK	OK	
FZ-SLC15 FZ-SLC100	-	OK	OK	OK	OK	OK
FZ-SC2M	-	OK	OK	OK		
	Flashlight unit	OK	OK	OK		OK
FZ-S	-	OK	OK			
	Flashlight unit	OK	OK			OK
FZ-S2M	-	OK	OK			
	Flashlight unit	OK	OK			OK

OK: Available

1.1.8 Additional Description

Position Compensation and Camera Image Input

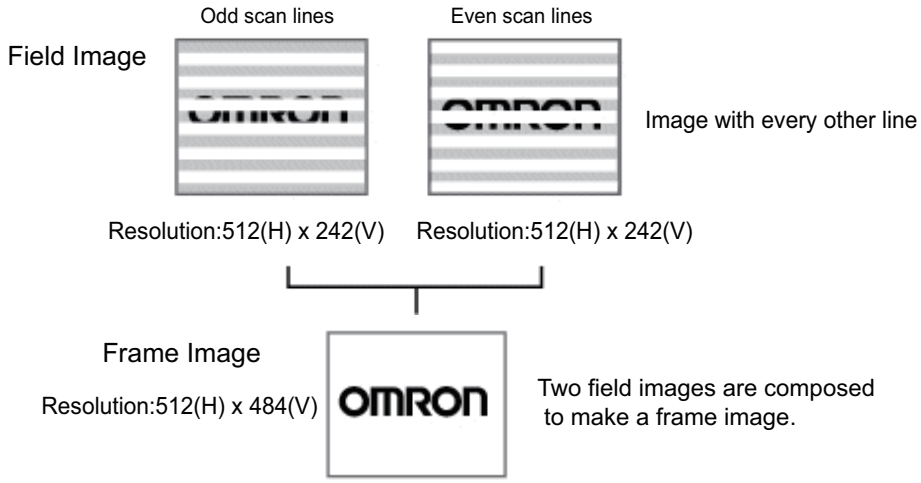
When creating a scene, if a [Camera Image Input] unit is positioned after a [Position Compensation] processing unit, that [Position Compensation] unit will be cancelled, which will cause the image of the measurement object to be restored to its former state before the scrolling is applied.



Position compensation of unit 1 is canceled and returns to the position before position compensation.

About Frame Images and Field Images

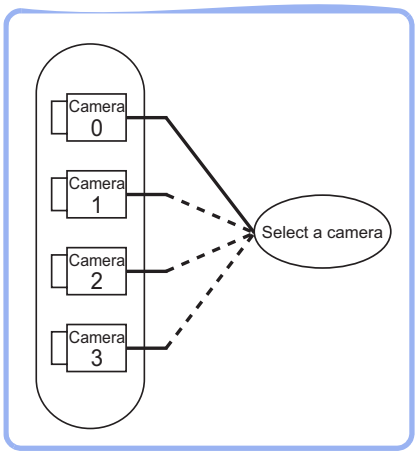
There are two methods to transfer one image from a camera to the controller: frame read and field read. Frame read is to read all of the scanned lines of the image, the result of which is called the frame image. Field read is to read half of the interlaced scanned lines of the image, the result of which is called the field image.



1.2 Camera Switching

Used for the following case

- When switching to images on cameras other than that has been set to [Camera Image Input] during scene processing



Important

- When switching from a monochrome camera to color camera, reconfigure the settings in the following units.

1.2.1 Setting up [Camera Switching]

1. In the Edit Flow window, tap [Camera Switching].
   The ProcItem Setting window is displayed.
   "1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

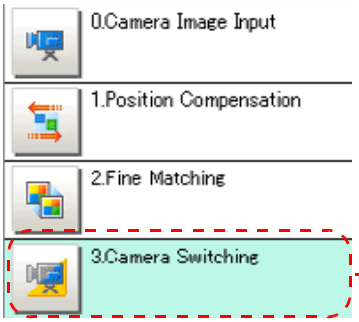
2. In the "Camera select" area, tap [▼] for "Camera No." and select a camera to be used for measurements.

   The "Image display" area will display images from selected cameras.

3. Tap [OK].
   After confirmation, the ProcItem Setting window will be closed.

1.2.2 Additional Description

When creating a scene, if a [Camera Switching] unit is positioned after a [Position Compensation] unit, that [Position Compensation] unit will be cancelled, which will cause the image of the measurement object to be restored to its former state before the scrolling is applied.



The Position Compensation for Unit 1 is being cancelled, making it restore to its former state before the Position Compensation was applied.

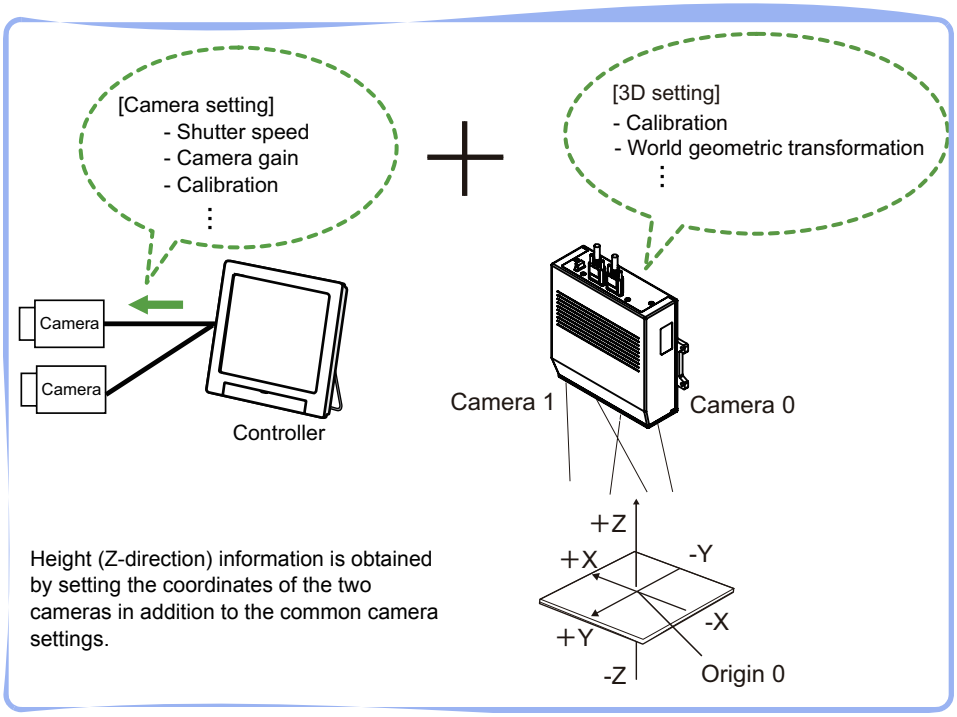
1.3 3D Camera Image Input

This processing item is for 3D measurement only. It sets the image input conditions and inputs an image from the camera. It also sets the 3D coordinates and the world coordinate system necessary for 3D measurement.

- About 3D Coordinate Setting
  3D measurement is performed with a combination of two or three cameras. In order to accurately measure the height direction, the position of each camera must be accurately determined and the coordinates of two cameras must be linked. This procedure is referred to as "3D coordinate setting" and a custom calibration tool is used.
- About World Coordinate System
  This is a coordinate system to indicate the spatial position of an object. It is used to handle displaying and moving of an object. In order to express the measurement in the coordinate system (world coordinate system) of an external device (such as industrial robot), the measurement must be converted to the world coordinate system. This operation is referred to as "world coordinates".
  The parameters used for the world coordinates are produced by photographing the calibration target with a camera and performing sampling measurement at several locations.

Used for the following case

- This processing item must be applied when measuring with 3D camera images
  Specify the conditions for inputting images from the camera and for storing images of the measured objects.
  Also, set up for linking the coordinates of the two cameras for 3D measurement and the settings for converting the coordinates to the spatial coordinates (the world coordinates).

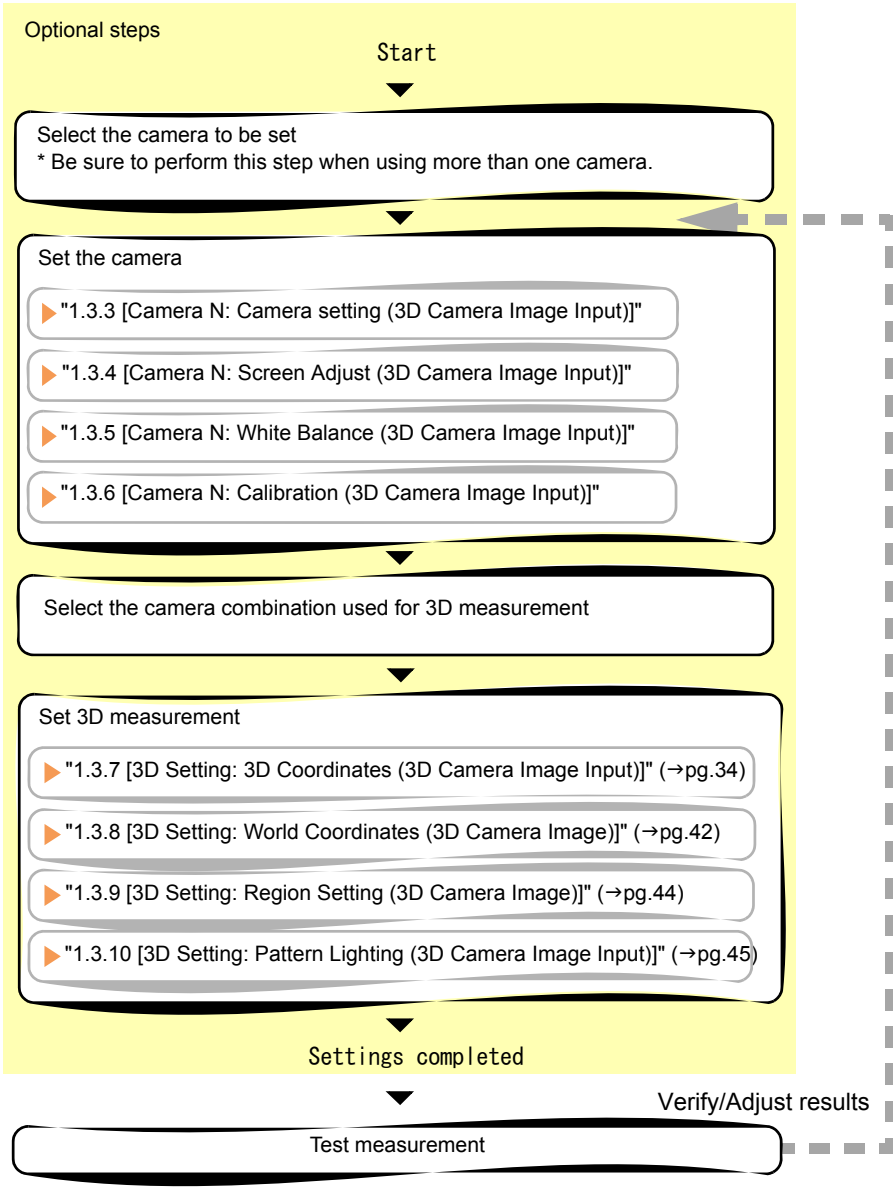


Important

- For Unit 0, make sure to set one of the following:
  - [Camera Image Input]
  - [3D Camera Image Input]
- When performing 3D measurement, be sure to insert the [3D Camera Image Input] into the scene.
- When switching from a monochrome camera to color camera, reconfigure the settings in the following units.

1.3.1 Setting [3D Camera Image Input]

The setting procedure for [3D Camera Image Input] is as follows:



POINT

Operations of the ProcItem Setting window

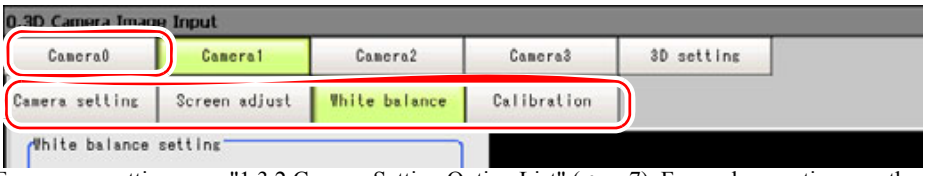
- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 In the Edit Flow window, tap [3D Camera Image Input].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area (top), tap [Camera N], where N is a Camera No., and configure imaging setting for that camera.



For camera settings, see "1.3.2 Camera Setting Option List" (→pg.7). For each operation, see the following:

- "1.3.3 [Camera N: Camera setting (3D Camera Image Input)]" (→pg.9)
- "1.3.4 [Camera N: Screen Adjust (3D Camera Image Input)]" (→pg.14)
- "1.3.5 [Camera N: White Balance (3D Camera Image Input)]" (→pg.22)
- "1.3.6 [Camera N: Calibration (3D Camera Image Input)]" (→pg.24)

POINT

- When setting multiple cameras, repeat the procedure above for each camera.

3 Select the combination of cameras to perform 3D measurement.

The following camera combinations are possible.

Table: Camera Combination

Option	Standard Camera [Note 1]	Description
0+1	Camera 0	Camera 0 and Camera 1 are used.
2+3	Camera 2	Camera 2 and Camera 3 are used.
0+1+2	Camera 0	Camera 0, Camera 1, and Camera 2 are used.

[Note 1]: Standard camera photographs from the front of the target object.

1. In the "Item tab" area (top), tap [3D setting].
2. In the "Set camera number" area, tap [▼] for [Cameras:] and select a camera number.

   When [3D setting] is specified, "Set camera number" is always displayed.

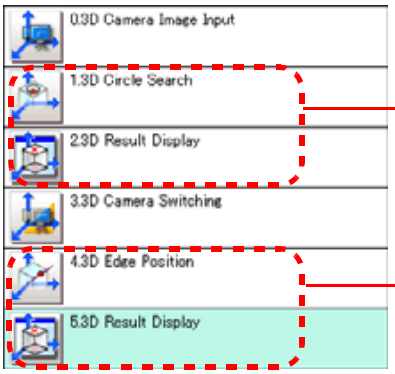
After selecting the camera, check the image displayed in the "Image display" area.

Important

- When changing the camera combination from two cameras to three cameras or three cameras to two cameras, a message appears indicating that the 3D coordinate settings will be initialized. If the camera combination is changed, reset the 3D coordinate setting parameters of the 3D setting.

POINT

- The images from the camera selected in the "Set camera number" area of [3D setting] will be the object to be measured in the following units.
  If you need to switch the camera during the process, insert a [3D Camera Switching] unit in the scene and switch the image source."1.4 3D Camera Switching" (→pg.49)



The image of the camera selected in the set camera number area of the [3D setting] of [0. 3D Camera Image Input] is the object to be measured.

The image of the camera selected in [3. 3D Camera Switching] is the object to be measured.

4 Perform 3D setting.

For each operation, see the following:

- "1.3.7 [3D Setting: 3D Coordinates (3D Camera Image Input)]" (→pg.34)
- "1.3.8 [3D Setting: World Coordinates (3D Camera Image)]" (→pg.42)
- "1.3.9 [3D Setting: Region Setting (3D Camera Image)]" (→pg.44)
- "1.3.10 [3D Setting: Pattern Lighting (3D Camera Image Input)]" (→pg.45)

If the tabs in the screen above are not displayed in the "Item tab" area (bottom), tap [3D setting] in the "Item tab" area (top).

5 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

6 Perform a test measurement.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"
An image from the selected camera is displayed in the "Image display" area.

7 Adjust the image, as necessary, if the image cannot be input properly because it is out of focus or for some other reason.

1.3.2 Camera Setting Option List

You can perform detailed camera settings in [3D Camera Image Input]. The following items are available for camera settings. For details and settings of each item, see the respective reference page.

POINT

- The setting options differ depending on the camera type and lighting mode.
  "1.3.11 Camera/Lighting Combination and Available Functions" (→pg.46)

Table: Camera Setting Option List

Item	Description
Camera setting	Specify the camera settings such as the shutter speed or flashlight. "1.3.3 [Camera N: Camera setting (3D Camera Image Input)]" (→pg.9)
Camera settings	Specify the shutter speed and the camera gain. " Camera settings" (→pg.9)
Frame/Field	Select the unit to be treated as one image. This area is displayed only when a monochrome camera is used. " Frame/Field - for Monochrome Cameras Only" (→pg.11)
Number of lines to be read	Narrow the image range to be scanned. " Number of Lines to be Read" (→pg.11)
Electronic flash setting	Specify flashlight settings. " Electronic Flash Setting" (→pg.13)
Screen adjust	Adjust the lighting and the lens. "1.3.4 [Camera N: Screen Adjust (3D Camera Image Input)]" (→pg.14)
Lighting control	Adjust the amount of light (brightness) of the lighting. " Lighting Control" (→pg.14)
Lens setting	Adjust the camera zoom, focus, and iris. " Lens Setting (When Connecting an Intelligent Camera or an Auto-focus Camera)" (→pg.19)
Common setting for all cameras	Set the target area to apply the automatic setting for focus, iris, and white balance, and specify the iris base density. " Common Setting for All Cameras (When Connecting an Intelligent Camera or an Auto-focus Camera)" (→pg.21)
White balance	Adjust the white balance. "1.3.5 [Camera N: White Balance (3D Camera Image Input)]" (→pg.22)
Calibration	Set when measurements (measurements in camera coordinates) are to be output in actual dimensions. Select the calibration setting method and generate the calibration parameters. "1.3.6 [Camera N: Calibration (3D Camera Image Input)]" (→pg.24)
Calibration setting	The following pattern generation methods are available. Select the appropriate method.
Point	Specify a point in pixels to generate the calibration parameters. " Setting up Calibration by Specifying Any Points (Point)" (→pg.25)
Parameter	Specify a numeric value and generate the calibration parameters. " Setting up Calibration by Entering Values (Parameter)" (→pg.28)
Sampling	Perform a sampling measurement to generate the calibration parameters. " Setting up Calibration by Sampling Measurement (Sampling)" (→pg.30)
Calibration parameter	Check the calibration settings. " View Calibration Parameters" (→pg.33)

1.3.3 [Camera N: Camera setting (3D Camera Image Input)]

The following items can be set in Camera setting.

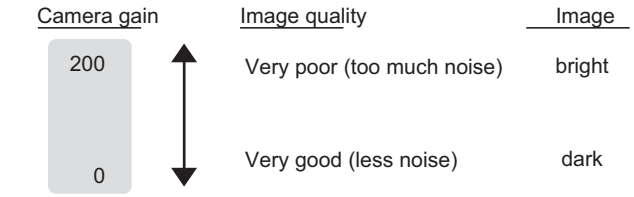
- " Camera settings" (→pg.9)
- " Frame/Field - for Monochrome Cameras Only" (→pg.11)
- " Number of Lines to be Read" (→pg.11)
- " Electronic Flash Setting" (→pg.13)

POINT

- The displayed items differ depending on the camera type and lighting mode. Perform the following procedures as needed to suit the environment of your camera.
  "1.3.11 Camera/Lighting Combination and Available Functions" (→pg.46)

Camera settings

Adjust the settings related to camera shutter speed and camera gain.
Select the shutter speed appropriate for the speed of the measured object. Choose faster shutter speed if the measured object is moving fast and the image is blurred.
Where the specific shutter speed, iris, and lighting condition cannot be used to brighten the image, the camera gain should be adjusted. Usually, the factory default value can be used.



(Factory default: 85)

1 In the "Item tab" area, tap [Camera setting].

The Camera Setting window is displayed.

2 In the "Camera settings" area, specify the shutter speed.

Select "Select typical value", and tap [▼] to set the shutter speed.

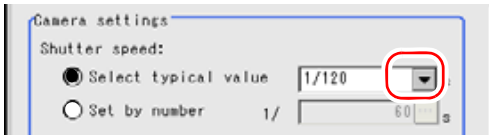


Table: Camera Setting (3D Camera Image Input) - Camera Condition Setting

Item	Set Value [Factory Default]	Description
Shutter speed	Options (example) ・[1/120] (For 2 Mega pixel cameras) ・1/200 ・[1/500] (For 0.3 Mega pixel cameras) ・1/1000 ・1/2000 ・1/4000 ・1/8000 ・1/20000	Option values for the shutter speed differ depending on the camera type.

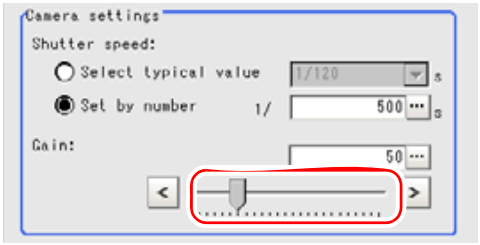
Specifying a value directly:

Select "Set by number", tap [...] and specify a value.

For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"

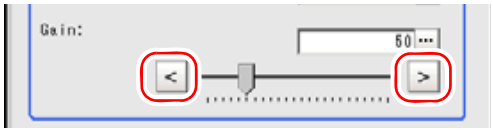
3 In the "Camera settings" area, specify the camera gain.

While verifying the camera-input image, adjust "Gain" by dragging the slider in the "Camera settings" area.



Fine-tuning

Tap the buttons at both ends of the slider.



Specifying a value directly:

Tap [...] for "Gain" and input a value.

For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"

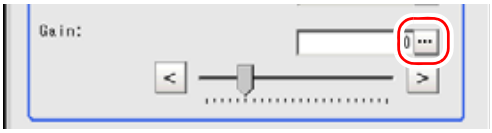


Table: Camera Setting (3D Camera Image Input) - Camera Settings

Item	Set Value [Factory Default]	Description
Gain	0 to 230 [50] (for camera with more than 640 by 480 pixels) [85] (for camera with 640 by 480 pixels or less)	Adjust the camera gain when specific shutter speed, iris, and lighting condition cannot be used to brighten the image. Usually, the factory default value can be used.

For the subsequent operations, see "1.3.1 Setting [3D Camera Image Input]" (→pg.5).

Frame/Field - for Monochrome Cameras Only

Select the unit to be treated as one image.

POINT

- For frames and fields, see " About Frame Images and Field Images" (→pg.47).

1 In the "Item tab" area, tap [Camera setting].

The Camera Setting window is displayed.

2 In the "Frame/field" area, select either [Frame] or [Field].

Table: Camera Setting (3D Camera Image Input) - Frame/Field

Item	Set Value [Factory Default]	Description
Frame/Field	[Frame]	Measurements are made in units of frames.
	Field	Measurements are made in units of fields. Select "Field" when you prefer shorter image input time rather than higher accuracy. Processing becomes faster since each image is scanned while skipping one scan line per two consecutive lines, but the measurement accuracy lowers since the vertical resolution of images lowers.

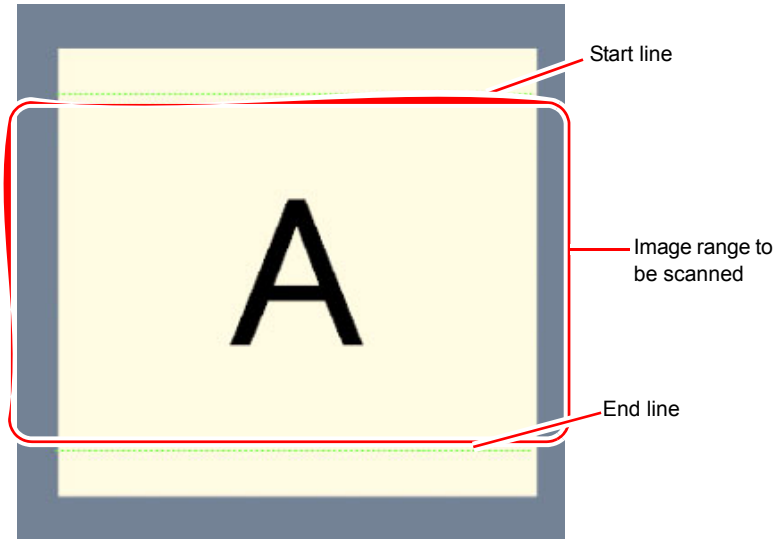
For the subsequent operations, see "1.3.1 Setting [3D Camera Image Input]" (→pg.5).

Number of Lines to be Read

By narrowing the image range to be scanned, the image scan time can be shortened.

Set the range taking the offset of the measured object into consideration.

The part of the image narrowed down by the start line and the end line will be displayed in the "Image display" area of the ProcItem Setting window or of the Main screen.



POINT

About minimum lines

- The minimum lines (the minimum number of lines between the start and end lines) are 12 lines.

About coordinate values

- The coordinate values displayed as the measurement result are those values of the display position on the monitor.
- The coordinate values do not vary with the settings for the "Number of lines to be read".

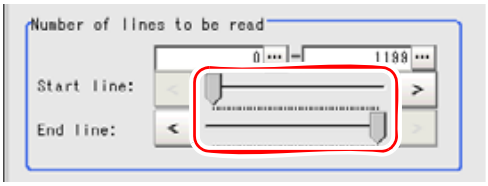
1 In the "Item tab" area, tap [Camera setting].

The Camera Setting window is displayed.

2 In the "Number of lines to be read" area, specify the start/end line.

When dragging the slider to change the start/end line

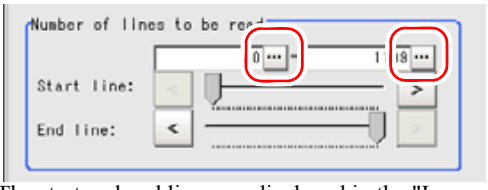
Drag the slider while verifying the image in the "Image display" area.



Specifying a value to change the start/end line:

In the "Number of lines to be read" area, tap [...] and input the coordinate values for the start/end line position.

For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"



The start and end lines are displayed in the "Image display" area.

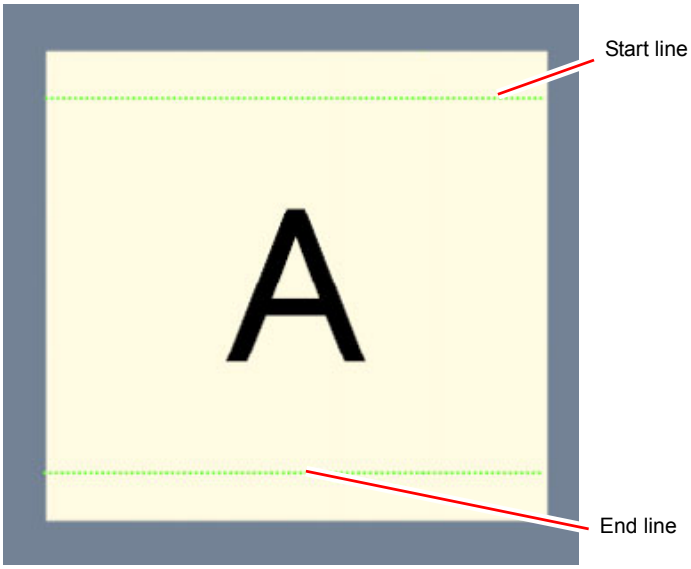


Table: Camera Setting (3D Camera Image Input) - Partial Scan Settings

Item	Set Value [Factory Default]	Description
Start line	0 to Y_PMAX	Specify the scan start position.
End line	0 to [Y_PMAX]	Specify the scan end position.

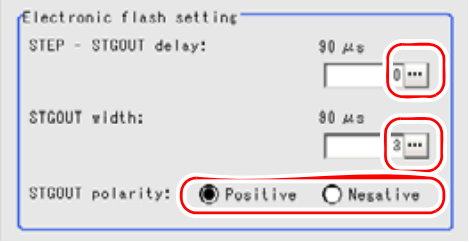
For the subsequent operations, see "1.3.1 Setting [3D Camera Image Input]" (→pg.5).

Electronic Flash Setting

1 In the "Item tab" area, tap [Camera setting].

The Camera Setting window is displayed.

2 In the "Electronic flash setting" area, specify each item.



1. Tap [...] for "STEP-STGOUT delay" and "STGOUT width" and input a value for each.
   For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"
2. Select the STGOUT pulse polarity.

Table: Camera Setting (3D Camera Image Input) - Electronic Flash Setting

Item	Set Value [Factory Default]	Description
STEP-STGOUT delay	[0] to 511 (1 count 30µs)	Refer to the timing chart and set the Waiting Time from the time the STEP signal is input to the strobe trigger output signal becomes ON. Delay Time=Count x 30µs + 90µs
STGOUT width	1 to 63 [3] (1 count 30µs)	Specify the strobe trigger pulse width.
STGOUT polarity	・[Positive] ・Negative	Select the strobe trigger pulse polarity. Positive: Flashes when strobe trigger output signal changes from OFF to ON. Negative: Flashes when strobe trigger output signal changes from ON to OFF.

For the subsequent operations, see "1.3.1 Setting [3D Camera Image Input]" (→pg.5).

1.3.4 [Camera N: Screen Adjust (3D Camera Image Input)]

The following items can be set in the screen adjustment option.

- " Lighting Control" (→pg.14)
- " Lens Setting (When Connecting an Intelligent Camera or an Auto-focus Camera)" (→pg.19)
- " Common Setting for All Cameras (When Connecting an Intelligent Camera or an Auto-focus Camera)" (→pg.21)

Lighting Control

The brightness of the lighting can be adjusted from the controller. You can choose to adjust the brightness for each part or select one of the preset patterns.

POINT

- Perform the lighting setting only when the camera being used has lighting equipment.
- When one scene contains two or more Camera Image Input units, lighting control can be performed only for the first Camera Image Input unit.

1 In the "Item tab" area, tap [Screen adjust].

2 In the "Lighting control" area, specify the brightness.

The displayed content depends on the connected camera.

When an intelligent camera is connected

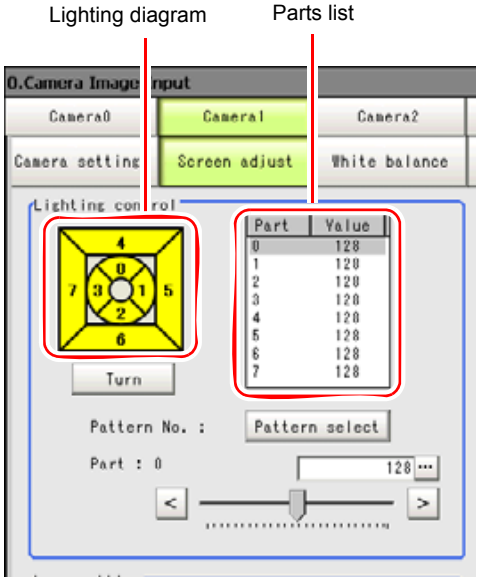
Set the brightness of parts 0 to 7 between the range of 0 and 255.

Brightness 0 indicates the lighting is OFF. The larger the number, the higher the brightness.

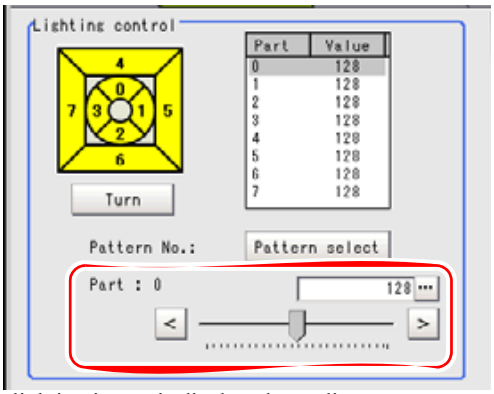
Important

- When model FZ-SLC15 is connected, only parts 0 to 3 are active. Changing parts 4 to 7 will not affect the brightness.

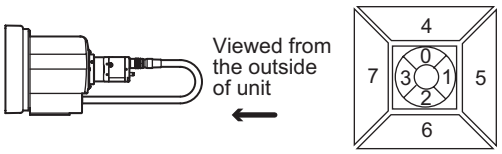
1. Check the part in the lighting diagram and tap the number of the part to set in the parts list.



2. While verifying the camera-input image in the "Image display" area, drag the slider to adjust the brightness.
   To fine-tune, tap the buttons at both ends of the slider.
   The "Value" for the selected part changes.



A lighting image is displayed as a diagram.



Capable to adjust light intensity of 8 positions

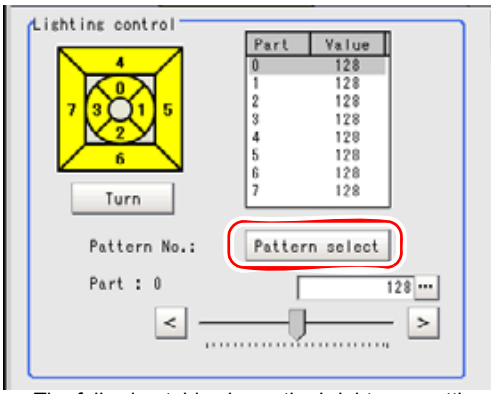
Table: Screen Adjust (3D Camera Image Input) - Lighting Setting

Item	Set Value [Factory Default]	Description
Brightness	[0] to 255 x 8ch	Adjustable in 256 steps

POINT

When selecting a preset lighting pattern:

- Tap [Pattern select] and select one of the preset lighting patterns. The selected pattern contains brightness settings to be applied to the respective parts.



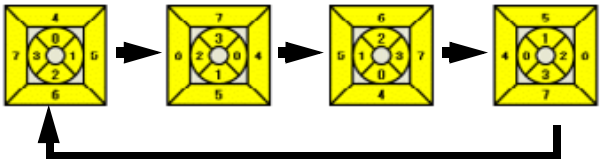
The following table shows the brightness settings in each pattern.

Table: Block Adjustment Pattern

Block Adjustment Pattern	Part 0	Part 1	Part 2	Part 3	Part 4	Part 5	Part 6	Part 7
Pattern 0	128	128	128	128	128	128	128	128
Pattern 1	255	255	255	255	255	255	255	255
Pattern 2	128	128	128	128	0	0	0	0
Pattern 3	255	255	255	255	0	0	0	0
Pattern 4	0	0	0	0	128	128	128	128
Pattern 5	0	0	0	0	255	255	255	255
Pattern 6	255	0	255	0	255	0	255	0
Pattern 7	0	255	0	255	0	255	0	255
Pattern 8	255	0	0	0	0	0	0	0
Pattern 9	0	255	0	0	0	0	0	0
Pattern 10	0	0	255	0	0	0	0	0
Pattern 11	0	0	0	255	0	0	0	0
Pattern 12	0	0	0	0	255	0	0	0
Pattern 13	0	0	0	0	0	255	0	0
Pattern 14	0	0	0	0	0	0	255	0
Pattern 15	0	0	0	0	0	0	0	255
Pattern 16	0	0	0	0	0	0	0	0

Change lighting number

- After the camera is installed, if the orientation of the camera does not match the orientation of the lighting parts, tap [Turn] under the lighting diagram. The lighting diagram rotates 90 degrees clockwise each time you tap [Turn], so that you can make the lighting part positions correspond to the actual lighting part positions.



For MG-WAVE connection:

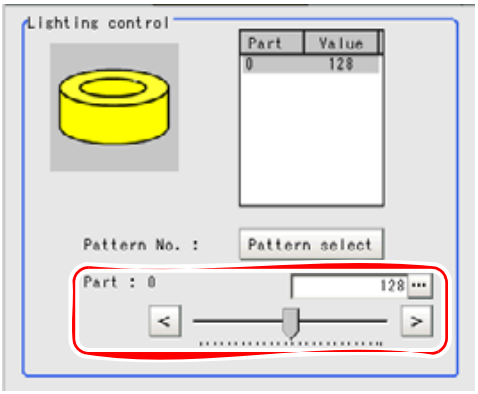
Set the brightness between the range of 0 and 255.

Brightness 0 indicates the lighting is OFF. The larger the number, the higher the brightness.

1. While verifying the camera-input image in the "Image display" area, drag the slider to adjust the brightness.

   To fine-tune, tap the buttons at both ends of the slider.

   The "Value" for the brightness changes.

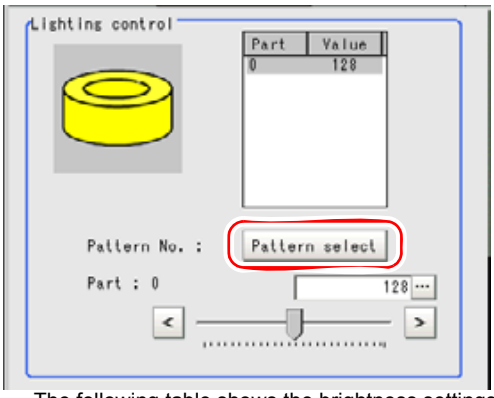


A lighting image is displayed as a diagram.

POINT

When selecting a preset lighting pattern:

- Each time you tap [Pattern select], the lighting pattern is switched to the next preset pattern.



The following table shows the brightness settings in each pattern.

Table: Adjustment Pattern

Adjustment Pattern	Part 0
Pattern 0	128
Pattern 1	255
Pattern 2	0

For other cameras

The brightness cannot be adjusted. The following message appears in the "Lighting control" area.

Lens Setting (When Connecting an Intelligent Camera or an Auto-focus Camera)

Adjust the lens of the camera.
The optimum value can be set automatically for focus and iris (auto focus, auto iris).
Depending on the focus setting, it may not be possible to set a large zoom value.

1 In the "Item tab" area, tap [Screen adjust].

2 While verifying the image in the "Image display" area, drag the slider in the "Lens setting" area.

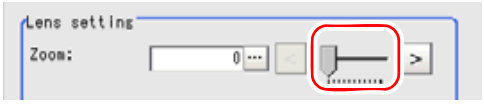
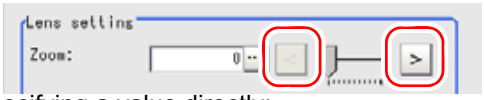


Table: Screen Adjust (3D Camera Image Input) - Lens Setting

Item	Set Value [Factory Default]	Description
Zoom	[0] to 1023	Switches between wide and telephoto by enlarging the image and performing interpolation.

When fine-tuning

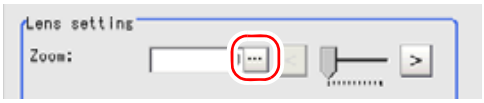
Tap the buttons at both ends of the slider.



Specifying a value directly:

Tap [...] for "Zoom" and input a value.

For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"



3 In the "Lens setting" area, specify values for "Focus" and "Iris".

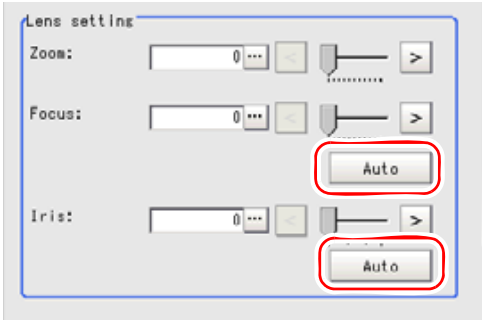
Table: Screen Adjust (3D Camera Image Input) - Lens Setting

Item	Set Value [Factory Default]	Description
Focus	[0] to 1023	Adjust the focus.
Iris	[0] to 31	Adjust the amount of light that passes through the lens.

Setting optimum values calculated automatically:

Tap [Auto] at the right of each item.

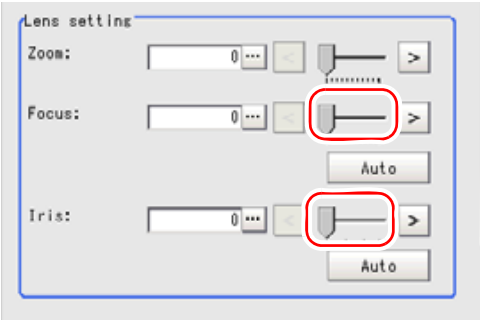
An appropriate value is calculated and set.



When adjusting the values manually

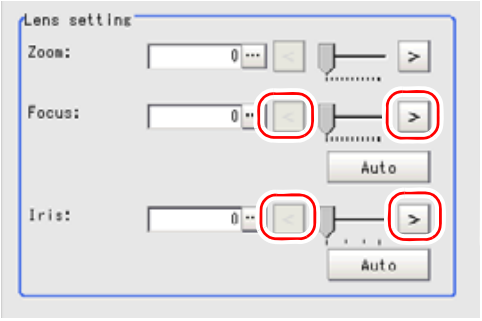
Drag the slider while verifying the image in the "Image display" area.

After the automatic setting, individual fine-tuning can still be performed.



Fine-tuning

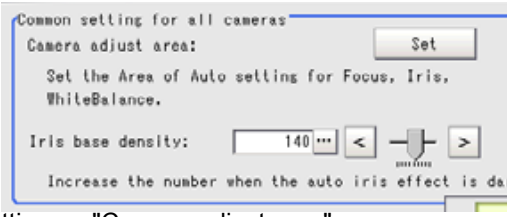
Tap the buttons at both ends of the slider.



Common Setting for All Cameras (When Connecting an Intelligent Camera or an Auto-focus Camera)

1 In the "Item tab" area, tap [Screen adjust].

2 In the "Common setting for all cameras" area, set up "Camera adjust area" and "Iris base density".

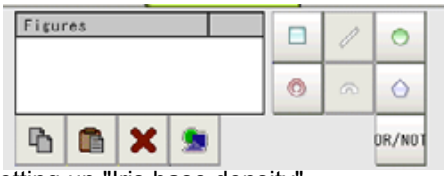


Setting up "Camera adjust area"

Specify the target area to apply automatic settings for focus, iris, and white balance.

1. Tap [Set] for "Camera adjust area".
   The "Figure setting" area is displayed.

2. Specify the target area using the Drawing Tools.
   "1.9 Setting Figures" (→pg.25), of "User's Manual"



When setting up "Iris base density"

Specify a larger value when the result with the automatic iris setting is dark.

1. Tap [...] for "Iris base density" and specify a value.
   For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"
   The value can be adjusted by dragging the slider or by tapping the buttons at both ends of the slider.

1.3.5 [Camera N: White Balance (3D Camera Image Input)]

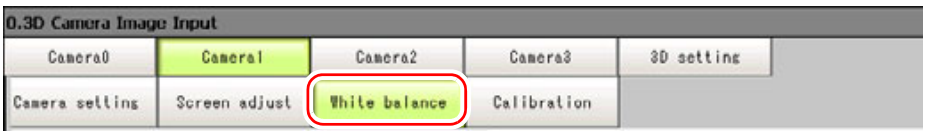
Set up the white balance to make white objects look white by calibrating the color of images scanned from cameras.
By adjusting the white balance, the white color can be appropriately reproduced under any lighting conditions
Appropriate value can also be set automatically.

POINT

- Perform the white balance setting only when a color camera is used.
- Be sure to perform the white balance setting in the following cases:
  - When a new system is installed
  - When a camera or lighting is changed

  Since measurement results may vary with changes of the white balance setting, be sure to verify the operation after it has changed.

1 In the "Item tab" area, tap [White balance].



2 In the "White balance setting" area, specify "R", "G", and "B" values.

Whiteness increases when the value of "R", "G", and "B" is increased.

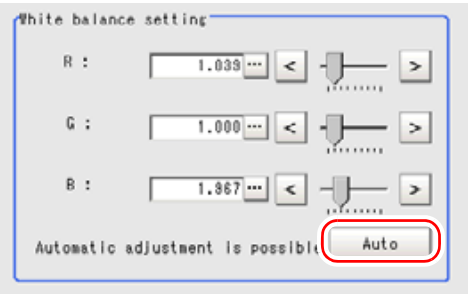
Table: White Balance Setting (3D Camera Image Input)

Item	Set Value [Factory Default]	Description
White balance setting ・R ・G ・B	0.001 to 7.999 (for each of "R", "G", and "B") For FZ-SC connection: [R=1.183] [G=1.000] [B=1.323] For FZ-SC2M connection: [R=1.394] [G=1.000] [B=1.222]	Adjust the white balance.

Setting optimum values calculated automatically:

Display the white area in the center of the screen and tap [Auto].

The white color displayed in the center of the screen is identified as "white" and white balance is set automatically to match this.

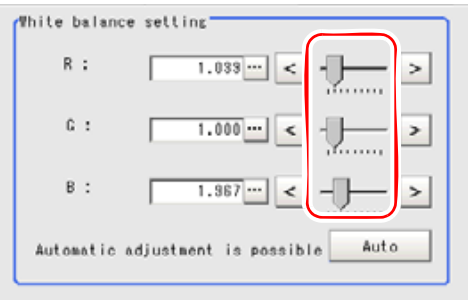


When adjusting the values manually

Specify the RGB values to be processed as white.

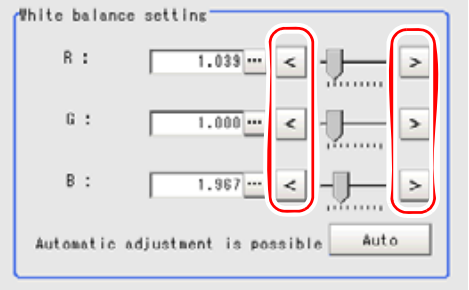
Drag the slider while verifying the image in the "Image display" area.

After the automatic setting, individual fine-tuning can still be performed.



Fine-tuning

Tap the buttons at both ends of the slider.



1.3.6 [Camera N: Calibration (3D Camera Image Input)]

By setting the calibration, the measurement result can be converted and output as actual dimensions.
Select your calibration method.
There are three calibration methods as shown below.

Table: Calibration (3D Camera Image Input)

Item	Description	Section to see
Point	Set up calibration by specifying any preferable points (in pixels).	" Setting up Calibration by Specifying Any Points (Point)" (→pg.25)
Parameter	Set up by inputting values directly.	" Setting up Calibration by Entering Values (Parameter)" (→pg.28)
Sampling	Set by sampling measurement.	" Setting up Calibration by Sampling Measurement (Sampling)" (→pg.30)

You can check the contents of the set calibration data.
" View Calibration Parameters" (→pg.33)
For calibration, see "11.4 Terminology" (→pg.12), of "User's Manual".

POINT

- When measurement results are to be output in actual dimension, set [Calibration] to "ON" in [Output parameter] for each unit. If [Calibration] is "OFF" (factory default), the coordinate values of the camera image are output as measurement results.

Important

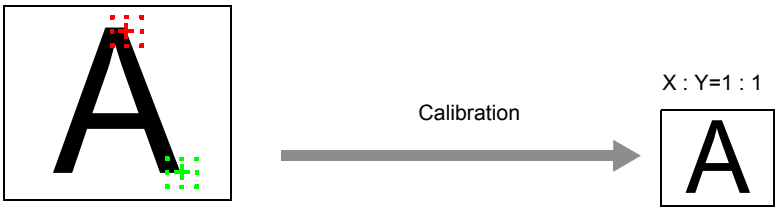
- [Camera N: Calibration] is used to set the calibration (function to convert to actual dimension) for the standard camera (camera photographing the object to be measured from the front). Even when 3D cameras are connected, this must be set when using only the front camera to measure 2D processing items. For 3D processing, calibration to spatial coordinate must be performed after calibration to actual dimension. Be sure to set the following.
  "1.3.7 [3D Setting: 3D Coordinates (3D Camera Image Input)]" (→pg.34)
  "1.3.8 [3D Setting: World Coordinates (3D Camera Image)]" (→pg.42)

Setting up Calibration by Specifying Any Points (Point)

This is a method to set calibration by specifying any points (in pixels).
The calibration parameter is calculated automatically when the actual coordinate of the specified location is entered. Up to 3 points can be specified.

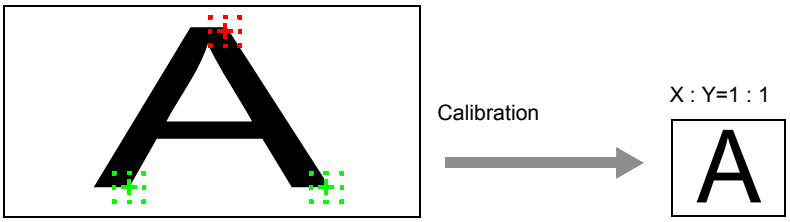
- When magnification is the same in X and Y directions
  Specify only 2 points.

X : Y=1 : 1



- When magnification is not the same in X and Y directions
  Specify 3 points.

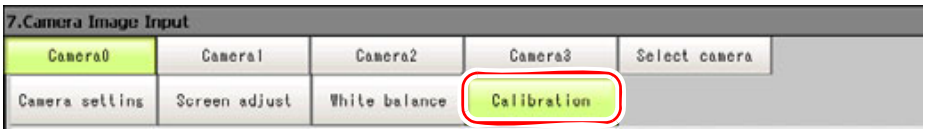
X : Y=5 : 3



POINT

- When 2 points are specified, the coordinate system is set to left-handed system (forward in the clockwise direction). Specify 3 points to perform calibration including the coordinate system.

1 In the "Item tab" area, tap [Calibration].

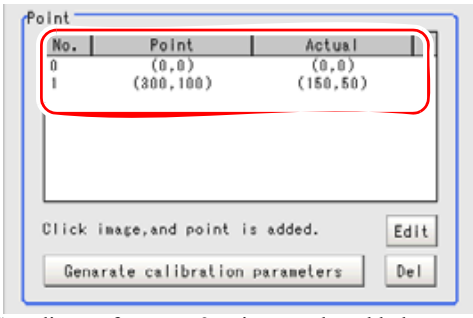


2 In the "Calibration setting" area, select "Point".

3 In the "Point" area, add a point coordinate pair.

Adding point coordinates

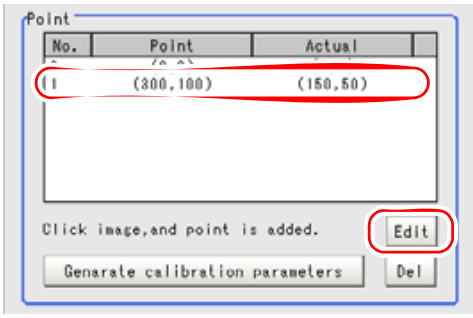
1. In the "Image display" area, tap a point whose position coordinates are to be added.
   The added point coordinates and the corresponding actual coordinates are reflected on the Point List.



Coordinates for up to 3 points can be added.

Editing coordinates

1. Select coordinates you want to edit on the Point List, and tap [Edit].



2. In the Coordinate Setting window, tap [...] for "Point" and "Actual", and specify the X and Y coordinate values for each of them.
   For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"

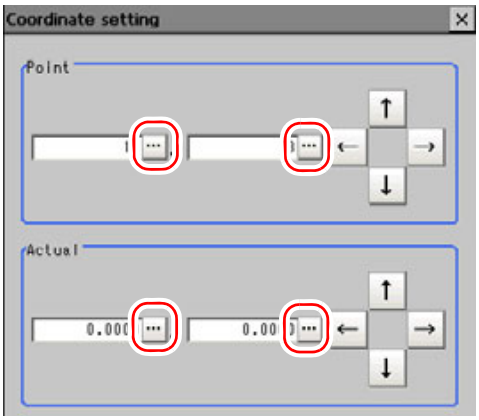


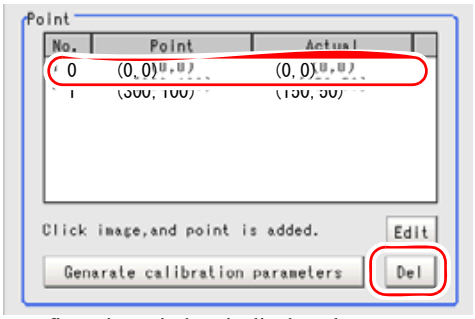
Table: Calibration Setting (3D Camera Image Input) - Point

Actual Coordinate	Set Value [Factory Default]
Point coordinate X	0 to 9999 [Point you tapped in the window]
Point coordinate Y	0 to 9999 [Point you tapped in the window]
Actual coordinate X	-99999.9999 to 99999.9999 [0]
Actual coordinate Y	-99999.9999 to 99999.9999 [0]

3. Tap [OK].
   The added point coordinates and the corresponding actual coordinates are reflected on the Point List.

Deleting Point Coordinates

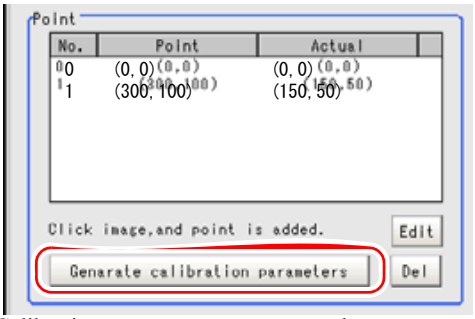
1. Select the coordinates you want to delete on the Point List, and tap [Del].



   A confirmation window is displayed.
2. Tap [OK].

4 Repeat the Step 3 to add point coordinates.

5 Tap [Generate calibration parameters].



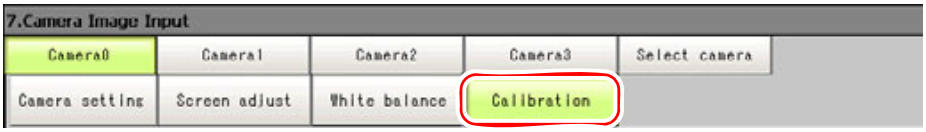
Calibration parameters are generated.

For the subsequent operations, see "1.3.1 Setting [3D Camera Image Input]" (→pg.5).

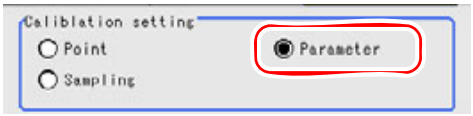
Setting up Calibration by Entering Values (Parameter)

Directly enter values as calibration data.

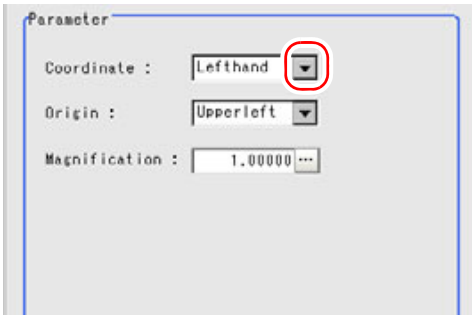
1 In the "Item tab" area, tap [Calibration].



2 In the "Calibration setting" area, select "Parameter".

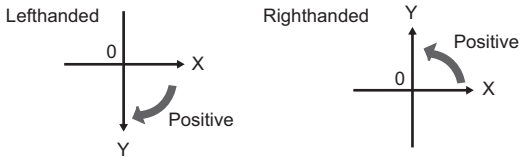


3 In the "Parameter" area, tap [▼] for "Coordinate" and select a coordinate system.

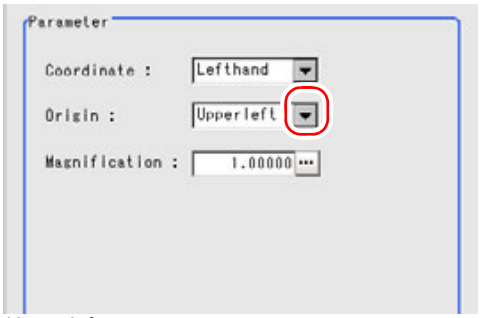


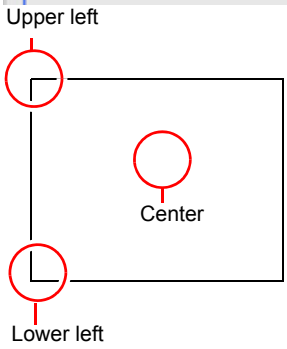
- Lefthand: Clockwise is forward when specifying the coordinate.

• Righthand: Counter-clockwise is forward when specifying the coordinate.



4 Tap [▼] for "Origin" and choose where to place the origin of the actual coordinate.

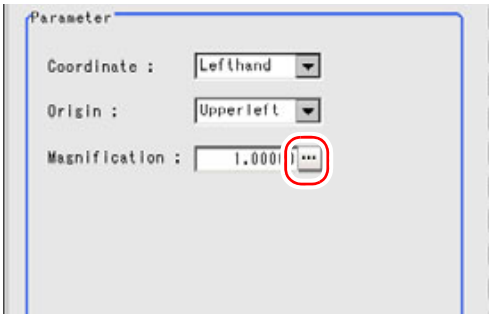




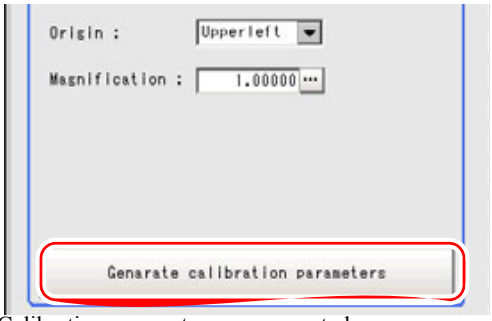
5 Tap [...] for "Magnification" and input a value of the actual size corresponding to one pixel.

Allowed range: 0.00001 to 9.99999

For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"



6 Tap [Generate calibration parameters].



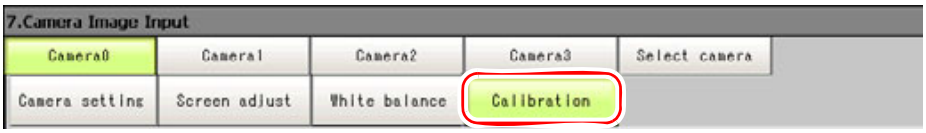
Calibration parameters are generated.

For the subsequent operations, see "1.3.1 Setting [3D Camera Image Input]" (→pg.5).

Setting up Calibration by Sampling Measurement (Sampling)

This is a method to set calibration based on measurement result.
Actual coordinates can be obtained by registering the model and searching the specified measurement area. Calibration parameters are calculated automatically from the obtained actual coordinates.

1 In the "Item tab" area, tap [Calibration].

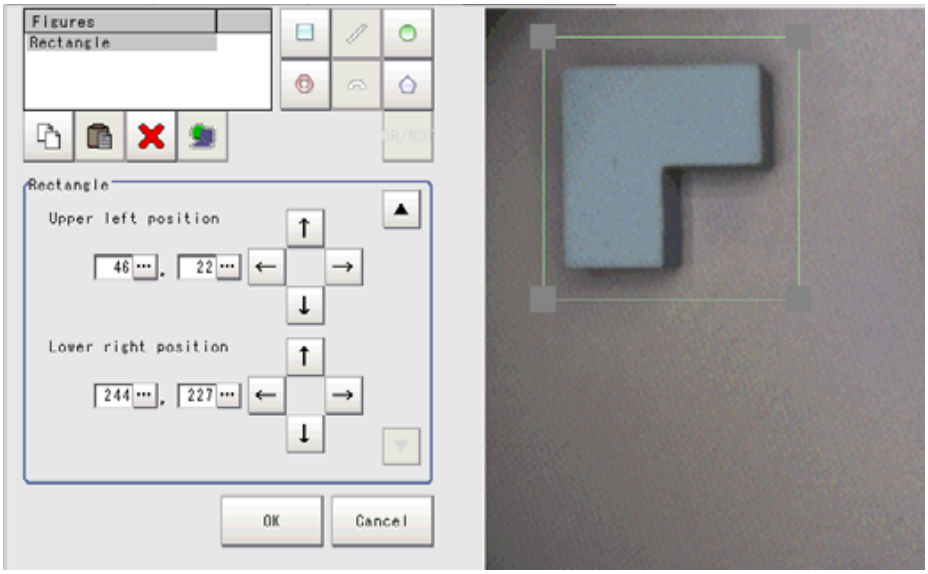


2 In the "Calibration setting" area, select "Sampling".

3 In the "Sampling" area, tap [Regist model].

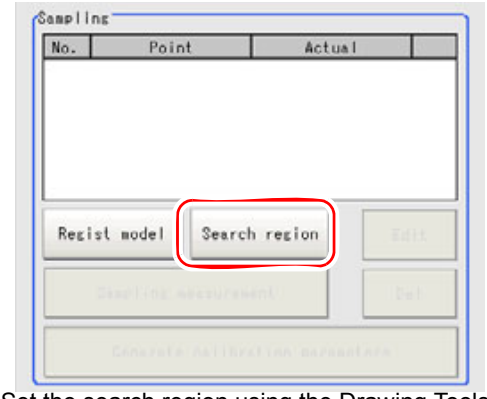
4 Register a model using the Drawing Tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"



5 Set the search region as necessary.

1. In the "Sampling" area, tap [Search region].

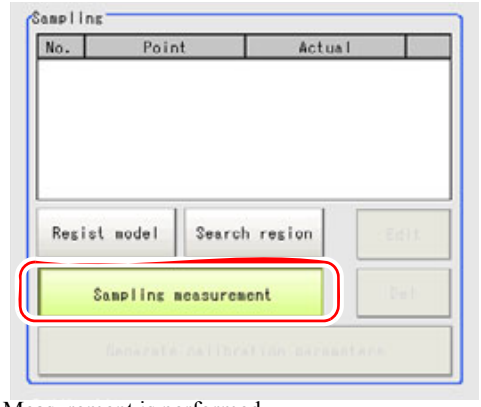


2. Set the search region using the Drawing Tools.

   The default is the entire screen.

   "1.9 Setting Figures" (→pg.25), of "User's Manual"

6 Tap [Sampling measurement].



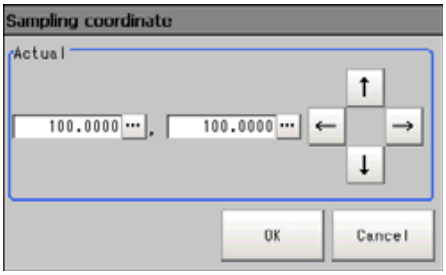
Measurement is performed.

The search result (cross-shaped cursor) is displayed in the "Image display" area, and the Sampling Coordinate window is displayed.

7 In the Sampling Coordinate window, tap [...] to enter the X and Y values.

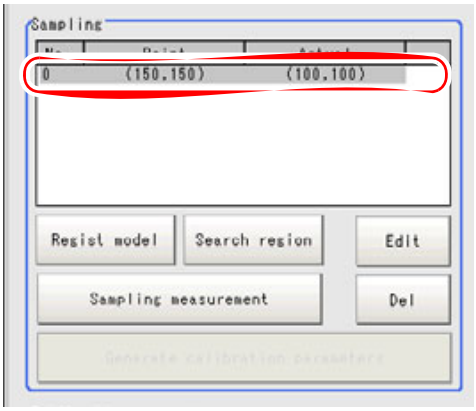
For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"

You can also use the arrow buttons to set the values.



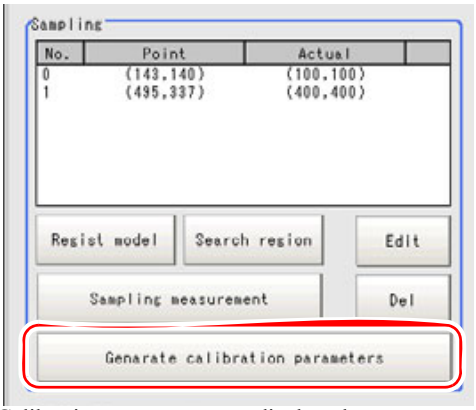
8 Tap [OK].

Point coordinates and actual coordinates are registered in the sampling area.

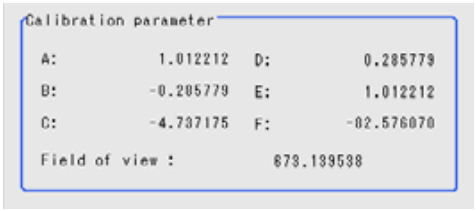


9 Move the object to be measured and repeat the Steps 3 to 8.

10 Tap [Generate calibration parameters].



Calibration parameters are displayed.



For the subsequent operations, see "1.3.1 Setting [3D Camera Image Input]" (→pg.5).

View Calibration Parameters

View the set calibration data.

1 In the "Item tab" area, tap [Calibration].

2 In the "Calibration parameter" area, confirm the calibration data.

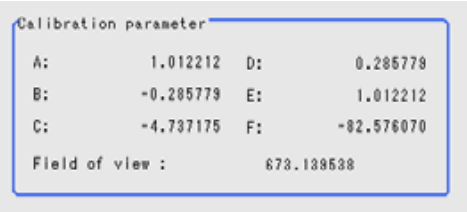


Table: View Calibration Parameters

Item	Set Value [Factory Default]	Description
A	Calculated value [1.000]	These are calibration conversion values. Camera coordinates are converted to actual coordinates based on these calibration conversion values. The conversion formulas to actual coordinates are as follows: ・(X, Y): Measurement point (camera coordinates), Unit: pix ・(X', Y'): Conversion point (actual coordinates) X'=A x X + B x Y + C Y'=D x X + E x Y + F
B	Calculated value [0.000]	
C	Calculated value [0.000]	
D	Calculated value [0.000]	
E	Calculated value [1.000]	
F	Calculated value [0.000]	
Sight	Calculated value [640]	This is an actual dimension in the X direction.

1.3.7 [3D Setting: 3D Coordinates (3D Camera Image Input)]

Adjust the coordinates between two cameras for 3D processing and set to convert measured value to actual dimensions. There are two ways to set the 3D coordinates. Select the method appropriate for the measurement environment (whether or not the measured object can be placed horizontally).

POINT

- When using an all-in-on camera, 3D coordinates are already set.
- Calibration target is used. Prepare it beforehand.

Important

- When re-specifying 3D coordinates, make sure to re-specify World coordinates settings.

Measurement when the Measured Object can be Placed Horizontally

Specify "Position Z" and sample at two points with the calibration target placed far and near the camera. Set 3D coordinates by registering each position.

1 Tap [3D setting] in the "Item tab" area (top) and tap [3D coordinates] in the "Item tab" area (bottom).

2 Select the combination of cameras to be used in the "Set camera number" area.

"1.3.1 Setting [3D Camera Image Input]" (→pg.5)

3 When using an all-in-one camera, uncheck "Availableness" of "The data camera has".

For an all-in-one camera, calibration is already set as factory default. Reset the calibration if the precision is insufficient.

POINT

- This item is displayed only when using an all-in-on camera.
- For an all-in-one camera, 3D coordinate setting parameters are provided as factory default.
  When using an all-in-one camera, specify whether to use data inside the camera as 3D coordinate setting parameters.

Table: 3D Setting - 3D Coordinates (3D Camera Image Input)

Item		Set Value [Factory Default]	Description
The data camera has			When using an all-in-one camera, specify whether to use data inside the camera as 3D coordinate setting parameters.
	Availableness	[Checked]	The data inside the camera is used as 3D coordinate setting parameters.
		Unchecked	The newly obtained data is used as 3D coordinate setting parameters.

4 Set the "Optical condition setting" and "Sampling condition" as necessary.

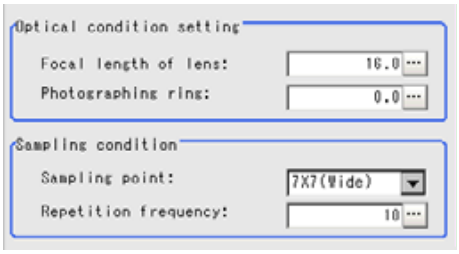
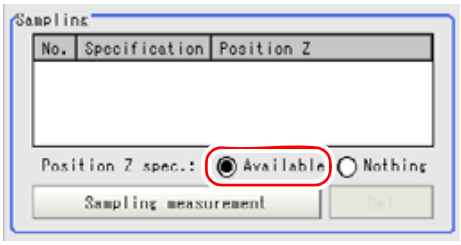


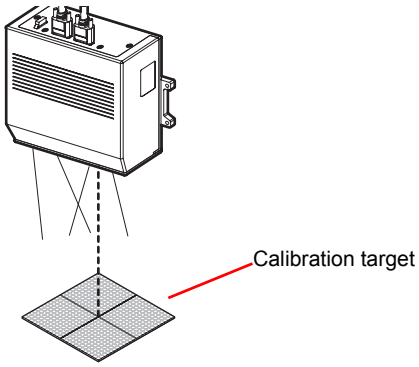
Table: 3D Setting - 3D Coordinates (3D Camera Image Input)

Item		Set Value [Factory Default]	Description
Optical condition setting	Focal length of lens	1.0 to 999.9 [16.0]	Set the focal length of the camera lens.
	Photographing ring	[0.0] to 999.9	Set the photographing ring of the camera.
Sampling condition	Sampling point	・5 x 5 ・7 x 7 ・9 x 9 ・11 x 11 ・[7 x 7 (Wide)] ・9 x 9 (Wide)	Select the number of sampling points for sampling measurement. Unit is n points x n points. Set up [3D coordinates] in the whole field of view. The correspondence between the field of view and sampling points are shown below: (Field of view: Sampling point) 35mm : 5 x 5 45mm : 7 x 7 55mm : 9 x 9 65mm : 11 x 11 75mm : 7 x 7 (Wide) 95mm : 9 x 9 (Wide)
	Repetition frequency	1 to 99 [10]	Set the number of sampling measurements performed per surface. Set [1] for environment with frequent vibrations.

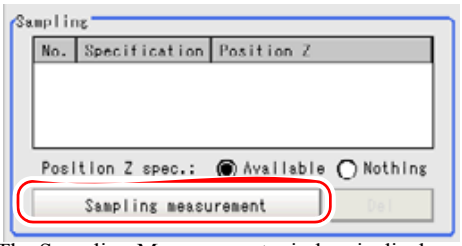
5 Select "Available" for "position Z spec." in the "Sampling" area.



6 Place the calibration target on the reference surface (0mm point).

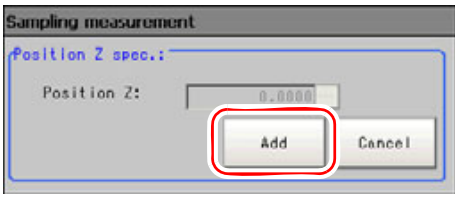


7 Tap [Sampling measurement].



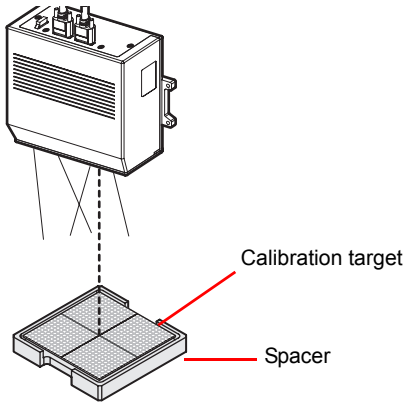
The Sampling Measurement window is displayed.

8 Tap [Add].



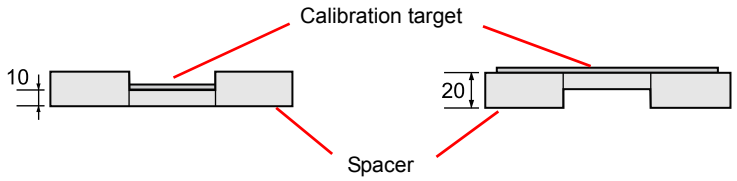
The sampling result is displayed in [Sampling].

9 Set the calibration target in the spacer.

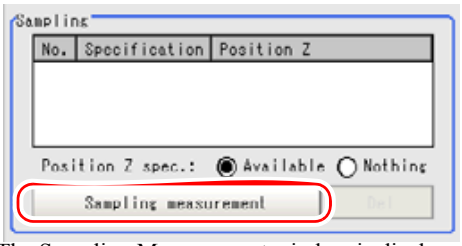


POINT

- The height will be 10mm when the calibration target is set on the concaved side of the spacer. The height will be 20mm when the calibration target is set on the other side of the spacer. Adjust as necessary.

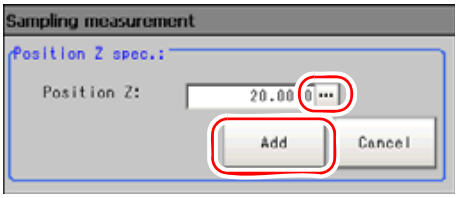


10 Tap [Sampling measurement].



The Sampling Measurement window is displayed.

11 Tap [...] for "Position Z" to set the spacer height ("20" or "10") and tap [Add].

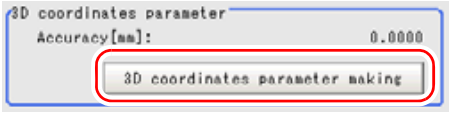


POINT

- When entering height information, assume that the direction toward the camera is +.

The sampling result is displayed in "Sampling".

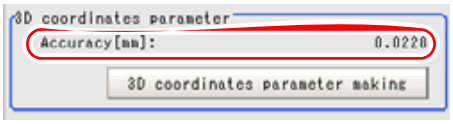
12 Tap [3D coordinates parameter making] in the "3D coordinate parameter" area.



POINT

- This button is disabled if there is only one sampling data in [Sampling].

3D coordinate setting is performed and the result is displayed as a message.
When 3D coordinate setting is successful, a value is displayed in "Accuracy".



POINT

Accuracy

- Assuming the actual height at the reference surface is Z0, and the height calculated with 3D coordinate setting (calibration) parameter is Z, the accuracy is expressed with the formula below:
  Accuracy = max{|Z(i)-Z0(i)|} (i: all the sampling points)

13 Repeat the Steps 2 to 12 when performing 3D measurement switching between Camera0+1 and Camera2+3.

POINT

- If information other than calibration target is in the field of view and sampling measurement is unsuccessful, adjust the sampling range with [Region setting].
  "1.3.9 [3D Setting: Region Setting (3D Camera Image)]" (→pg.44)

Measurement when the Measured Object cannot be Placed Horizontally

Take samples at several points while moving the calibration target without specifying [Position Z].

1 Tap [3D setting] in the "Item tab" area (top) and tap [3D coordinates] in the "Item tab" area (bottom).

2 Select the combination of cameras to use in the "Set camera number" area.

"1.3.1 Setting [3D Camera Image Input]" (→pg.5)

3 When using an all-in-one camera, uncheck "Availableness" of "The data camera has".

For an all-in-one camera, calibration is already set as factory default. Reset the calibration if the precision is insufficient.

POINT

- This item is displayed only when using an all-in-on camera.
- For an all-in-one camera, 3D coordinates setting parameters are provided as factory default.
  When using an all-in-one camera, specify whether to use data inside the camera as 3D coordinates setting parameters.

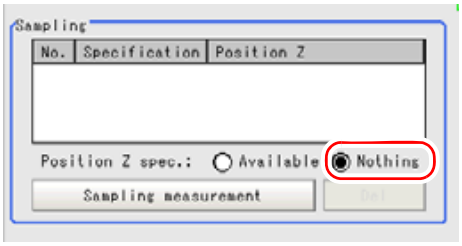
Table: 3D Setting - 3D Coordinates (3D Camera Image)

Item		Set Value [Factory Default]	Description
The data camera has			When using an all-in-one camera, specify whether to use data inside the camera as 3D coordinate setting parameters.
	Availableness	[Checked]	The data inside the camera is used as 3D coordinate setting parameters.
		Unchecked	The newly obtained data is used as 3D coordinate setting parameters.

4 Set the "Optical condition setting" and "Sampling condition" as necessary. However, set the "Repetition frequency" for the "Sampling condition" area to "1".

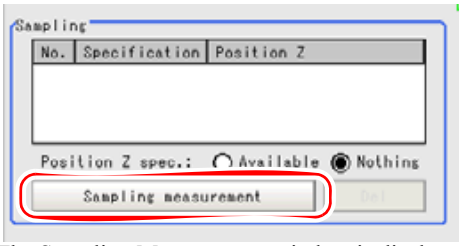
Set the other settings according to the environment. See the Step 4 of " Measurement when the Measured Object can be Placed Horizontally" (→pg.35) for the description of each item.

5 Select "Nothing" for "position Z spec." in the "Sampling" area.



6 Place the calibration target as horizontal as possible on the point to be the reference surface (0mm point).

7 Tap [Sampling measurement].



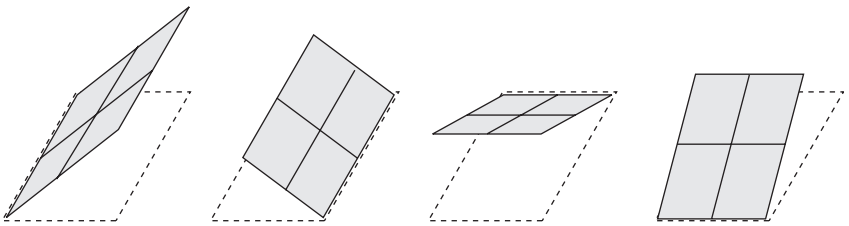
The Sampling Measurement window is displayed.

8 Tap [Add].

The sampling result is displayed in "Sampling".

9 With the calibration target tilted to the "right", "left", "forward", and "backward" at a height similar to the Step 6, repeat the Steps 7 and 8 for each direction.

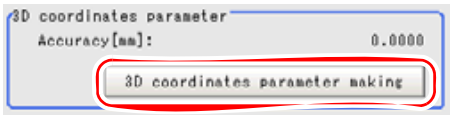
Tilt so that the height is about the thickness of the spacer (2cm).



The dotted lines indicate the reference surface

10 Change the position of the calibration target (distance from camera) and repeat the Steps 7 and 8 once more while it is "horizontal", and tilted "right", "left", "forward", and "backward".

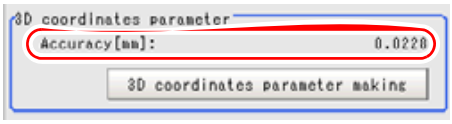
11 Tap [3D coordinates parameter making] in the "3D coordinate parameter" area.



POINT

- This button is disabled if there is only one sampling data in "Sampling".

3D coordinate setting is performed and the result is displayed as message.
When 3D coordinate setting is successful, a value is displayed in "Accuracy".



POINT

Accuracy

- Assuming the actual height at the reference surface is Z0, and the height calculated with 3D coordinate setting (calibration) parameter is Z, the accuracy is expressed with the formula below:
  Accuracy = max{|Z(i)-Z0(i)|} (i: all the sampling points)

12 Repeat the Steps 2 to 11 when performing 3D measurement switching between Camera0+1 and Camera2+3.

POINT

- If information other than calibration target is in the field of view and sampling measurement is unsuccessful, adjust the sampling range with [Region setting].
  "1.3.9 [3D Setting: Region Setting (3D Camera Image)]" (→pg.44)

1.3.8 [3D Setting: World Coordinates (3D Camera Image)]

Create a conversion parameter by photographing calibration target and performing sampling measurement at several points. Use this parameter to convert the [Measurement] in the image photographed with the camera to actual dimensions in the world coordinate (spatial coordinate).
The method of the measurement using a white circle outline at the center of the calibration target is described below.

1 Tap [3D setting] in the "Item tab" area (top) and tap [World coordinates] in the "Item tab" area (bottom).

2 In the "Sampling condition" area, tap [...] for "Repetition frequency" and enter a value.

For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"

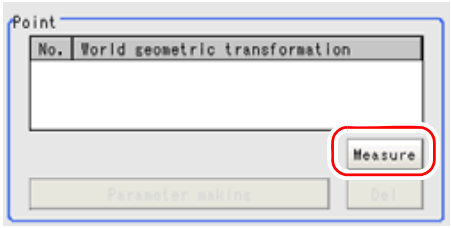
Table: 3D Setting: World Geometric Transformation (3D Camera Image Input)

Item	Set Value [Factory Default]	Description
Repetition frequency	1 to 99 [10]	Set the number of sampling measurements performed per surface. Set [1] for environment with frequent vibrations.

3 Photograph the calibration target with the camera.

The relatively large white circle outline printed at the center of calibration target is the sampling target.

4 In the "Point" area, tap [Measure].



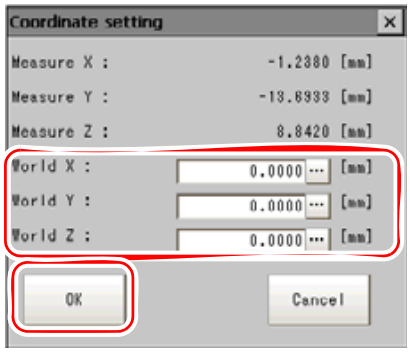
The circle at the center of calibration target is measured with each camera. Coordinate calculation is performed based on the measurement result.

The Coordinate Setting window is displayed. The measurement coordinates and world coordinates are displayed in the Coordinate Setting window.

POINT

- If the center circle cannot be found correctly, it may be easier to find if you measure after enclosing the center circle in an area that is inside all cameras in the Region setting.

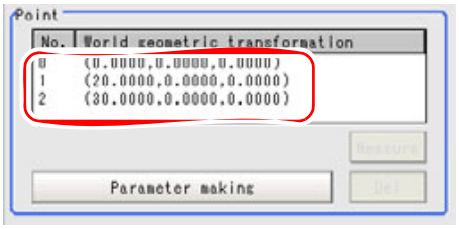
5 Change the world coordinate (spatial coordinate) as necessary and tap [OK].



Point coordinate is displayed at "Point".

6 Move the calibration target and repeat the Steps 4 and 5 twice.

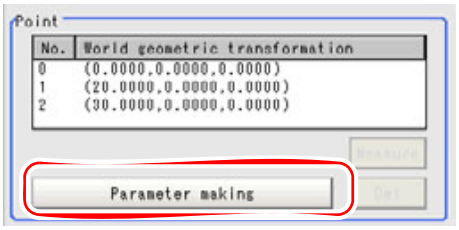
Register three points for "Point".



POINT

- To delete a registered point, select the point to delete from the list and tap [Delete].

7 After three points (No. 0 to 2) are entered in "Point", tap [Parameter making].



POINT

- This button is enabled only when three points are registered for "Point".

Parameter creation is performed. The result is displayed as a message.
When parameter creation is successful, a value is displayed in "Parameter".

1.3.9 [3D Setting: Region Setting (3D Camera Image)]

Set the measurement area for 3D coordinate setting and world geometric transformation.

1 Tap [3D setting] in the "Item tab" area (top) and tap [Region setting] in the "Item tab" area (bottom).

2 Tap [Edit].

The "Figure setting" area is displayed.

3 Specify the measurement range using the Drawing Tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"

4 In the "Figure setting" area, tap [OK].

The measurement range is registered and displayed in the "Image display" area.

1.3.10 [3D Setting: Pattern Lighting (3D Camera Image Input)]

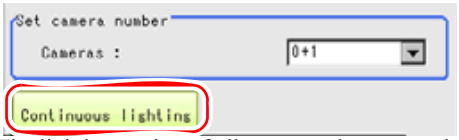
Set the lighting of all cameras connected to the controller.

1 Tap [3D setting] in the "Item tab" area (top) and tap [Pattern lighting] in the "Item tab" area (bottom).

2 Make setting for the lighting.

To have continuous lighting

Tap [Continuous lighting].



The lighting setting of all connected cameras changes their power of lighting to 50%.

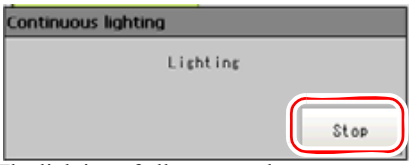
A [Continuous lighting] message is displayed.

POINT

- No other operation can be performed during continuous lighting.

To cancel continuous lighting

Tap [Stop].



The lighting of all connected cameras return to default lighting setting (50% power lighting setting is canceled).

1.3.11 Camera/Lighting Combination and Available Functions

The functions that can be set in [3D Camera Image Input] differ depending on the combination of your camera and lighting.

Table: Camera/Lighting Combination and Available Functions

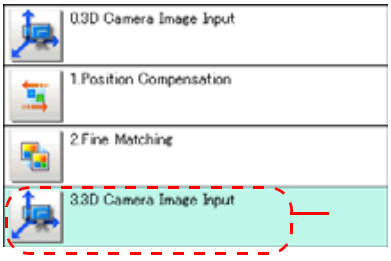
Camera and Lighting		Available Functions				
Camera	Peripheral	Camera setting		Screen adjustment		
		Shutter, gain	STGOUT	White balance	Lens	Lighting
FZ-SC	-	OK	OK	OK		
	Flashlight unit	OK	OK	OK		OK
FZ-SZC15 FZ-SZC100	-	OK	OK	OK	OK	
FZ-SLC15 FZ-SLC100	-	OK	OK	OK	OK	OK
FZ-SC2M	-	OK	OK	OK		
	Flashlight unit	OK	OK	OK		OK
FZ-S	-	OK	OK			
	Flashlight unit	OK	OK			OK
FZ-S2M	-	OK	OK			
	Flashlight unit	OK	OK			OK

OK: Available

1.3.12 Additional Description

Position Compensation and 3D Camera Image Input

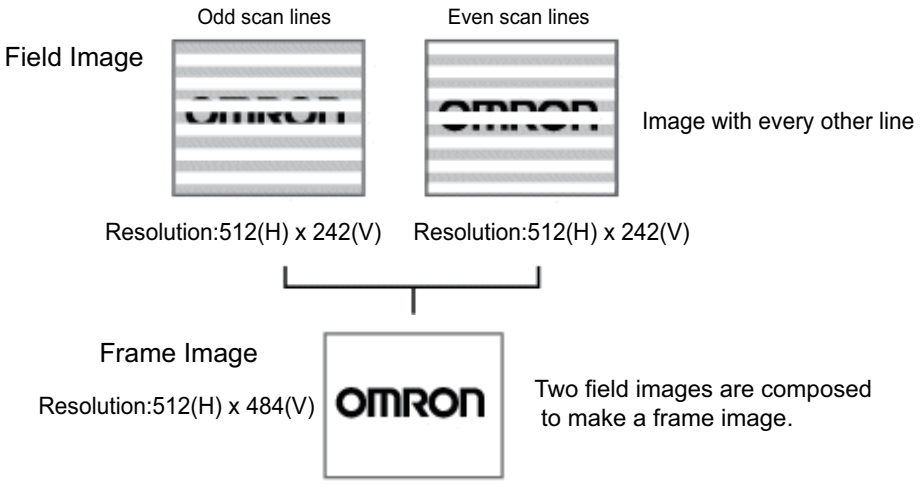
When creating a scene, if a [3D Camera Image Input] unit is positioned after a [Position Compensation] unit, that [Position Compensation] unit will be cancelled, which will cause the image of the measurement object to be restored to its former state before the scrolling is applied.



Position compensation of unit 1 is canceled and returns to the position before position compensation.

About Frame Images and Field Images

There are two methods to transfer one image from a camera to the controller: frame read and field read. Frame read is to read all of the scanned lines of the image, the result of which is called the frame image. Field read is to read half of the interlaced scanned lines of the image, the result of which is called the field image.

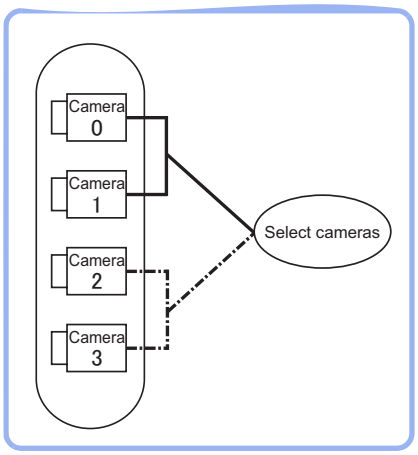


1.4 3D Camera Switching

This processing item is for 3D measurement only.

Used for the following case

- When using two pairs of cameras (four cameras in total) to make stereo measurements and you want to switch to images from other cameras than the camera combination specified in [3D Camera Image Input] within a scene.



Important

- 3D Camera Switching cannot be used while in 3-camera mode.
- When switching from a monochrome camera to color camera, reconfigure the settings in the following units.

1.4.1 Setting up [3D Camera Switching]

1 In the Edit Flow window, tap [3D Camera Switching].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Camera select" area, tap [▼] for "Camera No." and select a camera combination to be used for the measurements.

Table: 3D Camera Setting (3D Camera Switching)

Setting Item	Set Value [Factory Default]	Description
Camera No.	・[Camera 0+1] ・Camera 2+3	The "Image display" area will display images from each camera. ・When Camera 0+1 is selected Left side: Camera 0 Right side: Camera 1 ・When Camera 2+3 is selected Left side: Camera 2 Right side: Camera 3

3 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

2

Chapter 2 - Image Compensation

This chapter describes how to apply the pre-treatment that makes the measurement easier, and fit the position of measured parts on the input image for the precise measurement.

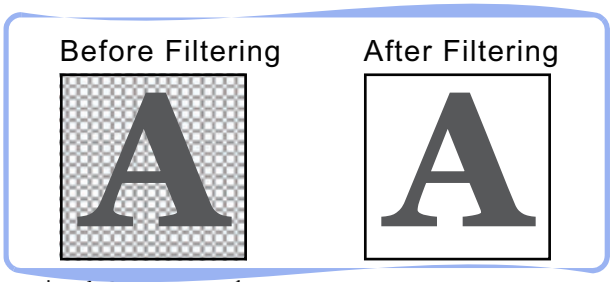
2.1 Filtering 2
2.1 Position Compensation 1
2.2 Color Gray Filter 8

2.1 Filtering

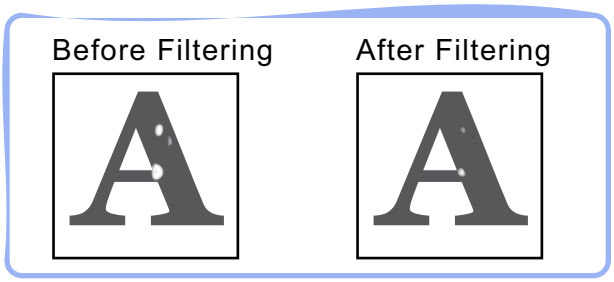
Process the images acquired from cameras in order to make them easier to be measurement.

Used for the following case

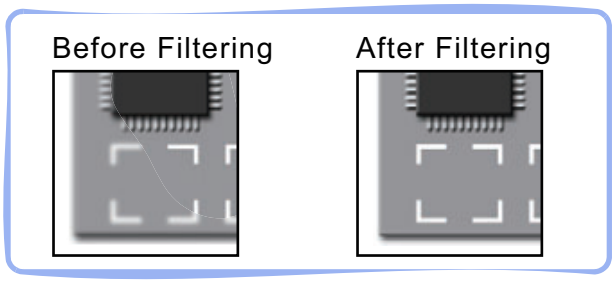
- When cutting the unnecessary background images, leaving only what needs to be measurement



- When noise shall be removed



- When other edges have been extracted, you still cannot see the marked edge clearly.



Important

- The filtering cannot be used for 3D measurement.

List of Filtering Items

Table: List of Filtering Items

Item Name	Description
Filtering parameters	Images acquired from the camera are processed to make them easier to be measured. There are nine filtering processing methods: [Weak smoothing], [Strong smoothing], [Dilate], [Erosion], [Median], [Extract edges], [Extract horizontal edges], [Extract vertical edges], and [Enhance edges]. "2.1.2 [Filtering Parameter (Filtering)]" (→pg.4)
Region setting	Specify a region to which to apply filtering. Instead of measuring the entire input image, narrowing the measurement region shortens the processing time. "2.1.3 [Region Setting (Filtering)]" (→pg.8)

2.1.1 Set up "Filtering"

Follow the below steps to set up Filtering.

POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 In the Edit Flow window, tap [Filtering].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area, tap [Filter param] and set up the filtering parameters.

See "2.1.2 [Filtering Parameter (Filtering)]" (→pg.4)

3 In the "Item tab" area, tap [Region setting] and specify the target region.

See "2.1.3 [Region Setting (Filtering)]" (→pg.8)

4 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

5 Perform a measurement test.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

6 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

When NG is displayed, please verify measurement results and make Adjust if necessary.

2.1.2 [Filtering Parameter (Filtering)]

Treat the images that you get from the camera in order to make them easier to be measurement.
There are nine filtering processing methods: [Weak smoothing], [Strong smoothing], [Dilate], [Erosion], [Median], [Extract edges], [Extract horizontal edges], [Extract vertical edges], and [Enhance edges].
Positioning the cursor will allow you to the image that has been pre-processed. Please confirm and select the pre-processed image.

1 In the "Item tab" area, tap [Filter param].

2 In the "Display" area, tap [Change display] to switch between two types of camera images.

The displayed contents of the "Image display" area will be switched.

Table: Filtering Parameter (Filtering) - Display

Item	Set Value [Factory defaults]	Description
Display	Through	The latest image is continuously input from the camera and is displayed.
	[Freeze]	The image that has been scanned during the immediately preceding measurement is displayed. The image is updated each time a measurement is made.

3 In the "Target" area, select the target image for filtering.

The displayed contents of the "Image display" area will be switched.

Table: Filtering Parameter (Filtering) - Target

Item	Set Value [Factory defaults]	Description
Target	[Camera image]	Filtering is applied to the images input from the camera that were set up before this unit ([Filtering]) of the scene. Preprocessing disabled.
	Prev. unit image	Filtering is applied to the images which have been processed in the [Position Compensation] and [Filtering] units that were set up before this unit ([Filtering]) of the scene.

4 In the "Filtering order" area, select the sequence in which to apply filtering.

Filtering is performed according to your settings, and the filtered result is displayed in the "Image display" area.

Table: Filtering Parameter (Filtering) - Direction

Item	Set Value [Factory defaults]	Description
Filtering order	・[Filtering → BGS] ・BGS → Filtering	Select the sequence of background removing/Filtering.

5 In the "Filtering setting" area, set up "Filtering" and "Filter size".

Table: Filtering Parameter (Filtering) - Filtering Setting

Item	Set Value [Factory defaults]	Description
Filtering	・[OFF] ・Weak smoothing ・Strong smoothing ・Dilate ・Erosion ・median ・Extract edges ・Extract vertical edges ・Extract horizontal edges ・Enhance edges	Select available Prev. re-meas. types. For Filtering options and application examples, see " Filtering options and examples" (→pg.6)
Filter size	・[3x3] ・5x5	Choose to use several surrounding pixels or not. With the larger mask size, the filtering can find more variation from neighboring pixels.

6 In the "BGS levels" area, specify the [Upper] and [Lower] limit values to suppress unnecessary background noise.

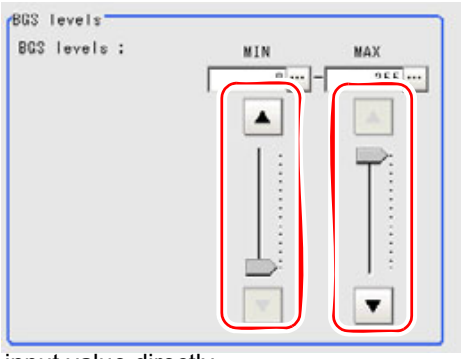
While looking at your image, specify the upper and lower limits for BGS levels.

For setting values, see " Background suppression" (→pg.8)

You can use the slider

Drag the slider up or down.

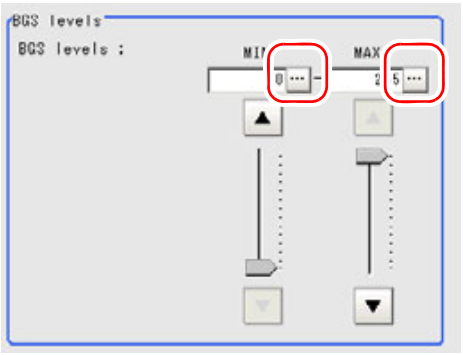
For fine-tuning, tap the buttons at both ends of the slider.



To input value directly

Tap [...] for "BGS levels" and input a value.

For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"



For the subsequent operations, see "2.1.1 Set up "Filtering"" (→pg.3).

Filtering options and examples

Treat the images that you get from the camera in order to make them easier to be measurement.

Table: Types of Filtering (Filtering)

Types of Filtering	The problems to be treated	Filtering Description	Example
Weak smoothing Strong smoothing	Small flecks on the measurement object	This filtering makes the flecks less visible.	Stable Searching
Dilate	Dark noise exists	This filtering removes noise by enlarging brighter area.	Noise removing of measurement objects
Erosion	Brighter noise exists	This filtering removes brighter noise by shrinking brighter area.	
Median	Small flecks on the measurement object	This filtering keep the profile and weaken flecks.	Edge Position (no accuracy is reduced)

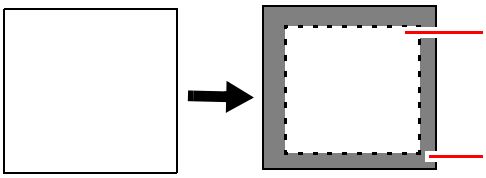
Table: Types of Filtering (Filtering)

Types of Filtering	The problems to be treated	Filtering Description	Example
Extract edges	Due to a comparatively lower image contrast, defects are difficult to be found	This filtering measures boundary line of the image (light and shade).	Defects measuring
Extract vertical edges	Due to a comparatively lower image contrast, defects are difficult to be found	This filtering measures vertical boundary line of the image (light and shade).	
Extract horizontal edges	Due to a comparatively lower image contrast, defects are difficult to be found	This filtering measures horizontal boundary line of the image(light and shade).	
Enhance edges	The measurement object is blurry (due to changes such as lighting fluctuation).	This filtering makes boundary lines between the lights and darks of the image understandable.	Edge positioning

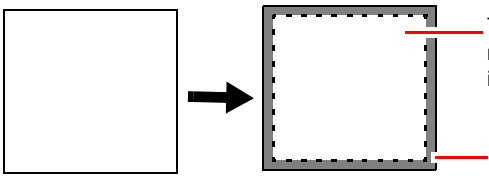
Notes about Filtering Setting

If filtering is applied to the image, the area around the image frame will become unstable. When the [Filtering] processing item has been set up in the scene, ensure that the measurement range to be set up in other processing items should not include the area around the image frame.
The width to be measurement will depend on the mask size.

- Filtersize: 5 x 5
  Set up to make 2-pixel width of the image frame not to be included in the measurement range.



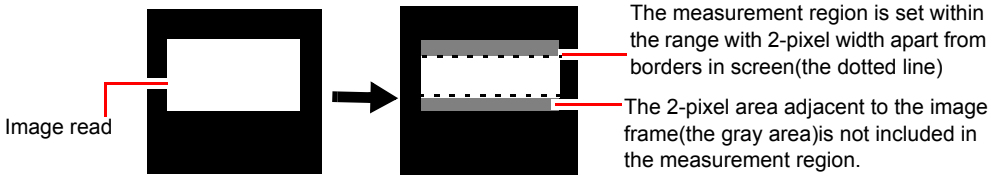
- Filter size: 3 x 3
  Set up to make 1-pixel width of the image frame not to be included in the measurement range.



When you use a partial-scan camera to delimit the image reading range

Make it not include the area around the image frame by proper set up.

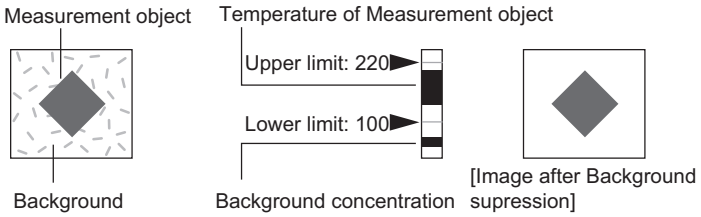
The width that will not included in the image reading range is the same as the above (in the following figure. Filter size:5 x 5). Background



Background suppression

The parts below [Lower] and above [Upper] will be set to the lower and upper limits of the brightness, respectively.

Example)lower limit: 100 upper limit: 220



Only images with a density ranging 100 to 220 could become measurement objects.

For the subsequent operations, see "2.1.1 Set up "Filtering"" (→pg.3).

2.1.3 [Region Setting (Filtering)]

Use a rectangle to specify a measurement region for [Filtering].

1. In the "Item tab" area, tap [Region setting].
2. When a measurement region is already registered, tap [Edit].

The "Figure setting" area is displayed.

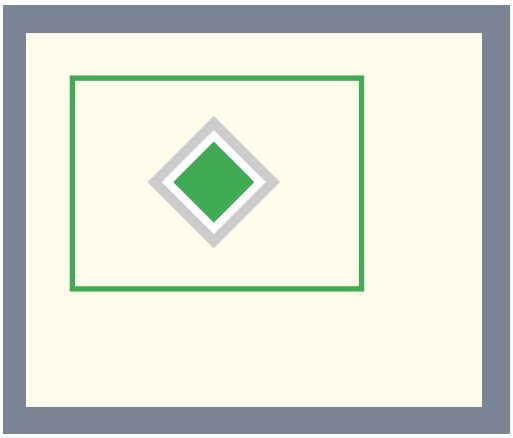
When no measurement region is registered, go to Step 3.

3 Specify the measurement region using Drawing Tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"

4 In the "Figure setting" area, tap [OK].

The measurement region is registered and displayed in the "Image display" area.



For the subsequent operations, see "2.1.1 Set up "Filtering"" (→pg.3).

2.1.4 When Using Measurement Results Externally (Filtering)

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in the "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: Filtering-Measured Data Overview

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
120	Target	Set/Get	0: Camera image 1: Prev. unit image

Table: Filtering-Measured Data Overview

No.	Data Name	Set/Get	Data Range
121	Filtering	Set/Get	0: OFF 1: Weak smoothing 2: Strong smoothing 3: Dilate 4: Erosion 5: Median 6: Extract vertical edges 7: Extract horizontal edges 8: Extract edges 9: Enhance edges
122	Direction	Set/Get	0: Filtering → BGS 1: BGS → Filtering
123	Filter size	Set/Get	0 : 3*3 1 : 5*5
124	Lower limit for BGS levels	Set/Get	0 to 255
125	Upper limit for BGS levels	Set/Get	0 to 255

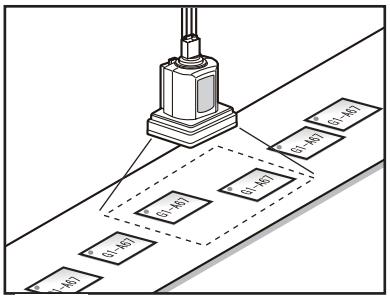
2.1 Position Compensation

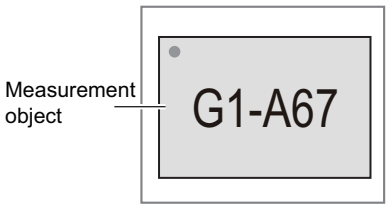
The position deflection of measurement objects can be corrected using measured values saved by other processing units. By comparing the measured coordinate with the reference coordinates, which were read from the previous unit, the image is scrolled by the amount of that difference.

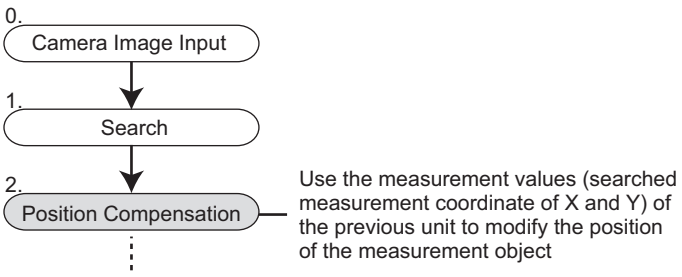
Used for the following case

- Even with different positions for the same measurement object, correct measurement can still be performed by correcting the position of the input image, thus eliminating the need to replace the measurement object.

Example) Using the searched position to perform position compensation







Other Processing items combined with Position Compensation

In [Position Compensation], the position is corrected according to the measured values (coordinates) from the previous unit. By combining the following processing items, the result of Position Compensation will be better.

Table: Processing Items Combined with Position Compensation

Processing Unit Type	Processing Item Name
Processing unit that performs search or matching (called "Search Unit" hereafter.)	"3.2 Search" (→pg.1) "3.3 Flexible Search" (→pg.1) "3.13 ECM Search" (→pg.60) "3.8 Circle Angle" (→pg.136)
Processing unit that measures the edge position (the following called "Edge position Unit".)	"3.4 Edge Position" (→pg.1) "3.17 Scan Edge Position" (→pg.120)
Processing unit to detect the center of gravity (Hereafter referred to as "processing unit for gravity center detection".)	"3.10 Gravity and Area" (→pg.18) "3.11 Labeling" (→pg.34)

Important

- When the position compensation method ([Scroll method]) is set to [1 unit scroll] or [2 unit scroll], scrolling will not be correctly performed if units other than the above unit(s) are used immediately before the [Position Compensation] unit within the scene.
  "2.1.3 [Scroll method (Position Compensation)]" (→pg.4)
- For Processing Items that are used in combination with [Position Compensation], set [Calibration] to "OFF" in [Output parameter].

2.1.1 Setting up [Position Compensation]

Set up [Position Compensation] using the following steps:

POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 In the Edit Flow window, tap [Position Compensation].
The ProcItem Setting window is displayed.
"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area, tap [Scroll method] and specify the position compensation method.
"2.1.3 [Scroll method (Position Compensation)]" (→pg.4)

3 In the "Item tab" area, tap [Region setting] to specify the measurement region.
"2.1.2 Region Setting (Position Compensation)" (→pg.3)

4 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

5 Perform a measurement test.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

6 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

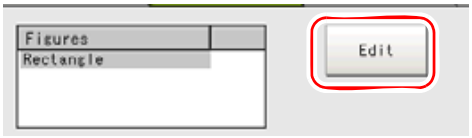
When NG is displayed, please verify measurement results and make Adjust if necessary.

2.1.2 Region Setting (Position Compensation)

Use the rectangle to set up the measurement region for [Position Compensation].

1 In the "Item tab" area, tap [Region setting].

2 When a measurement region is already registered, tap [Edit].

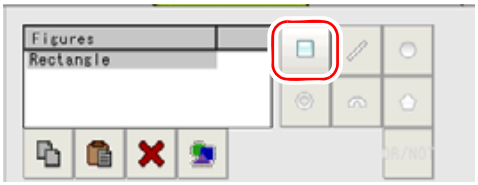


The "Figure setting" area is displayed.

When no measurement region is registered, go to Step 3.

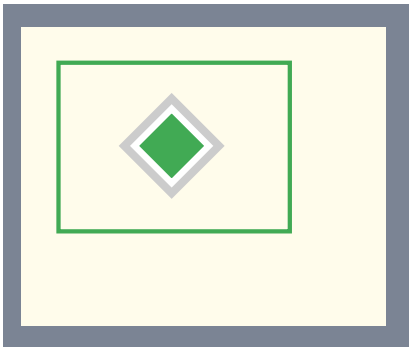
3 Specify the measurement area using Drawing Tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"



4 In the "Figure setting" area, tap [OK].

The measurement region is registered and displayed in the "Image display" area.



For the following operation, see "2.1.1 Setting up [Position Compensation]" (→pg.2).

2.1.3 [Scroll method (Position Compensation)]

Set up the scroll method for position deflection.

1 In the "Item tab" area, tap [Scroll method].

2 In the "Setting" area, tap [▼] for "Method" and select the scrolling method.

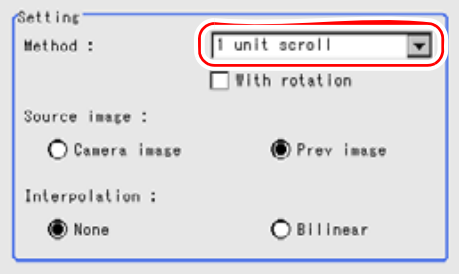


Table: Scroll Method (Position Compensation) - Setting - Type

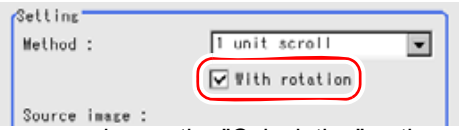
Setting Processing Item [Factory defaults]	Description
[1 unit scroll]	This item performs a scroll by referring to the coordinates of the [Search] or [Edge Position] unit (Note 1) preceding the [Position Compensation] processing unit itself. Moves the image position by the differential value between the reference and measurement Coordinate of the referring Search Unit or Edge Position Unit.
2 Unit scroll	This item performs a scroll by referring to the coordinates of the antepenultimate [Search] or [Edge Position] unit (Note 1) and the [Search] or [Edge Position] unit preceding the [Position Compensation] processing unit itself.
Calculation	Set up any Scroll method if you like. Set up reference and position. This can be performed behind any Unit for routine measurement.
Reset scroll	This item displays Image Input related images such as [Camera Image Input] and [Camera Switching]. With [Position Compensation] already performed, performing "Reset scroll" will restore the position to its state before the [Position Compensation]. With [Filtering] or [Color Gray Filter] already performed, performing "Reset scroll" will restore the image to its state before applying the filters.

[Note 1]: For Search units and Edge Position units, see " Other Processing items combined with Position Compensation" (→pg.2).

When you choose the [1 Unit scroll] or [2 Unit scroll],

Not only the X and Y axes but also the rotation angle should be position-modified.

For the Obtain Angle, you can also check the [With rotation] option to correct the position.



When you choose the "Calculation" option

The "With rotation" option cannot be set up. Continue to step 3.

When you choose "Reset scroll"

The following operations will not be necessary.

For the following operation, see "2.1.1 Setting up [Position Compensation]" (→pg.2).

3 For "Source image" in the "Setting" area, select the image type to which to apply scrolling.

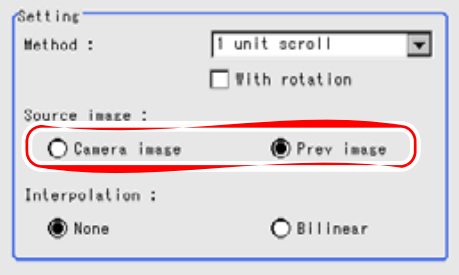


Table: Scroll method (Position Compensation) - Setting - Scroll target

Setting Processing Item [Factory defaults]	Description
Camera image	Scrolling is applied to the images that are input from the camera set up before this unit ([Position Compensation]) of the scene. Preprocessing disabled.
[Prev. image]	Scrolling is applied to the images which have been processed in the [Position Compensation] and [Filtering] units that are set up before this unit ([Position Compensation]) of the scene.

4 For "Interpolation" in the "Setting" area, specify whether to perform interpolation for scrolling.

Interpolation is the process to obtain the curve that joins more than one point, which can be set up in any Scroll.

Performing interpolation will allow you to improve the accuracy of Position Compensation.

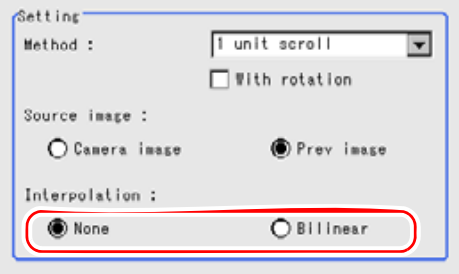


Table: Scroll method (Position Compensation) - Setting - Interpolation

Set Value [Factory defaults]	Description
[None]	Only pixels can be moved.
Bilinear	This option joins more than one point with a line in order to find a desired approximate value. The image will become more smoothing.

When you choose the "1 Unit scroll" or "2 Unit scroll" as the set up method,

The following operations will not be necessary. For the following operation, see "2.1.1 Setting up [Position Compensation]" (→pg.2).

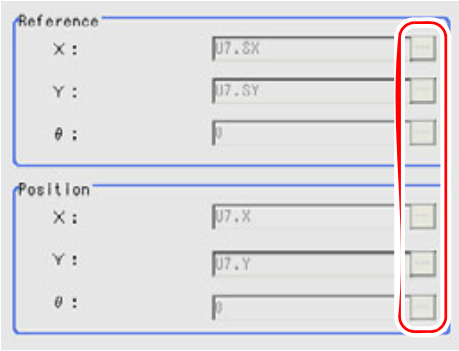
When you choose the "Calculation" option

Set up the reference and position. Continue to step 5.

5 Using expression, specify the "Reference" and "Position" which are used to determine the Position Compensation.

Differences between the respective values in the "Reference" and "Point" areas give the amount of scrolling to be performed.

1. Tap the [...] button on the right side of each item.



The Setting Expression window appears.

2. Specify an expression.

For how to specify an expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

For the following operation, see "2.1.1 Setting up [Position Compensation]" (→pg.2).

2.1.4 When Using measurement Results Externally (Position Compensation)

Value Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.

The measurement items displayed in the sub-menu are explained below.

For set up information about the Expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (Position Compensation)

Measurement items	Character string	Description
Judge	JG	Judgement result
Scroll X	DX	Scroll X
Scroll Y	DY	Scroll Y
Scroll θ	DT	Scroll θ
Measured value X	X	Measured value X Coordinate
Measured value Y	Y	Measured value Y Coordinate
Measured θ	TH	Angle
Reference X	SX	Reference X Coordinate

Table: Values Available in Expression (Position Compensation)

Measurement items	Character string	Description
Reference Y	SY	Reference Y Coordinate
Reference θ	ST	Reference angle

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in the "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Position Compensation)

No.	Data Name	Set/Get	Data Range
0	judgement result	Get only	0: Unmeasured 1: OK -1: NG
5	Scroll X	Get only	-99999.9999 to 99999.9999
6	Scroll Y	Get only	-99999.9999 to 99999.9999
7	Scroll θ	Get only	-999.9999 to 999.9999
8	Position X	Get only	0 to 99999.9999
9	Position Y	Get only	0 to 99999.9999
10	Measure θ	Get only	-360 to 360
11	Reference X	Get only	-99999.9999 to 99999.9999
12	Reference Y	Get only	-99999.9999 to 99999.9999
13	Reference θ	Get only	-999.9999 to 999.9999
120	Interpolation	Set/Get	0: None 1: Linear
121	Scroll method	Set/Get	0: 1 unit scroll 1: 2 unit scroll 2: Expression 3: Reset scroll
122	Scroll target	Set/Get	0: Camera image 1: Prev. unit image.
123	With rotation	Set/Get	0: no Turn 1: Turn

2.2 Color Gray Filter

This processing item converts color image input from a color camera to a monochrome image by passing it through a filter.

The available filters are "Primary color filter (RGB)", "Complementary color filter (CMY)", "Brightness filter", and "HSV method filter."

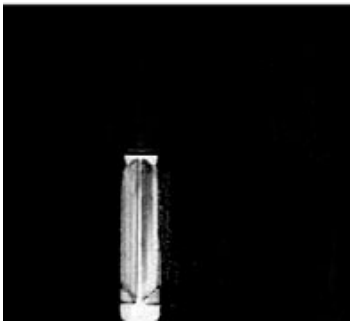
POINT

- The processing items after [Color Gray Filter] are the same as when a monochrome camera is connected.

Used for the following case

- To convert a color image to a monochrome image with a specific color enhanced

Example) To obtain a monochrome image with the dark red area enhanced



Important

- The color gray filter cannot be used for 3D measurement.

List of Color Gray Filter Items

Table: List of Color Gray Filter Items

Item Name	Description
Filter setting	This item sets the filter. "2.2.2 [Filter Setting (Color Gray Filter)]" (→pg.9)

2.2.1 Setting up the [Color Gray Filter]

The setting procedure for Color Gray Filter is as follows:

POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 In the Edit Flow window, tap [Color Gray Filter].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area, tap [Filter Setting] to set.

"2.2.2 [Filter Setting (Color Gray Filter)]" (→pg.9)

3 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

4 Perform a test measurement.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

5 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

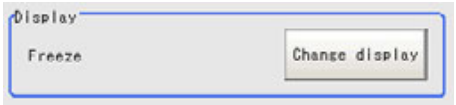
When "NG" is displayed, verify measurement results and make adjustments if necessary.

2.2.2 [Filter Setting (Color Gray Filter)]

Set the filter.

1 In the "Item tab" area, tap [Filter Setting].

2 In the "Display" area, tap [Change display] to switch between two types of camera images.



Display in the "Image display" area will be switched.

Table: Filter Setting (Color Gray Filter) - Display

Setting Item	Set Value [Factory Default]	Description
Display	Through	This option continuously inputs and displays the latest image from the camera.
	[Freeze]	This option displays the image that has been input during the last measurement. The image is updated every measurement.

3 Select the type of filter in the "Filter kind" area.

Table: Filter Setting (Color Gray Filter)

Setting Item	Set Value [Factory Default]	Description
Filter kind	[RGB filter]	Specify the color extraction range with R, G, and B.
	HSV filter	Specify the color extraction range with hue and saturation.

4 Set the filter with each filter type.

- " RGB Filter" (→pg.10)
- " HSV Filter" (→pg.11)

For the subsequent operations, see "2.2.1 Setting up the [Color Gray Filter]" (→pg.9).

RGB Filter

1 Select [RGB filter] in the "Filter kind" area.

2 Select the type of color filter in the "RGB filter" area.

If [Custom filter] is selected, set the [Gain (Red)], [Gain (Green)], and [Gain (Blue)] as necessary.

For RGB Gain, tap [...] of each item and enter a value. The values can also be adjusted by dragging the slider or by tapping the buttons at both ends of the slider.

How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"

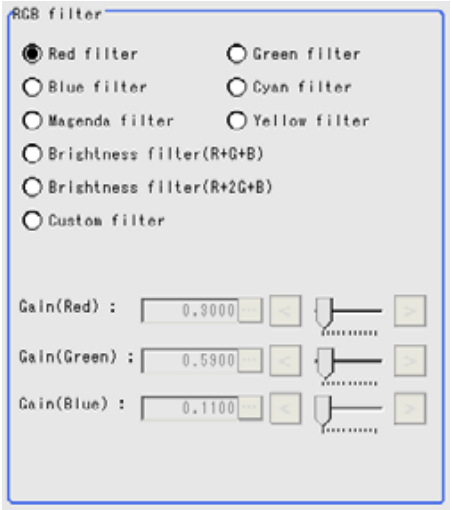
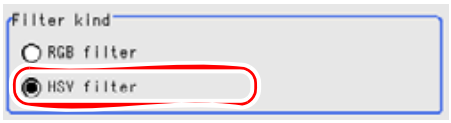


Table: Filter Setting (Color Gray Filter) - RGB Filter

Setting Item	Set Value [Factory Default]	Description
RGB filter	・[Red filter] ・Green filter ・Blue filter ・Cyan filter ・Magenta filter ・Yellow filter ・Brightness filter (R+G+B) ・Brightness filter (R+2G+B) ・Custom filter	This item produces the same effects as using the selected optical filters.
Gain (Red)	0.0001 to 9.9999 [0.3]	RGB gain values when processing with a custom filter. The density of the color component increases as the value increases. This can be set only when [Custom filter] is selected for RGB filter.
Gain (Green)	0.0001 to 9.9999 [0.59]	
Gain (Blue)	0.0001 to 9.9999 [0.11]	

HSV Filter

1 Select [HSV filter] in the "Filter kind" area.



2 Select the type of filter in the "HSV filter" area.

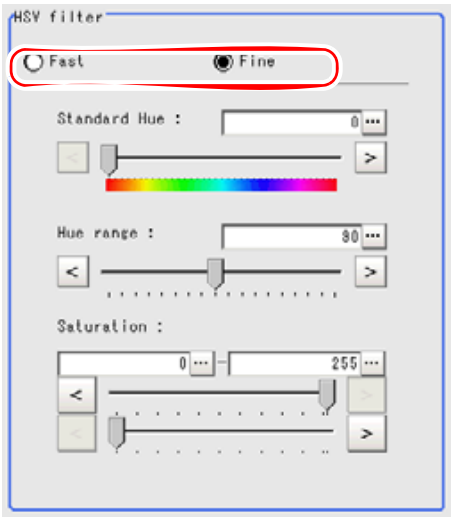


Table: Filter Setting (Color Gray Filter) - HSV Filter

Setting Item	Set Value [Factory Default]	Description
HSV filter	・Fast ・[Fine]	When [Fast] is selected, the color extraction range is set only by hue. When [Fine] is selected, extraction is set by [Standard Hue], [Hue range], and [Saturation].

3 Tap [...] of each item and enter a value.

Each item can also be set by dragging the slider or by tapping the buttons at both ends of the slider.

How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"

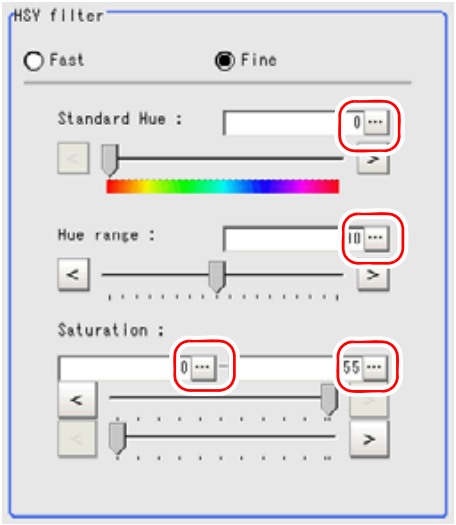


Table: Filter Setting (Color Gray Filter) - HSV Filter

Setting Item		Set Value [Factory Default]	Description
Standard Hue		[0] to 359	Specify the standard hue (tone) for the HSV filter. The density decreases as the difference in hue from the standard hue (difference in tone) increases.
Hue range		10 to180 [90]	Specify the Hue range (difference in tone) of the HSV filter. The hue difference is obtained by dividing the specified hue range into 255 subranges with the standard hue as the center subrange. The density of the hue outside the hue range is 0. This can be set only when [Fine] is selected.
Saturation	Upper limit	0 to [255]	Specify the upper and lower limits for Saturation (vividness). This can only be set when [Fine] is selected.
	Lower limit	[0] to 255	

2.2.3 When Using Measurement Results Externally (Color Gray Filter)

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Color Gray Filter)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
100	Filter kind	Set/Get	0: RGB filter 1: HSV filter
101	RGB filter Type	Set/Get	0: Red filter 1:Green filter 2: Blue filter 3: Cyan filter 4: Magenta filter 5: Yellow filter 6: Brightness filter (R+G+B) 7: Brightness filter (R+2G+B) 8: Custom filter
102	Gain (Red)	Set/Get	0.0001 to 9.9999
103	Gain (Green)	Set/Get	0.0001 to 9.9999
104	Gain (Blue)	Set/Get	0.0001 to 9.9999
105	HSV filter Type	Set/Get	0: Fast 1: Fine
106	Standard Hue	Set/Get	0 to 359
107	Hue range	Set/Get	10 to 180
108	Saturation Upper Limit	Set/Get	0 to 255
109	Saturation Lower Limit	Set/Get	0 to 255

3

Chapter 3 - Inspection and Measurement

This chapter describes how to set up the Processing Items that execute measurement. In addition, tips for adjustment addressing unstable measurement results and shortening measurement time will also be introduced.

3.1 Color Data 1
3.2 Search 1
3.3 Flexible Search 1
3.4 Edge Position 1
3.5 Edge Pitch 1
3.6 Defect 1
3.7 Fine Matching 1
3.8 Circle Angle 136
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3.14 Character Inspection 82
3.15 Model Dictionary 94
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3.19 3D Edge Position 158
3.20 3D Search 178
3.21 3D Circle Search 196
3.22 3D Height 212

3.1 Color Data

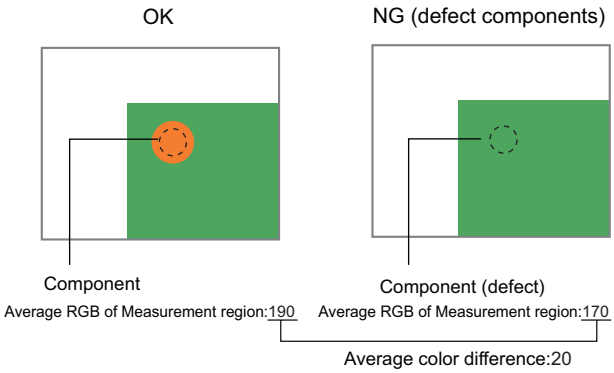
Detect by comparing the color bias between the available color difference of the reference colors (Color difference) and the calculated average color of the measurement region. Alternatively, you can only detect the color tone while neglect the effect of image brightness.
For monochrome cameras, examination is performed by measuring the difference between the average density of the measurement region and the registered reference density, and the density deviation in the measurement region.

Used for the following case

- When measuring the presence of measurement objects

Example) When re-measuring the presence of electronics components

Measure the presence with the color difference by averaging RGB values of the Measurement region.



For monochrome cameras, the presence of electronics components is examined by measuring the difference between the average density of the measurement region and the registered reference density.

List of Color Data Items

Color data items are explained below.

Table: List of Color Data Items

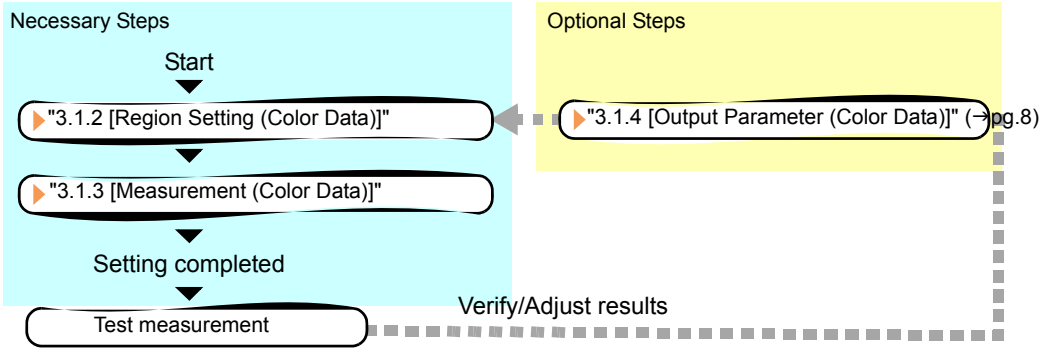
Item Name	Description
Region setting	This item specifies the measurement region. While the input image can be measurement as a whole, a quick and reliable measurement can be performed by set up the measurement region. "3.1.2 [Region Setting (Color Data)]" (→pg.3)

Table: List of Color Data Items

Item Name	Description
Measurement	This item specifies the judgement condition for measurement results. ・ For color cameras: Specify the average color value (RGB) and allowable color deviation from the average value as the conditions for judging the object to be OK. ・ For monochrome cameras: Specify the average density value and allowable density deviation from the average value as the conditions for judging the object to be OK. Measurement parameters can be changed as needed to address unstable measurement results or to increase the processing speed. Usually, the factory default value can be used. "3.1.3 [Measurement (Color Data)]" (→pg.4)
Output parameter	This item can be changed if necessary. Usually, the factory default value can be used. Specify whether to reflect the judgement result to the overall judgement of the scene. "3.1.4 [Output Parameter (Color Data)]" (→pg.8)

3.1.1 Setting up [Color Data]

The setting procedure for [Color data] is as follows.



POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 In the Edit Flow window, tap [Color Data].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area, tap [Region setting] and specify the measurement region.

"3.1.2 [Region Setting (Color Data)]" (→pg.3)

3 In the "Item tab" area, tap [Measurement parameter] and specify the judgement condition for OK.
"3.1.3 [Measurement (Color Data)]" (→pg.4)

4 Tap [OK].
After confirmation, the ProcItem Setting window will be closed.

5 Perform a measurement test.
"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

6 Verify measurement results.
"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"
When NG is displayed, please verify measurement results and make Adjust if necessary.
"3.1.5 Points on Measurement Test and Adjustment (Color Data)" (→pg.8)

3.1.2 [Region Setting (Color Data)]

A measurement region for [Color Data] can be specified as a rectangle, circle (ellipse), circumference, or polygon.

POINT

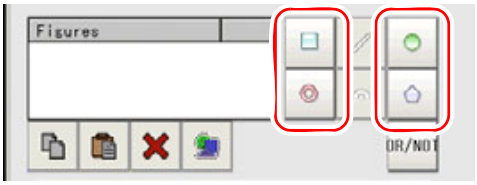
- Up to 8 figure can be used together to delimit the measurement region. Complex area can be drawn through image integration, or unnecessary sections are removed from the measurement region.
"1.9.3 OR Setting/NOT Setting" (→pg.38), of "User's Manual"

1 In the "Item tab" area, tap [Region setting].

2 When a measurement region is already registered, tap [Edit]. When no measurement region is registered, go to Step 3.

The "Figure setting" area is displayed.

3 Select a button in the Drawing toolbar.
"1.9 Setting Figures" (→pg.25), of "User's Manual"

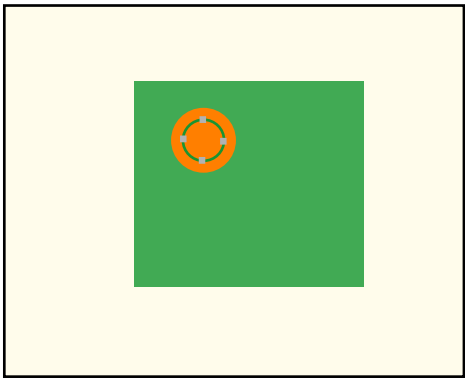


4 In the "Figure setting" area, specify a measurement region.

"1.9 Setting Figures" (→pg.25), of "User's Manual"

5 In the "Figure setting" area, tap [OK].

The measurement region is registered and displayed in the "Image display" area.



6 To automatically update reference colors during region setting, check "Auto update reference color".

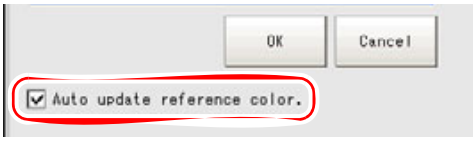


Table: Region setting (Color data) - Auto update reference color

Setting Item	Set Value [Factory Default]	Description
Auto update reference color	・[Checked] ・Unchecked	Select whether to automatically update reference colors during region setting. When checked, reference colors will be updated each time the region is re-specified. When unchecked, reference colors will not be updated when the region is re-specified

If you do not set "Auto update reference color", see the Step 3 of " For color cameras:" (→pg.5)

For the following operations, see "3.1.1 Setting up [Color Data]" (→pg.2).

3.1.3 [Measurement (Color Data)]

Specify a range to be judged as OK.

For color cameras:

1 In the "Item tab" area, tap [Measurement].

2 If necessary, check the "Normalization" option in the "Adjust image" area.

Usually, the factory default value can be used. When any settings have been changed, verify whether measurements can be performed correctly through actual measurement.

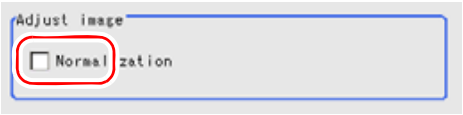


Table: Measurement (Color Data) - Adjust Image

Setting Item	Set Value [Factory Default]	Description
Normalization	・Checked ・[Unchecked]	Specify whether to normalize the brightness in calculating the color difference. When checked, the result is not affected by the total brightness and only the color tone can be detected.

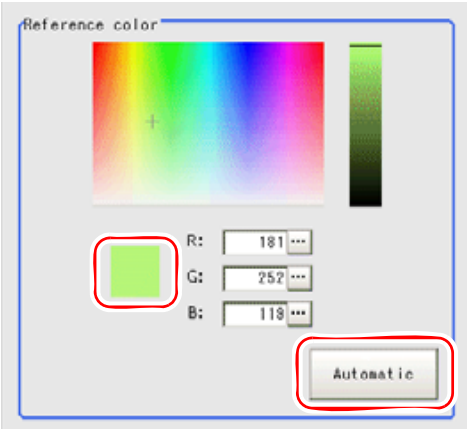
3 In the "Reference color" area, specify the reference color.

When the color of the specified measurement region is selected as the reference color

Tap [Automatic].

The color of the already-specified measurement region will be selected as the reference color and displayed in the "Reference color" area.

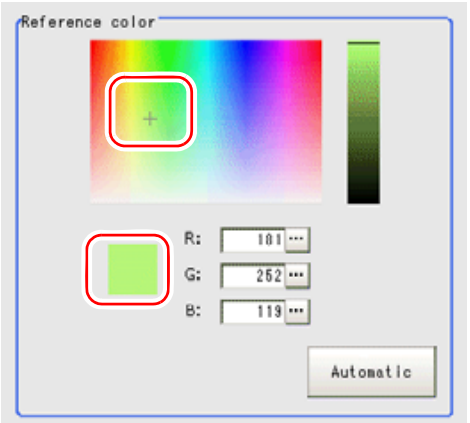
If the measurement region is not set up, no reference color will be selected.



"3.1.2 [Region Setting (Color Data)]" (→pg.3)

Manual setting

In the "Reference color" area, tap a desired color in the chart.

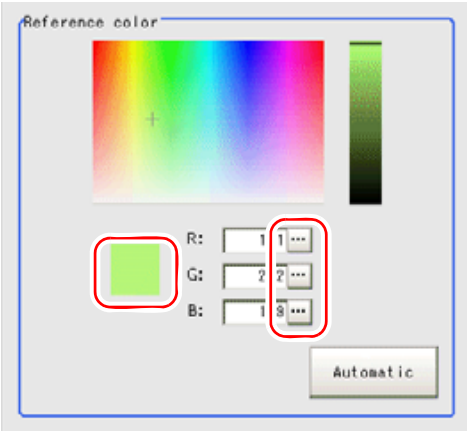


The selected color is set in the "Reference color" area.

Specifying the color by values

Just tap [...] beside each option and input value.

For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"



The selected color is set in the "Reference color" area.

4 When the setting has been changed, tap [Measure] in the "Detail" area to verify whether measurements can be made correctly.

5 In the "Judgement condition" area, tap [...] and input a value for each item.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

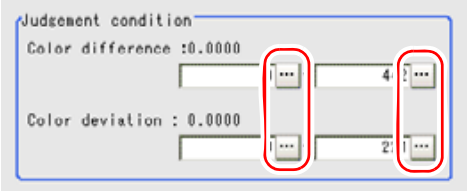


Table: Measurement - Judgement Condition (Color Data)

Setting Item		Set Value [Factory Default]	Description
Color difference	Upper	0 to [442]	Specify the upper and lower limit values for the color difference between the average color of the measurement region and the reference color specified in the "Reference color" area.
	Lower	[0] to 442	
Color deviation	Upper	0 to [221]	Specify the upper and lower limit values for the deviation of the average color in the measurement region.
	Lower	[0] to 221	

For the subsequent operations, see "3.1.1 Setting up [Color Data]" (→pg.2).

For monochrome cameras:

1 In the "Item tab" area, tap [Measurement].

2 In the "Judgement condition" area, tap [...] and input a value for each item.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

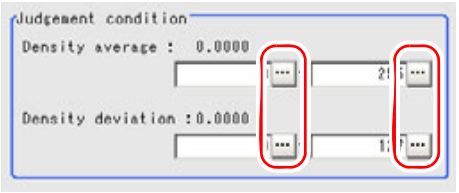


Table: Measurement (Color Data) - Judgement Condition

Setting Item		Set Value [Factory Default]	Description
Density average	Upper	0 to [255]	Specify the upper and lower limit values for judging the average density of the measurement region.
	Lower	[0] to 255	
Density deviation	Upper	0 to [127]	Specify the upper and lower limit values for the deviation of the average density in the measurement region.
	Lower	[0] to 127	

For the subsequent operations, see "3.1.1 Setting up [Color Data]" (→pg.2).

3.1.4 [Output Parameter (Color Data)]

Specify whether to reflect the judgement result to the overall judgement of the scene.

1 In the "Item tab" area, tap [Output parameter].

2 In the "Reflect to overall judgement" area, specify whether to reflect the measurement result to the overall judgement of the scene.

Table: Setting Values for Output Parameters

Setting Item	Set Value [Factory default]	Description
Reflect to overall judgement	・[ON] ・OFF	Select whether to reflect the judgement result of this processing unit to the overall judgement of the scene. ・Selecting "ON" reflects the judgement result of this processing unit on the overall judgement of the scene. ・Selecting "OFF" does not reflect the judgement result of this processing unit on the overall judgement of the scene.

POINT

- The overall judgement result of the scene is output to the OR signal to be sent via the parallel interface. Also, it is displayed in the Measurement Information Display area in the upper part of the Main screen.
  "10.4.4 Time Chart" (→pg.35), of "User's Manual"
  "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"

3.1.5 Points on Measurement Test and Adjustment (Color Data)

In addition to the camera image, the measurement region will also be displayed in "Image display" area.
In the "Detail result" area on the Main screen, you can confirm the following contents in text.
"6.3.2 Displaying Flow and Detail Result" (→pg.12), of "User's Manual"

For color cameras

Table: Color Data - Text Displayed

Displayed Items	Description
Judge	Judgement result
Average R	R (red) element average value
Average G	G (green) element average value

Table: Color Data - Text Displayed

Displayed Items	Description
Average B	B (blue) element average value
Color difference	The color difference between the average color and reference color in the measurement region
Color deviation	Color deviation in the measurement region

For monochrome cameras

Table: Text Displayed (Color Data)

Item	Description
Judge	Judgement result
Density average	Difference between the average density of the measurement region and the reference density in the measurement region
Density deviation	Density deviation in the measurement region

Point on Adjustment

Select the adjustment method referring to the following point.

When the processing speed is slow

- In the "Region setting" area, reduce the measurement region size.
  "3.1.2 [Region Setting (Color Data)]" (→pg.3)

3.1.6 Using Measurement Results Externally (Color Data)

Value Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.
For how to specify an expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

For color cameras

Table: Values Available in Expressions (Color Data)

Measurement items	Character string	Description
Judge	JG	Judgement condition
Average R	AR	R (red) element average value
Average G	AG	G (green) element average value
Average B	AB	B (blue) element average value
Color difference	AD	The color difference between the average color and reference color in the measurement region

Table: Values Available in Expressions (Color Data)

Measurement items	Character string	Description
Color deviation	DV	Color deviation in the measurement region

For monochrome cameras

Table: Values Available in Expressions (Color Data)

Measurement items	Character string	Description
Judge	JG	Judgement result
Density average	AD	Difference between the average density of the measurement region and the reference density in the measurement region
Density deviation	DV	Deviation in the measurement region

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in the "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Color Data)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Average R component value	Get only	0 to 255
6	Average G component value	Get only	0 to 255
7	Average B component value	Get only	0 to 255
8	Averaging color difference	Get only	0 to 442
9	Color deviation	Get only	0 to 221
10	Density average value (for monochrome cameras only)	Get only	0.000 to 255.000
11	Density deviation value (for monochrome cameras only)	Get only	0.000 to 127.000
12	Reference color difference	Get only	0.000 to 255.000
13	Reference color deviation	Get only	0.000 to 127.000
103	Reflect in OR	Set/Get	0: ON 1: OFF
120	Normalization	Set/Get	0: OFF 1: ON
121	R reference color	Set/Get	0 to 255
122	G reference color	Set/Get	0 to 255
123	B reference color	Set/Get	0 to 255
124	Upper limit for color difference	Set/Get	0 to 442

Table: External Reference List (Color Data)

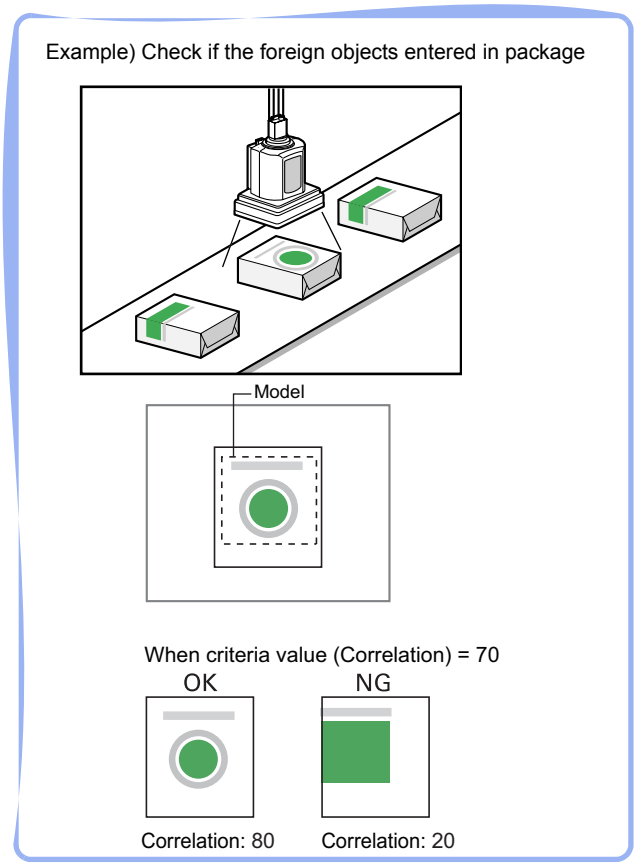
No.	Data Name	Set/Get	Data Range
125	Lower limit for color difference	Set/Get	0 to 442
126	Upper limit for color deviation	Set/Get	0 to 221
127	Lower limit for color deviation	Set/Get	0 to 221
128	Reference average density	Set/Get	0 to 255
129	Reference density deviation	Set/Get	0 to 127
130	Upper limit for average density (for monochrome cameras only)	Set/Get	0 to 255
131	Lower limit for average density (for monochrome cameras only)	Set/Get	0 to 255
132	Upper limit for density deviation (for monochrome cameras only)	Set/Get	0 to 127
133	Lower limit for density deviation (for monochrome cameras only)	Set/Get	0 to 127

3.2 Search

Register the feature images as a model, and then find the most similar part to these models from the input images .

Used for the following case

- When identifying the shape of measurement objects (for detecting defects and foreign matters)



List of Search Items

Search items are explained below.

Table: List of Search Items

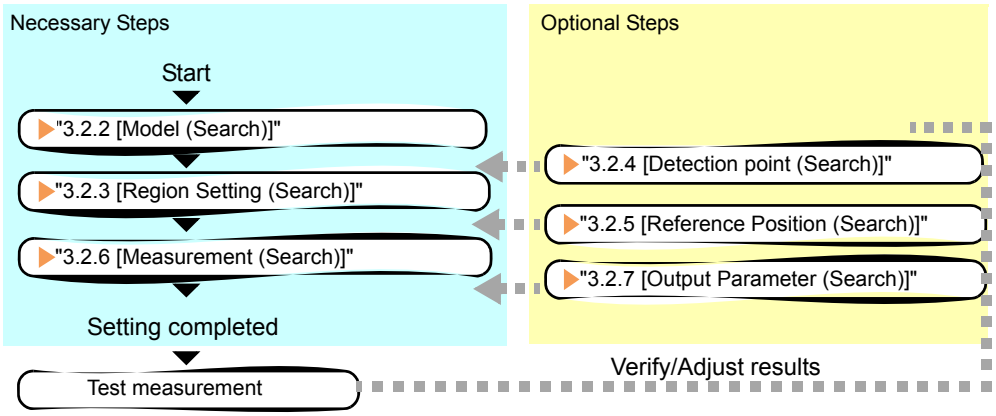
Item Name	Description
Model	This item registers the feature images as a model. Model parameter can be changed as needed to address unstable measurement results or to improve the processing speed. Usually, the factory default value can be used. "3.2.2 [Model (Search)]" (→pg.3)

Table: List of Search Items

Item Name	Description
Region setting	This item specifies the region to be measured. Instead of measuring the entire input image, narrowing the measurement region shortens the processing time. "3.2.3 [Region Setting (Search)]" (→pg.10)
Detection point	This item can be changed if necessary. Specify a position in the model that should be used as the detection coordinates during measurement. Usually, the central position of the set model is registered as the detection coordinates. "3.2.4 [Detection point (Search)]" (→pg.11)
Reference position	This item can be changed if necessary. Specify the reference position within the camera's field of view. "3.2.5 [Reference Position (Search)]" (→pg.13)
Measurement	This item specifies judgement conditions for measurement results. Set up OK criterion with which the coordinates (X, Y) of the measurement results and their corresponding evaluation value on the model will be judged. "3.2.6 [Measurement (Search)]" (→pg.14)
Output parameter	This item can be changed if necessary. Usually, the factory default value can be used. Use the Output parameter to specify how to treat the coordinate. "3.2.7 [Output Parameter (Search)]" (→pg.16)

3.2.1 Setting up [Search]

Set up search according to the following flow.



POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 In the Edit Flow window, tap [Search].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 The window opens with [Model] selected, so that you register the model as a pattern characteristic of the measurement object.

"3.2.2 [Model (Search)]" (→pg.3)

3 In the "Item tab" area, tap [Region setting] and specify the measurement region.

"3.2.3 [Region Setting (Search)]" (→pg.10)

4 In the "Item tab" area, tap [Measurement] and specify the judgement condition for OK.

"3.2.6 [Measurement (Search)]" (→pg.14)

Important

- After setting up the measurement, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement parameters, too.

5 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

6 Perform measurement test.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

7 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

When NG is displayed, please verify measurement results and make Adjust if necessary.

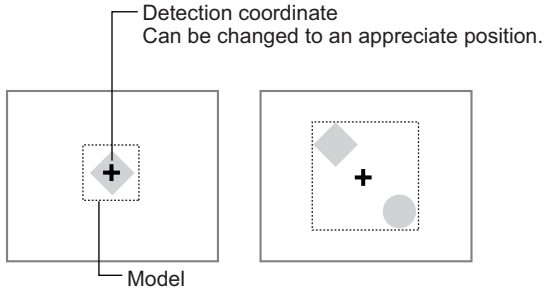
"3.2.8 Points on Measurement Test and Adjustment (Search)" (→pg.17)

3.2.2 [Model (Search)]

Register the Feature images of the measurement object as a model.

Important

- When a model is registered, the central coordinates of the model are registered as the detection coordinates (if multiple figures are combined, the central coordinates of the circumscribed rectangle are registered). For this, ensure the position of the measurement object to be correct when registering a model.



1 In the "Item tab" area, tap [Model].

When setting a new model, you do not have to tap [Model].

2 If necessary, set up the "Model parameter" area.

" Changing [Model Parameter]" (→pg.5)

3 Specify a region to be registered as a model by using one of the Drawing tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"

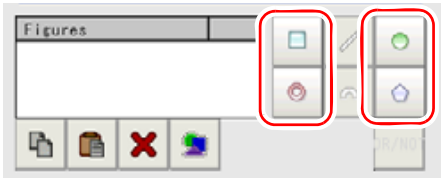


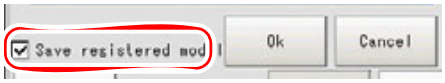
Table: Drawing Tools Available for Model (Search)

Drawing Objects	Drawing Tools
Rectangle	
Circle	
Circumference	
Polygon	

POINT

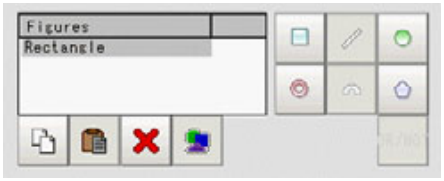
- If the model is an ellipse, its circumscribed rectangle is displayed as the search result of the model.

4 To save the registered model image, check the [Save registered model] option.



5 Tap [OK].

The model is registered.



POINT

- If you want to change only the detection coordinate after registering the model, set up [Detection point].
  "3.2.4 [Detection point (Search)]" (→pg.11)
- 'Registered model image' refers to the image saved when a model is registered. Saving a registered model image allows you to modify model parameters using that registered model image even when the actual measurement object is not present. Note that the scene data size increases when a registered model image is saved.

For the following operations, see "3.2.1 Setting up [Search]" (→pg.2)

Changing [Model Parameter]

This item can be changed if necessary. Usually, the factory default value can be used.
When any settings have been changed, verify whether measurements can be performed correctly through actual measurement.

POINT

- For search operations, see "4.6.2 Configuring Search" (→pg.39), of "User's Manual".

1 In the "Model parameter" area, select the search detection method and specify a value for each item.

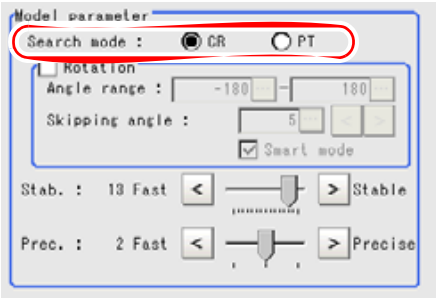


Table: Model - Model Parameter

Setting Item	Set Value [Factory Default]	Description
Search mode	[CR]	This search mode detects areas with a high degree of correlation between the registered model image and the input image.
	PT	This search mode detects areas with a high degree of shape similarity between the registered model image and the input image. It is available only when 3 Mega pixel color camera is connected. "4.6.2 Configuring Search" (→pg.39), of "User's Manual"

When "CR" is selected:

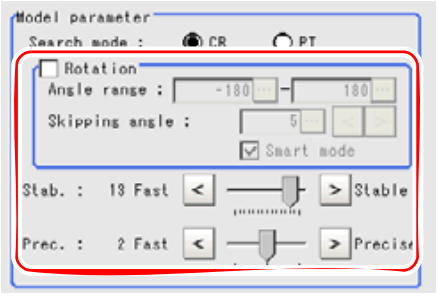


Table: Model - Model Parameter - CR

Setting Item	Set Value [Factory Default]	Description
Rotation	・Checked ・[Unchecked]	Specify whether to rotate the image during a search.

Table: Model - Model Parameter - CR

Setting Item		Set Value [Factory Default]	Description
Angle range	Upper	-180 to [180]	Specify the upper and lower limit values for [Angle range] (rotation angle) during a search. The normal direction is clockwise. Settings must satisfy: lower limit ≦ upper limit.
	Lower	[-180] to 180	
Skipping angle		1 to 30 [5]	Specify the stepping angle (in degrees) by which the model is rotated to create rotated models. A smaller angle increases stability, but slows down the processing.
Smart mode		・[Checked] ・Unchecked	Specify whether or not to enable Smart mode. Checking the [Smart mode] option enables a high-speed rotation search. The stability may be lowered when the model shape aspect ratio is large or when the NOT mask is used.
Stab. (Stability)		1 to 15 [9] (for cameras with more than 640 by 480 pixels) [12] (for cameras with 640 by 480 pixels or less)	Specify the stability of detection. A larger value increases stability. A smaller value speeds up processing. If lowering stability leads to slower processing, it is likely that many candidates have been detected. In this case, specify a larger value for [Candidate LV] or [Stab.].
Prec. (Precision)		1 to 3 [2]	Specify the position precision of the measurement coordinates. A larger value increases precision, and a smaller value speeds up processing.

1. If necessary, check "Rotation" and specify a value for each rotation item.
   For "Angle range" and "Skipping angle", tap [...] and specify a range of the rotation angle.
   How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"
   The "Skipping angle" value can be adjusted by tapping [<] or [>].
2. The values for "Stab." and "Prec." can be specified by dragging the slider.
   The value can also be adjusted by tapping the buttons at both ends of the slider.

When "PT" is selected:

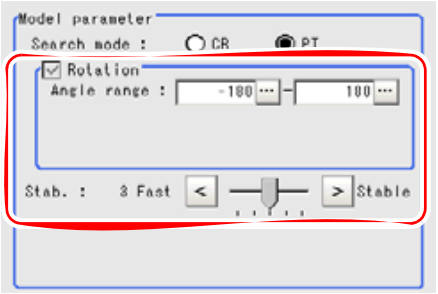


Table: Model - Model Parameter - PT

Setting Item			Set Value [Factory Default]	Description
Rotation			・[Checked]	When "PT" is selected for "Search mode", search cannot be performed without rotation.
	Angle range	Upper	-180 to [180]	Specify the upper and lower limit values for "Angle range" (rotation angle) during a search. The normal direction is clockwise. Settings must satisfy: lower limit ≦ upper limit.
		Lower	[-180] to 180	
Stab. (Stability)			1 to 5 [3]	Specify the stability of detection. A larger value increases stability, and a smaller value speeds up processing. If lowering stability leads to slower processing, it is likely that many candidates have been detected. In this case, specify a larger value for "Candidate LV" or "Stab.".

1. If necessary, specify a value for each item.
   Tap [...] for "Angle range" and specify the range of the rotation angle.
   How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"
2. The value for "Stab." can be specified by dragging the slider.
   The value can also be adjusted by tapping the buttons at both ends of the slider.

Points on Adjustment

To improve measurement results, make adjustments as described below.
For adjustments, see also "5.4 Points on Adjustment" (→pg.11), of "User's Manual".

When measurement results are unstable

- If the model image consists of detailed figures, specify a larger value for "Stab.".
- If images that should be judged OK based on the model image vary in some degree, specify a smaller value for "Candidate LV".
- If the measurement results are unstable only when "Rotation" is selected, specify a smaller value for "Skipping angle".
- When "Rotation" is selected, if the model region shape is complex, uncheck the "Smart mode" option.

When the processing speed is slow

- If the model image is a simple figure or a large figure, specify a smaller value for "Stab.".

- If images that should be judged OK based on the model image, have less variation, specify a larger value for "Candidate LV".
- When "Rotation" is selected, if the model image is a simple figure, specify a larger value for "Skipping angle".
- When "Rotation" is selected, if the model region shape is simple, check the "Smart mode" option.

For other adjustment methods, see " Shortening Measurement Time by Setting Processing Item" (→pg.11), of "User's Manual".

Displaying a Model

Display a registered model in the "Image display" area.

1 In the "Registered model image" area, tap [Disp model].

The registered model image is displayed in the "Image display" area.

2 In the "Registered model image" area, tap [Input image].

The previous input image is re-displayed in the "Image display" area.

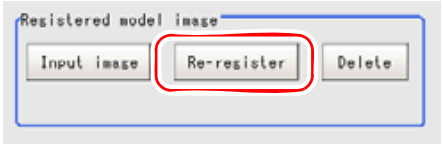
Re-registering a Model

When model parameters are modified, re-register the model.

1 In the "Registered model image" area, tap [Disp model].

The registered model image is displayed in the "Image display" area.

2 In the "Registered model image" area, tap [Re-register].



The model is re-registered using the modified model parameters.

Deleting the Registered Model Image

To delete the registered model image:

1 In the "Registered model image" area, tap [Delete].

A confirmation message appears.

2 Tap [Yes].

The registered model image is deleted.

3.2.3 [Region Setting (Search)]

Use a rectangle to specify a measurement region for [Search].

1 In the "Item tab" area, tap [Region setting].

2 Tap [Edit].

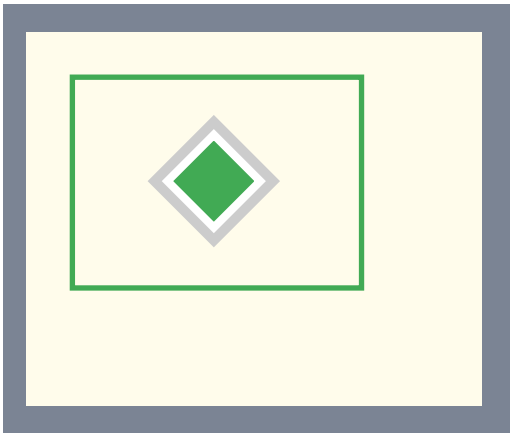
The "Figure setting" area is displayed.

3 Specify a region where the model is searched by using the Drawing tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"

4 In the "Figure setting" area, tap [OK].

The measurement range is registered and displayed in the "Image display" area.



For the subsequent operations, see "3.2.1 Setting up [Search]" (→pg.2).

3.2.4 [Detection point (Search)]

This item can be changed if necessary. When a model is registered, its detection coordinates are automatically set to the central coordinates of the model. This item can be used to change the detection coordinates to any desired position.

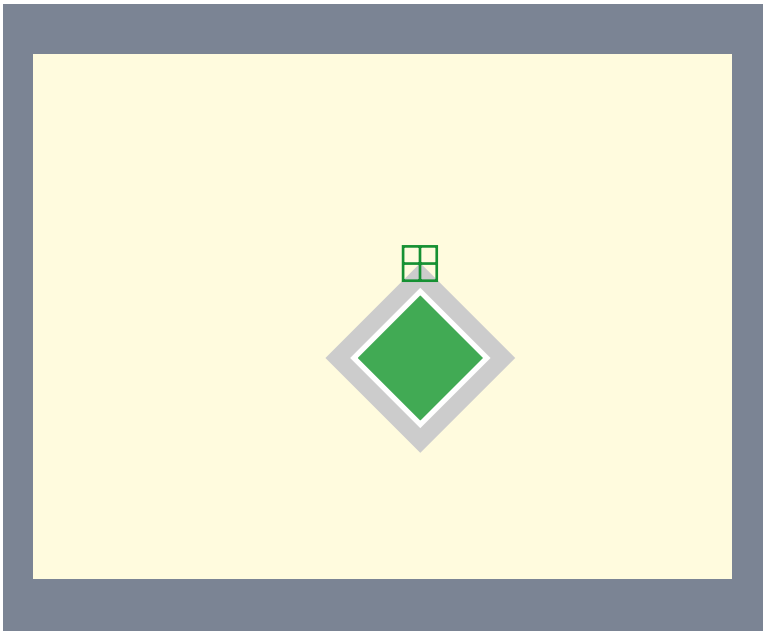
For the detection point, see "11.4 Terminology" (→pg.12), of "User's Manual".

POINT

- After changing the detection coordinates to another position, re-registering the model will change it back to the central coordinates of the model.

1 In the "Item tab" area, tap [Detection point].

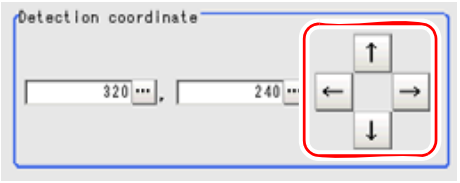
In the "Image display" area, the current detection point is displayed with a cross-shaped cursor.



2 Change the detection coordinates.

Using arrow buttons to change the detection point coordinates:

In the "Detection coordinate" area, tap one of the arrow buttons.



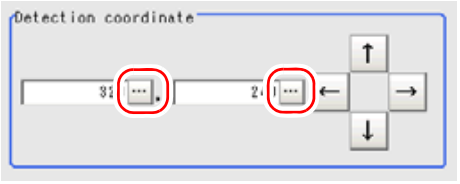
In the "Image display" area, the cross-shaped cursor will move one pixel per tap.

The X and Y coordinate values in the "Detection coordinate" area will also change as the cross-shaped cursor moves.

Specifying values to change the detection point coordinates:

In the "Detection coordinate" area, tap [...] for each of [X] and [Y] to specify a value for your desired detection coordinates.

How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"



The cross-shaped cursor in the "Image display" area will move to the specified coordinate position.

POINT

Tips for position adjustment

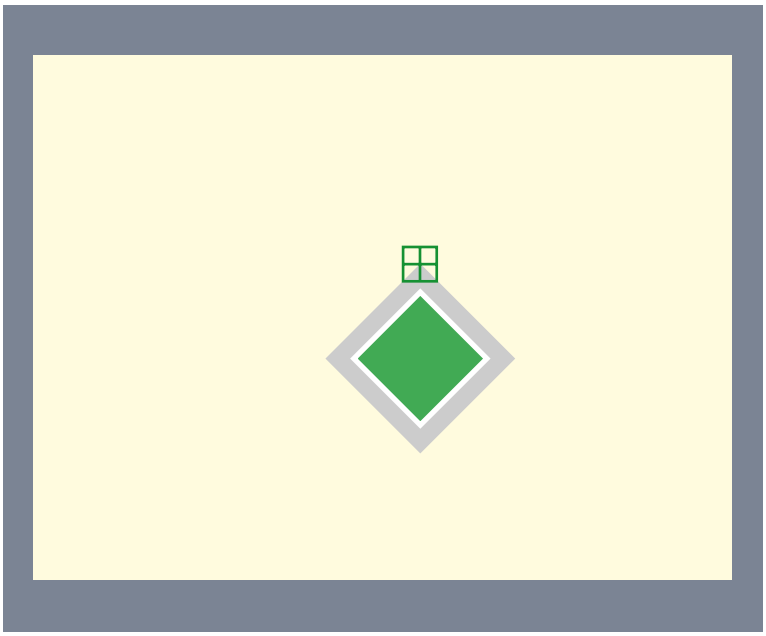
- You can easily specify the detection point if you first input approximate coordinate values and then adjust them using arrow buttons in the "Detection coordinate" area. The Zoom function is useful for fine adjustment.
  For the Zoom function, see "1.8 Using Zoom Function" (→pg.24), of "User's Manual".

3.2.5 [Reference Position (Search)]

This item can be changed if necessary. The reference position is automatically set at the same time the measurement region is specified. This item can be used to change the reference position to any desired position.
For the reference position, see "11.4 Terminology" (→pg.12), of "User's Manual".

1 In the "Item tab" area, tap [Reference position].

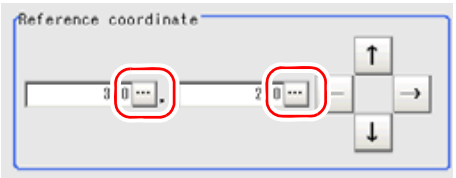
In the "Image display" area, the current reference position is displayed with a cross-shaped cursor.



2 Change the reference position.

In the "Reference coordinate" area, tap [...] for each item and specify values for your desired reference coordinates (the coordinates of the reference position).

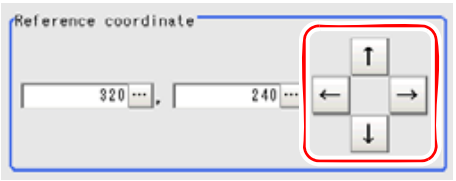
How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"



The cross-shaped cursor in the "Image display" area will move to the specified coordinate position.

Using arrow buttons to change the coordinate position:

In the "Reference coordinate" area, tap one of the arrow buttons.

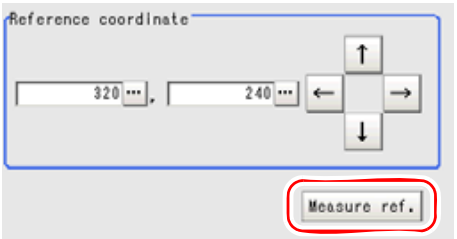


In the "Image display" area, the cross-shaped cursor will move one pixel per tap.

In the "Reference coordinate" area, the reference coordinate values (X, Y) will also change as the cross-shaped cursor moves.

Changing the reference position by measurement:

While the image to be measured is displayed, tap [Measure ref.].



The measurement coordinates are re-calculated and reflected in "Reference coordinate" of the "Reference coordinate" area.

POINT

Tips for position adjustment

- You can easily specify the reference position if you first input approximate coordinate values and then adjust them using arrow buttons in the "Reference coordinate" area. The Zoom function is useful for fine adjustment.
  For the Zoom function, see "1.8 Using Zoom Function" (→pg.24), of "User's Manual".

3.2.6 [Measurement (Search)]

Specify the judgement condition for measurement results. Specify the criteria to judge the measurement result if its X and Y coordinates and its correlation with the model are OK.

1 In the "Item tab" area, tap [Measurement].

2 In the "Measurement condition" area, specify a value for each item.

Tap [...] for "Candidate LV", and specify a value. The value can also be adjusted by tapping [<] and [>].

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

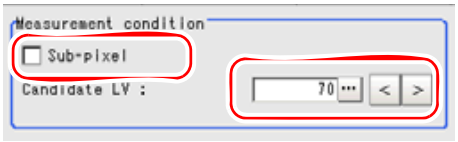


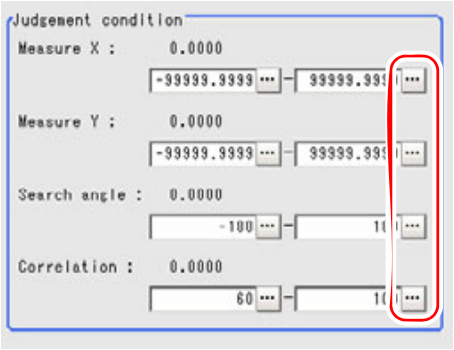
Table: Measurement (Search)

Setting Item	Set Value [Factory Default]	Description
Sub-pixel	・Checked ・[Unchecked]	Specify whether or not to perform measurement with sub-pixel interpolation. Sub-pixel processing achieves higher accuracy, but slows down measurement processing. For sub-pixels, see "11.4 Terminology" (→pg.12), of "User's Manual".
Candidate LV	0 to 100 [70]	Specify the threshold value with which to detect candidate points in a rough search. Specify a smaller value when model search results are unstable.

3 When the setting has been changed, tap [Measure] in the "Detail" area to verify whether measurements can be made correctly.

4 In the "Judgement condition" area, tap [...] and input a value for each item.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"



POINT

- The values displayed in the individual fields are the measurement results of the displayed image. Take these values into consideration to determine the upper and lower limit values.

Table: Measurement (Search) - Judgement Condition

Setting Item		Set Value [Factory Default]	Description
Measured coordinate X	Upper	-99999.9999 to [99999.9999]	Specify the range of X-axis shifting that is judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Measured coordinate Y	Upper	-99999.9999 to [99999.9999]	Specify the range of Y-axis shifting that is judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Angle	Upper	-180 to [180]	Specify the range of angles that are judged to be OK.
	Lower	[-180] to 180	
Correlation[Note 1]	Upper	0 to [100]	Specify the range of correlation values that are judged to be OK.
	Lower	0 to 100 [60]	

[Note 1]: When the Correlation value of the measurement result is 0, the judgement result will be NG regardless of the Measurement settings.

For the following operations, see "3.2.1 Setting up [Search]" (→pg.2)

3.2.7 [Output Parameter (Search)]

Select options for the measured results, namely the coordinates, which are output to the external devices.

Important

- After setting up the measurement, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

1 In the "Item tab" area, tap [Output parameter].

2 Specify a value for each item.

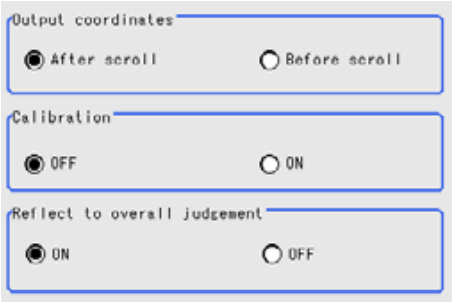


Table: Setting Values for Output Parameter

Setting Options	Set Value [Factory defaults]	Description
Output coordinate	・[After scroll] ・Before scroll	Select whether to output measurement results to external devices before or after the position deflection correction is applied.
Calibration	・[OFF] ・ON	Select whether to output measurement results to external devices by converting them into the coordinates with actual size (calibration: ON) or into the coordinates of camera image (calibration: OFF).
Reflect to overall judgement	・[ON] ・OFF	Select whether to reflect the judgement result of this processing unit to the overall judgement of the scene. ・Selecting "ON" reflects the judgement result of this processing unit on the overall judgement of the scene. ・Selecting "OFF" does not reflect the judgement result of this processing unit on the overall judgement of the scene.

POINT

- For output coordinates and calibration, see "4.6.5 Configuring Coordinates" (→pg.45), of "User's Manual".
- The overall judgement result of the scene is output to the OR signal to be sent via the parallel interface. Also, it is displayed in the "Measurement information display" area in the upper part of the Main screen.
  "10.4.4 Time Chart" (→pg.35), of "User's Manual"
  "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"

3.2.8 Points on Measurement Test and Adjustment (Search)

In addition to the camera-input image, the registered model and the detection coordinates (the cross-shaped cursor) will also be displayed in the "Image display" area.

In the "Detail result" area on the Main screen, you can confirm the following contents in text.
"6.3.2 Displaying Flow and Detail Result" (→pg.12), of "User's Manual"

Table: Text Displayed (Search)

Item	Description
Judge	Judgement result
Correlation	Correlation
Measure X	X coordinate of the position where the model is detected
Measure Y	Y coordinate of the position where the model is detected
Correlation	Angle of the position where the model is detected

Points on Adjustment

Please choose your Adjust methods as follows.

When search fails (searching other positions)

To improve the search accuracy, the following Adjust should be made to measurement parameters.

- Specify a larger value for [Prec.].
  " Changing [Model Parameter]" (→pg.5)
- Check the "Sub-pixel" option.
  "3.2.6 [Measurement (Search)]" (→pg.14)

When the processing speed is slower

- Reduce the measurement region size in [Region Setting].
  "3.2.3 [Region Setting (Search)]" (→pg.10)
- Reduce the region registered in the model in [Model].
  "3.2.2 [Model (Search)]" (→pg.3)

In addition, adjust other options in the "Model parameter" area of [Model].
" Points on Adjustment" (→pg.8)

When the judgement is NG (insufficient memory)

- Reduce the measurement region size in [Region Setting].
  "3.2.3 [Region Setting (Search)]" (→pg.10)

Reduce the amount of information necessary for measurements by making the following adjustment in the "Model parameter" area of [Model].

- Set "Stab." or "Skipping angle" to a value closer to the factory default.
- Specify a smaller value for "Prec.".
  " Changing [Model Parameter]" (→pg.5)

POINT

- If lowering "Stab." leads to slower processing, it is likely that many candidates have been detected. In this case, specify a larger value for "Candidate LV" or "Stab.".

3.2.9 When Using Measurement Results Externally (Search)

Value Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (Search)

Measurement items	Character string	Description
Judgement result	JG	Judgement result
Correlation	CR	Correlation related with models
Measure X	X	The X Coordinate that is used to find the position of the model
Measure Y	Y	The Y Coordinate that is used to find the position of the model
Angle	TH	The Angle that is used to find the position of the model
Reference coordinate X	SX	The X Coordinate of the reference of a registered model
Reference coordinate Y	SY	The Y Coordinate of the reference of a registered model
Reference angle	ST	Angle when registering models
Detection point RX	RX	X coordinate of the registered model
Detection point RY	RY	Y coordinate of the registered model

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in the "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Search)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Correlation	Get only	0 to 100
6	Measured coordinate X	Get only	-99999.9999 to 99999.9999
7	Measured coordinate Y	Get only	-99999.9999 to 99999.9999
8	Angle	Get only	-180 to 180
9	Reference coordinate X	Get only	-99999.9999 to 99999.9999
10	Reference coordinate Y	Get only	-99999.9999 to 99999.9999
11	Reference angle	Get only	-180 to 180
12	Detection coordinate X	Get only	-99999.9999 to 99999.9999

Table: External Reference List (Search)

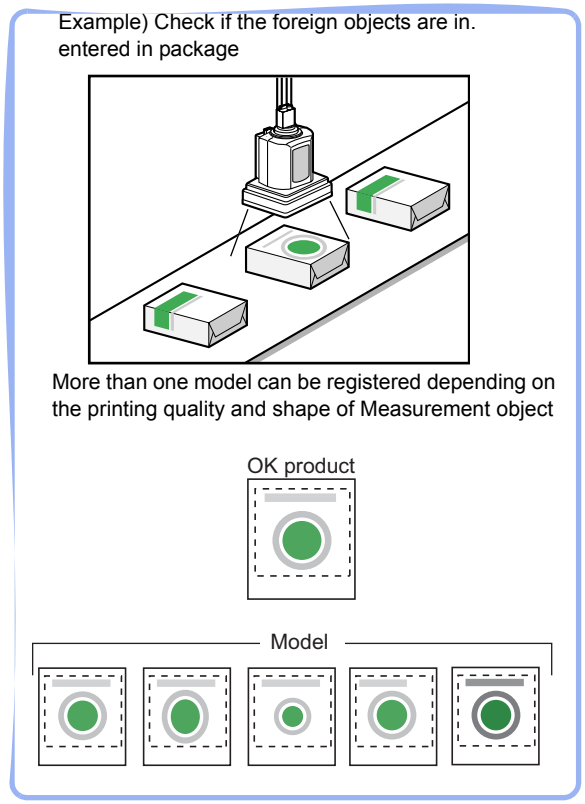
No.	Data Name	Set/Get	Data Range
13	Detection coordinate Y	Get only	-99999.9999 to 99999.9999
101	Output coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect in OR	Set/Get	0: ON 1: OFF
120	Search mode	Set/Get	0: CR 1: PT
121	Rotation	Set/Get	0: OFF 1: ON
122	Upper limit of the angle	Set/Get	-180 to 180
123	Lower limit of the angle	Set/Get	-180 to 180
124	Skipping angle	Set/Get	1 to 30
125	Smart mode	Set/Get	0: OFF 1: ON
126	Stab. (CR)	Set/Get	1 to 15
127	Prec. (Precision)	Set/Get	1 to 3
128	Stab. (PT)	Set/Get	1 to 5
129	Reference coordinate X	Set/Get	0 to 99999.9999
130	Reference coordinate Y	Set/Get	0 to 99999.9999
132	Detection point X	Set/Get	0 to 99999.9999
133	Detection point Y	Set/Get	0 to 99999.9999
134	Sub-pixel	Set/Get	0: OFF 1: ON
135	Candidate LV	Set/Get	0 to 100
136	Upper limit of Position X	Set/Get	-99999.9999 to 99999.9999
137	Lower limit of Position X	Set/Get	-99999.9999 to 99999.9999
138	Upper limit of Position Y	Set/Get	-99999.9999 to 99999.9999
139	Lower limit of Position Y	Set/Get	-99999.9999 to 99999.9999
140	Upper limit of the angle	Set/Get	-180 to 180
141	Lower limit of the angle	Set/Get	-180 to 180
142	Upper limit of the correlation	Set/Get	0 to 100
143	Lower limit of the correlation	Set/Get	0 to 100
144	Save registered model	Set/Get	0: OFF 1: ON

3.3 Flexible Search

Register the multiples features(model) of a measurement object in advance. Find the parts that are most similar with the multiple models from the input image, and measure the correlation (similarity) and position.

Used for the following case

- When identifying the shape of the measurement objects with deviation



List of Flexible Search Items

Flexible Search items are explained below.

Table: List of Flexible Search Items

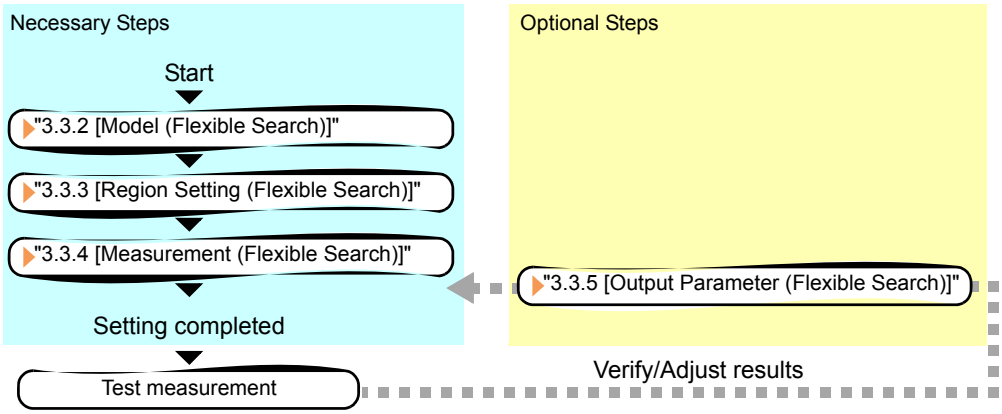
Item Name	Description
Model	This item registers the feature images as a model. Model parameter values can be changed as needed to address unstable measurement results or to improve the processing speed. Usually, the factory default value can be used. "3.3.2 [Model (Flexible Search)]" (→pg.3)

Table: List of Flexible Search Items

Item Name	Description
Region setting	This item specifies the measurement region. Input images can also be entirely measurement. Limiting the measurement region may allow a fast and reliable processing. "3.3.3 [Region Setting (Flexible Search)]" (→pg.9)
Measurement	This item specifies the judgement condition for measurement results. Specify the criteria to judge the measurement result if its X and Y coordinates and its correlation with the model are OK. "3.3.4 [Measurement (Flexible Search)]" (→pg.10)
Output parameter	This item can be changed if necessary. Usually, the factory default value can be used. Use the Output parameter to specify how to treat the coordinate. "3.3.5 [Output Parameter (Flexible Search)]" (→pg.12)

3.3.1 Setting up [Flexible Search]

Set up flexible search according to the following steps.



POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 In the Edit Flow window, tap [Flexible search].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area, tap [Model] to register patterns characteristic of the measurement object as a model.

"3.3.2 [Model (Flexible Search)]" (→pg.3)

3 In the "Item tab" area, tap [Region setting] and specify the measurement region.

"3.3.3 [Region Setting (Flexible Search)]" (→pg.9)

4 In the "Item tab" area, tap [Measurement] and specify the judgement condition for OK.

"3.3.4 [Measurement (Flexible Search)]" (→pg.10)

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement parameters, too.

5 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

6 Perform a measurement test.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

7 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

When NG is displayed, please verify measurement results and make Adjust if necessary.

"3.3.6 Points on Measurement Test and Adjustment (Flexible search)" (→pg.13)

3.3.2 [Model (Flexible Search)]

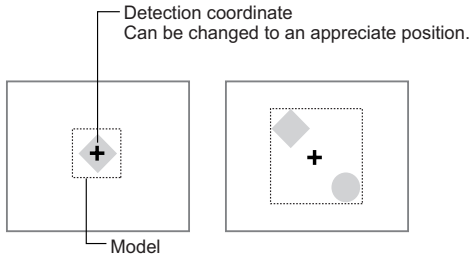
Register the parts to measure as the model.

Total 5 types of models ranging 0 to 4 can be registered, with no restriction on the size.

If the model is different in the case of quality and shape, please register more than one model.

Important

- When a model is registered, the central coordinates of the model are registered as the detection coordinates (if multiple figures are combined, the central coordinates of the circumscribed rectangle are registered). For this, ensure the position of the measurement object to be correct when registering a model.

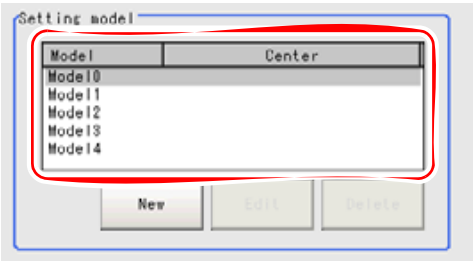


1 In the "Item tab" area, tap [Model].

2 If necessary, set up the "Model parameter" area.

" Changing [Model Parameter]" (→pg.5)

3 In the "Setting model" area, select a model and tap [New].



The "Detail" area for model registration is displayed.

4 Specify a region to be registered as a model by using one of the Drawing tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"

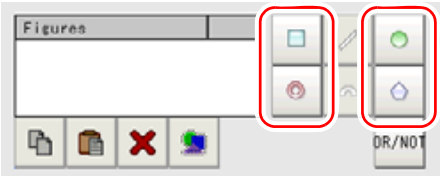


Table: Drawing Tools Available for Models (Flexible Search)

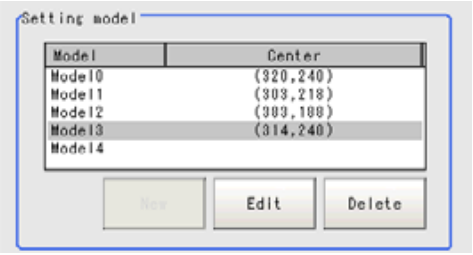
Drawing objects	Drawing Tools
Rectangle	
Circle	
Circumference	
Polygon	

POINT

- If the model is an ellipse, its circumscribed rectangle is displayed as the search result of the model.

5 In the "Figure setting" area, tap [OK].

The model is registered and the model's central X and Y coordinate values are displayed in the "Setting model" area.



The image specified for the model is displayed in the "Image display" area.

6 To register two or more models, repeat the Steps 3 to 5.

Changing [Model Parameter]

This item can be changed if necessary. Usually, the factory default value can be used.
When any settings have been changed, verify whether measurements can be performed correctly through actual measurement.

POINT

- For search operations, see "4.6.2 Configuring Search" (→pg.39), of "User's Manual".

1 In the "Model parameter" area, select the search detection method and specify a value for each item.

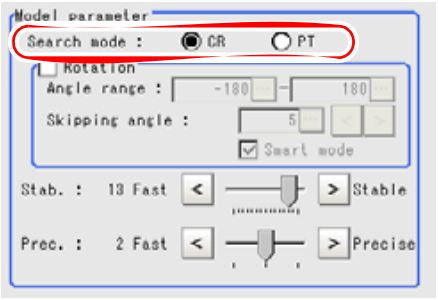


Table: Model - Model Parameter

Setting Item	Set Value [Factory Default]	Description
Search mode	[CR]	This search mode detects areas with a high degree of correlation between the registered model image and the input image.
	PT	This search mode detects areas with a high degree of shape similarity between the registered model image and the input image. It is available only when 3 Mega pixel color camera is connected. "4.6.2 Configuring Search" (→pg.39), of "User's Manual"

When "CR" is selected:

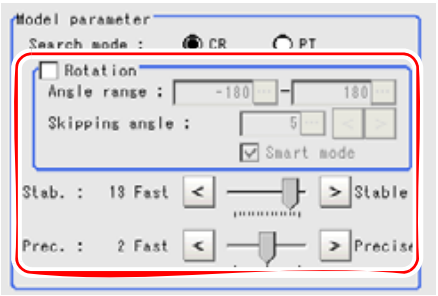


Table: Model - Model Parameter - CR

Setting Item	Set Value [Factory Default]	Description
Rotation	・Checked ・[Unchecked]	Specify whether to rotate the image during a search.

Table: Model - Model Parameter - CR

Setting Item		Set Value [Factory Default]	Description
Angle range	Upper	-180 to [180]	Specify the upper and lower limit values for [Angle range] (rotation angle) during a search. The normal direction is clockwise. Settings must satisfy: lower limit ≦ upper limit.
	Lower	[-180] to 180	
Skipping angle		1 to 30 [5]	Specify the stepping angle (in degrees) by which the model is rotated to create rotated models. A smaller angle increases stability, but slows down the processing.
Smart mode		・[Checked] ・Unchecked	Specify whether or not to enable Smart mode. Checking the [Smart mode] option enables a high-speed rotation search. The stability may be lowered when the model shape aspect ratio is large or when the NOT mask is used.
Stab. (Stability)		1 to 15 [9] (for cameras with more than 640 by 480 pixels) [12] (for cameras with 640 by 480 pixels or less)	Specify the stability of detection. A larger value increases stability. A smaller value speeds up processing. If lowering stability leads to slower processing, it is likely that many candidates have been detected. In this case, specify a larger value for [Candidate LV] or [Stab.].
Prec. (Precision)		1 to 3 [2]	Specify the position precision of the measurement coordinates. A larger value increases precision, and a smaller value speeds up processing.

1. If necessary, check "Rotation" and specify a value for each rotation item.
   For "Angle range" and "Skipping angle", tap [...] and specify a range of the rotation angle.
   How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"
   The "Skipping angle" value can be adjusted by tapping [<] or [>].
2. The values for "Stab." and "Prec." can be specified by dragging the slider.
   The value can also be adjusted by tapping the buttons at both ends of the slider.

When "PT" is selected:

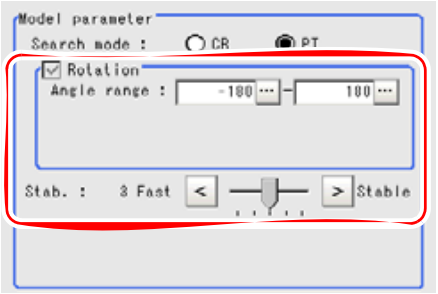


Table: Model - Model Parameter - PT

Setting Item			Set Value [Factory Default]	Description
Rotation			・[Checked]	When "PT" is selected for "Search mode", search cannot be performed without rotation.
	Angle range	Upper	-180 to [180]	Specify the upper and lower limit values for "Angle range" (rotation angle) during a search. The normal direction is clockwise. Settings must satisfy: lower limit ≦ upper limit.
		Lower	[-180] to 180	
Stab. (Stability)			1 to 5 [3]	Specify the stability of detection. A larger value increases stability, and a smaller value speeds up processing. If lowering stability leads to slower processing, it is likely that many candidates have been detected. In this case, specify a larger value for "Candidate LV" or "Stab.".

1. If necessary, specify a value for each item.
   Tap [...] for "Angle range" and specify the range of the rotation angle.
   How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"
2. The value for "Stab." can be specified by dragging the slider.
   The value can also be adjusted by tapping the buttons at both ends of the slider.

Points on Adjustment

To improve measurement results, make adjustments as described below.
For adjustments, see also "5.4 Points on Adjustment" (→pg.11), of "User's Manual".

When measurement results are unstable

- If the model image consists of detailed figures, specify a larger value for "Stab.".
- If images that should be judged OK based on the model image vary in some degree, specify a smaller value for "Candidate LV".
- If the measurement results are unstable only when "Rotation" is selected, specify a smaller value for "Skipping angle".
- When "Rotation" is selected, if the model region shape is complex, uncheck the "Smart mode" option.

When the processing speed is slow

- If the model image is a simple figure or a large figure, specify a smaller value for "Stab.".

- If images that should be judged OK based on the model image, have less variation, specify a larger value for "Candidate LV".
- When "Rotation" is selected, if the model image is a simple figure, specify a larger value for "Skipping angle".
- When "Rotation" is selected, if the model region shape is simple, check the "Smart mode" option.

For other adjustment methods, see " Shortening Measurement Time by Setting Processing Item" (→pg.11), of "User's Manual".

For the following operations, see "3.3.1 Setting up [Flexible Search]" (→pg.2).

3.3.3 [Region Setting (Flexible Search)]

Use a rectangle to specify a measurement region for [Flexible Search].

POINT

- For information about the search processing, see "4.6.2 Configuring Search" (→pg.39), of "User's Manual".

1 In the "Item tab" area, tap [Region setting].

2 Tap [Edit].

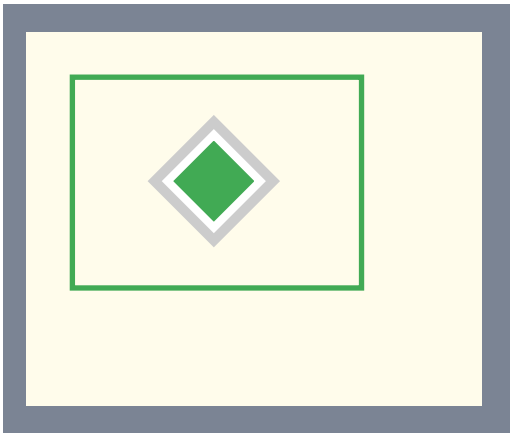
The "Figure setting" area is displayed.

3 Specify a region where the model is searched by using the Drawing tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"

4 In the "Figure setting" area, tap [OK].

The measurement range is registered and displayed in the "Image display" area.



For the following operations, see "3.3.1 Setting up [Flexible Search]" (→pg.2).

3.3.4 [Measurement (Flexible Search)]

Specify the judgement condition for measurement results. Specify the criteria to judge the measurement result if its X and Y coordinates and its correlation with the model are OK.

1 In the "Item tab" area, tap [Measurement].

2 In the "Measurement condition" area, specify a value for each item.

Tap [...] for "Candidate LV", and specify a value. The value can also be adjusted by tapping [<] and [>].

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

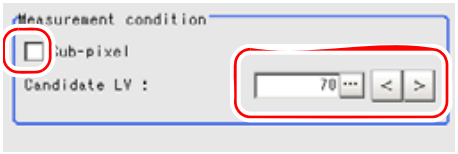


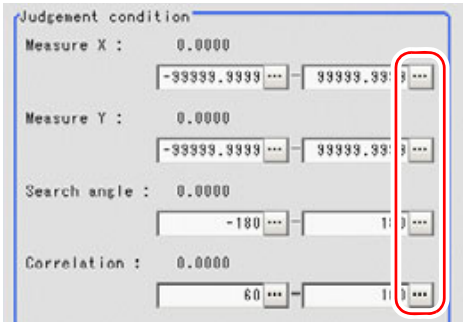
Table: Measurement (Flexible Search)

Setting Item	Set Value [Factory Default]	Description
Sub-pixel	・Checked ・[Unchecked]	Specify whether or not to perform measurement with sub-pixel interpolation. Sub-pixel processing achieves higher accuracy, but slows down measurement processing. For sub-pixels, see "11.4 Terminology" (→pg.12), of "User's Manual".
Candidate LV	0 to 100 [70]	Specify the threshold value with which to detect candidate points in a rough search. Specify a smaller value when model search results are unstable.

3 When the setting has been changed, tap [Measure] in the "Detail" area to verify whether measurements can be made correctly.

4 In the "Judgement condition" area, tap [...] and input a value for each item.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual".



POINT

- The values displayed in the individual fields are the measurement results of the displayed image. Take these values into consideration to determine the upper and lower limit values.

Table: Measurement (Flexible Search) - Judgement Condition

Setting Item		Set Value [Factory Default]	Description
Measured coordinate X	Upper	-99999.9999 to [99999.9999]	Specify the range of X-axis shifting that is judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Measured coordinate Y	Upper	-99999.9999 to [99999.9999]	Specify the range of Y-axis shifting that is judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Angle	Upper	-180 to [180]	Specify the range of angles that are judged to be OK.
	Lower	[-180] to 180	
Correlation[Note 1]	Upper	0 to [100]	Specify the range of correlation values that are judged to be OK.
	Lower	0 to 100 [60]	

[Note 1]: When the correlation value of the measurement result is 0, the judgement result will be NG regardless of the measurement settings.

For the subsequent operations, see "3.3.1 Setting up [Flexible Search]" (→pg.2).

3.3.5 [Output Parameter (Flexible Search)]

Select options for the measured results, namely the coordinates, which are output to the external devices.

Important

- After setting up the measurement, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

1 In the "Item tab" area, tap [Output parameter].

2 Specify a value for each item.

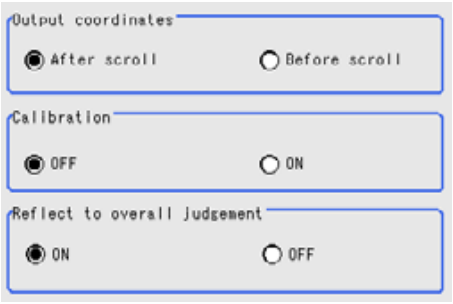


Table: Setting Values for Output Parameter

Setting Options	Set Value [Factory defaults]	Description
Output coordinate	・[After scroll] ・Before scroll	Select whether to output measurement results to external devices before or after the position deflection correction is applied.
Calibration	・[OFF] ・ON	Select whether to output measurement results to external devices by converting them into the coordinates with actual size (calibration: ON) or into the coordinates of camera image (calibration: OFF).
Reflect to overall judgement	・[ON] ・OFF	Select whether to reflect the judgement result of this processing unit to the overall judgement of the scene. ・Selecting "ON" reflects the judgement result of this processing unit on the overall judgement of the scene. ・Selecting "OFF" does not reflect the judgement result of this processing unit on the overall judgement of the scene.

POINT

- For output coordinates and calibration, see "4.6.5 Configuring Coordinates" (→pg.45), of "User's Manual".
- The overall judgement result of the scene is output to the OR signal to be sent via the parallel interface. Also, it is displayed in the "Measurement information display" area in the upper part of the Main screen.
  "10.4.4 Time Chart" (→pg.35), of "User's Manual"
  "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"

For the subsequent operations, see "3.3.1 Setting up [Flexible Search]" (→pg.2).

3.3.6 Points on Measurement Test and Adjustment (Flexible search)

In addition to the camera image, the model and the search coordinates (the cross-shaped cursor) will also be displayed in the "Image display" area.

In the "Detail result" area on the Main screen, you can confirm the following contents in text.

"6.3.2 Displaying Flow and Detail Result" (→pg.12), of "User's Manual"

Table: Text Displayed (Flexible Search)

Item	Description
Judge	Judgement result
Model No.	Model No. with the largest correlation value
Correlation	Correlation
Measured coordinate X	X coordinate of the position where the model is detected
Measured coordinate Y	Y coordinate of the position where the model is detected
Angle	Angle of the position where the model is detected

Points on Adjustment

Please choose your Adjust methods as follows.

When search fails (searching other positions)

To improve the search accuracy, the following Adjust should be made to [Measurement].

- Specify a larger value for "Prec.".
  " Changing [Model Parameter]" (→pg.5)
- Check the "Sub-pixel" option.
  "3.3.4 [Measurement (Flexible Search)]" (→pg.10)

When the processing speed is slower

- In [Region setting], reduce the measurement region and set up again.
  "3.3.3 [Region Setting (Flexible Search)]" (→pg.9)
- Reduce the region registered in the model in [Model registration].
  "3.3.2 [Model (Flexible Search)]" (→pg.3)

In addition, adjust other options in the "Model parameter" area of [Model].

" Points on Adjustment" (→pg.8)

When the judgement is NG (insufficient memory)

- Reduce the measurement region size in [Region Setting].
  "3.3.3 [Region Setting (Flexible Search)]" (→pg.9)

Reduce the amount of information necessary for measurements by making the following adjustment in the "Model parameter" area of [Model].

- Set "Stab." or "Skipping angle" to a value closer to the factory default.

- Specify a smaller value for "Prec.".
  " Changing [Model Parameter]" (→pg.5)

POINT

- If lowering "Stab." leads to slower processing, it is likely that many candidates have been detected. In this case, specify a larger value for "Candidate LV" or "Stab."

3.3.7 When Using measurement Results Externally (Flexible Search)

Value Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (Flexible Search)

Measurement items	Character string	Description
Judge	JG	Judgement result
Model No.	NO	Model No. of the biggest correlation
Correlation	CR	Correlation related with models
Position X	X	X coordinate that is used to find the position of the model
Position Y	Y	Y coordinate that is used to find the position of the model
Angle	TH	Angle that is used to find the position of the model
Reference X	SX	X coordinate of the reference of a registered model
Reference Y	SY	Y coordinate of the reference of a registered model
Reference angle	ST	Angle that is registered in the model
Detection point RX	RX	X coordinate of the registered model
Detection point RY	RY	Y coordinate of the registered model

External Reference List

The data types and their numbers that are available to refer from other processing units and external equipment are shown below. For the input method, see "Input Format" in "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Flexible Search)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG

Table: External Reference List (Flexible Search)

No.	Data Name	Set/Get	Data Range
5	Model No.	Get only	0 to 4
6	Correlation	Get only	0 to 100
7	Measured coordinate X	Get only	-99999.9999 to 99999.9999
8	Measured coordinate Y	Get only	-99999.9999 to 99999.9999
9	Angle	Get only	-180 to 180
10	Reference position X	Get only	-99999.9999 to 99999.9999
11	Reference position Y	Get only	-99999.9999 to 99999.9999
12	Reference angle	Get only	-180 to 180
13	Detection point X	Get only	-99999.9999 to 99999.9999
14	Detection point Y	Get only	-99999.9999 to 99999.9999
101	Output coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect in OR	Set/Get	0: ON, 1: OFF
120	Search mode	Set/Get	0: CR (Correlation) 1: PT (Pattern)
121	Rotation	Set/Get	0: OFF 1: ON
122	Upper limit of the angle	Set/Get	-180 to 180
123	Lower limit of the angle	Set/Get	-180 to 180
124	Skipping angle	Set/Get	1 to 30
125	Smart mode	Set/Get	0: OFF 1: ON
126	Stab. (CR)	Set/Get	1 to 15
127	Prec. (Precision)	Set/Get	1 to 3
128	Stab. (PT)	Set/Get	1 to 5
134	Sub-pixel	Set/Get	0: OFF 1: ON
135	Candidate LV	Set/Get	0 to 100
136	Upper limit of Position X	Set/Get	-99999.9999 to 99999.9999
137	Lower limit of Position X	Set/Get	-99999.9999 to 99999.9999
138	Upper limit of Position Y	Set/Get	-99999.9999 to 99999.9999
139	Lower limit of Position Y	Set/Get	-99999.9999 to 99999.9999
140	Upper limit of the angle	Set/Get	-180 to 180
141	Lower limit of the angle	Set/Get	-180 to 180

Table: External Reference List (Flexible Search)

No.	Data Name	Set/Get	Data Range
142	Upper limit of the correlation	Set/Get	0 to 100
143	Lower limit of the correlation	Set/Get	0 to 100

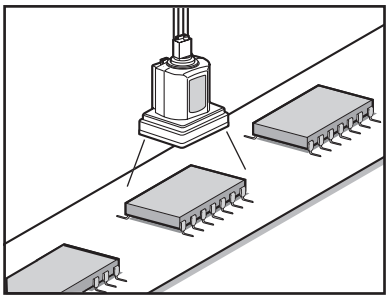
3.4 Edge Position

Detects the position of the measurement object according to the color change within in the measurement region.

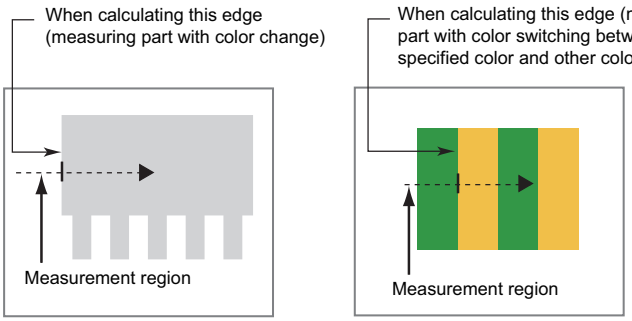
Used for the following case

- When calculating edge coordinates of measurement objects

Example) Dimension measurement of finished products



Searches edges by the color change in measurement region. Edge measurement can be enabled by specifying the color of measurement object.



- When calculating width of measurement objects
  With the expression, the width of the measurement object can be calculated based on the edge position difference of 2 points.

List of Edge Position Items

Edge position items are explained below.

Table: List of Edge Position Items

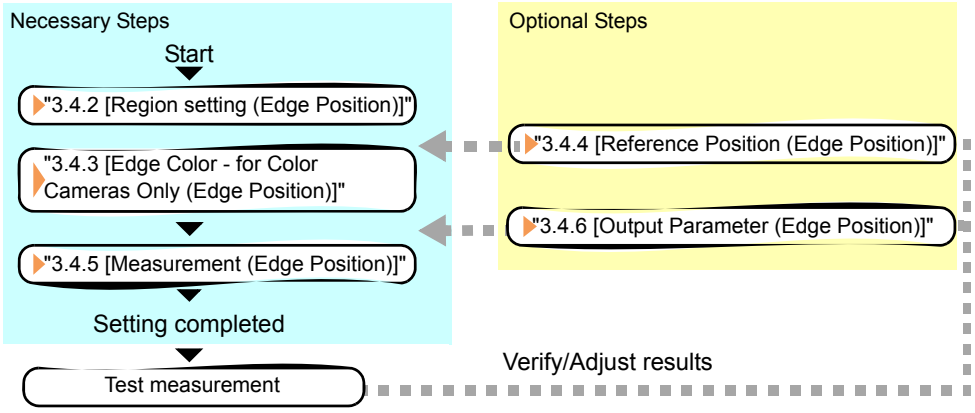
Menu Name	Description
Region setting	This item specifies the measurement region. "3.4.2 [Region setting (Edge Position)]" (→pg.3)

Table: List of Edge Position Items

Menu Name	Description
Edge color (for color cameras only)	This item specifies an edge color information to be detected. "3.4.3 [Edge Color - for Color Cameras Only (Edge Position)]" (→pg.5)
Reference position	This item can be changed if necessary. The edge position is registered, which is once measured when setting up the region. "3.4.4 [Reference Position (Edge Position)]" (→pg.7)
Measurement	This item specifies the judgement condition for measurement results. Measurement values can be changed as needed to address unstable measurement results. The displayed items are different depending on whether your camera is a color or monochrome camera. Normally the factory default value will be used. "3.4.5 [Measurement (Edge Position)]" (→pg.9)
Output parameter	This item can be changed if necessary. Usually, the factory default value can be used. Use the Output parameter to specify how to treat the coordinate. "3.4.6 [Output Parameter (Edge Position)]" (→pg.14)

3.4.1 Setting up [Edge Position]

Set up Edge position with the following steps.



POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 Tap [Edge position] in the Edit Flow window.

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area, tap [Region setting] and specify the measurement region.

"3.4.2 [Region setting (Edge Position)]" (→pg.3)

3 In the "Item tab" area, tap [Edge color] to specify the reference color to be detected as the edge.

"3.4.3 [Edge Color - for Color Cameras Only (Edge Position)]" (→pg.5)

4 In the "Item tab" area, tap [Measurement] and specify the judgement condition for OK.

"3.4.5 [Measurement (Edge Position)]" (→pg.9)

Important

- After setting up the measurement, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

5 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

6 Perform a measurement test.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

7 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

When NG is displayed, please verify measurement results and make Adjust if necessary.

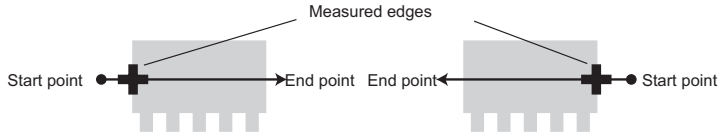
"3.4.7 Points on Test Measurement and Adjustment (Edge Position)" (→pg.15)

3.4.2 [Region setting (Edge Position)]

Use a straight line (arrow), circumference, or arc to specify a measurement region for [Edge position]

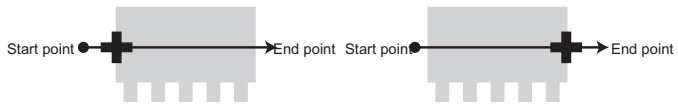
POINT

- Measurement results differ depending on the positions of the start point and end point of the measurement region.
  When set up the measurement region, attention should be paid to the detecting direction of the edge.



Drawing the line from left to right and from right to left will lead to different measured edges.

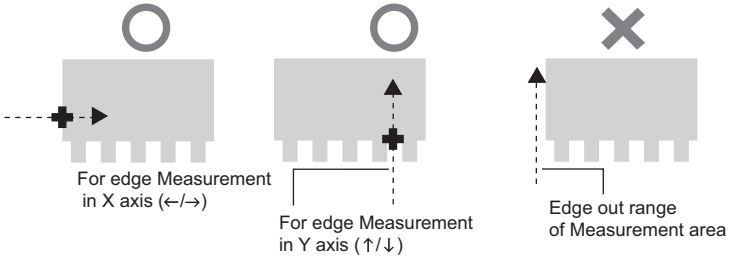
- When executing the selected edge color-based edge measurement, different edge detecting mode will lead to different measurement results, even the direction of the straight line is the same.



For "Specifying Color IN" edge measurement mode

For "Specifying Color OUT" edge measurement mode

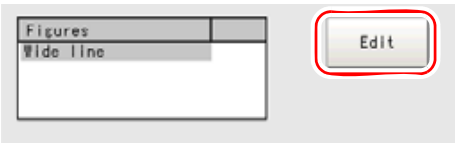
- Measurement cannot be performed if there is no edge within the measurement region. When determining the size and position of the measurement region, please specify the moving range of the Measurement object.



- The direction of the drawn arrow can be changed by tapping [ ] in the "Detail" area.
- Use the Zoom function if the measurement region is too small to identify the direction of the arrow.
  For the Zoom function, see "1.8 Using Zoom Function" (→pg.24), of "User's Manual".

1 In the "Item tab" area, tap [Region setting].

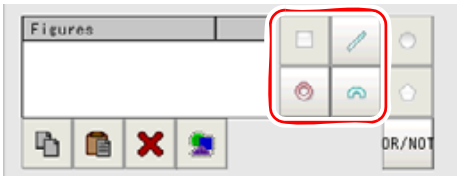
2 When a measurement region is already registered, tap [Edit]. When no measurement region is registered, go to Step 3.



The "Figure setting" area is displayed.

3 Specify the measurement region using Drawing Tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"

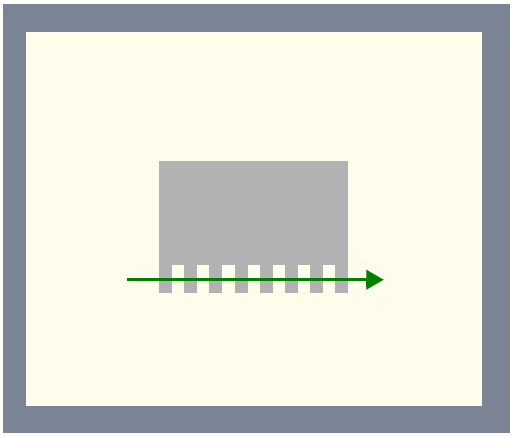


4 If necessary, in the "Region parameter "area, check the "Circle / Arc with width counterclockwise" option to specify the measurement direction for a wide circle or arc.

When a wide circle or arc is selected as the figure to register, specify counterclockwise for its measurement direction.

5 In the "Figure setting" area, tap [OK].

The measurement region is registered and displayed in the "Image display" area.



For the following operations, see"3.4.1 Setting up [Edge Position]" (→pg.2).

3.4.3 [Edge Color - for Color Cameras Only (Edge Position)]

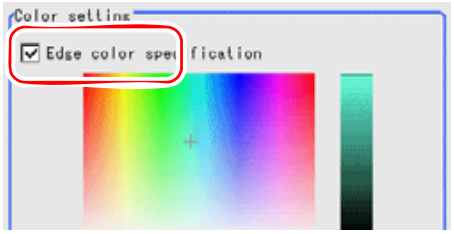
Specify the criteria with which edges are searched.

1 In the "Item tab" area, tap [Edge color].

2 If necessary, check [Edge color specification] in the "Color setting" area.

After checking, continue to measure the edges based your expected [Edge color] and [Detection mode].

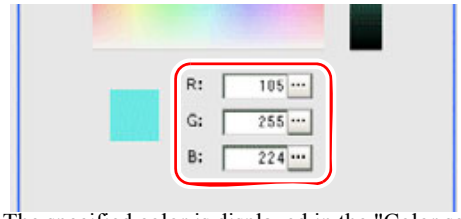
If not checking, the position where the changing rate of color in the measurement region will be detected as the edge.



3 Select the color that will be used as the edge (the reference color with which the edge is detected).

In the "Color setting" area, tap [...] for each of "R" (red), "G" (green), and "B" (blue), and specify a value respectively.

For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"



The specified color is displayed in the "Color setting" area.

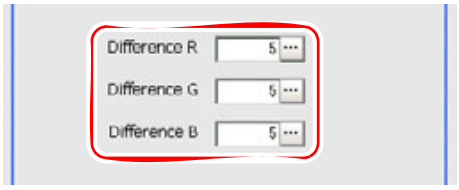
4 Use the color that is specified as the reference color for the edge as the standard color (Difference) that is used as the basis for recognizing an edge.

In the "Color setting" area, tap [...] for each of "Difference R", "Difference G", and "Difference B", and specify a value respectively.

The bigger the "Difference" value, the bigger the color range that is used as basis for recognizing an edge.

The defaulted value are all "5".

For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"



5 Select an edge detection method in [Detection mode].

Table: Edge Color (Edge Position)

Option	Set Value [Factory defaults]	Description
Detection mode	・Color IN ・Color OUT	This option detects the area between the selected edge color and other color where color change occurs as the edge. The detecting direction is from the start point of the straight line in the measurement region to its end point. ・Color IN This is the mode under which the position where the colors other than the selected edge colors start to change to the selected edge colors is detected as the edge. ・Color OUT This is the mode under which the position where the selected edge colors start to change to the colors other than the selected edge colors is detected as the edge.

For the following operations, see"3.4.1 Setting up [Edge Position]" (→pg.2).

3.4.4 [Reference Position (Edge Position)]

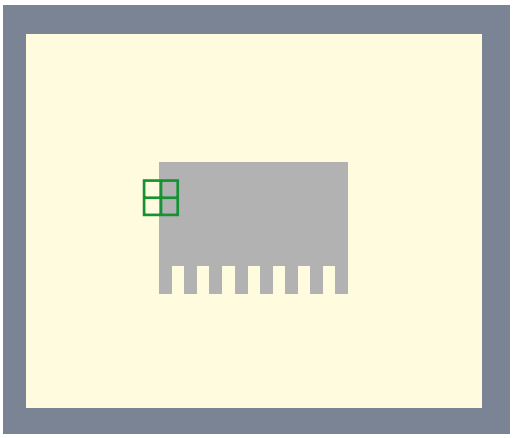
This item can be changed if necessary. The reference position is automatically set at the same time the measurement region is specified. This item can be used to change the reference position to any desired position.

POINT

- After changing the reference position to any desired position, re-registering the measurement region will automatically change it back to the default position.

1 In the "Item tab" area, tap [Reference position].

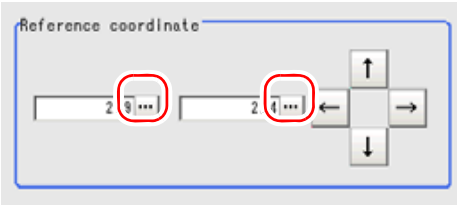
In the "Image display" area, the current reference position is displayed with a cross-shaped cursor.



2 Change the reference position.

In the "Reference coordinate" area, tap [...] for each item and specify values for your desired reference coordinates (the coordinates of the reference position).

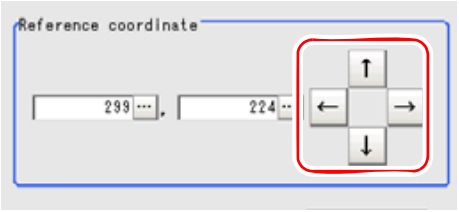
How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"



The cross-shaped cursor in the "Image display" area will move to the specified coordinate position.

Using arrow buttons to change the reference position:

In the "Reference coordinate" area, tap one of the arrow buttons.



In the "Image display" area, the cross-shaped cursor will move one pixel per tap.

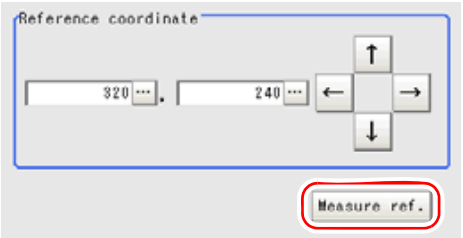
In the "Reference coordinate" area, the reference coordinate values (X, Y) will also change as the cross-shaped cursor moves.

POINT

Tips for position adjustment

- You can easily specify the coordinates if you first input approximate coordinate values and then adjust them by moving the cross-shaped cursor in the "Image display" area. The Zoom function is useful for fine adjustment.
  For the Zoom function, see "1.8 Using Zoom Function" (→pg.24), of "User's Manual".

3 When the measurement parameter has been changed, tap [Measure ref.].

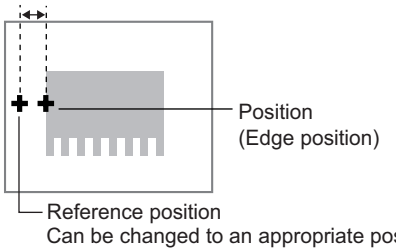


The edge position is re-calculated using the modified parameter and reflected in the "Reference coordinate" area.

POINT

Since the reference position can be changed, it is useful for measuring distance from a specific position.

- Confirm the reference position of the currently displayed image, and then change it to an appropriate position. A positional check can be performed by calculating the difference between the reference position and the measured position using an expression.



After changing the reference position to any desired position, changing the measurement region will automatically change it back to the default position.

3.4.5 [Measurement (Edge Position)]

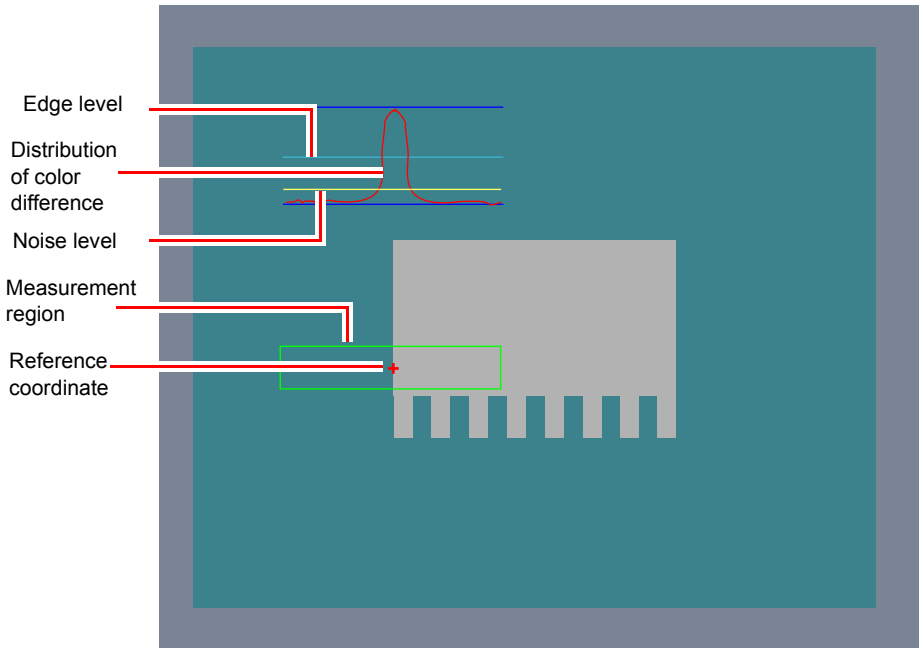
Specify the range to be judged as OK.

POINT

- For the Measurement Details about the edge image, see "4.6.3 Edge Measurement" (→pg.42), of "User's Manual".

1 In the "Item tab" area, tap [Measurement].

The edge profile of the measurement region (curve) is displayed in the "Image display" area.



2 If necessary, specify a value for each item in the "Measurement condition" area.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

"Edge No." can be specified by tapping [<] and [>].

The values for "Edge level" and "Edge color level" can be adjusted by dragging the slider or by tapping the buttons at both ends of the slider.

For color cameras:

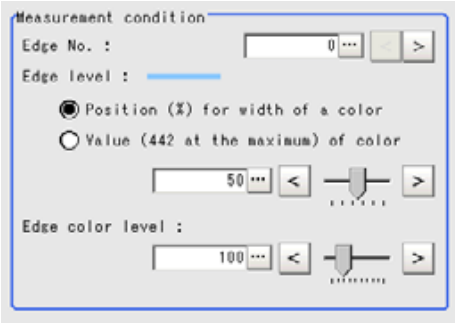


Table: Measurement (Edge Position)

Setting Item	Set Value [Factory Default]	Description
Edge No.	0 to 99 [0]	Specify the number of the edge to be extracted. Edge numbers are assigned to the detected edges, starting with 0 from the start point to the end point in the direction of the arrow of the measurement region.
Edge level	・Position (%) for width of a color 0 to 100 [50] ・Value of color 0 to 442 [20]	Select a color difference level with which the edge is detected. "4.6.3 Edge Measurement" (→pg.42), of "User's Manual"
Edge color level	0 to 442 [100]	Specify a level to remove colors other than the color specified in [Edge color] to enhance the edge color. This option can be specified only if the [Edge color specification] is checked in [Edge color]. "3.4.3 [Edge Color - for Color Cameras Only (Edge Position)]" (→pg.5)

For monochrome cameras:

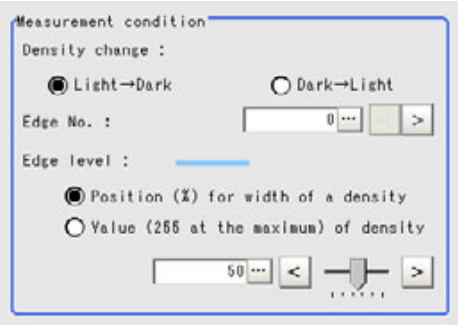


Table: Measurement (Edge Position)

Setting Item	Set Value [Factory Default]	Description
Density change	[Light → Dark] Dark → Light	Select whether a black-to-white change or a white-to-black change should be recognized as a density change in the specified region.
Edge No.	0 to 99 [0]	Specify the code No. used to extract edge. Code numbers are assigned to detected edges starting from 0 and going on in the direction from the start point (the arrow point) to the end point (the direction of arrow) in the selected area.
Edge level	・Position (%) for width of a density 0 to 100 [50] ・Value of density 0 to 255 [20]	Select the density change level to be detected as edges. "4.6.3 Edge Measurement" (→pg.42), of "User's Manual"

3 If necessary, in the "Noise removal" area, tap [...] and specify a value for each item.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

The value for "Noise level" can be adjusted by dragging the slider or by tapping the buttons at both ends of the slider.

The "Noise width" value can also be adjusted by tapping [<] and [>].

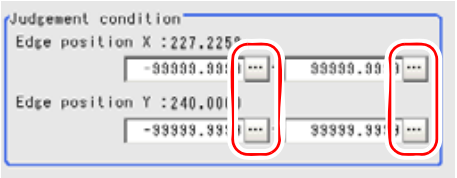
Table: Measurement (Edge Position) - Noise Removal

Setting Item	Set Value [Factory Default]	Description
Noise level	0 to 442 [5]	This item used to judge the level of edge. Calculate the max and min chromatic aberrations of the detected areas in the edge. If the difference of the max and min chromatic aberrations is lower than the noise level, the edge will not exist. When the detection is affected by noise, increase the value. " Noise Level" (→pg.43), of "User's Manual"
Noise width	0 to 9999 [0]	Specify the width of noise. Starting from the position where edges are initially detected and within the range of the noise width, the detected point will be regarded as noise if the chromatic aberration distribution is again lower than the Edge level. When the detection is affected by noise, increase the value. " Noise Width" (→pg.43), of "User's Manual"

4 When the setting has been changed, tap [Measure] in the "Detail" area to verify whether measurements can be made correctly.

5 In the "Judgement condition" area, tap [...] and input a value for each item.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"



POINT

- The values displayed in the individual fields are the measurement results of the displayed image. Take these values into consideration to determine the upper and lower limit values.

Table: Measurement (Edge Position) - Judgement Condition

Setting Item		Set Value [Factory Default]	Description
Edge position X	Upper	-99999.9999 to [99999.9999]	Specify the range of X-axis shifting that is judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Edge position Y	Upper	-99999.9999 to [99999.9999]	Specify the range of Y-axis shifting that is judged to be OK.
	Lower	[-99999.9999] to 99999.9999	

For the subsequent operations, see "3.4.1 Setting up [Edge Position]" (→pg.2).

Changing the Profile Display Setting

This item can be changed if necessary. Usually, the factory default value can be used.
To enlarge the graph along the vertical axis when the region is a circumference or arc, check the [Zoom] option and adjust the size by tapping one of the arrow buttons.

3.4.6 [Output Parameter (Edge Position)]

Select options for the measured results, namely the coordinates, which are output to the external devices.

Important

- After setting up the measurement, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

1 In the "Item tab" area, tap [Output parameter].

2 Specify a value for each item.

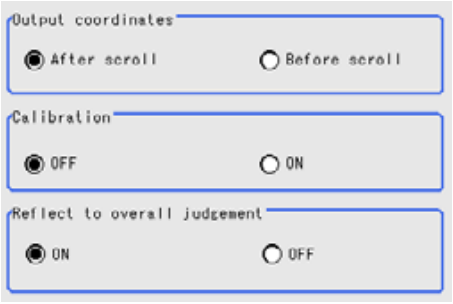


Table: Setting Values for Output Parameter

Setting Options	Set Value [Factory defaults]	Description
Output coordinate	・[After scroll] ・Before scroll	Select whether to output measurement results to external devices before or after the position deflection correction is applied.
Calibration	・[OFF] ・ON	Select whether to output measurement results to external devices by converting them into the coordinates with actual size (calibration: ON) or into the coordinates of camera image (calibration: OFF).
Reflect to overall judgement	・[ON] ・OFF	Select whether to reflect the judgement result of this processing unit to the overall judgement of the scene. ・Selecting "ON" reflects the judgement result of this processing unit on the overall judgement of the scene. ・Selecting "OFF" does not reflect the judgement result of this processing unit on the overall judgement of the scene.

POINT

- For output coordinates and calibration, see "4.6.5 Configuring Coordinates" (→pg.45), of "User's Manual".
- The overall judgement result of the scene is output to the OR signal to be sent via the parallel interface. Also, it is displayed in the "Measurement information display" area in the upper part of the Main screen.
  "10.4.4 Time Chart" (→pg.35), of "User's Manual"
  "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"

For the following operations, see"3.4.1 Setting up [Edge Position]" (→pg.2).

3.4.7 Points on Test Measurement and Adjustment (Edge Position)

In addition to the camera-input image, the measurement region and the edge position (the cross-shaped cursor) will also be displayed in the "Image display" area.

In the "Detail result" area on the Main screen, you can confirm the following contents in text.
"6.3.2 Displaying Flow and Detail Result" (→pg.12), of "User's Manual"

Table: Edge Position - Text Displayed

Displayed Items	Description
Judge	Judgement result
Edge position X	X coordinate of the measured edge position
Edge position Y	Y coordinate of the measured edge position

Points on Adjustment

Please choose your Adjust methods as follows.

When the edge cannot be detected satisfactorily

- Set up the options in [Measurement].
  "3.4.5 [Measurement (Edge Position)]" (→pg.9)
- Select edge colors from [Edge color].
  "3.4.3 [Edge Color - for Color Cameras Only (Edge Position)]" (→pg.5)

Noise detecting

- Specify a higher value for [Noise level] and [Noise width] in [Measurement].
  "3.4.5 [Measurement (Edge Position)]" (→pg.9)

3.4.8 When Using measurement Results Externally (Edge Position)

Value Available in Expression

When this unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Edge position - The value that can be used by the Arithmetic Expression

Measurement items	Character string	Description
Judge	JG	Judgement result
Edge position X	X	X coordinate of the measured edge position
Edge position Y	Y	Y coordinate of the measured edge position
Reference position X	SX	Reference coordinate X
Reference position Y	SY	Reference coordinate Y

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in the "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Edge Position)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Edge position X	Get only	0 to 99999.9999
6	Edge position Y	Get only	0 to 99999.9999
7	Reference coordinate X	Get only	0 to 99999.9999
8	Reference coordinate Y	Get only	0 to 99999.9999
101	Output coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF, 1: ON
103	Reflect in OR	Set/Get	0: ON, 1: OFF
120	Edge color specification	Set/Get	0: OFF 1: ON
121	Edge color R	Set/Get	0 to 255
122	Edge color G	Set/Get	0 to 255
123	Edge color B	Set/Get	0 to 255
124	Difference R	Set/Get	0 to 127
125	Difference G	Set/Get	0 to 127
126	Difference B	Set/Get	0 to 127
127	Detection mode	Set/Get	0: Color IN 1: Color OUT
129	Reference coordinate X	Set/Get	0 to 99999.9999
130	Reference coordinate Y	Set/Get	0 to 99999.9999
131	Edge No.	Set/Get	0 to 99
132	Edge level	Set/Get	0 to 100
133	Noise level	Set/Get	0 to 442
134	Noise width	Set/Get	0 to 9999
135	Edge color level	Set/Get	0 to 442
136	Upper limit of the edge position X	Set/Get	-99999.9999 to 99999.9999
137	Lower limit of the edge position X	Set/Get	-99999.9999 to 99999.9999
138	Upper limit of the edge position Y	Set/Get	-99999.9999 to 99999.9999
139	Lower limit of the edge position Y	Set/Get	-99999.9999 to 99999.9999

Table: External Reference List (Edge Position)

No.	Data Name	Set/Get	Data Range
140	Monochrome edge detection mode	Set/Get	0: Light → Dark 1: Dark → Light
141	Edge level absolute value	Set/Get	0 to 442
142	Edge level specification mode	Set/Get	0: %, 1: Absolute value
143	Clockwise/Counterclockwise	Set/Get	0: Clockwise, 1: Counterclockwise

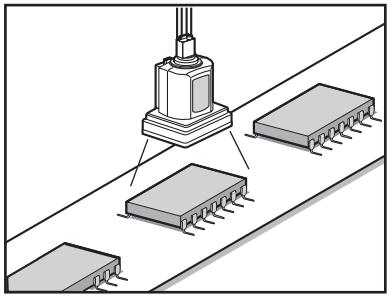
3.5 Edge Pitch

Finds and counts the edges by measuring the color change within the measurement region.

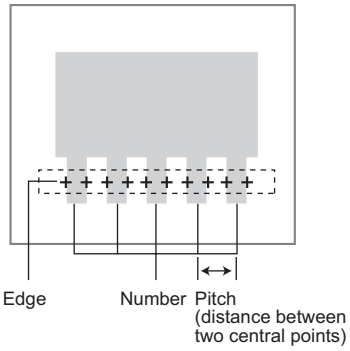
Used for the following case

- When calculating number of pins of IC or connectors

Example) Measurement of number of IC pins



- When calculating pin width and the spacing between two pins



List of Edge Pitch Items

Edge pitch items are explained below.

Table: List of Edge Pitch Items

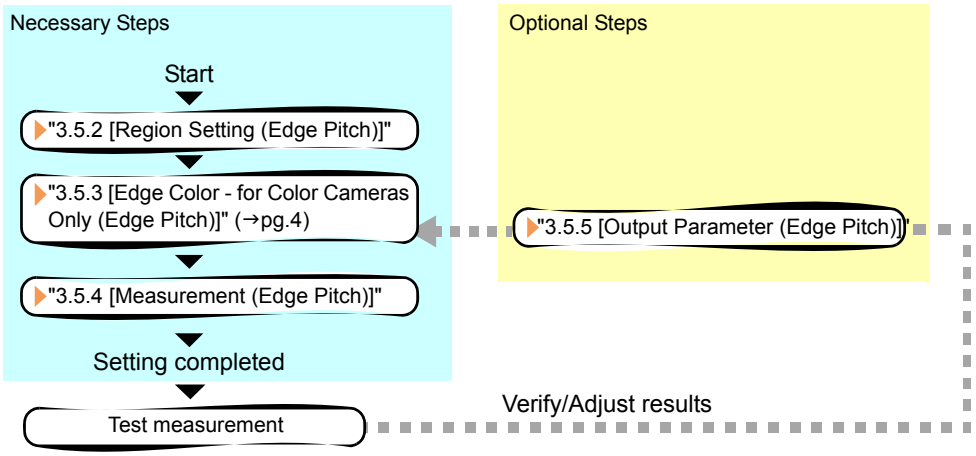
Item Name	Description
Region setting	This item specifies the measurement region. "3.5.2 [Region Setting (Edge Pitch)]" (→pg.3)
Edge color (for color cameras only)	This item selects the color information of the edges to be detected. "3.5.3 [Edge Color - for Color Cameras Only (Edge Pitch)]" (→pg.4)

Table: List of Edge Pitch Items

Item Name	Description
Measurement	This item specifies Judgement conditions for measurement results. Measurement values can be changed as needed to address unstable measurement results. Specify the counting spacing and width. The displayed items are different depending on whether your camera is a color or monochrome camera. Normally the factory default value will be used. "3.5.4 [Measurement (Edge Pitch)]" (→pg.5)
Output parameter	This item can be changed if necessary. Normally the factory default value will be used. Use the Output parameter to specify how to treat the coordinate. "3.5.5 [Output Parameter (Edge Pitch)]" (→pg.8)

3.5.1 Setting up [Edge pitch]

Set up the "Edge pitch" with the following steps.



POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 Tap [Edge pitch] in the Edit Flow window.

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area, tap [Region setting] and specify the measurement region.

"3.5.2 [Region Setting (Edge Pitch)]" (→pg.3)

3 In the "Item tab" area, tap [Edge color] to specify the reference color to be detected as the edge.

"3.5.3 [Edge Color - for Color Cameras Only (Edge Pitch)]" (→pg.4)

4 In the "Item tab" area, tap [Measurement] and specify the judgement condition for OK.

"3.5.4 [Measurement (Edge Pitch)]" (→pg.5)

Important

- After setting up the measurement, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

5 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

6 Perform a measurement test.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

7 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

When NG is displayed, please verify measurement results and make Adjust if necessary.

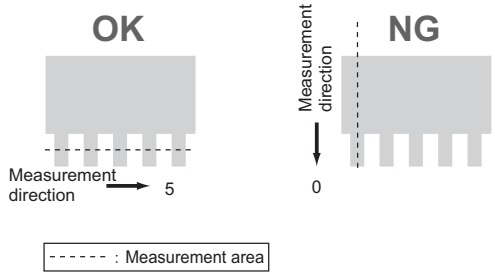
"3.5.6 Points on Measurement Test and Adjustment (Edge Pitch)" (→pg.9)

3.5.2 [Region Setting (Edge Pitch)]

Use a straight line, circumference, or arc to specify a measurement region for [Edge pitch].

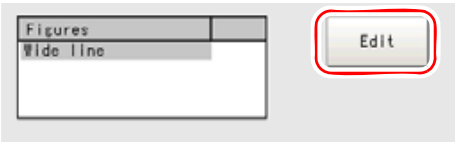
POINT

- When setting up a measurement region, please include all the edges to be detected.



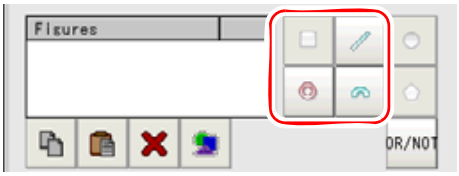
1 In the "Item tab" area, tap [Region setting].

2 When a measurement region is already registered, tap [Edit].

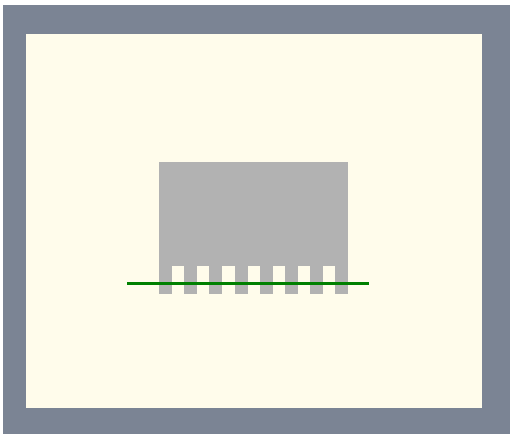


The "Figure setting" area is displayed.
When no measurement region is registered, go to Step 3.

3 Specify the measurement region using the Drawing Tools.
"1.9 Setting Figures" (→pg.25), of "User's Manual"



4 In the "Figure setting" area, tap [OK].
The measurement region is registered and displayed in the "Image display" area.



For the following operations, see"3.5.1 Setting up [Edge pitch]" (→pg.2).

3.5.3 [Edge Color - for Color Cameras Only (Edge Pitch)]

Specify the criteria with which edges are searched.

1 In the "Item tab" area, tap [Edge color].

2 Specify colors for the edges to be counted (used as the reference color for edge detecting).

In the "Color specification setting" area, tap [...] for each of "R" (red), "G" (green), and "B" (blue), and specify a value respectively.

For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"

The specified color is displayed in the "Color specification setting" area.

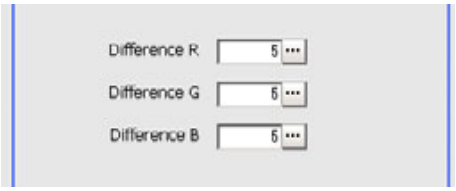
3 Use the color that is specified as the reference color for the edge as the standard color (Difference) that is used as the basis for recognizing an edge.

In the "Color specification setting" area, tap [...] for each of "Difference R", "Difference G", and "Difference B", and specify a value respectively.

The bigger the Difference value, the bigger the color range that is used as basis for recognizing an edge.

The defaulted value are all "5".

For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"



3.5.4 [Measurement (Edge Pitch)]

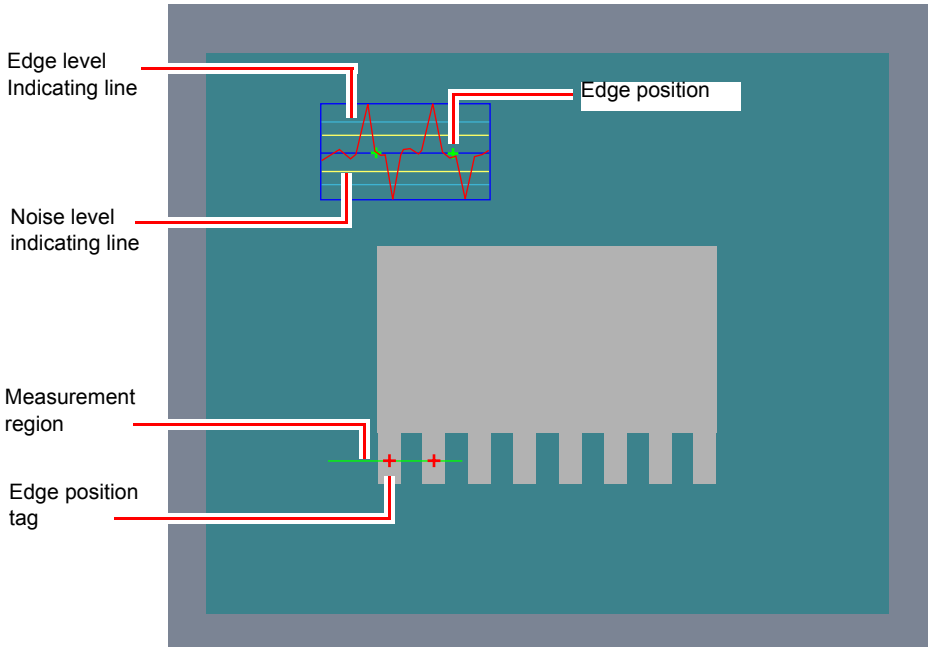
Specify the range to be judged as OK.

POINT

- For the Measurement Details about the edge image, see "4.6.3 Edge Measurement" (→pg.42), of "User's Manual".

1 In the "Item tab" area, tap [Measurement].

The edge profile of the measurement region (straight line) is displayed in the "Image display" area.



2 In the "Measurement condition" area, specify a value for each item.

For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual".

The values for "Edge level" and "Edge color level" can be adjusted by dragging the slider or by tapping the buttons at both ends of the slider.

For color cameras:

Table: Measurement (Edge Pitch) - Measurement Condition

Setting Item	Set Value [Factory Default]	Description
Edge level	0 to 100 [50]	Specify a color changing level with which the edge is detected. If the measurement result is smaller than the actual number of edges, specify a smaller value for [Edge level] (or the minimum level). Conversely, if the measurement result is larger than the actual number of edges, specify a larger value for [Edge level] (or the minimum level). "4.6.3 Edge Measurement" (→pg.42), of "User's Manual"
Edge color level	0 to 9999 [100]	Specify a level to remove colors other than the color specified in [Edge color] to enhance the edge color.

For monochrome cameras:

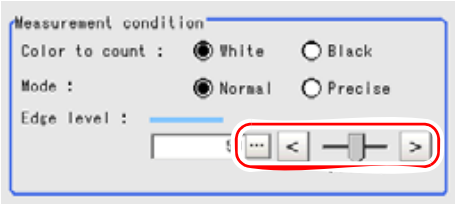


Table: Measurement (Edge Pitch) - Measurement Condition

Setting Options	Set Value	Description
Color to count	・[White] ・Black	Select an edge color to be measured.
Mode	・[Normal] ・Precise	Use [Normal], when both the width of each pin and the distance between pins are two pixels or more. With [Precise], either the width or the distance can be less than two pixels.
Edge level	0 to 100 [50]	Specify the density change level to be detected as edges. When the Measurement result is lower than the actual number, please tune down the Edge level (or the min level). Whereas the Measurement result is higher than the actual number, please tune up the Edge level (or the min level). "4.6.3 Edge Measurement" (→pg.42), of "User's Manual"

3 If necessary, in the "Noise removal" area, tap [...] and specify a value for each item.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

The "Noise level" value can be adjusted by dragging the slider or by tapping the buttons at both ends of the slider.

The "Noise width" value can also be adjusted by tapping [<] and [>].

Table: Measurement (Edge Pitch) - Noise Removal

Setting Item	Set Value [Factory Default]	Description
Noise level	0 to 442 [5]	This item obtains the maximum and minimum values of the color/density in the edge detection region. If the difference is less than the noise level, no edge is assumed to exist. When the detection is affected by noise, increase the value. " Noise Level" (→pg.43), of "User's Manual"
Noise width	0 to 9999 [0]	Specify the width of noise. When the color/density distribution falls below the edge level within the noise width from the first detected edge position, the detected points are considered as noise. When the detection is affected by noise, increase the value. " Noise Width" (→pg.43), of "User's Manual"

4 When the setting has been changed, tap [Measure] in the "Detail" area to verify whether measurements can be made correctly.

5 In the "Judgement condition" area, tap [...] and input a value for each item.

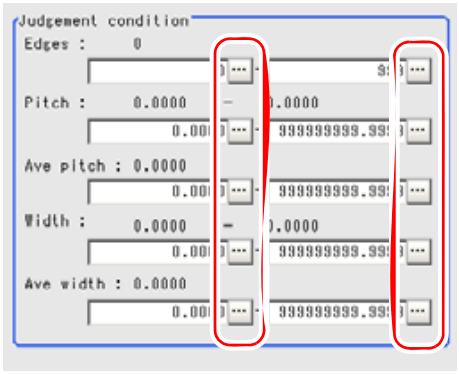
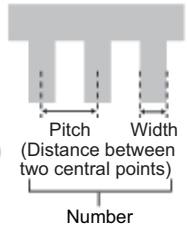


Table: Measurement (Edge Pitch) - Judgement Condition

Setting Item		Set Value [Factory Default]	Description
Edges	Upper	0 to [999]	Specify a range to be judged as OK. 
	Lower	[0] to 999	
Pitch	Upper	0 to [99999.9999]	
	Lower	[0] to 99999.9999	
Ave pitch	Upper	0 to [99999.9999]	
	Lower	[0] to 99999.9999	
Width	Upper	0 to [99999.9999]	
	Lower	[0] to 99999.9999	
Ave width	Upper	0 to [99999.9999]	
	Lower	[0] to 99999.9999	

For the following operations, see"3.5.1 Setting up [Edge pitch]" (→pg.2).

3.5.5 [Output Parameter (Edge Pitch)]

Select options for the measured results, namely the coordinates, which are output to the external devices.

Important

- After setting up the measurement, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

1 In the "Item tab" area, tap [Output parameter].

2 Specify a value for each item.

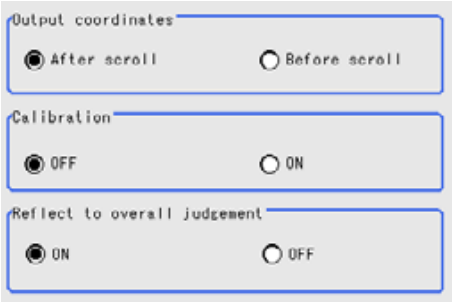


Table: Setting Values for Output Parameter

Setting Options	Set Value [Factory defaults]	Description
Output coordinate	・[After scroll] ・Before scroll	Select whether to output measurement results to external devices before or after the position deflection correction is applied.
Calibration	・[OFF] ・ON	Select whether to output measurement results to external devices by converting them into the coordinates with actual size (calibration: ON) or into the coordinates of camera image (calibration: OFF).
Reflect to overall judgement	・[ON] ・OFF	Select whether to reflect the judgement result of this processing unit to the overall judgement of the scene. ・Selecting "ON" reflects the judgement result of this processing unit on the overall judgement of the scene. ・Selecting "OFF" does not reflect the judgement result of this processing unit on the overall judgement of the scene.

POINT

- For output coordinates and calibration, see "4.6.5 Configuring Coordinates" (→pg.45), of "User's Manual".
- The overall judgement result of the scene is output to the OR signal to be sent via the parallel interface. Also, it is displayed in the "Measurement information display" area in the upper part of the Main screen.
  "10.4.4 Time Chart" (→pg.35), of "User's Manual"
  "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"

For the following operations, see "3.5.1 Setting up [Edge pitch]" (→pg.2).

3.5.6 Points on Measurement Test and Adjustment (Edge Pitch)

In addition to the camera image, the models and the search coordinates (the cross-shaped cursor) will also be displayed in the "Image display" area.

In the "Detail result" area on the Main screen, you can confirm the following contents in text.
"6.3.2 Displaying Flow and Detail Result" (→pg.12), of "User's Manual"

Table: Text Displayed (Edge Pitch)

Item	Description
Judge	Judgement result
Edge Pitch	The number of edge
Average pitch	The average edge pitch
Max. pitch	The edge minimum pitch
Min. pitch	The edge minimum pitch
Average width	The average edge width
Max. width	The edge maximum width
Min. width	The edge minimum width

Points on Adjustment

Choose the adjustment methods as follows.

When the edge cannot be detected satisfactorily

- Set up the options in [Measurement].
  "3.5.4 [Measurement (Edge Pitch)]" (→pg.5)

Noise detecting

- Set up the options in [Measurement].
  "3.5.4 [Measurement (Edge Pitch)]" (→pg.5)

3.5.7 When Using measurement results externally (Edge Pitch)

Value Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.
For how to set up expression,see"4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (Edge Pitch)

Measurement items	Character string	Description
Judge	JG	Judgement result
Edge Pitch	N	The number of detected edges
Average pitch	P	The average pitch of detected edges
Max. pitch	PH	The maximum pitch of detected edges

Table: Values Available in Expression (Edge Pitch)

Measurement items	Character string	Description
Min. pitch	PL	The minimum pitch of detected edges
Average width	W	The average width of detected edges
Max. width	WH	The maximum width of detected edges
Min. width	WL	The minimum width of detected edges

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in the "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Edge Pitch)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Edges	Get only	0 to 999
6	Average pitch	Get only	0 to 99999.9999
7	Max. pitch	Get only	0 to 99999.9999
8	Min. pitch	Get only	0 to 99999.9999
9	Average width	Get only	0 to 99999.9999
10	Max. width	Get only	0 to 99999.9999
11	Min. width	Get only	0 to 99999.9999
101	Output coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect in OR	Set/Get	0: ON 1: OFF
120	Edge color R	Set/Get	0 to 255
121	Edge color G	Set/Get	0 to 255
122	Edge color B	Set/Get	0 to 255
123	Edge color Difference R	Set/Get	0 to 127
124	Edge color Difference G	Set/Get	0 to 127
125	Edge color Difference B	Set/Get	0 to 127
127	Edge level	Set/Get	0 to 100
128	Noise level	Set/Get	0 to 442
129	Noise width	Set/Get	0 to 9999
130	Upper of Edge Pitch	Set/Get	0 to 1000

Table: External Reference List (Edge Pitch)

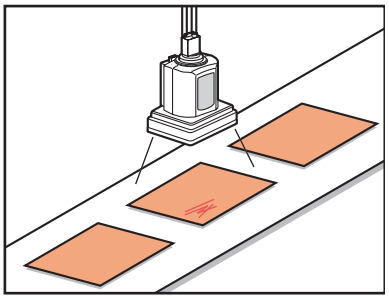
No.	Data Name	Set/Get	Data Range
131	Lower of Edge Pitch	Set/Get	0 to 1000
132	Upper of Average pitch	Set/Get	0 to 99999.9999
133	Lower of Average pitch	Set/Get	0 to 99999.9999
134	Upper limit of the pitch	Set/Get	0 to 99999.9999
135	Lower limit of the pitch	Set/Get	0 to 99999.9999
136	Upper of Average width	Set/Get	0 to 99999.9999
137	Lower of Average width	Set/Get	0 to 99999.9999
138	Upper limit of the width	Set/Get	0 to 99999.9999
139	Lower limit of the width	Set/Get	0 to 99999.9999
140	Edge color level	Set/Get	0 to 442
141	Color to count	Set/Get	0: White 1: Black
142	Mode	Set/Get	0: Normal 1: Precise

3.6 Defect

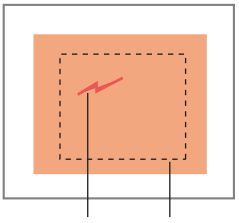
Detect with the color difference within the measurement region.

Used for the following case

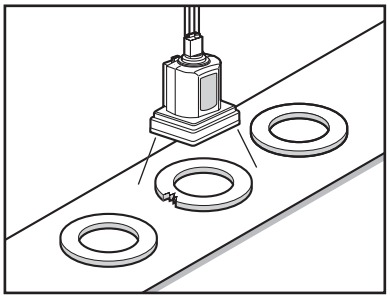
- Check the defect, stain and spot of plain measurement objects



Find defects by the color change within the measurement region



- Measure appearance defects and defects of parts



List of Defect Items

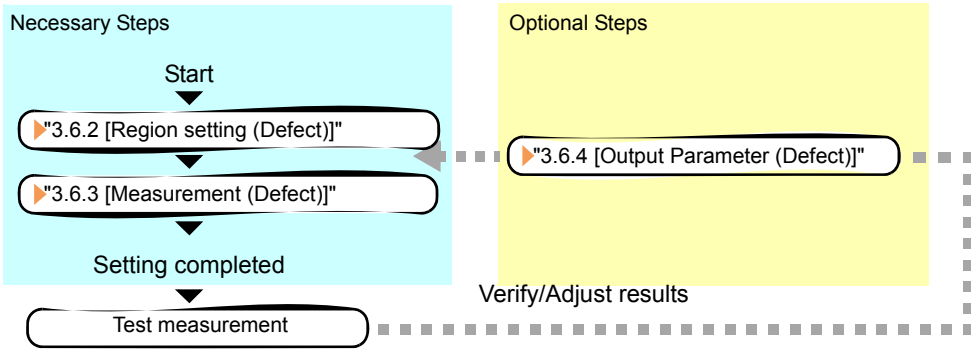
Defect items are as follows.

Table: List of Defect Items

Item Name	Description
Region setting	This item specifies the measurement region. Input images can also be entirely measurement. Limiting the measurement region may allow a fast and reliable processing. "3.6.2 [Region setting (Defect)]" (→pg.3)
Measurement	This item specifies the judgement condition for measurement results. Measurement can be changed as needed to address unstable measurement results or to increase the processing speed. Specify the parameter values with which to decide on defects. The displayed items are different depending on whether your camera is a color or monochrome camera. Normally the factory default value will be used. "3.6.3 [Measurement (Defect)]" (→pg.5)
Output parameter	This item can be changed if necessary. Normally the factory default value will be used. Use the Output parameter to specify how to treat the coordinate. "3.6.4 [Output Parameter (Defect)]" (→pg.8)

3.6.1 Setting up [Defect]

Set up the defects as follows.



POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 Tap [Defect] in the Edit Flow window.

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area, tap [Region setting] to set up the measurement region.

"3.6.2 [Region setting (Defect)]" (→pg.3)

3 In the "Item tab" area, tap [Measurement] and specify the judgement condition for OK.

"3.6.3 [Measurement (Defect)]" (→pg.5)

Important

- After setting up the measurement, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed after setting up the judgement condition, re-specify the measurement, too.

4 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

5 Perform a measurement test.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

6 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

When NG is displayed, please verify measurement results and make Adjust if necessary.

"3.6.5 Points on Measurement Test and Adjustment (Defect)" (→pg.8)

3.6.2 [Region setting (Defect)]

The measurement region for [Defect] is specified with rectangle, circle (ellipse), circumference, arc, or polygon.

When drawing the measurement region, measurement is performed on the displayed image, with the measurement results being registered as the reference (used as the X and Y Coordinate to find the position of defects). For this, when drawing the measurement region, the measurement object should be correctly placed.

POINT

- Do not draw the measurement region in places with marks and patterns because this will not discriminate defects and stains.
- When the measurement region is lower than the Lower limit of defect size, the measurement results may become NG.
  For the defect detection size, Please Ellipse to"3.6.3 [Measurement (Defect)]" (→pg.5).

Table: Region Setting Method (Defect)

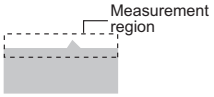
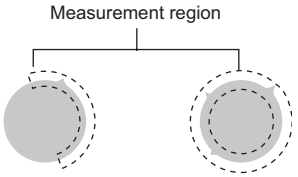
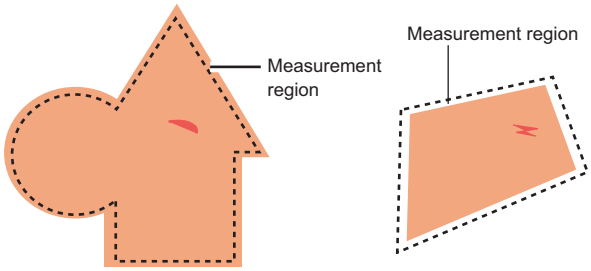
Shape	Description
Wide line	Selected when detecting defects and stains of the measurement objects. Up to 8 figures can be drawn. When multiple figures are drawn, Region inspection mode is used. 

Table: Region Setting Method (Defect)

Shape	Description
Wide circle, wide arc	Selected when detecting defects and stains of the circle objects. Up to 8 figures can be drawn. When multiple figures are drawn, Region inspection mode is used. 
Region	Selected when detecting the overall defects of specified zones and measurement objects. Up to 8 shapes (straight line, rectangle, oval, circle, circumference, arc, polygon) can be combined when drawing a figure (Region inspection mode). 

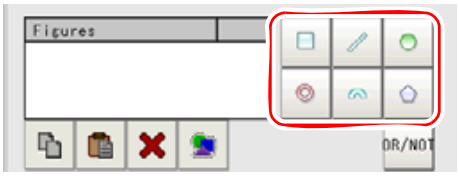
1 In the "Item tab" area, tap [Region setting].

2 When a measurement region is already registered, tap [Edit]. When no measurement region is registered, go to Step 3.

The "Figure setting" area is displayed.

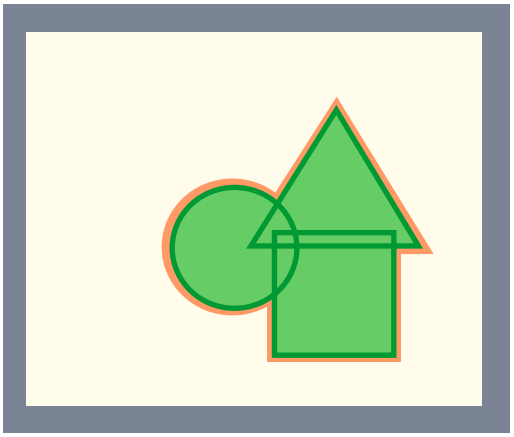
3 Specify the measurement region using Drawing Tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"



4 In the "Figure setting" area, tap [OK].

The measurement region is registered and displayed in the "Image display" area.

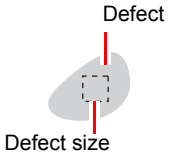


Please verify the sequent operations by following "3.6.1 Setting up [Defect]" (→pg.2).

3.6.3 [Measurement (Defect)]

Specify the range to be judged as OK.

After drawing an measurement region, a rectangle is automatically formed in this region (the defect detection region). Move the defect detection region, calculate separately the mean concentration, and obtain the detection difference with surrounding defects (referred to as defect level). Then, calculate defect level with all defect detection regions. If the maximum value exceeds the criteria value, there are defects in the measurement region.



Increasing "Defect size" allows to shorten processing time, but will reduce measurement accuracy.

If conditions are changed, please verify with actual measurement.

1 In the "Item tab" area, tap [Measurement].

2 Set the value of each item in the "Defect size" area.

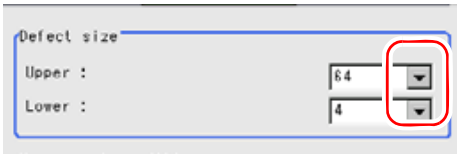
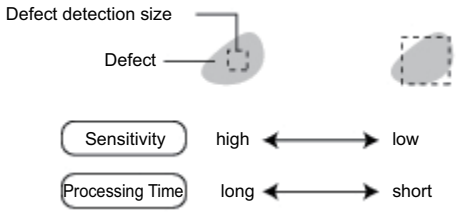


Table: Measurement (Defect)

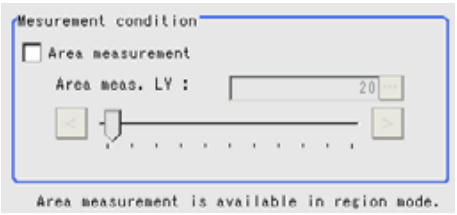
Setting Option		Set Value [Factory defaults]	Description
Defect size	Upper	・4 ・8 ・12 ・16 ・24 ・32 ・[64]	Specify the upper and lower limit of defect size based on the size of stain to be detected. The larger the difference between upper and lower limits, the easier it is possible to detect the defects of various sizes. The larger the defect size, the more weaker the measurement sensitivity of upper and lower limits and the shorter the processing time. 
	Lower	・[4] ・8 ・12 ・16 ・24 ・32 ・64	

3 If necessary, set the value of each item in the "Measurement condition" area.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

The "Area meas. LV" can be set also by dragging the slider or by tapping the buttons at the ends of the slider.

For color cameras:



For monochrome cameras:

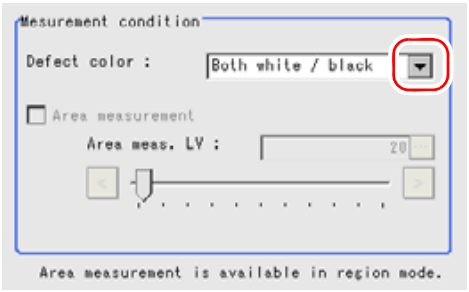


Table: Measurement (Defect)

Setting Item	Set Value [Factory default]	Description
Detect Color (for monochrome cameras only)	Black	Select this value when defects look darker than the background.
	White	Select this value when defects look brighter than the background.
	[Both white / black]	Select this value when the brightness of defects cannot be decided.
Area measurement	・Checked ・[Unchecked]	This item divides the high defect value regions into groups, and outputs the gravity center coordinates of the group with the largest area. This setting is only available in region mode.
Area meas. LV	0 to 999 [20]	Specify the defect value that is included in the defect area at the Area measurement.

4 When the setting has been changed, tap [Measure] in the "Detail" area to verify whether measurements can be made correctly.

5 In the "Judgement condition" area, tap [...] and input a value for each item.

For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual".

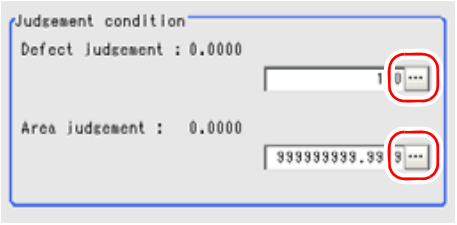


Table: Measurement - Judgement Condition (Defect)

Item	Set Value [Factory defaults]	Description
Defect judgement	0 to 999 [100]	Specify the upper limit of Defect judgement (the Lower is fixed at 0). When "30" is selected, the OK value should be within the range of 0 to 30.
Area judgement	0 to A_MAX	Specify the maximum defect area.

Please verify the sequent operations by following "3.6.1 Setting up [Defect]" (→pg.2).

3.6.4 [Output Parameter (Defect)]

Specify whether to reflect the judgement result to the overall judgement of the scene.

1 In the "Item tab" area, tap [Output parameter].

2 In the "Reflect to overall judgement" area, specify whether to reflect the measurement result to the overall judgement of the scene.

Table: Setting Values for Output Parameters

Setting Item	Set Value [Factory default]	Description
Reflect to overall judgement	・[ON] ・OFF	Select whether to reflect the judgement result of this processing unit to the overall judgement of the scene. ・Selecting "ON" reflects the judgement result of this processing unit on the overall judgement of the scene. ・Selecting "OFF" does not reflect the judgement result of this processing unit on the overall judgement of the scene.

POINT

- The overall judgement result of the scene is output to the OR signal to be sent via the parallel interface. Also, it is displayed in the Measurement Information Display area in the upper part of the Main screen.
  "10.4.4 Time Chart" (→pg.35), of "User's Manual"
  "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"

3.6.5 Points on Measurement Test and Adjustment (Defect)

In addition to the camera image, the measurement region will also be displayed in the "Image display" area.

In the "Detail result" area on the Main screen, you can confirm the following contents in text.
"6.3.2 Displaying Flow and Detail Result" (→pg.12), of "User's Manual"

Table: Defect - Text Displayed (Defect)

Displayed Items	Description
Judge	Judgement result
Defect level	Measurement defect level
Position X	X Coordinate of measurement defect position

Table: Defect - Text Displayed (Defect)

Displayed Items	Description
Position Y	Y Coordinate of measurement defect position
Defect area	The measured maximum defect area
Defect gravity X	The gravity center X coordinates of the measured maximum defect area
Defect gravity Y	The gravity center Y coordinates of the measured maximum defect area

Points on Adjustment

Please choose your adjustment methods as follows.

When the processing speed is slower

Perform the following settings in [Measurement].

- Set up [Defect Size] to a larger value.
- Reduce the difference between the upper and lower limits of [Defect Size].
  "3.6.3 [Measurement (Defect)]" (→pg.5)

when performing defect detecting on noise

- Set up [Defect judgement] in [Judgement condition] to a larger value.
  "3.6.3 [Measurement (Defect)]" (→pg.5)

3.6.6 When Using Measurement Results Externally (Defect)

Value Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The items and contents displayed in the sub-menu are shown in the following table.
For how to set up expression,see"4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (Defect)

Measurement items	Character string	Description
Judge	JG	Judgement result
Defect	F	Measurement defect level
Position X	X	X Coordinate of measurement defect position
Position Y	Y	Y Coordinate of measurement defect position
Defect area	AR	The measured maximum defect area
Defect gravity X	GX	The gravity center X coordinates of the measured maximum defect area
Defect gravity Y	GY	The gravity center Y coordinates of the measured maximum defect area

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in the "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Defect)

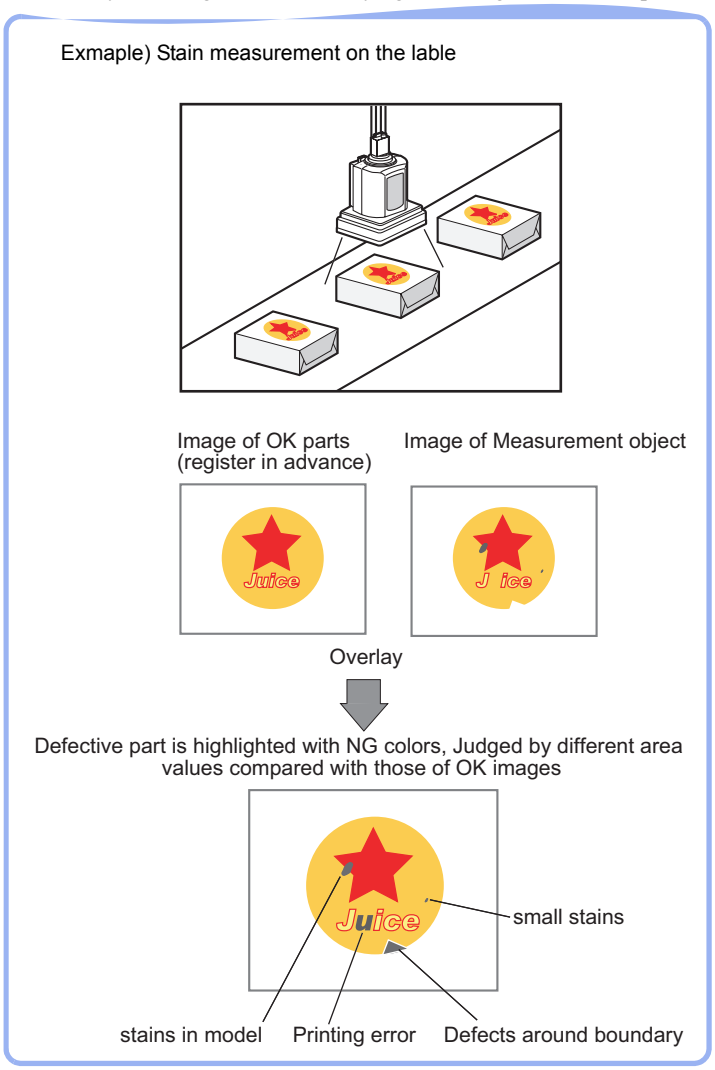
No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1 : Judgement result OK -1 : Judgement result NG
5	Defect level	Get only	0 to 999
6	Defect coordinate X	Get only	0 to 99999.9999
7	Defect coordinate Y	Get only	0 to 99999.9999
8	Defect area	Get only	0 to 999999999.9999
9	Defect gravity X	Get only	0 to 99999.9999
10	Defect gravity Y	Get only	0 to 99999.9999
103	Reflect in to overall judgement	Set/Get	0: ON 1: OFF
120	Upper of defect detection size	Set/Get	0: 4 1: 8 2: 12 3: 16 4: 24 5: 32 6: 64
121	Lower of defect detection size	Set/Get	0: 4 1: 8 2: 12 3: 16 4: 24 5: 32 6: 64
122	Defect judgement	Set/Get	0 to 999
123	Detect Color (for monochrome cameras only)	Set/Get	0: Both, 1: White, 2: Black
124	Area measurement	Set/Get	0: OFF, 1: ON
125	Area measurement level	Set/Get	0 to 999
126	Area judgement	Set/Get	0 to 999999999.9999

3.7 Fine Matching

Difference can be detected in a fast and highly accurate way by overlapping registered OK images with input images.

Used for the following case

- When accurately detecting trivial defects lying in the edges of text and patterns



List of Fine Matching Items

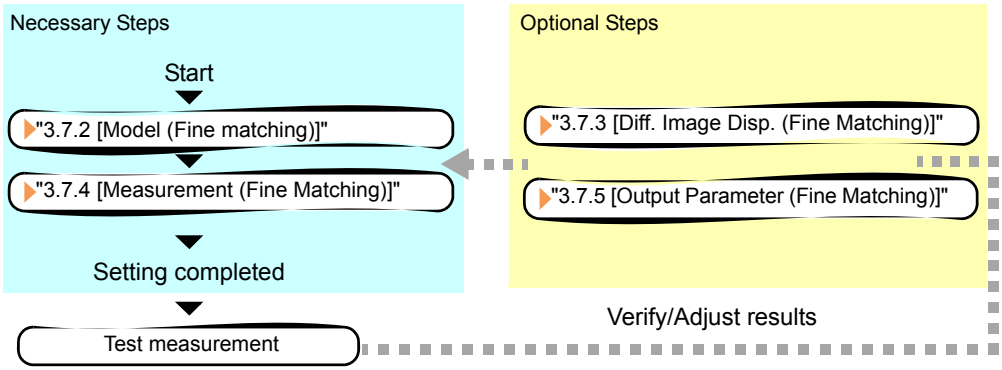
Fine matching items are explained below.

Table: List of Fine Matching Items

Item Name	Description
Model	This item registers the features images as a model. Model parameter values can be changed as needed to address unstable measurement results or to improve the processing speed. Usually, the factory default value can be used. "3.7.2 [Model (Fine matching)]" (→pg.3)
Difference image display	This item can be changed if necessary. Normally the factory default value will be used. When defects cannot be detected satisfactorily, change the decision differential value. "3.7.3 [Diff. Image Disp. (Fine Matching)]" (→pg.5)
Measurement	This item specifies the judgement condition for measurement results. Specify the criteria to judge the measurement result if its X and Y coordinates and its correlation with the model are OK. Measurement can be changed as needed to address unstable measurement results or to increase the processing speed. Normally the factory default value will be used. "3.7.4 [Measurement (Fine Matching)]" (→pg.7)
Output parameter	This item can be changed if necessary. Usually, the factory default value can be used. Use the Output parameter to specify how to treat the coordinate. "3.7.5 [Output Parameter (Fine Matching)]" (→pg.11)

3.7.1 Setting up [Fine matching]

Set up [Fine Matching] in the follow steps.



POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 Tap [Fine matching] in the Edit Flow window.

The "Procitem Setting" window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 The window opens with [Model] selected, so that you register the model as a pattern characteristic of the measurement object.
"3.7.2 [Model (Fine matching)]" (→pg.3)

3 In the "Item tab" area, tap [Measurement] and specify the judgement condition for OK.
"3.7.4 [Measurement (Fine Matching)]" (→pg.7)

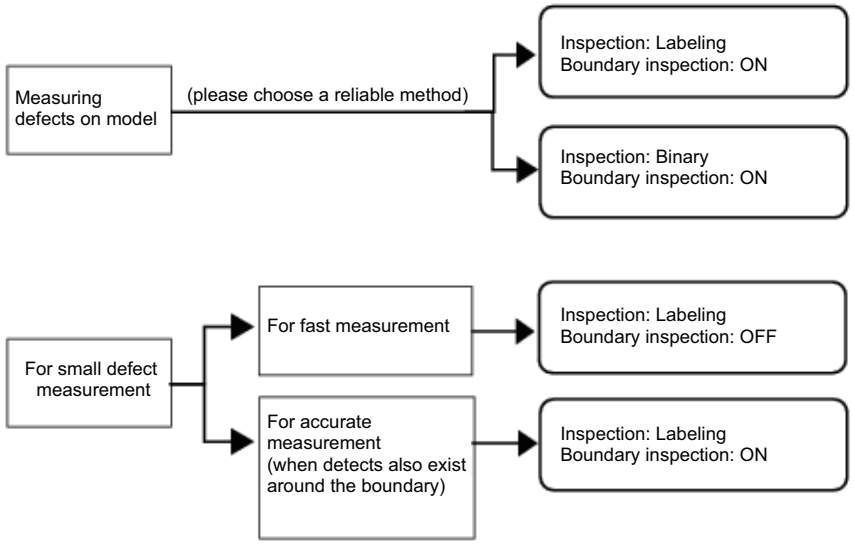
4 Tap [OK].
After confirmation, the ProcItem Setting window will be closed.

5 Perform a measurement test.
"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

6 Verify measurement results.
"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"
When NG is displayed, please verify measurement results and make adjustment if necessary.
"3.7.6 Points on Measurement Test and Adjustment (Fine Matching)" (→pg.13)

POINT

- Specify [Boundary inspection] in [Model] and [Inspection] in [Measurement] depending on situations as follows.



3.7.2 [Model (Fine matching)]

Register a fine image as the model. By matching this model with input images, unmatched parts will be detected as defects.
For the fine matching, the two pixels on the edge of the image cannot be registered as the model.

POINT

- The registering range will be lower if the images of measurement object are set with Filtering. When you set the image reading range using a camera with the partial scanning function, the range is also limited. "2.1 Filtering" (→pg.2)

1 In the "Item tab" area, tap [Model].

When setting a new model, you do not have to tap [Model].

2 If necessary, set up the "Model parameter" area.

" Changing Model Parameters" (→pg.5)

3 Use the following Tools to specify the Model Registration range.

"1.9 Setting Figures" (→pg.25), of "User's Manual"

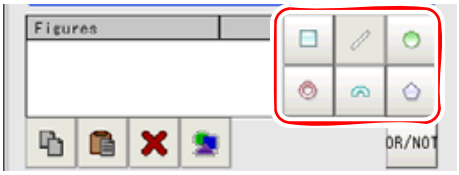


Table: Drawing Tools Available for Model Registration (Fine Matching)

Drawing objects	Drawing Tools
Rectangle	
Circle	
Circumference	
Wide arc	
Polygon	

POINT

- If the model is an ellipse, its circumscribed rectangle is displayed as the search result of the model.

4 In the "Figure setting" area, tap [OK].

The model is registered.

Changing Model Parameters

This item can be changed if necessary. Usually, the factory default value can be used.
When any settings have been changed, verify whether measurements can be performed correctly through actual measurement.

1 In the "Model parameter" area, specify a value for each item.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"
The "Boundary level" value can be adjusted by tapping [<] and [>].

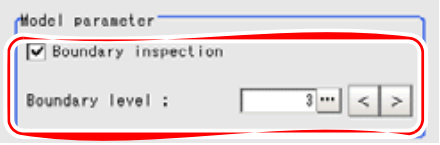
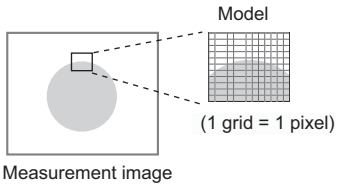


Table: Model (Fine Matching)

Setting Item	Set Value [Factory Default]	Description
Boundary inspection	Selects the matching method for boundary areas where density changes.	
	[Checked]	All areas are subject to the inspection, so that defects around boundaries can be detected. The edges similar to those in the model image are not regarded as defects. Check this option when inspecting defects around boundaries, such as chips and burrs.
	Unchecked	Boundary areas are excluded from the inspection. Defects around boundaries are not to be detected. "Boundary level" can be used to specify how many pixels around boundaries should be excluded from the inspection.  If the measurement object moves up slightly, its difference with the model will be detected as the edge part. When setting Edge Measurement to "Disabled", the range of the "Model edge ± Boundary level" will be outside of the measurement object. Example} When "Edge level" is 3, the range with a width of 6 pixels will not be outside of the measurement object.
Boundary level	0 to 9 [3]	Specify the level to assimilate variations around boundaries where density changes. Depending on the "Boundary inspection" value, the meaning is different.

For the following operations, see "3.7.1 Setting up [Fine matching]" (→pg.2).

3.7.3 [Diff. Image Disp. (Fine Matching)]

This item can be changed if necessary. Usually, the factory default value can be used.

Modify this setting when defects cannot be detected successfully.
When any settings have been changed, verify whether measurements can be performed correctly through actual measurement.

1 In the "Item tab" area, Tap [Diff. image disp.].

2 In the "Revision processing" area, select a value for each item.

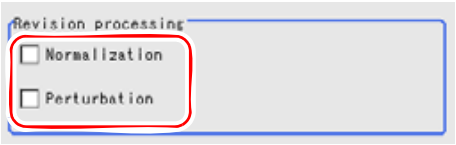


Table: Diff Image Disp (Fine Matching) - Revision Processing

Setting Item	Set Value [Factory Default]	Description
Normalization	・Checked ・[Unchecked]	Specify whether to perform normalization based on the brightness in the registered model. When normalization is checked, the density is adjusted before matching, so that the matching is not affected by changes in the total image brightness or the lighting fluctuations. When normalization is performed on the measured objects without patterns, the total image brightness is changed and the measurement does not work correctly. Model image Measurement image (When the whole image turns dark)
Perturbation	・Checked ・[Unchecked]	Specify whether to adjust minute positioning errors in the model matching.

3 In the "Difference parameter" area, tap [...] for "Difference" and specify a value for difference judgement.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

The value can be adjusted by dragging the slider or by tapping the buttons at both ends of the slider.

Specifying a value will update the difference image in the "Image display" area.

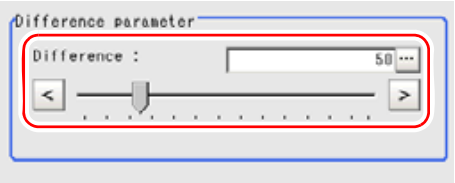
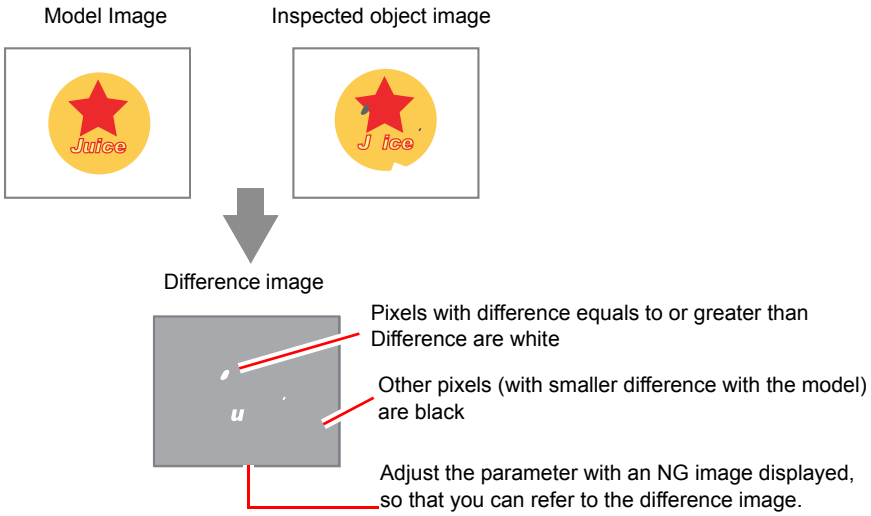


Table: Diff. Image Disp. (Fine Matching) - Difference Parameter

Item	Set Value [Factory Default]	Description
Difference	0 to 255 [50]	Difference is the reference grayscale used when calculating differences between the model and the inspected object image.

Pixels with difference equals to or greater than Difference are converted to white and other pixels are converted to black, so that only defects are converted to white and measured.



For the subsequent operations, see "3.7.1 Setting up [Fine matching]" (→pg.2).

3.7.4 [Measurement (Fine Matching)]

The judge OK conditions involve the number of labels, area and defect coordinates. Defect Coordinates are the gravity center of detected defects.

1 In the "Item tab" area, tap [Measurement].

2 If necessary, set up the "Measurement condition" area.

" Modifying the Measurement Condition" (→pg.8)

3 When the setting has been changed, tap [Measure] in the "Detail" area to verify whether measurements can be made correctly.

4 In the "Judgement condition" area, tap [...] and input a value for each item.

For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual".

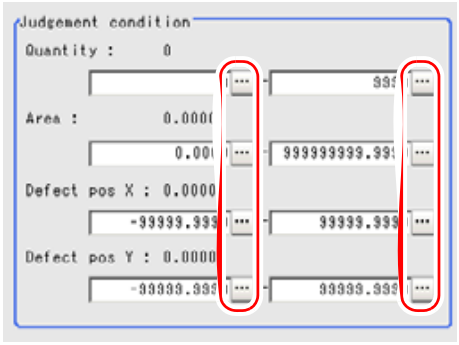


Table: Measurement (Fine Matching) - Judgement Condition

Setting Options		Set Value [Factory Default]	Description
Count	Upper	0 to [9999]	Specify the range of the number of OK labels. When the "Binary" is used, the entire white pixels will be regarded as one label.
	Lower	[0] to 9999	
Area	Upper	0 to [999999999.9999]	Specify the area range of OK labels. When the "Labeling" method is used, the area of the label No. will be specified instead.
	Lower	[0] to 999999999.9999	
Defect coordinate X	Upper	-99999.9999 to [99999.9999]	Specify the X and Y axis move range of gravity position of OK labels. When the "Labeling" method is used, the gravity position of the label No. will be specified instead.
	Lower	[-99999.9999] to 99999.9999	
Defect coordinate Y	Upper	-99999.9999 to [99999.9999]	Specify the X and Y axis move range of gravity position of OK labels. When the "Labeling" method is used, the gravity position of the label No. will be specified instead.
	Lower	[-99999.9999] to 99999.9999	

For the inspection method, see " Modifying the Measurement Condition" (→pg.8).

For the subsequent operations, see "3.7.1 Setting up [Fine matching]" (→pg.2).

Modifying the Measurement Condition

This item can be changed if necessary. Usually, the factory default value can be used.

1 Select "Inspection" in the "Measurement condition" area.

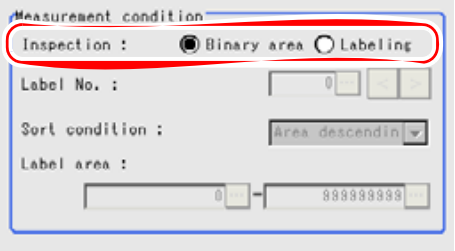
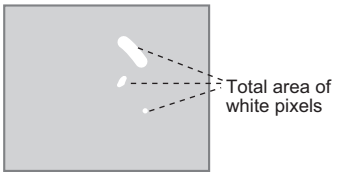
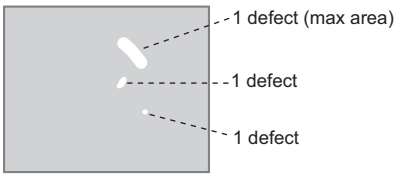


Table: Measurement (Fine Matching) - Measurement Condition - Inspection

Setting Options	Set Value [Factory defaults]	Description
Inspection	Images that are different from the model will be converted into 2-digits images internally. Inspections that are used to detect 2-digits images should be selected.	
	[Binary]	Defect is judged based on the total area of white pixels. 
	Labeling	A white pixel will be detected as 1 label, which is then compared with a label which is consistent with the set conditions. With this, defect will be determined. 

2 When "Labeling" is selected for "Inspection" in Step 1, tap [...] or [▼] for each of the following items and specify a value respectively.

If "Binary" is chosen in the "Inspection", the following operations are not necessary.

For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual".

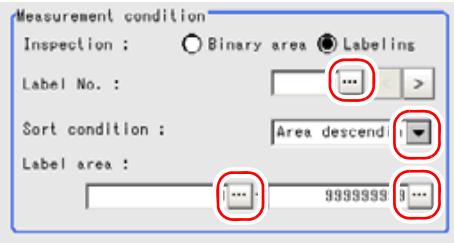
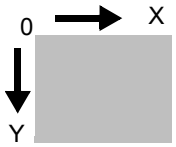
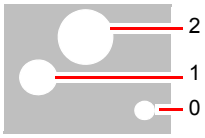
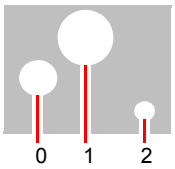
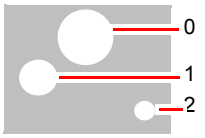


Table: Measurement (Fine Matching) - Measurement Condition

Item	Set Value [Factory defaults]	Description
Label No.	0 to 2499 [0]	Specify the label number used to determine whether defects exist. Different settings for "Sort condition" will lead to different un-matching method.

Table: Measurement (Fine Matching) - Measurement Condition

Item		Set Value [Factory defaults]	Description
Sort condition		Specify the conditions by which label numbers are re-assigned. When the X and Y Coordinate are in accordance with the reference value, the upper left will become the origin, which will not affect the Coordinate set up through "Camera Image". 	
		Area ascending	No. re-assigning begins from the label with a smaller area. 
		[Area descending]	No. re-assigning begins from the label with a larger area.
		X ascending	No. re-assigning begins from the label with a smaller gravity X-Coordinate. 
		X descending	No. re-assigning begins from the label with a bigger gravity X-Coordinate.
		Y ascending	No. re-assigning begins from the label with a smaller gravity Y-Coordinate. 
		Y descending	No. re-assigning begins from the label with a bigger gravity Y-Coordinate.
Label area	Upper	0 to [999999999]	Input the area range that is accepted as the label.
	Lower	[0] to 999999999	

3.7.5 [Output Parameter (Fine Matching)]

Select options for the measured results, namely the coordinates, which are output to the external devices.

Important

- After setting up the measurement, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

1 In the "Item tab" area, tap [Output parameter].

2 Specify a value for each item.

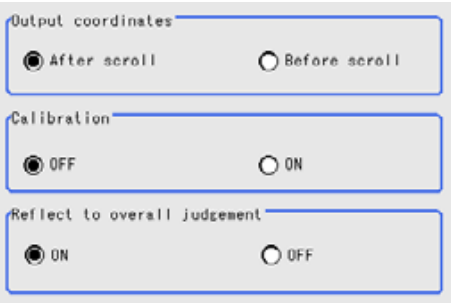


Table: Setting Values for Output Parameter

Setting Options	Set Value [Factory defaults]	Description
Output coordinate	・[After scroll] ・Before scroll	Select whether to output measurement results to external devices before or after the position deflection correction is applied.
Calibration	・[OFF] ・ON	Select whether to output measurement results to external devices by converting them into the coordinates with actual size (calibration: ON) or into the coordinates of camera image (calibration: OFF).
Reflect to overall judgement	・[ON] ・OFF	Select whether to reflect the judgement result of this processing unit to the overall judgement of the scene. ・Selecting "ON" reflects the judgement result of this processing unit on the overall judgement of the scene. ・Selecting "OFF" does not reflect the judgement result of this processing unit on the overall judgement of the scene.

POINT

- For output coordinates and calibration, see "4.6.5 Configuring Coordinates" (→pg.45), of "User's Manual".
- The overall judgement result of the scene is output to the OR signal to be sent via the parallel interface. Also, it is displayed in the "Measurement information display" area in the upper part of the Main screen.
  "10.4.4 Time Chart" (→pg.35), of "User's Manual"
  "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"

3.7.6 Points on Measurement Test and Adjustment (Fine Matching)

In addition to the camera image, the measurement region will also be displayed in "Image display" area.
In the "Detail result" area on the Main screen, you can confirm the following contents in text.
"6.3.2 Displaying Flow and Detail Result" (→pg.12), of "User's Manual"

Table: Displayed Text (Fine Matching)

Displayed Items	Description
Judge	Judgement result
Quantity	Number of defects
Area	Defect area
Defect coordinate X	Defect coordinate X
Defect coordinate Y	Defect coordinate Y

Points on Adjustment

Please choose your adjustment methods as follows.

When the processing speed is slower

- Set up [Model] as follows:
  - Inspection: [OFF]

  "3.7.2 [Model (Fine matching)]" (→pg.3)
- Perform the following settings in [Measurement].
  - Inspection: [Labeling]

  "3.7.4 [Measurement (Fine Matching)]" (→pg.7)

When detecting the detects around the boundary

- Set up [Model] as follows:
  - Inspection: [OFF]

  "3.7.2 [Model (Fine matching)]" (→pg.3)
- Perform the following settings in [Measurement].
  - Inspection: [Labeling]

  "3.7.4 [Measurement (Fine Matching)]" (→pg.7)

When performing defect detecting on noise

- Adjust the [Difference] value in [Diff. image disp.].
  "3.7.3 [Diff. Image Disp. (Fine Matching)]" (→pg.5)

When defects cannot be detected

- Adjust the [Difference] value in [Diff. image disp.].
  "3.7.3 [Diff. Image Disp. (Fine Matching)]" (→pg.5)

3.7.7 When Using Measurement Results Externally (Fine Matching)

Value Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (Fine Matching)

Measurement items	Character string	Description
Judge	JG	Judgement result
Quantity	DA	Number of labels
Area	AR	Area
Position X	X	X Coordinate of gravity position of measurement defects
Position Y	Y	Y Coordinate of gravity position of measurement defects

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in the "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Fine Matching)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Number of labels	Get only	0 to 9999
6	Area	Get only	0 to 999999999.9999
7	Position X	Get only	-99999.9999 to 99999.9999
8	Position Y	Get only	-99999.9999 to 99999.9999
101	Output coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF, 1: ON
103	Reflect in to overall judgement	Set/Get	0: ON, 1: OFF
120	Boundary inspection	Set/Get	0: OFF, 1: ON
121	Edge level	Set/Get	0 to 9
122	Normalization	Set/Get	0: OFF 1: ON
123	Perturbation	Set/Get	0: OFF 1: ON

Table: External Reference List (Fine Matching)

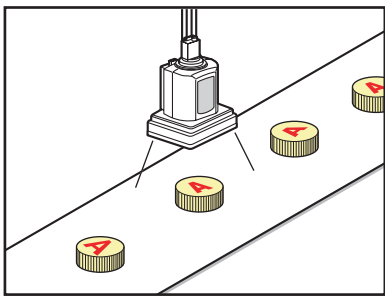
No.	Data Name	Set/Get	Data Range
124	Difference	Set/Get	0 to 255
125	Detection method	Set/Get	0: Binary 1: Labeling
126	Label No.	Set/Get	0 to 2499
127	Sort condition	Set/Get	0: area descending order 1: area ascending order 2: X descending 3: X ascending 4: Y descending 5: Y ascending
128	Upper limit of Labeling condition	Set/Get	0 to 999999999.9999
129	Lower limit of Labeling condition	Set/Get	0 to 999999999.9999
130	Upper limit of Quantity	Set/Get	0 to 9999
131	Lower limit of Quantity	Set/Get	0 to 9999
132	Upper limit of Area	Set/Get	0 to 999999999.9999
133	Lower limit of Area	Set/Get	0 to 999999999.9999
134	Upper limit of defect X-Coordinate	Set/Get	-99999.9999 to 99999.9999
135	Lower limit of defect Coordinate-X	Set/Get	-99999.9999 to 99999.9999
136	Upper limit of defect Coordinate-Y	Set/Get	-99999.9999 to 99999.9999
137	Lower limit of defect Coordinate-Y	Set/Get	-99999.9999 to 99999.9999

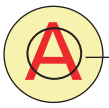
3.8 Circle Angle

Used for the following case

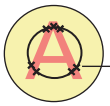
- When correcting the tilting of circle measurement objects

Example)Appearance measurement while correcting the nut rotation

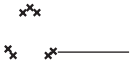




Draw a circle to encircle the part that has the basic features of the image in order to define the registering conditions for featured points/measured points.



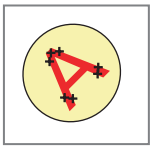
Based on the conditions defined on the controller, inspect the featured points on the circumference with the pixel unit, which will be registered as the reference position.



(Featured points for the reference position)

Reference image

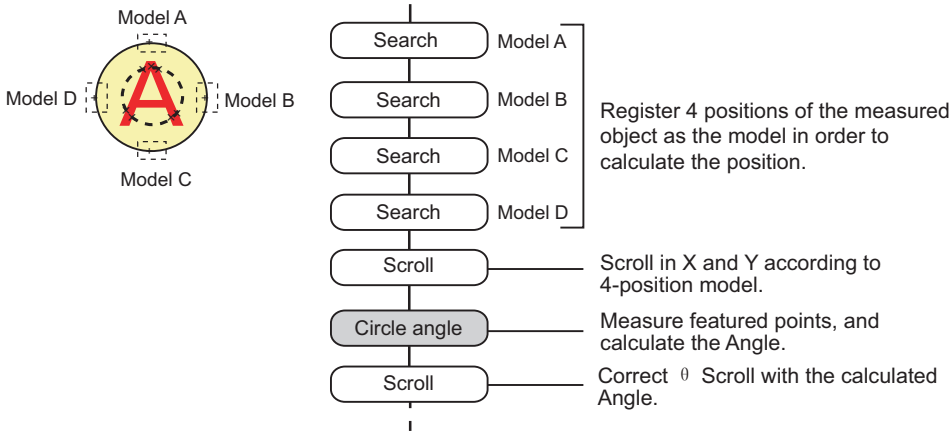
Input image



The degree of angle is calculated by comparing the featured points of the reference image with those of the input image.

POINT

- The center position of the measured object should be always fixed in order to efficiently use the Circle Angle. Prior to Circle Angle, ProcItems related to position correction should be performed, making the Coordinate of the measurement object to stay a fixed position.
  Example)



List of Circle Angle Items

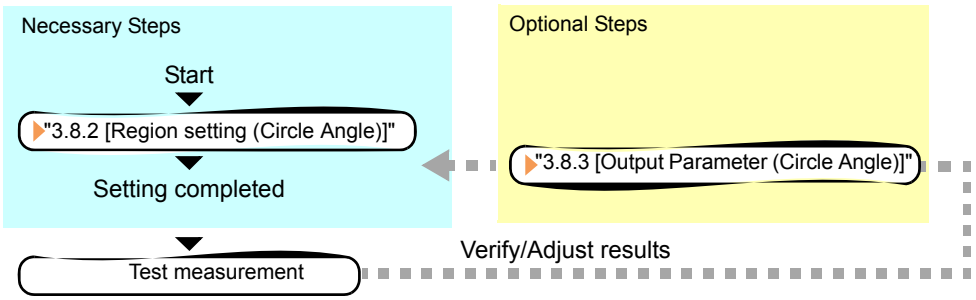
Circle Angle items are shown as follows.

Table: List of Circle Angle Items

Menu Name	Description
Region setting	This item specifies the measurement region. Input images can also be entirely measurement. Limiting the measurement region may allow a fast and reliable processing. If measurement results are unstable, change detection conditions as needed. Normally the factory default value will be used. "3.8.2 [Region setting (Circle Angle)]" (→pg.138)
Output parameter	This item can be changed if necessary. Normally the factory default value will be used. Use the Output parameter to specify how to treat the coordinate. "3.8.3 [Output Parameter (Circle Angle)]" (→pg.141)

3.8.1 Setting up [Circle Angle]

The Circle Angle should be set up with the following procedure.



POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 In the Edit Flow window, tap [Circle angle].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area, tap [Region setting] and specify the measurement region.

"3.8.2 [Region setting (Circle Angle)]" (→pg.138)

3 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

4 Perform a measurement test.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

5 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

When NG is displayed, please verify measurement results and make Adjust if necessary.

"3.8.4 Points on Measurement Test and Adjustment (Circle Angle)" (→pg.142)

3.8.2 [Region setting (Circle Angle)]

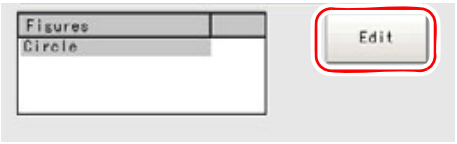
Use circle to specify the measurement region for [Circle angle] (cannot use Ellipse).

POINT

- When drawing the measurement region, the featured part should lie on the circumference.

1 In the "Item tab" area, tap [Region setting].

2 When a measurement region is already registered, tap [Edit].



The "Figure setting" area is displayed.
When no measurement region is registered, go to Step 3.

3 In the "Detection condition" area, if necessary, tap [...] or [▼] and input a value for each item.

Normally the factory default value will be used. Change can be made to specific settings of the registered conditions and comparing conditions of the detecting point. After settings are changed, please verify with actual measurement.
How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"
"Skipping angle" or "Edge pitch" can be specified by tapping [<] and [>].

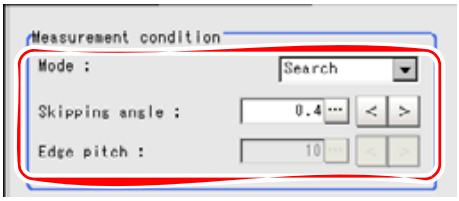
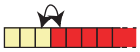
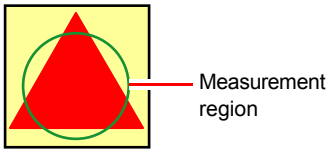
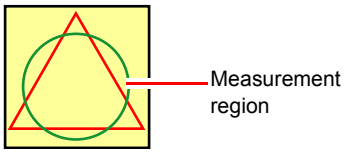
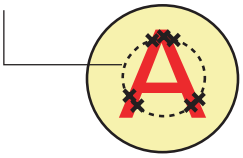
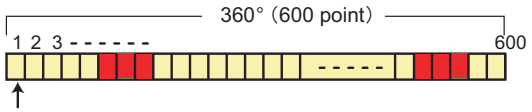
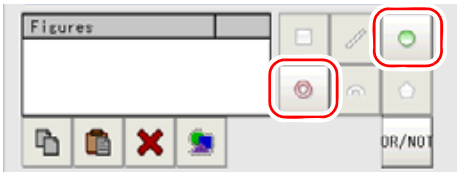


Table: Detection condition (Circle Angle)

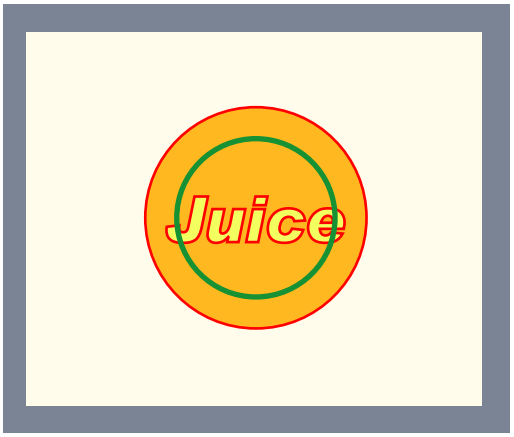
Setting Options	Set Value [Factory defaults]	Description
Mode	[Search]	This option compares the color difference with the adjacent pixels, which will be used as the basis to determine the degree of Angle.
	Edge	This option compares the color difference with the adjacent pixels [Note 1]. The point with a larger color difference can be used to determine the degree of Angle.  The measurement object should applicable to the following cases. 
	Defect	This option compares the color difference with the adjacent pixels [Note 1]. The position of the point with a larger color difference can be used to determine the degree of Angle. The measurement object should applicable to the following cases. 
Skipping angle	0.1 to 10 [0.4]	Specify the interval degree of Angle of the extracted point. Calculate the color of all points on the circumference (360 ° / Skipping angle) of the selected Skipping angle. Example) When the scale unit is 0.6° Measure 600 point on this line in the pixel unit.   Calculate the color for every other point. For the initial setting, the optimal value will be automatically set up based on the radius of the drawn circle. The bigger the set value, the faster the Unit. But the detected Angle and Obtain accuracy will be lower.
Edge pitch	1 to 99 [10]	Specify the spacing for calculating color difference. This function is enabled only after the "Edge" or "Defect" of the "Mode" is selected.

[Note 1]: The adjacent pixel is the pixel that has the comparing spacing (the value that is set up in [Edge Pitch] of the Details conditions).

4 Specify the measurement region using Drawing tools.
"1.9 Setting Figures" (→pg.25), of "User's Manual"



5 Tap [OK].
The measurement region is registered and displayed in the "Image display" area.



Please verify the sequent operations by following "3.8.1 Setting up [Circle Angle]" (→pg.137).

3.8.3 [Output Parameter (Circle Angle)]

Specify how to treat the coordinates to be output to the external devices as measurement results.

1 In the "Item tab" area, tap [Output parameter].

2 Set up each item.

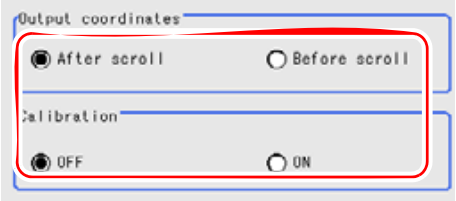


Table: Circle Angle - Measurement

Setting Options	Set Value [Factory defaults]	Description
Output coordinates	・[After scroll] ・Before scroll	Select which coordinate values should be output to the external device as measurement results, values before scroll or values after scroll.
Calibration	・[OFF] ・ON	Select which coordinate values should be output to the external device as measurement results, values converted to the actual dimension (Calibration: ON) or values in the camera image (Calibration: OFF).

POINT

- For details on the Output parameter, see "4.6.5 Configuring Coordinates" (→pg.45), of "User's Manual".

3.8.4 Points on Measurement Test and Adjustment (Circle Angle)

In addition to camera images, the measurement region will also be displayed in the "Image display" area.
In the "Detail result" area on the Main screen, you can confirm the following contents in text.
"6.3.2 Displaying Flow and Detail Result" (→pg.12), of "User's Manual"

Table: Text Displayed (Circle Angle)

Displayed Items	Description
Judge	Judgement result
Rotation Angle	Measured Angle
Center position X	Center position X of measurement circle
Center position Y	Center position Y of measurement circle
Reference angle	Degree of Reference Angle of the circle which is set up as the measurement region
Reference X	Reference X of circle which is set up as the measurement region
Reference Y	Reference Y of circle which is set up as the measurement region

Points on Adjustment

Please choose your adjustment methods as follows.

When detecting cannot be performed satisfactorily

- Specify a smaller value for "Skipping angle" in [Region setting].
  "3.8.2 [Region setting (Circle Angle)]" (→pg.138)

When the processing speed is slower

- Specify a larger value for "Skipping angle" in [Region setting].
  "3.8.2 [Region setting (Circle Angle)]" (→pg.138)
- When "Mode" is set to "Search" in [Region setting], change it to "Edge" or "Defect".
  "3.8.2 [Region setting (Circle Angle)]" (→pg.138)

3.8.5 When Using measurement Results Externally (Circle Angle)

Value Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The items and contents displayed in the sub-menu are shown in the following table.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (Circle Angle)

Measurement items	Character string	Description
Judge	JG	Judgement result
Center position X	X	Center position X of circle center of measurement results
Center position Y	Y	Center position Y of circle center of measurement results
Rotation Angle	TH	Degree of Angle of measurement results
Reference X	SX	Reference X of the circle specified as the measurement region [Note 1]
Reference Y	SY	Reference Y of the circle specified as the measurement region [Note 1]
Reference angle	ST	Degree of Angle of the measurement region

[Note 1]: Since measuring is performed on the same position every time when the circle Angle is calculated, then "Central position X = Reference SX, Central position Y = Reference SY".

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in the "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Circle Angle)

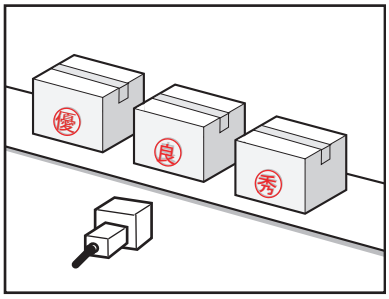
No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Center X	Get only	0 to 99999.9999
6	Center Y	Get only	0 to 99999.9999
7	Rotation angle	Get only	-180 to 180
8	Reference X	Get only	0 to 99999.9999
9	Reference Y	Get only	0 to 99999.9999
10	Reference angle	Get only	-180 to 180
101	Output coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
120	Mode	Set/Get	0: Search 1: Edge 2:Defect
121	Skipping angle	Set/Get	0.1 to 10
122	Edge pitch	Set/Get	1 to 99

3.9 Classification

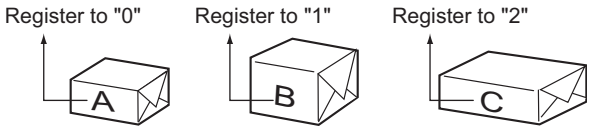
Used for the following case

- When various kinds of product on the production line need to be sorted and identified

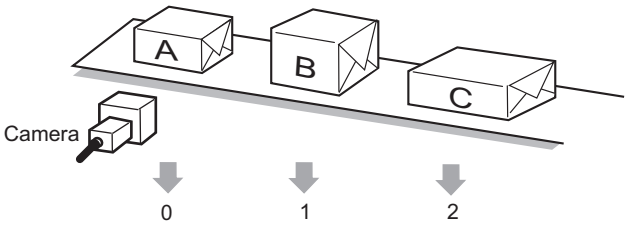
Example) Grade recognition of orange packing box



Register the classification condition as a model first.



Output model No. that is most similar with the input image. Which will be received by the external device and sorted in the following process. (when there are no similar models, NG(-1) will be output).



The most similar model No. will be output.

List of Classification Items

Classification items are explained below.

Table: List of Classification Items

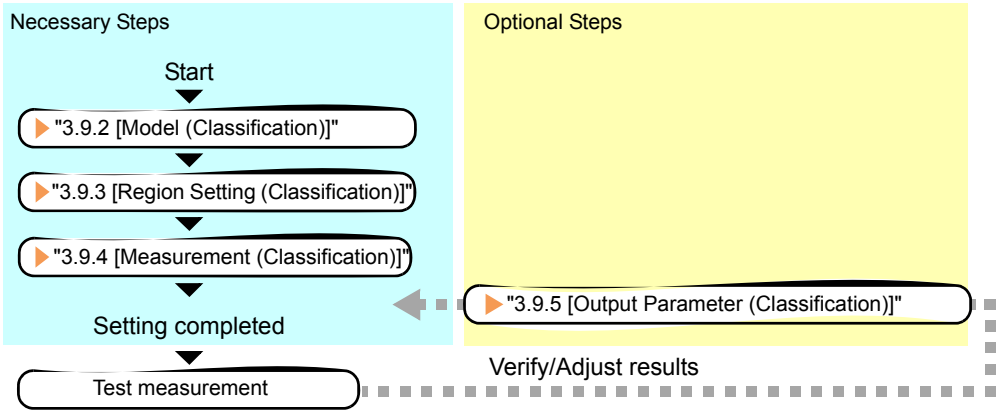
Menu Name	Description
Model	This item registers the features images as a model. Model parameter values can be changed as needed to address unstable measurement results or to improve the processing speed. Usually, the factory default value can be used. "3.9.2 [Model (Classification)]" (→pg.3)

Table: List of Classification Items

Menu Name	Description
Region setting	This item specifies the measurement region. Input images can also be entirely measurement. Limiting the measurement region may allow a fast and reliable processing. "3.9.3 [Region Setting (Classification)]" (→pg.9)
Measurement	This item specifies Judgement conditions for measurement results. Set up OK criterion with which the coordinates (X, Y) of the measurement results and their corresponding evaluation value on the model will be judged. "3.9.4 [Measurement (Classification)]" (→pg.10)
Output parameter	This item can be changed if necessary. Usually, the factory default value can be used. Use the Output parameter to specify how to treat the coordinate. "3.9.5 [Output Parameter (Classification)]" (→pg.12)

3.9.1 Setting up [Classification]

Classification can be set up as follows.



POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 Tap [Classification] in the Edit Flow window.

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area, tap [Model] to register characteristics of the measurement object as a pattern.

"3.9.2 [Model (Classification)]" (→pg.3)

3 In the "Item tab" area, tap [Region setting] and specify the measurement region.

"3.9.3 [Region Setting (Classification)]" (→pg.9)

4 In the "Item tab" area, tap [Measurement] and specify the judgement condition for OK.

"3.9.4 [Measurement (Classification)]" (→pg.10)

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement parameters, too.

5 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

6 Perform a measurement test.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

7 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

When NG is displayed, please verify measurement results and make Adjust if necessary.

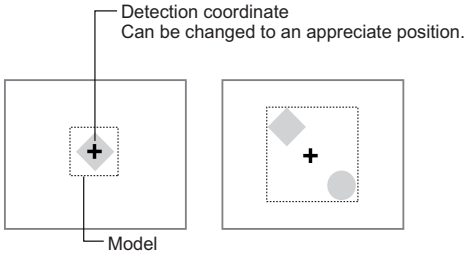
"3.9.6 Points on Measurement Test and Adjustment (Classification)" (→pg.13)

3.9.2 [Model (Classification)]

Register the classification reference as models beforehand.
The model can be registered within Index 0 to 35, and up to 5 models can be registered for one index.
Where variance of the printing quality and shape, more than one models should be registered in the same index.

Important

- When a model is registered, the central coordinates of the model are registered as the detection coordinates (if multiple figures are combined, the central coordinates of the circumscribed rectangle are registered). For this, ensure the position of the measurement object to be correct when registering a model.

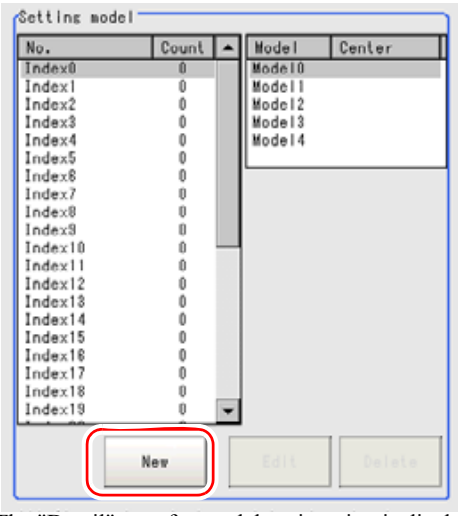


1 In the "Item tab" area, tap [Model].

2 If necessary, set up the "Model parameter" area.

" Changing [Model Parameter]" (→pg.6)

3 In the "Setting model" area, select a model and tap [Model].



The "Detail" area for model registration is displayed.

4 Specify a region to be registered as a model by using one of the Drawing tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"

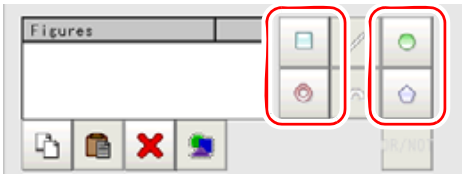


Table: Drawing Tools Available for Models (Classification)

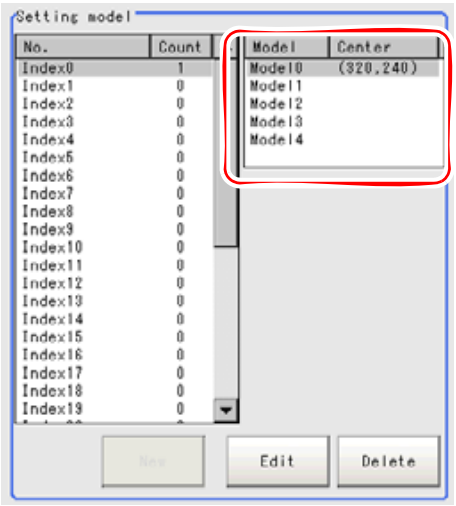
Drawing objects	Drawing Tools
Rectangle	
Circle	
Circumference	
Polygon	

POINT

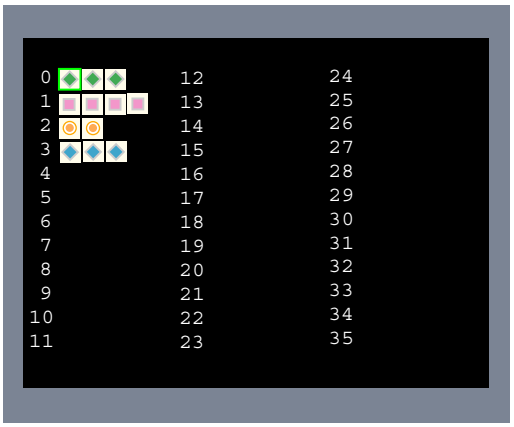
- If the model is an ellipse, its circumscribed rectangle is displayed as the search result of the model.

5 Tap [OK].

The model is registered and the model's central X and Y coordinate values are displayed in the "Setting model" area.



The image specified for the model is displayed in the "Image display" area.



POINT

Model Status and Measurement

- The model state may affect the measurement time and accuracy as follows. Please select in-good-state (clean) measurement objects during Model.
  - In the case of big or complicated model, processing time is prolonged.
  - In the case of extremely small model, or absence of features, search is unstable.

6 To register two or more models, repeat the Steps 3 to 5.

For the following operations, see"3.9.1 Setting up [Classification]" (→pg.2).

Changing [Model Parameter]

This item can be changed if necessary. Usually, the factory default value can be used.
When any settings have been changed, verify whether measurements can be performed correctly through actual measurement.

POINT

- For search operations, see "4.6.2 Configuring Search" (→pg.39), of "User's Manual".

1 In the "Model parameter" area, select the search detection method and specify a value for each item.

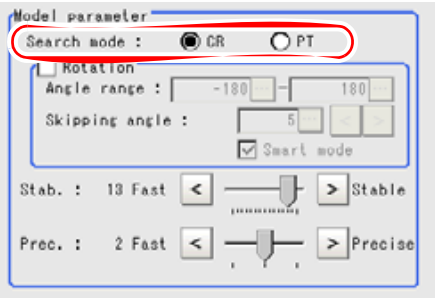


Table: Model - Model Parameter

Setting Item	Set Value [Factory Default]	Description
Search mode	[CR]	This search mode detects areas with a high degree of correlation between the registered model image and the input image.
	PT	This search mode detects areas with a high degree of shape similarity between the registered model image and the input image. It is available only when 3 Mega pixel color camera is connected. "4.6.2 Configuring Search" (→pg.39), of "User's Manual"

When "CR" is selected:

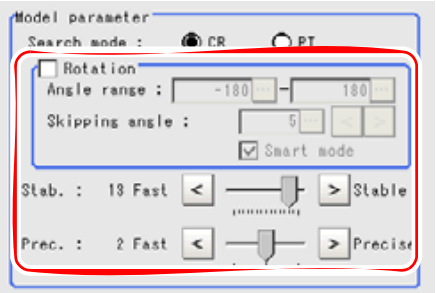


Table: Model - Model Parameter - CR

Setting Item		Set Value [Factory Default]	Description
Rotation		・Checked ・[Unchecked]	Specify whether to rotate the image during a search.
Angle range	Upper	-180 to [180]	Specify the upper and lower limit values for [Angle range] (rotation angle) during a search. The normal direction is clockwise. Settings must satisfy: lower limit ≦ upper limit.
	Lower	[-180] to 180	
Skipping angle		1 to 30 [5]	Specify the stepping angle (in degrees) by which the model is rotated to create rotated models. A smaller angle increases stability, but slows down the processing.
Smart mode		・[Checked] ・Unchecked	Specify whether or not to enable Smart mode. Checking the [Smart mode] option enables a high-speed rotation search. The stability may be lowered when the model shape aspect ratio is large or when the NOT mask is used.
Stab. (Stability)		1 to 15 [9] (for cameras with more than 640 by 480 pixels) [12] (for cameras with 640 by 480 pixels or less)	Specify the stability of detection. A larger value increases stability. A smaller value speeds up processing. If lowering stability leads to slower processing, it is likely that many candidates have been detected. In this case, specify a larger value for [Candidate LV] or [Stab.].
Prec. (Precision)		1 to 3 [2]	Specify the position precision of the measurement coordinates. A larger value increases precision, and a smaller value speeds up processing.

1. If necessary, check "Rotation" and specify a value for each rotation item.
   For "Angle range" and "Skipping angle", tap [...] and specify a range of the rotation angle.
   How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"
   The "Skipping angle" value can be adjusted by tapping [<] or [>].
2. The values for "Stab." and "Prec." can be specified by dragging the slider.
   The value can also be adjusted by tapping the buttons at both ends of the slider.

When "PT" is selected:

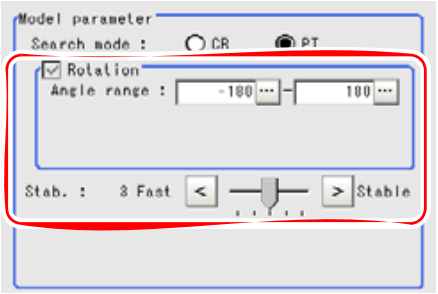


Table: Model - Model Parameter - PT

Setting Item			Set Value [Factory Default]	Description
Rotation			・[Checked]	When "PT" is selected for "Search mode", search cannot be performed without rotation.
	Angle range	Upper	-180 to [180]	Specify the upper and lower limit values for "Angle range" (rotation angle) during a search. The normal direction is clockwise. Settings must satisfy: lower limit ≦ upper limit.
		Lower	[-180] to 180	
Stab. (Stability)			1 to 5 [3]	Specify the stability of detection. A larger value increases stability, and a smaller value speeds up processing. If lowering stability leads to slower processing, it is likely that many candidates have been detected. In this case, specify a larger value for "Candidate LV" or "Stab.".

1. If necessary, specify a value for each item.
   Tap [...] for "Angle range" and specify the range of the rotation angle.
   How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"
2. The value for "Stab." can be specified by dragging the slider.
   The value can also be adjusted by tapping the buttons at both ends of the slider.

Points on Adjustment

To improve measurement results, make adjustments as described below.
For adjustments, see also "5.4 Points on Adjustment" (→pg.11), of "User's Manual".

When measurement results are unstable

- If the model image consists of detailed figures, specify a larger value for "Stab.".
- If images that should be judged OK based on the model image vary in some degree, specify a smaller value for "Candidate LV".
- If the measurement results are unstable only when "Rotation" is selected, specify a smaller value for "Skipping angle".
- When "Rotation" is selected, if the model region shape is complex, uncheck the "Smart mode" option.

When the processing speed is slow

- If the model image is a simple figure or a large figure, specify a smaller value for "Stab.".

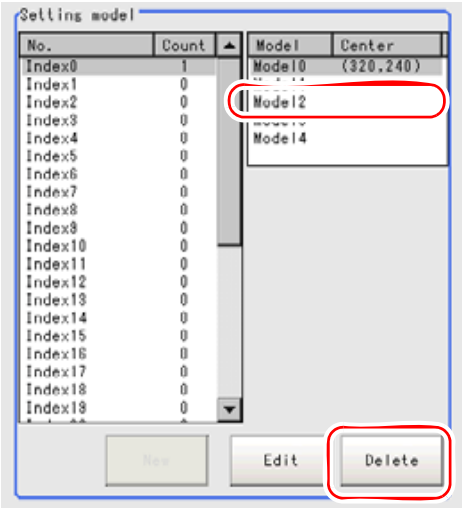
- If images that should be judged OK based on the model image, have less variation, specify a larger value for "Candidate LV".
- When "Rotation" is selected, if the model image is a simple figure, specify a larger value for "Skipping angle".
- When "Rotation" is selected, if the model region shape is simple, check the "Smart mode" option.

For other adjustment methods, see " Shortening Measurement Time by Setting Processing Item" (→pg.11), of "User's Manual".

Deleting a Model

Deletes a registered model.

1 Select the model from the list and tap [Delete].



3.9.3 [Region Setting (Classification)]

Use the rectangle to set up the measurement region for [Classification].

1 In the "Item tab" area, tap [Region setting].

2 Tap [Edit].

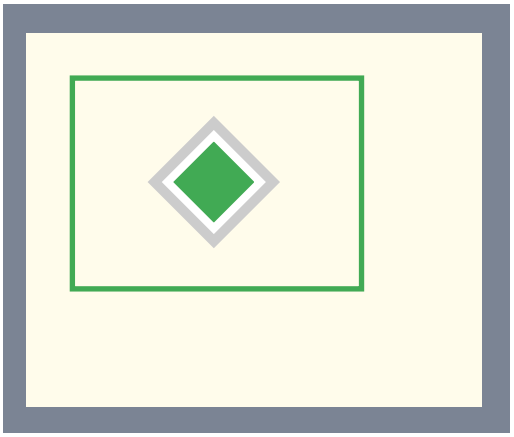
The "Figure setting" area is displayed.

3 Specify a region where the model is searched by using the Drawing tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"

4 In the "Figure setting" area, tap [OK].

The measurement range is registered and displayed in the "Image display" area.



For the following operations, see "3.9.1 Setting up [Classification]" (→pg.2).

3.9.4 [Measurement (Classification)]

Set up the OK Judgement conditions based on the value in the model and the position (X, Y) to be found.

1 In the "Item tab" area, tap [Measurement].

2 In the "Measurement condition" area, specify a value for each item.

Tap [...] for "Candidate LV" and specify a value. The value can also be adjusted by tapping [<] and [>].

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

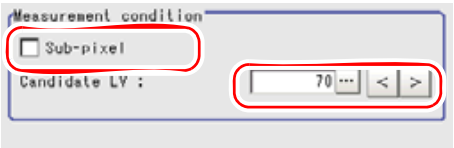


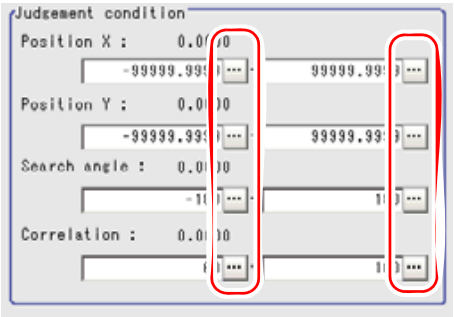
Table: Measurement (Search)

Setting Item	Set Value [Factory Default]	Description
Sub-pixel	・Checked ・[Unchecked]	Specify whether or not to perform measurement with sub-pixel interpolation. Sub-pixel processing achieves higher accuracy, but slows down measurement processing. For sub-pixels, see "11.4 Terminology" (→pg.12), of "User's Manual".
Candidate LV	0 to 100 [70]	Specify the threshold value used when detecting candidate points by a rough search. Specify a smaller value when model search results are unstable.

3 When the setting has been changed, tap [Measure] in the "Detail" area to verify whether measurements can be made correctly.

4 In the "Judgement condition" area, tap [...] and input a value for each item.

For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual".



POINT

- The value beside each option are measurement results of the displayed image. Please determine the upper and lower limits based on these value.

Table: Measurement (Classification) - Judgement Condition

Setting Item		Set Value [Factory Default]	Description
Measured coordinate X	Upper	-99999.9999 to [99999.9999]	Specify the range of X-axis shifting that is judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Measured coordinate Y	Upper	-99999.9999 to [99999.9999]	Specify the range of Y-axis shifting that is judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Angle	Upper	-180 to [180]	Specify the range of angles that are judged to be OK.
	Lower	[-180] to 180	
Correlation	Upper	0 to [100]	Specify the range of correlation values that are judged to be OK.
	Lower	[0] to 100	

For the following operations, see "3.9.1 Setting up [Classification]" (→pg.2).

3.9.5 [Output Parameter (Classification)]

Select options for the measured results, namely the coordinates, which are output to the external devices.

Important

- After setting up the measurement, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

1 In the "Item tab" area, tap [Output parameter].

2 Specify a value for each item.

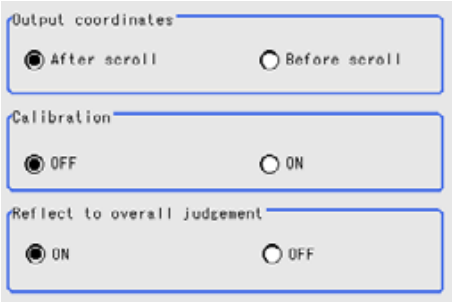


Table: Setting Values for Output Parameter

Setting Options	Set Value [Factory defaults]	Description
Output coordinate	・[After scroll] ・Before scroll	Select whether to output measurement results to external devices before or after the position deflection correction is applied.
Calibration	・[OFF] ・ON	Select whether to output measurement results to external devices by converting them into the coordinates with actual size (calibration: ON) or into the coordinates of camera image (calibration: OFF).
Reflect to overall judgement	・[ON] ・OFF	Select whether to reflect the judgement result of this processing unit to the overall judgement of the scene. ・Selecting "ON" reflects the judgement result of this processing unit on the overall judgement of the scene. ・Selecting "OFF" does not reflect the judgement result of this processing unit on the overall judgement of the scene.

POINT

- For output coordinates and calibration, see "4.6.5 Configuring Coordinates" (→pg.45), of "User's Manual".
- The overall judgement result of the scene is output to the OR signal to be sent via the parallel interface. Also, it is displayed in the "Measurement information display" area in the upper part of the Main screen.
  "10.4.4 Time Chart" (→pg.35), of "User's Manual"
  "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"

For the following operations, see "3.9.1 Setting up [Classification]" (→pg.2).

3.9.6 Points on Measurement Test and Adjustment (Classification)

In addition to the camera image, the pattern and search (cross-shaped cursor) will also be displayed in the "Image display" area.

In the "Detail result" area on the Main screen, you can confirm the following contents in text.
"6.3.2 Displaying Flow and Detail Result" (→pg.12), of "User's Manual"

Table: Text Displayed (Classification)

Item	Description
Judge	Judgment result
Index	Index No. of the biggest Correlation
Model No	Model No. of the biggest Correlation
Correlation	Correlation related with models
Measured coordinate X	X coordinate of the position where the model is detected
Measured coordinate Y	Y coordinate of the position where the model is detected
Angle	Angle of the position where the model is detected

Points on Adjustment

Please choose your adjustment methods as follows.

When search fails (searching other positions)

Make adjustments as follows to improve search precision:

- Specify a larger value for "Prec.".
  " Changing [Model Parameter]" (→pg.6)
- Check the "Sub-pixel" option.
  "3.9.4 [Measurement (Classification)]" (→pg.10)

When the processing speed is slower

- In [Region setting], reduce the measurement region and set up again.
  "3.9.3 [Region Setting (Classification)]" (→pg.9)
- In [Model], reduce the size of the region registered as the model.
  "3.9.2 [Model (Classification)]" (→pg.3)

In addition, adjust other options in the "Model parameter" area of [Model].
" Points on Adjustment" (→pg.8)

When the judgement is NG (insufficient memory):

- Reduce the measurement region size in [Region Setting].
  "3.9.3 [Region Setting (Classification)]" (→pg.9)

Reduce the amount of information necessary for measurements by making the following adjustment in the "Model parameter" area of [Model].

- Set "Stab." or "Skipping angle" to a value closer to the factory default.
- Specify a smaller value for "Prec.".
  " Changing [Model Parameter]" (→pg.6)

POINT

- If lowering "Stab." leads to slower processing, it is likely that many candidates have been detected. In this case, specify a larger value for "Candidate LV" or "Stab."

3.9.7 When Using Measurement Results Externally (Classification)

Value Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (Classification)

Measurement items	Character string	Description
Judge	JG	Judgement result
Index	IN	Index No. with the biggest Correlation
Model No.	NO	Model No. with the biggest Correlation
Correlation	CR	Correlation related with models
Position X	X	X coordinate of the position where the model is detected
Position Y	Y	Y coordinate of the position where the model is detected
Angle	TH	Angle of the position where the model is detected
Reference Position X	SX	Reference X of the registered model
Reference Position Y	SY	Reference Y of the registered model
Detection point RX	RX	X coordinate of the registered model
Detection point RY	RY	Y coordinate of the registered model

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in the "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Classification)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Index	Get only	-1: No models found 0 to 4

Table: External Reference List (Classification)

No.	Data Name	Set/Get	Data Range
6	Model No.	Get only	-1: No models found 0 to 35
7	Correlation	Get only	0 to 100
8	Measured coordinate X	Get only	-99999.9999 to 99999.9999
9	Measured coordinate Y	Get only	-99999.9999 to 99999.9999
10	Angle	Get only	-180 to 180
11	Reference position X	Get only	-99999.9999 to 99999.9999
12	Reference position Y	Get only	-99999.9999 to 99999.9999
13	Reference angle	Get only	-180 to 180
14	Detection coordinate X	Get only	-99999.9999 to 99999.9999
15	Detection coordinate Y	Get only	-99999.9999 to 99999.9999
101	Output coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect in OR	Set/Get	0: ON, 1: OFF
120	Search mode	Set/Get	0: CR (Correlation) 1: PT (Pattern)
121	Rotation	Set/Get	0: OFF 1: ON
122	Upper limit of the angle	Set/Get	-180 to 180
123	Lower limit of the angle	Set/Get	-180 to 180
124	Skipping angle	Set/Get	1 to 30
125	Smart mode	Set/Get	0: OFF 1: ON
126	Stab. (CR)	Set/Get	1 to 15
127	Prec. (Precision)	Set/Get	1 to 3
128	Stab. (PT)	Set/Get	1 to 5
129	Reference coordinate X	Set/Get	0 to 99999.9999
130	Reference coordinate Y	Set/Get	0 to 99999.9999
132	Detection point X	Set/Get	0 to 99999.9999
133	Detection point Y	Set/Get	0 to 99999.9999
134	Sub-pixel	Set/Get	0: OFF 1: ON
135	Candidate LV	Set/Get	0 to 100
136	Upper limit of Position X	Set/Get	-99999.9999 to 99999.9999
137	Lower limit of Position X	Set/Get	-99999.9999 to 99999.9999

Table: External Reference List (Classification)

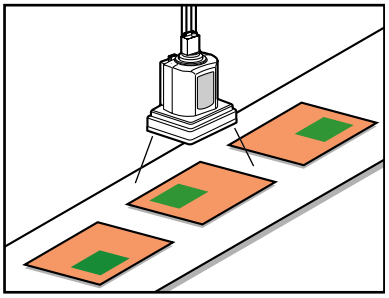
No.	Data Name	Set/Get	Data Range
138	Upper limit of Position Y	Set/Get	-99999.9999 to 99999.9999
139	Lower limit of Position Y	Set/Get	-99999.9999 to 99999.9999
140	Upper limit of the angle	Set/Get	-180 to 180
141	Lower limit of the angle	Set/Get	-180 to 180
142	Upper limit of the correlation	Set/Get	0 to 100
143	Lower limit of the correlation	Set/Get	0 to 100

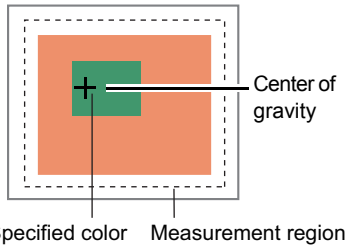
3.10 Gravity and Area

Select the color of the measurement objects, and the color area will be used for measurement.

Used for the following case

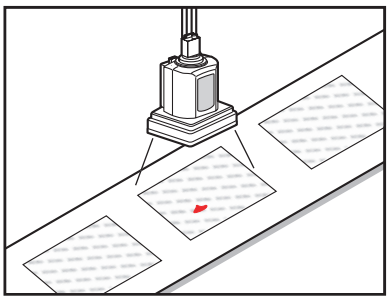
- Label Deviation Measurement

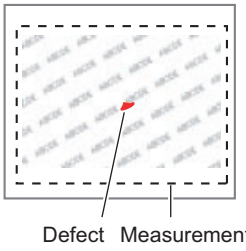




Measurement can be enabled by gravity coordinates of specified color in measurement region.

- Defect and Defect measurement of the measurement objects whose appearances are not defined





Measurement can be enabled by area of specified color in measurement region.

List of Gravity and Area Items

Gravity and Area items are explained below.

Table: List of the Color Area Items

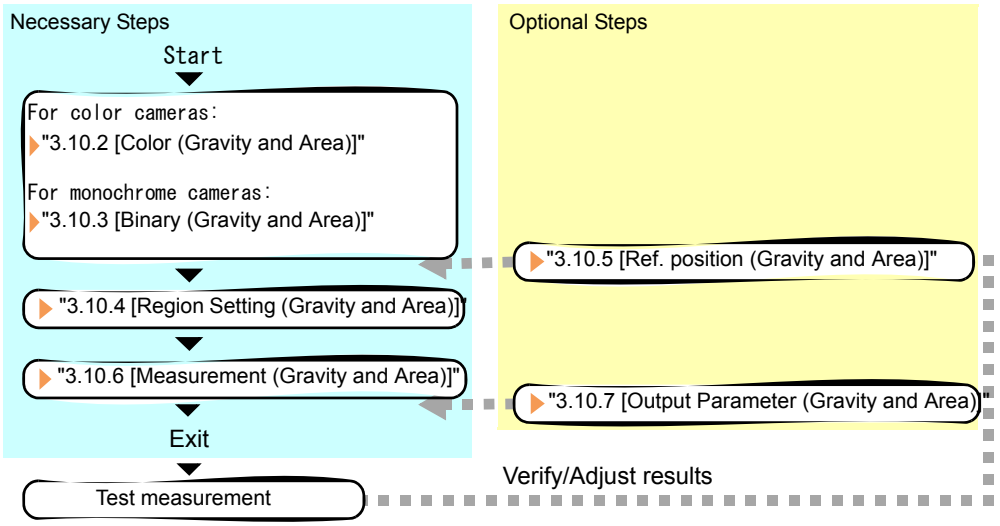
Menu Name	Description
Color (for color cameras only)	The colors that are used to select sampling areas and edges. Since the color hue, color saturation, and brightness can be selected, then fine-tuning can be performed to colors. "3.10.2 [Color (Gravity and Area)]" (→pg.21)

Table: List of the Color Area Items

Menu Name	Description
Binary (for monochrome cameras only)	This item specifies the binary level for converting 256-grayscale images input from the camera into binary images. Converted white pixels are measured. Adjust the binary level so that the measurement object is converted to white pixels. "3.10.3 [Binary (Gravity and Area)]" (→pg.23)
Region setting	This item specifies the measurement region. While the input image can be measurement as a whole, a quick and reliable measurement can be performed by set up the measurement region. "3.10.4 [Region Setting (Gravity and Area)]" (→pg.25)
Reference position	This item can be changed if necessary. Normally the central position of the registered model will be used as the reference. "3.10.5 [Ref. position (Gravity and Area)]" (→pg.26)
Measurement	This item specifies the judgement condition for measurement results. Specify the upper and lower limit values for the area and the gravity center X/Y. Measurement parameters can be changed as needed to address unstable measurement results or to increase the processing speed. Normally the factory default value will be used. "3.10.6 [Measurement (Gravity and Area)]" (→pg.27)
Output parameter	This item can be changed if necessary. Usually, the factory default value can be used. Use the Output parameter to specify how to treat the coordinate. "3.10.7 [Output Parameter (Gravity and Area)]" (→pg.29)

3.10.1 Setting up [Gravity and Area]

The setting procedure for [Gravity and Area] is as follows.



POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 In the Edit Flow window, tap [Gravity and Area].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 For color cameras, in the "Item tab" area, tap [Color] to specify the color used for measurement.

"3.10.2 [Color (Gravity and Area)]" (→pg.21)

3 For monochrome cameras, in the "Item tab" area, tap [Binary] to specify a color used for measurement.

"3.10.3 [Binary (Gravity and Area)]" (→pg.23)

4 In the "Item tab" area, tap [Region setting] and specify the measurement region.

"3.10.4 [Region Setting (Gravity and Area)]" (→pg.25)

5 In the "Item tab" area, tap [Measurement] and specify the judgement condition for OK.

"3.10.6 [Measurement (Gravity and Area)]" (→pg.27)

6 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

7 Perform a measurement test.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

8 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

When NG is displayed, please verify measurement results and make Adjust if necessary.

"3.10.8 Points on Measurement Test and Adjustment (Gravity and Area)" (→pg.30)

3.10.2 [Color (Gravity and Area)]

1 In the "Item tab" area, tap [Color].

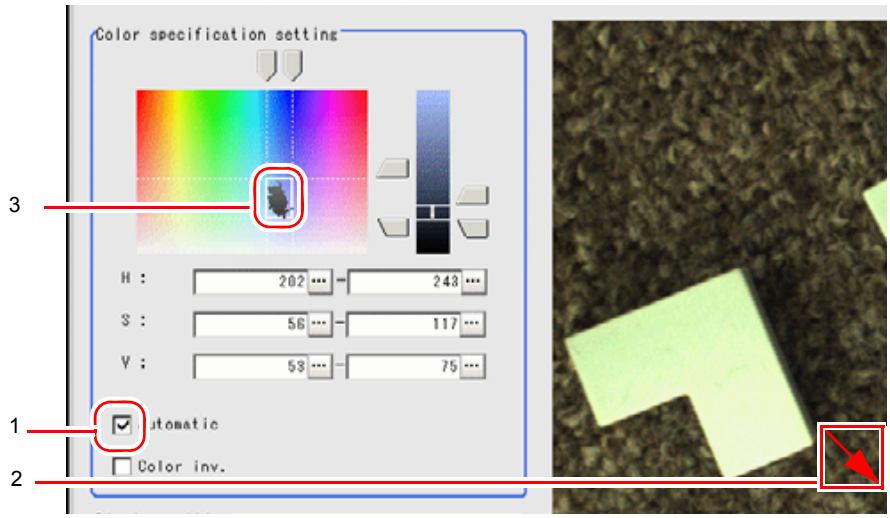
2 In the "Color specification setting" area, specify the reference color.

Table: Color (Gravity and Area) - Color Specification Setting

Item		Set Value [Factory defaults]	Description
H	Max.	0 to [359]	Specify the color hue (difference of color hues).
	Min.	[0] to 359	
S	Max.	0 to [255]	Specify color saturation (difference of color saturations).
	Min.	[0] to 255	
V	Max.	0 to [255]	Specify the brightness (difference of brightness).
	Min.	[0] to 255	
Automatic		・Checked ・[Unchecked]	When checked, each range of hue, saturation, and value are set automatically.
Color inv.		・Checked ・[Unchecked]	When checked, areas with a specified color from the image region's area are not measured.

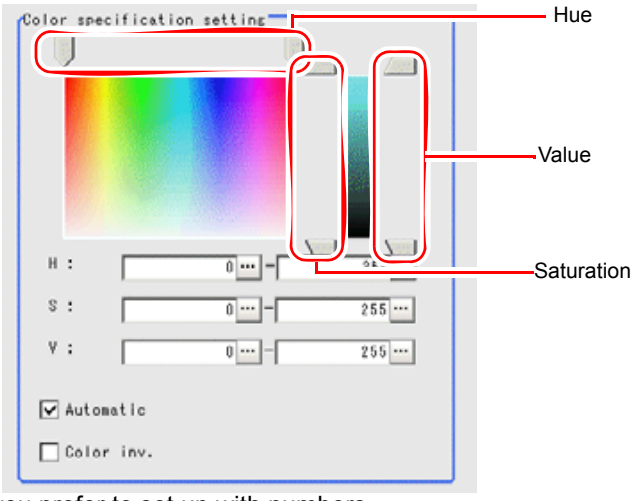
When specifying color using the camera input image

1. Make sure the [Automatic] option is checked.
2. In the "Image display" area, specify the color area you want to detect by dragging the cursor from the upper left corner to the lower right corner of that area.
3. The color of the specified area is automatically set.



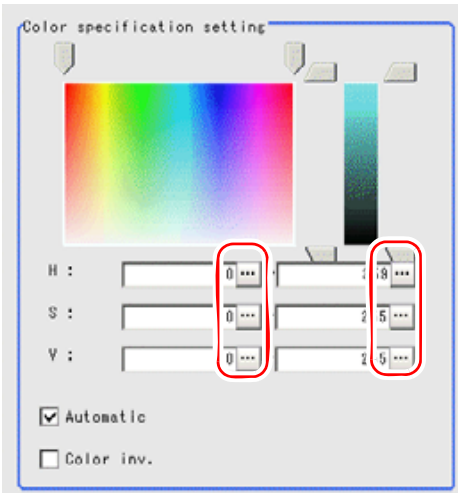
When specifying color in the "Color specification setting" area

In the "Color specification setting" area, drag the sliders for "H" (Hue), "S" (Saturation), and "V" (Value).



If you prefer to set up with numbers

In the "Color specification setting" area, tap [...] for "H", "S", and "V" and specify each value.
For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"



3 If necessary, in the "Display setting" area, set up display settings for the images displayed in the "Image display" area.

Table: Color (Gravity and Area) - Disp Setting

Setting Options		Set Value [Factory defaults]	Description
Extract image		・[Checked] ・Unchecked	The sampled image obtained through the selected color will be displayed in the "Image display" area.
	BG color	・[Black] ・White ・Red ・Green ・Blue	The area outside the "Image display" area which is filled by selected colors.

Extract image
(before specifying colors)

Extract image
(after specifying colors - background color: black)

For the subsequent operations, see "3.10.1 Setting up [Gravity and Area]" (→pg.19).

3.10.3 [Binary (Gravity and Area)]

1 In the "Item tab" area, tap [Binary].

2 In the "Binary setting" area, specify the reference density range.

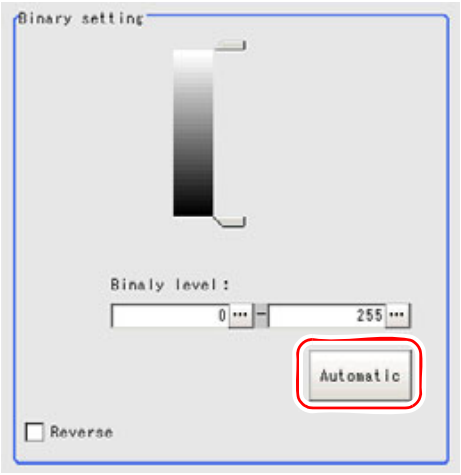
Table: Binary Setting (Gravity and Area)

Item		Set Value [Factory Default]	Description
Binary level	Upper	0 to [255]	Specify the level for converting 256-grayscale images to binary images. Adjust the binary level so that the measurement object is converted to white pixels. You can also adjust the binary level so that only intermediate density is measured.
	Lower	0 to 255 [128]	
Reverse		・[Checked] ・Unchecked	This item reverses black and white colors.

Setting optimum values calculated automatically:

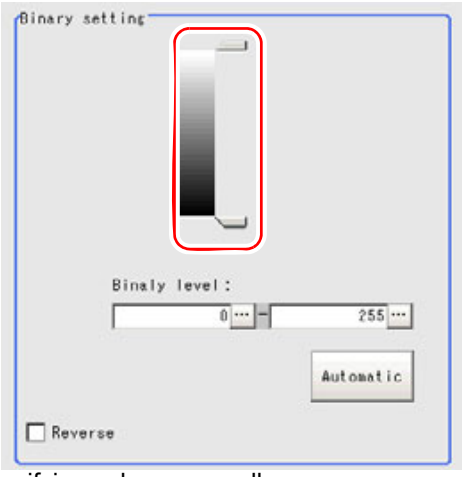
In the "Binary setting" area, tap [Automatic].

The reference density range is set in "Binary level".



Specifying values with sliders:

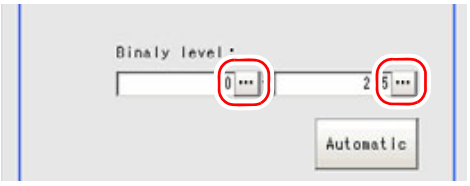
Drag each slider up and down to specify a value.



Specifying values manually:

Tap [...] for "Binary level" and specify a value.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"



For the subsequent operations, see "3.10.1 Setting up [Gravity and Area]" (→pg.19).

3.10.4 [Region Setting (Gravity and Area)]

Use a rectangle, circle (ellipse), circumference, or polygon to specify a measurement region for [Gravity and Area].

POINT

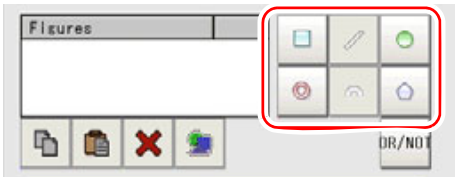
- Up to 3 figure can be used together to delimit the measurement region. Complex area can be drawn through image integration, or unnecessary sections are removed from the measurement region.
  "1.9.3 OR Setting/NOT Setting" (→pg.38), of "User's Manual"

1 In the "Item tab" area, tap [Region setting].

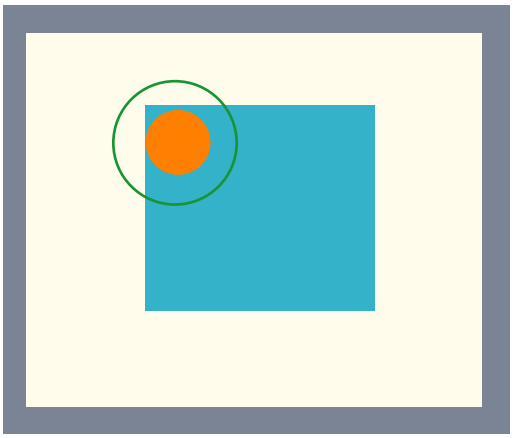
2 When a measurement region is already registered, tap [Edit].

The Figure Setting window is displayed.
When no measurement region is registered, go to Step 3.

3 Specify the measurement region using Drawing tools.
"1.9 Setting Figures" (→pg.25), of "User's Manual"



4 In the "Figure setting" area, tap [OK].
The measurement region is registered and displayed in the "Image display" area.



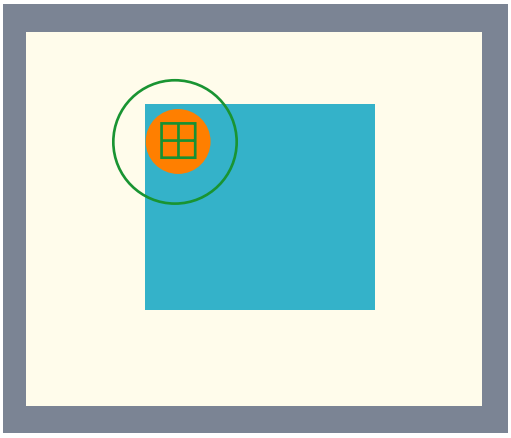
For the following operations, see "3.10.1 Setting up [Gravity and Area]" (→pg.19).

3.10.5 [Ref. position (Gravity and Area)]

This item can be changed if necessary. When the measurement region is set, the reference position is automatically set at the gravity center of the region. At the same time, the reference area is also automatically set on the basis of the measurement region.
This item can be used to change the reference position to any desired position.

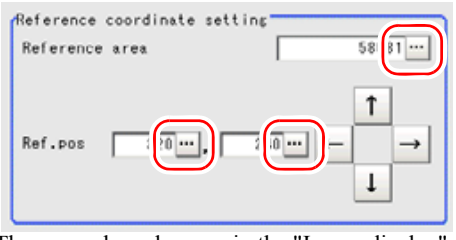
1 In the "Item tab" area, tap [Ref. positon].

In the "Image display" area, the current reference coordinates will be displayed as the cross-shaped cursor.



2 Change the reference.

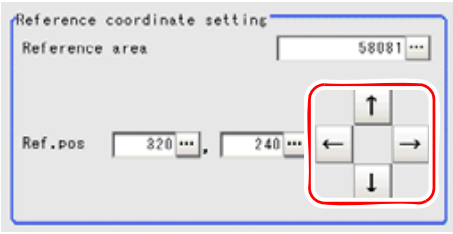
In the "Reference coordinate setting" area, tap [...] for each item and specify the reference area and reference position coordinate values.
For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"



The cross-shaped cursor in the "Image display" area will move to the specified coordinate position.

Move the cursor in the "Image display" area to change the reference.

In the "Reference coordinate setting" area, tap one of the arrow buttons.



The cursor in the "Image display" area will move one pixel per tap.

The value of the reference in the "Detail" area will also change as the cursor moves.

POINT

Key issues about position Adjust

- First input approximate coordinate values, then move the cursor in the "Image display" area to fine tune. This will make adjustment easier. Using the Zoom funtion will make fine tuning easier.
  For the Zoom function, see "1.8 Using Zoom Function" (→pg.24), of "User's Manual".

3.10.6 [Measurement (Gravity and Area)]

Specify a range to be judged as OK.

1 In the "Item tab" area, tap [Measurement].

2 If necessary, in the "Measurement condition" area, select an option for [Fill profile].

If the measurement target has hole(s) in it, specify how to process the hole(s). Usually, the factory default value can be used.

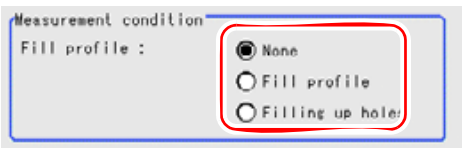


Table: Measurement (Gravity and Area) - Measurement Condition

Setting Item	Set Value [Factory Default]	Description
Fill profile	[OFF]	Holes are not measured.
	Fill profile	In the measurement region, the part between the extracted-color start point and end point in the X-axis direction is measured as having the extracted color. Since filling is applied only to the X-axis direction, the processing is faster than [Filling up holes].
	Filling up holes	The part surrounded by the extracted color, like a doughnut hole, is filled with the extracted color.

3 If necessary, in the "Display setting" area, set up display settings for the images displayed in the "Image display" area.

For color cameras:

Table: Measurement (Gravity and Area) - Display Setting

Setting Item	Set Value [Factory Default]	Description
Extract image	・[Checked] ・Unchecked	When checked, the image extracted with the specified color is displayed in the "Image display" area.
BG color	・[Black] ・White ・Red ・Green ・Blue	The background area surrounding the extracted image is filled with the specified color.

For monochrome cameras:

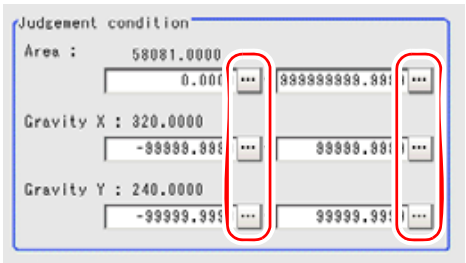
Table: Measurement (Gravity and Area) - Display Setting

Setting Item	Set Value [Factory Default]	Description
Binary image	・[Checked] ・Unchecked	The image is displayed in binary with black and white.

4 When the setting has been changed, tap [Measure] in the "Detail" area to verify whether measurements can be made correctly.

5 In the "Judgement condition" area, tap [...] and input a value for each item.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"



POINT

- The values displayed in the individual fields are the measurement results of the displayed image. Take these values into consideration to determine the upper and lower limit values.

Table: Measurement (Gravity and Area) - Judgement Condition

Setting Item		Set Value [Factory Default]	Description
Area	Upper	0 to [999999999.9999]	Specify the area to be judged as OK.
	Lower	[0] to 999999999.9999	
Gravity X	Upper	-99999.9999 to [99999.9999]	Specify the range of X-axis shifting that is judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Gravity Y	Upper	-99999.9999 to [99999.9999]	Specify the range of Y-axis shifting that is judged to be OK.
	Lower	[-99999.9999] to 99999.9999	

For the subsequent operations, see "3.10.1 Setting up [Gravity and Area]" (→pg.19).

3.10.7 [Output Parameter (Gravity and Area)]

Select options for the measured results, namely the coordinates, which are output to the external devices.

Important

- After setting up the measurement, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

1 In the "Item tab" area, tap [Output parameter].

2 Specify a value for each item.

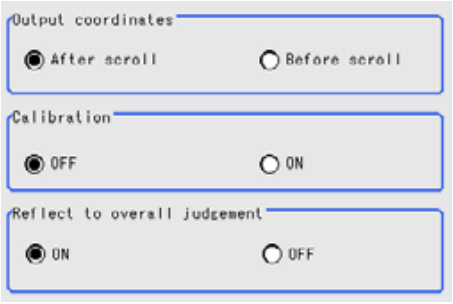


Table: Setting Values for Output Parameter

Setting Options	Set Value [Factory defaults]	Description
Output coordinate	・[After scroll] ・Before scroll	Select whether to output measurement results to external devices before or after the position deflection correction is applied.
Calibration	・[OFF] ・ON	Select whether to output measurement results to external devices by converting them into the coordinates with actual size (calibration: ON) or into the coordinates of camera image (calibration: OFF).
Reflect to overall judgement	・[ON] ・OFF	Select whether to reflect the judgement result of this processing unit to the overall judgement of the scene. ・Selecting "ON" reflects the judgement result of this processing unit on the overall judgement of the scene. ・Selecting "OFF" does not reflect the judgement result of this processing unit on the overall judgement of the scene.

POINT

- For output coordinates and calibration, see "4.6.5 Configuring Coordinates" (→pg.45), of "User's Manual".
- The overall judgement result of the scene is output to the OR signal to be sent via the parallel interface. Also, it is displayed in the "Measurement information display" area in the upper part of the Main screen.
  "10.4.4 Time Chart" (→pg.35), of "User's Manual"
  "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"

For the following operations, please refer to "3.10.1 Setting up [Gravity and Area]" (→pg.19).

3.10.8 Points on Measurement Test and Adjustment (Gravity and Area)

In addition to camera images, the measurement region will also be displayed in "Image display" area.

In the "Detail result" area on the Main screen, you can confirm the following contents in text.
"6.3.2 Displaying Flow and Detail Result" (→pg.12), of "User's Manual"

Table: Text Displayed (Gravity and Area)

Displayed Items	Description
Judge	Judgement result
Area	Area
Gravity X	Center of gravity coordinate X
Gravity Y	Center of gravity coordinate Y

Points on Adjustment

Please choose your adjustment methods as follows.

When the Measurement Results are unstable

- For color cameras:
  In [Color], select the area whose color will be sampled and the area whose color will not be sample.
  The setup should be such that two stable parts of color hue\color saturation\color value are formed.
  "3.10.2 [Color (Gravity and Area)]" (→pg.21)
- For monochrome camers:
  In [Binary], change the reference density range.
  "3.10.3 [Binary (Gravity and Area)]" (→pg.23)

3.10.9 When Using Measurement Results Externally (Gravity and Area)

Value Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (Gravity and Area)

Measurement items	Character string	Description
Judge	JG	Judgement result
Area	AR	Area
Gravity X	X	Center of gravity coordinate X
Gravity Y	Y	Center of gravity coordinate Y
Area	SA	Reference Area
Reference X	SX	Reference X
Reference Y	SY	Reference Y

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in the "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Gravity and Area)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Area	Get only	0 to 999999999.9999
6	Gravity X	Get only	-99999.9999 to 99999.9999
7	Gravity Y	Get only	-99999.9999 to 99999.9999
8	Reference Area	Get only	0 to 999999999.9999
9	Reference X	Get only	-99999.9999 to 99999.9999
10	Reference Y	Get only	-99999.9999 to 99999.9999
101	Output Coordinate	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0:OFF, 1:ON
103	Reflect to overall judgement	Set/Get	0:ON, 1:OFF
120	Register the max color hue	Set/Get	0 to 359
121	Register the min color hue	Set/Get	0 to 359
122	Register the max color saturation	Set/Get	0 to 255
123	Register the min color saturation	Set/Get	0 to 255
124	Register the max color value	Set/Get	0 to 255
125	Register the min color value	Set/Get	0 to 255
126	Extract image	Set/Get	0: OFF, 1: ON
127	Background color	Set/Get	0:Black, 1:White, 2:Red, 3:Green, 4:Blue
128	Fill profile	Set/Get	0:OFF, 1:ON
129	Color inv.	Set/Get	0:OFF, 1:ON
132	Reference Area	Set/Get	0 to 999999999.9999
133	Reference X	Set/Get	0 to 99999.9999
134	Reference Y	Set/Get	0 to 99999.9999
135	Upper of area	Set/Get	0 to 999999999.9999
136	Lower of area	Set/Get	0 to 999999999.9999
137	Gravity X Upper	Set/Get	-99999.9999 to 99999.9999
138	Gravity X Lower	Set/Get	-99999.9999 to 99999.9999
139	Gravity Y Upper	Set/Get	-99999.9999 to 99999.9999

Table: External Reference List (Gravity and Area)

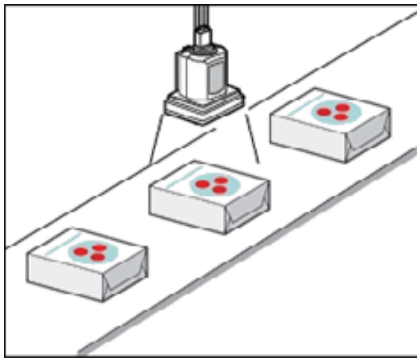
No.	Data Name	Set/Get	Data Range
140	Gravity Y Lower	Set/Get	-99999.9999 to 99999.9999
141	Upper limit of the binary level	Set/Get	0 to 255
142	Lower limit of the binary level	Set/Get	0 to 255
143	Binary image	Set/Get	0:OFF, 1:ON

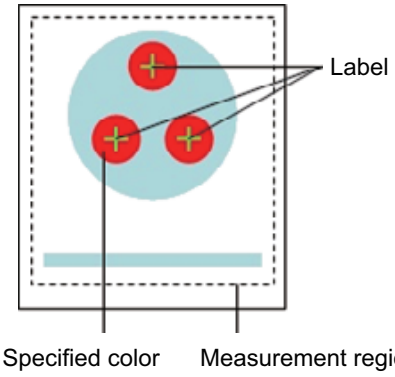
3.11 Labeling

You can specify a color in the measured object to count the number of labels with that color, or obtain the area and gravity center with a specified label number.

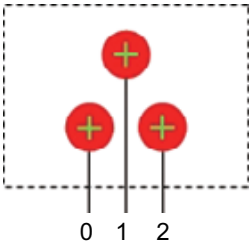
Used for the following case

- Label Offset Measurement





Examination is based on the number and the area of labels in the measurement region.



The extracted labels are sorted by area or gravity center and re-numbered.

List of Labeling Items

Labeling items are explained below.

Table: List of Labeling Items

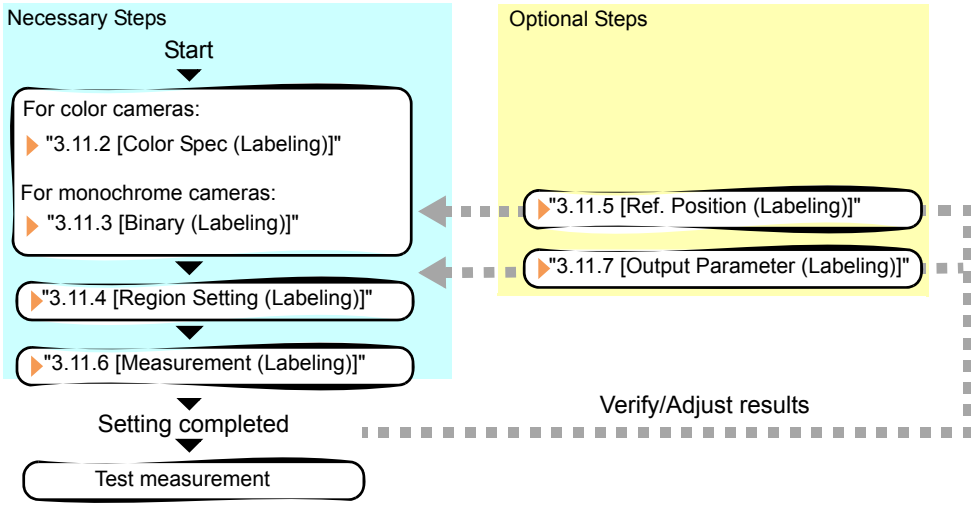
Item Name	Description
Color spec (for color cameras only)	The colors that are used to select sampling areas and edges. Since the color hue, color saturation, and brightness can be selected, then fine-tuning can be performed to colors. "3.11.2 [Color Spec (Labeling)]" (→pg.36)
Binary (for monochrome cameras only)	This item specifies the binary level for converting 256-grayscale images input from the camera into binary images. Converted white pixels are measured. Adjust the binary level so that the measurement object is converted to white pixels. "3.11.3 [Binary (Labeling)]" (→pg.39)

Table: List of Labeling Items

Item Name	Description
Region setting	This item is used to set up the measurement region. While the input image can be measured as a whole, a quick and reliable measurement can be performed by set up the measured range. "3.11.4 [Region Setting (Labeling)]" (→pg.40)
Reference position	This item can be changed if necessary. Normally the central position of the registered model will be used as the reference coordinate. "3.11.5 [Ref. Position (Labeling)]" (→pg.41)
Measurement	This item specify the judgement condition for measurement results. It specifies the upper and lower limit values for the number of labels, the area, and the gravity center X/Y. Measurement parameters can be changed as needed to address unstable measurement results or to increase the processing speed. Usually, the factory default value can be used. "3.11.6 [Measurement (Labeling)]" (→pg.43)
Output parameter	This item can be changed if necessary. Usually, the factory default value can be used. Use the Output parameter to specify how to treat the coordinate. "3.11.7 [Output Parameter (Labeling)]" (→pg.45)

3.11.1 Setting up [Labeling]

Color labeling can be set up as follows.



POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 In the Edit Flow window, tap [Labeling].
The ProcItem Setting window is displayed.
"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 For color cameras, in the "Item tab" area, tap [Color spec] to specify the color used for measurement.
"3.11.2 [Color Spec (Labeling)]" (→pg.36)

3 For monochrome cameras, in the "Item tab" area, tap [Binary] to specify a color used for measurement.
"3.11.3 [Binary (Labeling)]" (→pg.39)

4 In the "Item tab" area, tap [Region setting] and specify the measurement region.
"3.11.4 [Region Setting (Labeling)]" (→pg.40)

5 In the "Item tab" area, tap [Measurement] and specify the judgement condition for OK.
"3.11.6 [Measurement (Labeling)]" (→pg.43)

6 Tap [OK].
After confirmation, the ProcItem Setting window will be closed.

7 Perform a measurement test.
"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

8 Verify measurement results.
"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"
When NG is displayed, please verify measurement results and make adjustment if necessary.
"3.11.8 Points on Test Measurement and Adjustment (Labeling)" (→pg.47)

3.11.2 [Color Spec (Labeling)]

1 In the "Item tab" area, tap [Color spec].

2 In the "Color specification setting" area, specify the reference color.

Table: Color Spec (Labeling) - Color Specification Setting

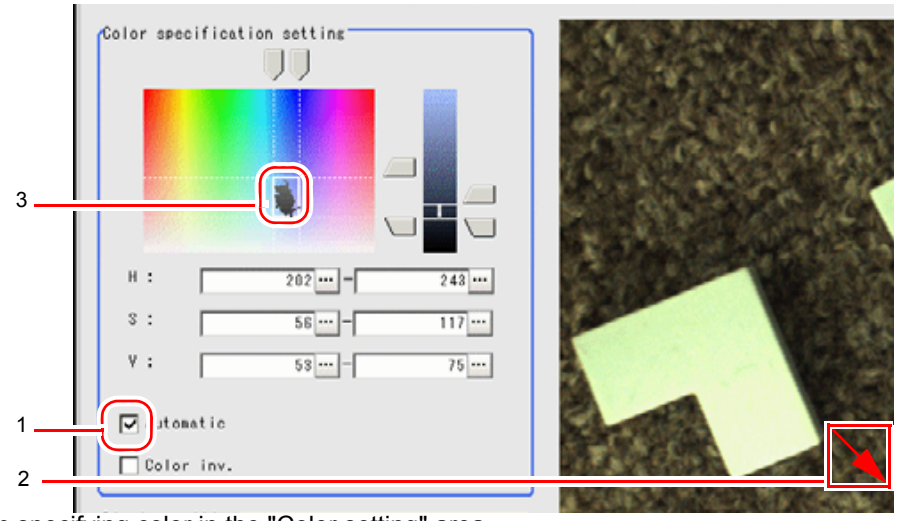
Item		Set Value [Factory defaults]	Description
H	Max.	0 to [359]	Specify the color phase (difference of color hues).
	Min.	[0] to 359	
S	Max.	0 to [255]	Specify color saturation (difference of color saturations).
	Min.	[0] to 255	

Table: Color Spec (Labeling) - Color Specification Setting

Item		Set Value [Factory defaults]	Description
V	Max.	0 to [255]	Specify the brightness (difference of brightness).
	Min.	[0] to 255	
Automatic		・Checked ・[Unchecked]	When checked, each range of hue, saturation, and value are set automatically.
Color inv.		・Checked ・[Unchecked]	When checked, areas with a specified color from the image region's area are not measured.

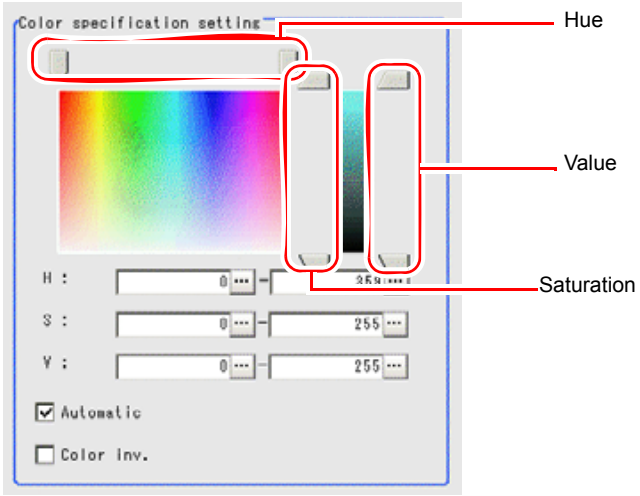
When specifying color using the camera input image

1. Make sure the "Automatic" option is checked.
2. In the "Image display" area, specify the color area you want to detect by dragging the cursor from the upper left corner to the lower right corner of that area.
3. The color of the specified area is automatically set.



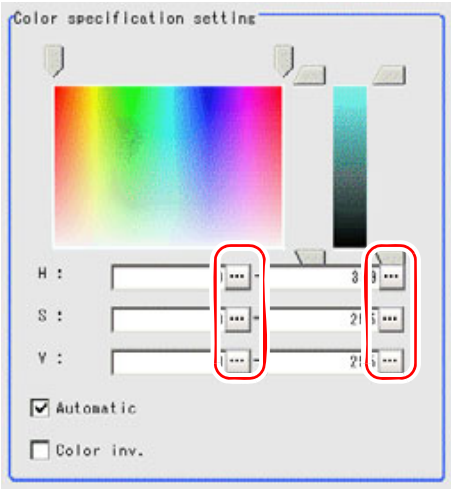
When specifying color in the "Color setting" area

In the "Color specification setting" area, drag the sliders for "H" (Hue), "S" (Saturation), and "V" (Value).



Specifying values manually:

In the "Color specification setting" area, tap [...] for "H", "S", and "V" and specify each value.
For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"



3 If necessary, in the "Display setting" area, set up display settings for the images displayed in the "Image display" area.

Table: Color Spec (Labeling) - Display Setting

Setting Options		Set Value [Factory defaults]	Description
Extract image		・[Checked] ・Unchecked	The sampled image obtained through the selected color will be displayed in the "Image display" area.
	BG	・[Black] ・White ・Red ・Green ・Blue	The area outside the image area which is filled by selected colors.

Extract image
(before specifying colors)

Extract image
(after specifying colors - background color: black)

3.11.3 [Binary (Labeling)]

1 In the "Item tab" area, tap [Binary].

2 In the "Binary setting" area, specify the reference density range.

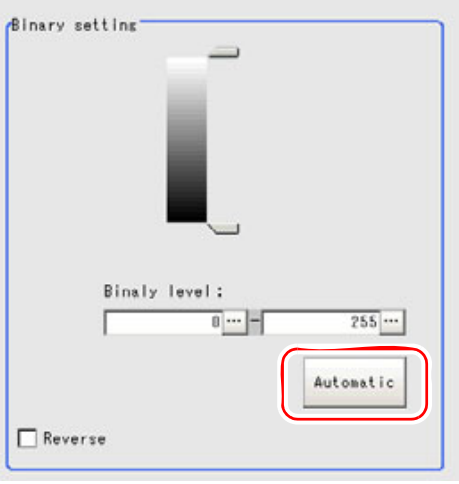
Table: Binary Setting (Labeling)

Item		Set Value [Factory Default]	Description
Binary level	Upper	0 to [255]	Specify the level for converting 256-grayscale images to binary images. Adjust the binary level so that the measurement object is converted to white pixels. You can also adjust the binary level so that only intermediate density is measured.
	Lower	0 to 255 [128]	
Reverse		・ [Checked] ・ Unchecked	This item reverses black and white colors.

Setting optimum values calculated automatically:

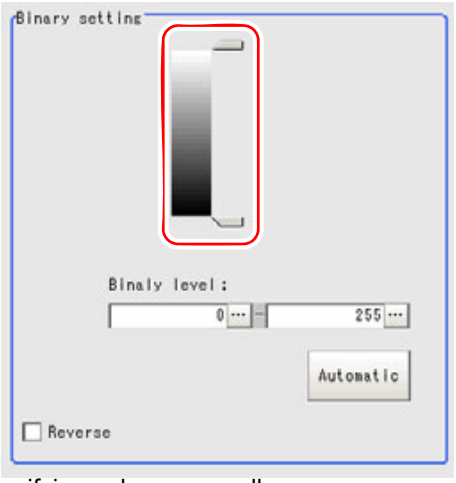
In the "Binary setting" area, tap [Automatic].

The reference density range is set in "Binary level".



Specifying values with sliders:

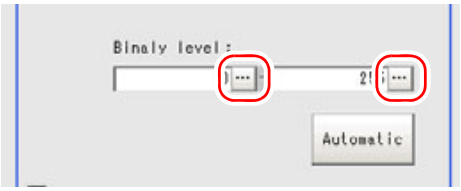
Drag each slider up and down to specify a value.



Specifying values manually:

Tap [...] for "Binary level" and specify a value.

How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"



3.11.4 [Region Setting (Labeling)]

Use a rectangle, straight line, circle (ellipse), circumference, or polygon to specify a measurement region for [Labeling].

POINT

- Up to 3 graphs can be used together to delimit the measured region. Complex area can be drawn through image integration, or unnecessary sections are removed from the measurement region. "1.9.3 OR Setting/NOT Setting" (→pg.38), of "User's Manual"

1 In the "Item tab" area, tap [Region setting].

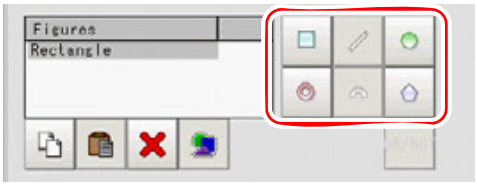
2 When a measurement region is already registered, tap [Edit].

The "Figure setting" area is displayed.

When no measurement region is registered, go to Step 3.

3 Specify the measurement region using Drawing Tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"

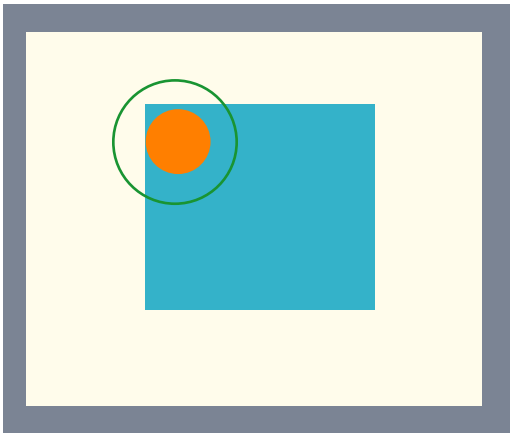


4 In the "Figure setting" area, specify a region to be measured.

"1.9 Setting Figures" (→pg.25), of "User's Manual"

5 In the "Figure setting" area, tap [OK].

The measurement region is registered and displayed in the "Image display" area.



For the following operations, please refer to "3.11.1 Setting up [Labeling]" (→pg.35).

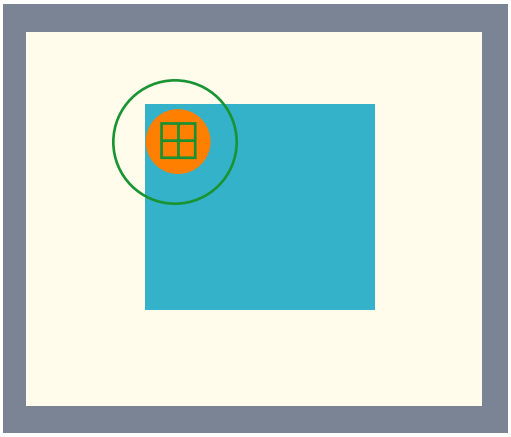
3.11.5 [Ref. Position (Labeling)]

This item can be changed if necessary. When the measurement region is set, the reference position is automatically set at the gravity center of the region. At the same time, the reference area is also automatically set on the basis of the measurement region.

This item can be used to change the reference position to any desired position.

1 In the "Item tab" area, tap [Ref. positon].

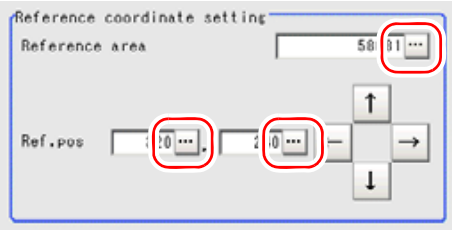
In the "Image display" area, the current reference coordinates will be displayed as the cross-shaped cursor.



2 Change the reference.

In the "Reference coordinate setting" area, tap [...] for each item and specify the reference area and reference position coordinate values.

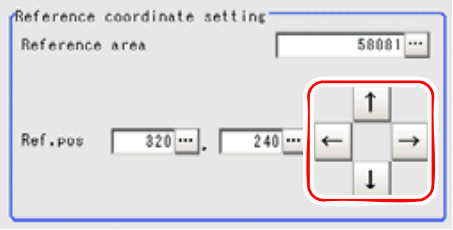
For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"



The cross-shaped cursor in the "Image display" area will move to the specified coordinate position.

Move the cursor in the "Image display" area to change the reference.

In the "Reference coordinate setting" area, tap one of the arrow buttons.



The cursor in the "Image display" area will move one pixel per tap.

The value of the reference in the "Detail" area will also change as the cursor moves.

POINT

Key issues about position Adjust

- First input approximate coordinate values, then move the cursor in the "Image display" area to fine tune. This will make adjustment easier. Using the Zoom funtion will make fine tuning easier.
  For the Zoom function, see "1.8 Using Zoom Function" (→pg.24), of "User's Manual".

3.11.6 [Measurement (Labeling)]

Specify the Judgement condition.

1 In the "Item tab" area, tap [Measurement].

2 If necessary, in the "Labeling condition" area, specify a value for each item.
For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"
Normally the factory default value will be used.

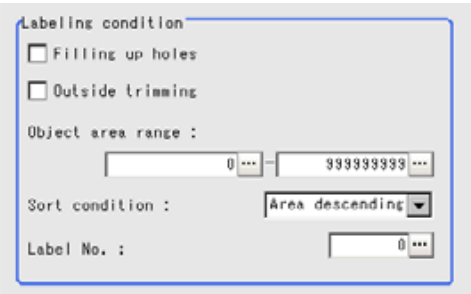


Table: Measurement (Labeling) - Labeling Condition

Setting Item	Set Value [Factory Default]	Description
Filling up holes	・Checked ・[Unchecked]	Select the process method for the part encircled by the designated color circle. When checked, the hole is processed as having the specified color.
Outside trimming		This option can be used only when the designated color that doesn't need to be measured exists in the measured region. When checked, the whole area outside of the measurement region is extracted as having the specified color.

Table: Measurement (Labeling) - Labeling Condition

Setting Item		Set Value [Factory Default]	Description
Object area range	Upper	0 to [999999999]	Specify a range of the area to be judged as a label.
	Lower	[0] to 999999999	
Sort condition		・ Area ascending ・ [Area descending] ・ X ascending ・ X descending ・ Y ascending ・ Y descending	Specify the conditions by which label code number is re-assigned. When the X and Y coordinates are in accordance with the reference values, the upper left will become the origin.
Label No.		[0] to 2499	Specify the label number for the input and output data.

3 If necessary, in the "Display setting" area, set up display settings for the images displayed in the "Image display" area.

For color cameras:

Table: Measurement (Labeling) - Display Setting

Setting Item		Set Value [Factory Default]	Description
Extract image		・ [Checked] ・ Unchecked	When checked, the image extracted with the specified color is displayed in the "Image display" area.
	BG color	・ [Black] ・ White ・ Red ・ Green ・ Blue	The background area surrounding the extracted image is filled with the specified color.

For monochrome cameras:

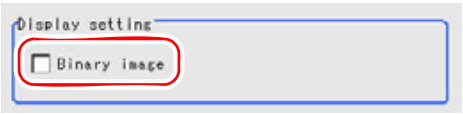


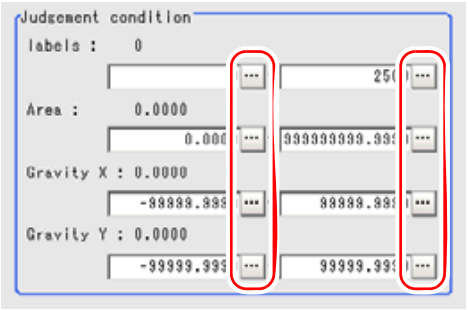
Table: Measurement (Labeling) - Display Setting

Setting Item	Set Value [Factory Default]	Description
Binary image	・ [Checked] ・ Unchecked	The image is displayed in binary with black and white.

4 When the setting has been changed, tap [Measure] in the "Detail" area to verify whether measurements can be made correctly.

5 In the "Judgement condition" area, tap [...] and input a value for each item.

How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"



POINT

- The values displayed in the individual fields are the measurement results of the displayed image. Take these values into consideration to determine the upper and lower limit values.

Table: Measurement (Labeling) - Judgement Condition

Setting Item		Set Value [Factory Default]	Description
Labels	Upper	0 to [2500]	Specify the number of labels to be judged as OK.
	Lower	[0] to 2500	
Area	Upper	0 to [999999999.9999]	Specify the area to be judged as OK.
	Lower	[0] to 999999999.9999	
Gravity X	Upper	-99999.9999 to [99999.9999]	Specify the range of X-axis shifting that is judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Gravity Y	Upper	-99999.9999 to [99999.9999]	Specify the range of Y-axis shifting that is judged to be OK.
	Lower	[-99999.9999] to 99999.9999	

For the subsequent operations, see "3.11.1 Setting up [Labeling]" (→pg.35).

3.11.7 [Output Parameter (Labeling)]

Select options for the measured results, namely the coordinates, which are output to the external devices.

Important

- After setting up the measurement, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

1 In the "Item tab" area, tap [Output parameter].

2 Specify a value for each item.

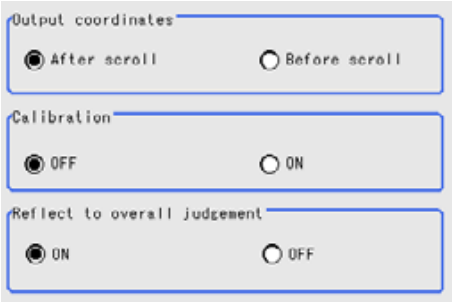


Table: Setting Values for Output Parameter

Setting Options	Set Value [Factory defaults]	Description
Output coordinate	・[After scroll] ・Before scroll	Select whether to output measurement results to external devices before or after the position deflection correction is applied.
Calibration	・[OFF] ・ON	Select whether to output measurement results to external devices by converting them into the coordinates with actual size (calibration: ON) or into the coordinates of camera image (calibration: OFF).
Reflect to overall judgement	・[ON] ・OFF	Select whether to reflect the judgement result of this processing unit to the overall judgement of the scene. ・Selecting "ON" reflects the judgement result of this processing unit on the overall judgement of the scene. ・Selecting "OFF" does not reflect the judgement result of this processing unit on the overall judgement of the scene.

POINT

- For output coordinates and calibration, see "4.6.5 Configuring Coordinates" (→pg.45), of "User's Manual".
- The overall judgement result of the scene is output to the OR signal to be sent via the parallel interface. Also, it is displayed in the "Measurement information display" area in the upper part of the Main screen.
  "10.4.4 Time Chart" (→pg.35), of "User's Manual"
  "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"

For the following operations, please refer to "3.11.1 Setting up [Labeling]" (→pg.35).

3.11.8 Points on Test Measurement and Adjustment (Labeling)

In addition to camera images, the measurement region will also be displayed in "Image display" area.
In the "Detail result" area on the Main screen, you can confirm the following contents in text.
"6.3.2 Displaying Flow and Detail Result" (→pg.12), of "User's Manual"

Table: Text Displayed (Labeling)

Displayed Items	Description
Judge	Judgement result
Number of labels	Number of labels
Area	Area
Gravity position X	Gravity X
Gravity position Y	Gravity Y

Points on Adjustment

Please choose your adjustment methods as follows.

When the Measured Results are unstable

- For color cameras:
  In [Color spec], select the area whose color will be sampled and the area whose color will not be sample. The setup should be such that two stable parts of color phase, color degree, color brightness are formed.
  "3.11.2 [Color Spec (Labeling)]" (→pg.36)
- For monochrome cameras:
  In [Binary], change the reference density range.
  "3.11.3 [Binary (Labeling)]" (→pg.39)

3.11.9 When Using Measurement Results Externally (Labeling)

Value Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (Labeling)

Measurement items	Character string	Description
Judge	JG	Judgement result
Number of labels	L	Number of labels
Area	AR	Area

Table: Values Available in Expression (Labeling)

Measurement items	Character string	Description
Gravity X	X	Gravity X-coordinate
Gravity Y	Y	Gravity Y-coordinate
Reference area	SA	Reference area
Reference X	SX	Reference X
Reference Y	SY	Reference Y

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in the "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Labeling)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Number of labels	Get only	0 to 2500
6	Area	Get only	0 to 999999999.9999
7	Gravity X	Get only	-99999.9999 to 99999.9999
8	Gravity Y	Get only	-99999.9999 to 99999.9999
9	Reference area	Get only	0 to 999999999.9999
10	Reference position X	Get only	-99999.9999 to 99999.9999
11	Reference position Y	Get only	-99999.9999 to 99999.9999
101	Output coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect in to overall judgement	Set/Get	0: ON 1: OFF
120	Hue Max.	Set/Get	0 to 359
121	Hue Min.	Set/Get	0 to 359
122	Saturation Max.	Set/Get	0 to 255
123	Saturation Min.	Set/Get	0 to 255
124	Brightness value Max.	Set/Get	0 to 255
125	Brightness value Min.	Set/Get	0 to 255
126	Extract image	Set/Get	0: OFF 1: ON

Table: External Reference List (Labeling)

No.	Data Name	Set/Get	Data Range
127	Background color	Set/Get	0: black 1: white 2: red 3: green 4: blue
128	Reference area	Set/Get	0 to 999999999.9999
129	Reference coordinate X	Set/Get	0 to 99999.9999
130	Reference coordinate Y	Set/Get	0 to 99999.9999
131	Color inverse	Set/Get	0: OFF 1: ON
132	Filling up holes	Set/Get	0: OFF 1: ON
133	Outside trimming	Set/Get	0: OFF 1: ON
134	Upper limit of the object area range	Set/Get	0 to 999999999.9999
135	Lower limit of the object area range	Set/Get	0 to 999999999.9999
136	Sort condition	Set/Get	0: Area descending 1: Area ascending 2: X descending 3: X ascending 4: Y descending 5: Y ascending
137	Label No.	Set/Get	0 to 2499
138	Upper limit of the number of labels	Set/Get	0 to 2500
139	Lower limit of the number of labels	Set/Get	0 to 2500
140	Upper limit of the area	Set/Get	0 to 999999999.9999
141	Lower limit of the area	Set/Get	0 to 999999999.9999
142	Upper limit of the gravity center X	Set/Get	-99999.9999 to 99999.9999
143	Lower limit of the gravity center X	Set/Get	-99999.9999 to 99999.9999
144	Upper limit of the gravity center Y	Set/Get	-99999.9999 to 99999.9999
145	Lower limit of the gravity center Y	Set/Get	-99999.9999 to 99999.9999
146	Upper limit of the binary level (for monochrome cameras only)	Set/Get	0 to 255
147	Lower limit of the binary level (for monochrome cameras only)	Set/Get	0 to 255
148	Reverse (for monochrome cameras only)	Set/Get	0: No reverse 1: Reverse

3.12 Label Data

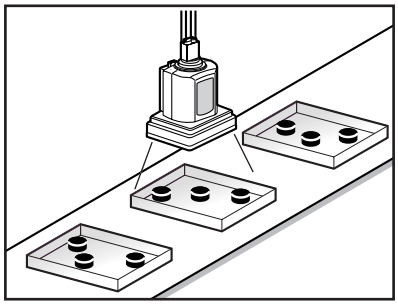
You can specify a desired label number and obtain measurement values for that label stored by other processing units.
The processing items that can be set up as the reference objects are the following items that perform the labeling processing.

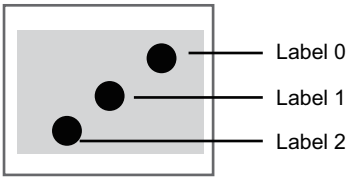
- Labeling

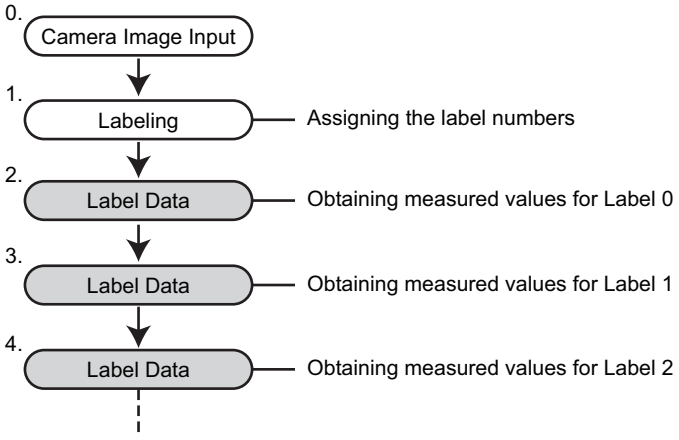
Used for the following case

- Label Offset Measurement

Example) Obtaining the position for each block







POINT

- Do not insert the following processing items between [Label Data] and [Labeling] Units:

- Camera Image Input
- Camera Switching
- Position Compensation

List of Label Data Items

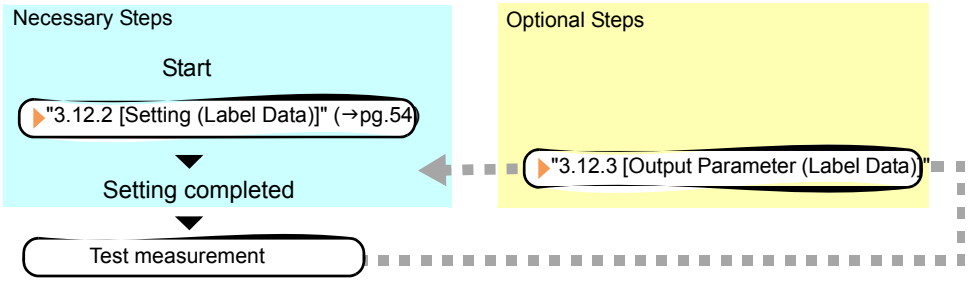
Label Data items are explained below.

Table: List of Label Data Items

Item Name	Description
Setting	Specify the unit number and label number of the processing unit that is designated as the reference object. In addition, specify the judgement conditions for measurement results. Specify the upper and lower limit values for the area and the gravity center X/Y. "3.12.2 [Setting (Label Data)]" (→pg.54)
Output parameter	This item can be changed if necessary. Usually, the factory default value can be used. Use the Output parameter to specify how to treat the coordinate. "3.12.3 [Output Parameter (Label Data)]" (→pg.55)

3.12.1 Setting up [Label Data]

Set up the "Label data" with the following steps.



POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 Tap [Label data] in the Edit Flow window.

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area, tap [Setting] to specify the label conditions used for measurement and the judgement conditions to be judges as OK.

"3.12.2 [Setting (Label Data)]" (→pg.54)

3 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

4 Perform a measurement test.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

5 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"
When NG is displayed, please verify measurement results and make adjustment if necessary.
"3.12.4 Points on Measurement Test and Adjustment (Label Data)" (→pg.57)

3.12.2 [Setting (Label Data)]

Specify the labeling unit number and the label number to be referenced, as well as the range to be judged as OK.
After settings are changed, please verify with actual measurement.

1 In the "Item tab" area, tap [Setting].

2 In the "Label setting" area, tap [...] or [▼] and specify a value for each item.

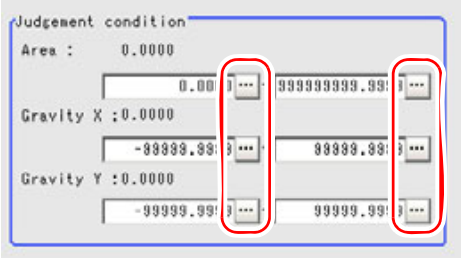
Table: Setting (Label Data) - Label Setting

Setting Options	Set Value [Factory defaults]	Description
Label Unit	[None] to 9999	Specify the number of the unit for which the reference object has been set up. As an option, display the number of the unit for which the following processing items have been set up. ・ Labeling
Label No.	[0] to 2499	Specify the number of the label for the reference object.

3 When the setting has been changed, tap [Measure] in the "Detail" area to verify whether measurements can be made correctly.

4 In the "Judgement condition" area, tap [...] and input a value for each item.

How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"



POINT

- The values displayed in the individual fields are the measurement results of the displayed image. Take these values into consideration to determine the upper and lower limit values.

Table: Setting (Label Data) - Judgement Condition

Setting Item		Set Value [Factory Default]	Description
Area	Upper	0 to [999999999.9999]	Specify the area to be judged as OK.
	Lower	[0] to 999999999.9999	
Gravity X	Upper	-99999.9999 to [99999.9999]	Specify the range of X-axis shifting that is judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Gravity Y	Upper	-99999.9999 to [99999.9999]	Specify the range of Y-axis shifting that is judged to be OK.
	Lower	[-99999.9999] to 99999.9999	

For the following operations, please refer to "3.12.1 Setting up [Label Data]" (→pg.53).

3.12.3 [Output Parameter (Label Data)]

Selects the options for the measured results, namely the coordinates, which are output to the external devices.

Important

- After setting up "Judgement condition" in [Setting], changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, set up "Judgement condition" again.

1 In the "Item tab" area, tap [Output parameter].

2 Specify a value for each item.

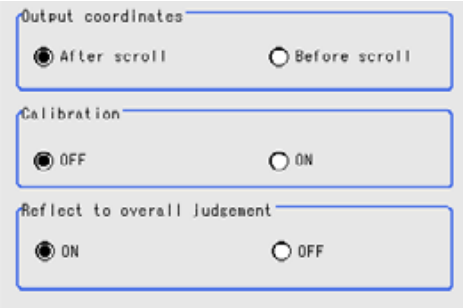


Table: Setting Values for Output Parameter

Setting Options	Set Value [Factory defaults]	Description
Output Coordinate	・[After scroll] ・Before scroll	Select whether to output measured results to external devices before or after the position deflection correction is applied.
Calibration	・[OFF] ・ON	Select whether to output measurement results to external devices by converting them into the coordinates with actual size (calibration: ON) or into the coordinates of camera image (calibration: OFF).
Reflect to overall judgement	・[ON] ・OFF	Select whether to reflect the judgement result of this processing unit to the overall judgement of the scene. ・Selecting "ON" reflects the judgement result of this processing unit on the overall judgement of the scene. ・Selecting "OFF" does not reflect the judgement result of this processing unit on the overall judgement of the scene.

POINT

- For output coordinates and calibration, see "4.6.5 Configuring Coordinates" (→pg.45), of "User's Manual".
- The overall judgement result of the scene is output to the OR signal to be sent via the parallel interface. Also, it is displayed in the "Measurement information display" area in the upper part of the Main screen.
  "10.4.4 Time Chart" (→pg.35), of "User's Manual"
  "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"

For the subsequent operations, see "3.12.1 Setting up [Label Data]" (→pg.53).

3.12.4 Points on Measurement Test and Adjustment (Label Data)

In addition to camera images, the measurement region will also be displayed in "Image display" area.
In the "Detail result" area on the Main screen, you can confirm the following contents in text.
"6.3.2 Displaying Flow and Detail Result" (→pg.12), of "User's Manual"

Table: Text Displayed (Label Data)

Displayed Items	Description
Judge	Judgement result
Area	Area
Gravity X	Gravity X
Gravity Y	Gravity Y

3.12.5 When Using Measured Results Externally (Label Data)

Value Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (Label Data)

Measurement items	Character string	Description
Judge	JG	Judgement result
Label No.	LN	Label No.
Area	AR	Area
Gravity X	X	Gravity X-coordinate
Gravity Y	Y	Gravity Y-coordinate

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in the "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Label Data)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Label No.	Get only	0 to 2499

Table: External Reference List (Label Data)

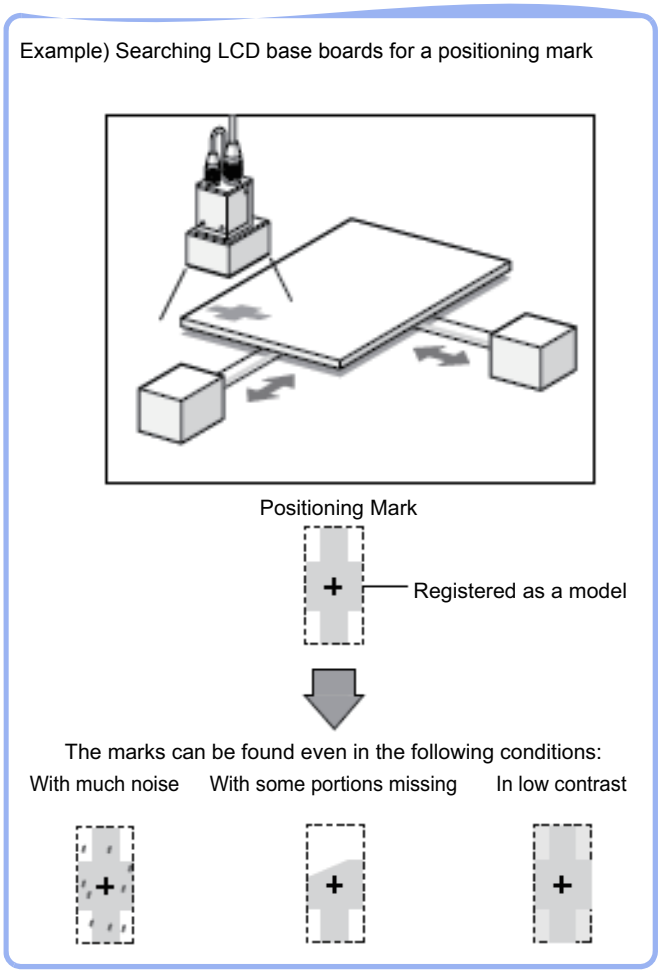
No.	Data Name	Set/Get	Data Range
6	Area	Get only	0 to 999999999.9999
7	Gravity X	Get only	-99999.9999 to 99999.9999
8	Gravity Y	Get only	-99999.9999 to 99999.9999
101	Output coordinate	Set/Get	0: After scroll 1:Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Label Unit	Set/Get	None (-1) to 9999
121	Label No.	Set/Get	0 to 2499
122	Upper limit of the area	Set/Get	0 to 999999999.9999
123	Lower limit of the area	Set/Get	0 to 999999999.9999
124	Upper limit of gravity X	Set/Get	-99999.9999 to 99999.9999
125	Lower limit of gravity X	Set/Get	-99999.9999 to 99999.9999
126	Upper limit of gravity Y	Set/Get	-99999.9999 to 99999.9999
127	Lower limit of gravity Y	Set/Get	-99999.9999 to 99999.9999

3.13 ECM Search

This processing item searches the input image for parts having a high degree of similarity to the target mark (model), and measures its correlation value and position.
This processing assures a stable search even for low-contrast or noisy images.
For ECM search, 25 pixels at each end of an image cannot be registered as a part of the model.

Used for the following cases

- When identifying the shape of measurement objects (for detecting defects or foreign matters)



List of ECM Search Items

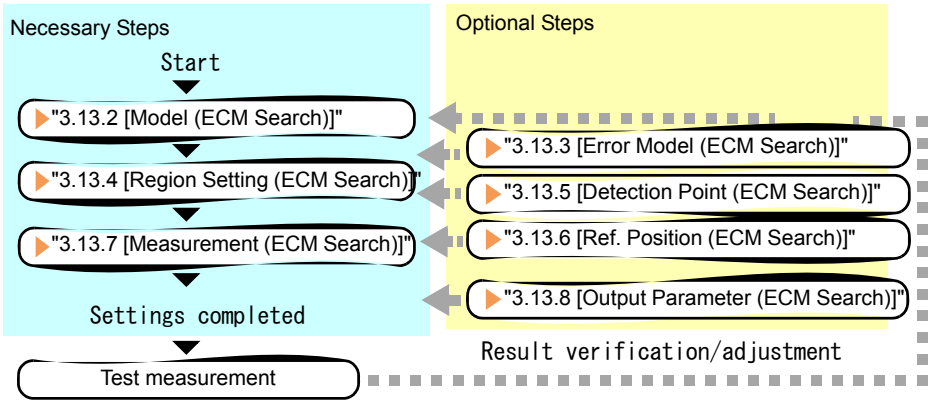
ECM Search items are explained below.

Table: List of ECM Search Items

Item Name	Description
Model	This item registers the pattern characteristic of the measurement image as a model. Model parameter values can be changed as needed to address unstable measurement results or to improve the processing speed. Usually, the factory default value can be used. "3.13.2 [Model (ECM Search)]" (→pg.62)
Error model	This item can be changed if necessary. As an error model, register a model with the similar characteristics to the registered one, but with its correlation lowered when measured. "3.13.3 [Error Model (ECM Search)]" (→pg.67)
Region setting	This item specifies the region to be measured. Instead of measuring the entire input image, narrowing the measurement region shortens the processing time. "3.13.4 [Region Setting (ECM Search)]" (→pg.69)
Detection point	This item can be changed if necessary. Usually, the central position of the set model is registered as the search detection point. "3.13.5 [Detection Point (ECM Search)]" (→pg.70)
Reference position	This item can be changed if necessary. Usually, the central position of the registered region is specified as the reference position. "3.13.6 [Ref. Position (ECM Search)]" (→pg.71)
Measure	This item specifies the judgement condition for measurement results. Specify the criteria to judge the measurement result if its X and Y coordinates and its correlation with the model are OK. "3.13.7 [Measurement (ECM Search)]" (→pg.73)
Output parameter	This item can be changed if necessary. Usually, the factory default value can be used. Use the Output parameter to specify how to treat the coordinate. "3.13.8 [Output Parameter (ECM Search)]" (→pg.75)

3.13.1 Setting up [ECM Search]

The setting procedure for [ECM Search] is as follows:



POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 In the Edit Flow window, tap [ECM Search].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 The window opens with [Model] selected, so that you register the model as a pattern characteristic of the measurement object.

"3.13.2 [Model (ECM Search)]" (→pg.62)

3 In the "Item tab" area, tap [Region setting] and specify the measurement region.

"3.13.4 [Region Setting (ECM Search)]" (→pg.69)

4 In the "Item tab" area, tap [Measurement] and specify the judgement condition for OK.

"3.13.7 [Measurement (ECM Search)]" (→pg.73)

Important

- After setting up the measurement, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

5 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

6 Perform a measurement test.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

7 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

When "NG" is displayed, verify measurement results and make adjustments if necessary.

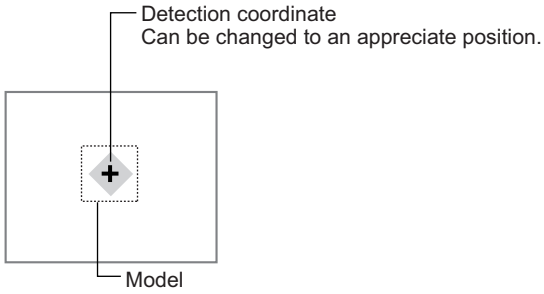
"3.13.9 Points on Test Measurement and Adjustment (ECM Search)" (→pg.76)

3.13.2 [Model (ECM Search)]

Register the pattern characteristic of the measurement object as a model.

Important

- When a model is registered, the central coordinates of the model are registered as the detection coordinates. For this reason, place the measurement object in the correct position when registering a model.



- Upon re-registering a model, error models are deleted. Register error models when re-registering a model.

1 In the "Item tab" area, tap [Model].

When setting a new model, you do not have to tap [Model].

2 If necessary, set up the "Model parameter" area.

" Changing Model Parameters" (→pg.64)

3 Specify a region to be registered as a model by using one of the Drawing tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"

Table: Drawing Tools Available for Model Registration (ECM Search)

Available objects to be drawn	Drawing Tools
Rectangle	

4 In the "Figure setting" area, tap [OK].

The model is registered.

5 If necessary, tap [Mask] and specify values.

" Registering a Mask" (→pg.65)

6 If necessary, tap [Edge extraction] to specify values.

" Extracting Edges" (→pg.66)

7 To check the model display, tap [Display model].

The registered model image is displayed in the "Image display" area.

POINT

- If you want to change only the detection coordinate after registering the model, set up [Detection point].
  "3.13.5 [Detection Point (ECM Search)]" (→pg.70)

For the subsequent operations, see "3.13.1 Setting up [ECM Search]" (→pg.61).

Changing Model Parameters

This item can be changed if necessary. Usually, the factory default value can be used.
When any settings have been changed, verify whether measurements can be performed correctly through actual measurement.

1 In the "Model parameter" area, specify a value for each item.

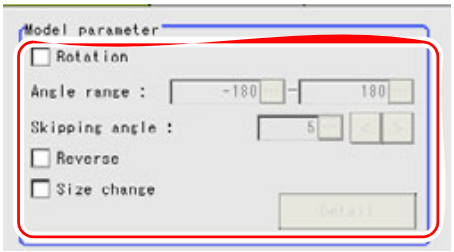


Table: Model (ECM Search) - Model Parameter

Setting Item		Set Value [Factory Default]	Description
Rotation		・Checked ・[Unchecked]	Specify whether to rotate the model.
Angle range	Upper	-180 to [180]	Specify the upper and lower limit values for "Angle range" (rotation angle) during a search. The normal direction is clockwise. Settings must satisfy: lower limit upper limit.
	Lower	[-180] to 180	
Skipping angle		1 to 30 [5]	Specify the stepping angle (in degrees) by which the model is rotated to create rotated models. A smaller angle increases stability, but slows down the processing.
Reverse		・Checked ・[Unchecked]	Specify whether to allow reverse of lights and darks for the model.
Size change		・Checked ・[Unchecked]	Specify whether to allow size change for the model. When checked, tap [Detail] and specify a value for each item.

1. If necessary, check "Rotation" and specify a value for each rotation item.
   For "Angle range" and "Skipping angle", tap [...] and specify a range of the rotation angle.
   How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"
   The [Skipping angle] value can be adjusted by tapping [<] or [>].
2. If necessary, check the "Reverse" or "Size change" option.

2 When the "Size change" option is checked, tap [Detail].

The "Model parameter: Size change" area is displayed.

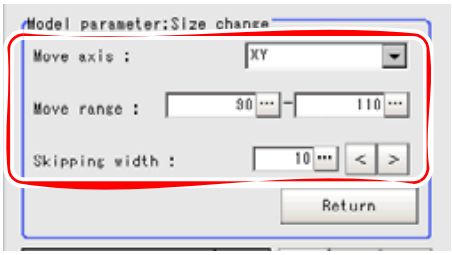


Table: Model (ECM Search) - Model Parameter: Size Change

Setting Item		Set Value [Factory Default]	Description
Move axis		・[XY] ・X ・Y	Specify the direction in which to change the model size.
Move range (%)	Upper	50 to 150 [110]	Specify the range in which to change the model size.
	Lower	50 to 150 [90]	
Skipping width (%)		10 to 99 [10]	Specify the stepping percentage by which the model size is changed within [Move range] to create resized models. A smaller width increases precision, but slows down the processing.

1. Tap [...] or [▼] and specify a value for each item.
   How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"
   The [Skipping angle] value can be adjusted by tapping [<] or [>].

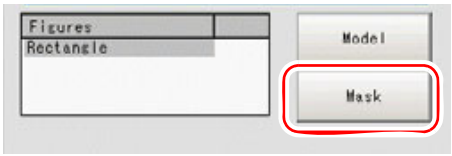
3 Tap [Return].

The "Model parameter" area is displayed.

Registering a Mask

By registering a mask, the part you do not want included in the model is excluded.

1 Tap [Mask].



The "Figure setting" area is displayed.

2 Specify a figure to be registered as a mask by using one of the drawing tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"

Table: Drawing Tools Available for Mask Registration (ECM Search)

Available objects to be drawn	Drawing Tools
Rectangle	
Circle	
Circumference	
Polygon	

3 Tap [OR/NOT].

The figure to be registered as a mask is displayed in red.

4 In the "Figure setting" area, tap [OK].

Extracting Edges

This item can be changed if necessary. Use this item when specifying the edge extraction parameters.

Important

When two different sets of [Edge extraction] settings are needed for the model registration and for measurement:

- Change the [Edge extraction] settings after registering a model.
  Note that, if the model is re-registered after the change, the changed settings are reflected in the registered model.

1 In the "Item tab" area, tap [Edge extraction].

2 In the "Edge extraction setting" area, tap [...] or [▼] and specify a value for each item.

The "Edge level" value can be specified by dragging the slider or tapping one of the buttons at both ends of the slider.

How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"

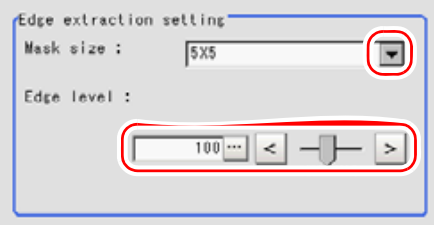


Table: Model (ECM Search) - Edge Extraction Setting

Setting Item	Set Value [Factory Default]	Description
Mask size	・3x3 ・[5x5] ・7x7 ・9x9	Specify the range of pixels which are used to extract the edge. With a larger mask size, search is less affected by variation in pixels.
Edge level	0 to 255 [100]	Specify the background suppressing level for an image of which the edge is extracted. Adjust the edge level when the edge is hard to see, due to low contrast with the background, or when unnecessary background noise should be removed.

3.13.3 [Error Model (ECM Search)]

As an error model, register a model with the similar characteristics to the registered one, but with its correlation lowered when measured.

1 In the "Item tab" area, tap [Error model].

2 Specify a region to be registered as a model by using one of the Drawing tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"

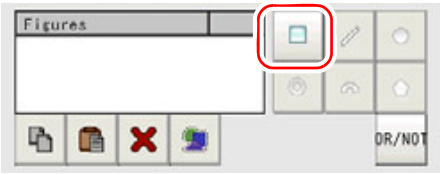


Table: Drawing Tools Available for Error Model (ECM Search)

Available objects to be drawn	Drawing Tools
Rectangle	

3 In the "Figure setting" area, tap [OK].

The model is registered.

4 If necessary, tap [Mask] and specify values.

" Registering a Mask" (→pg.68)

5 To check the model display, tap [Display model].

The registered model image is displayed in the "Image display" area.

Registering a Mask

By registering a mask, the part you do not want included in the model is excluded.

1 Tap [Mask].

The "Figure setting" area is displayed.

2 Specify a figure to be registered as a mask by using one of the Drawing tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"

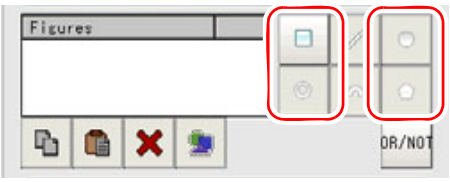


Table: Drawing Tools Available for Mask Registration (ECM Search)

Available objects to be drawn	Drawing Tools
Rectangle	
Circle	
Circumference	
Polygon	

3 Tap [OR/NOT].

The figure to be registered as a mask is displayed in red.

4 In the "Figure setting" area, tap [OK].

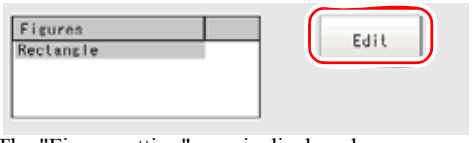
Important

- Upon re-registering a model, error models are deleted. Register error models when re-registering a model.

3.13.4 [Region Setting (ECM Search)]

Use a rectangle or circle (ellipse) to specify a measurement region for [ECM Search].

1. In the "Item tab" area, tap [Region setting].
2. Tap [Edit].



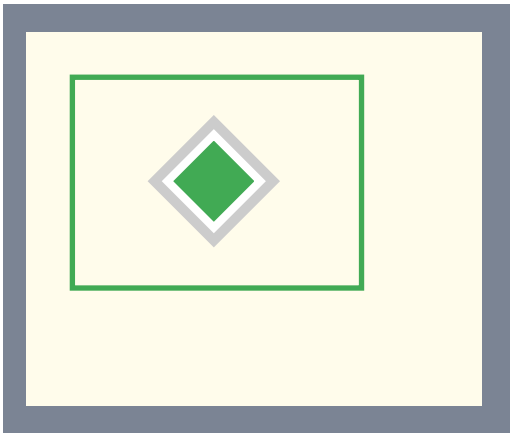
The "Figure setting" area is displayed.

3. Specify a region where the model is searched by using the Drawing tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"

4. In the "Figure setting" area, tap [OK].

The measurement range is registered and displayed in the "Image display" area.



For the subsequent operations, see "3.13.1 Setting up [ECM Search]" (→pg.61).

3.13.5 [Detection Point (ECM Search)]

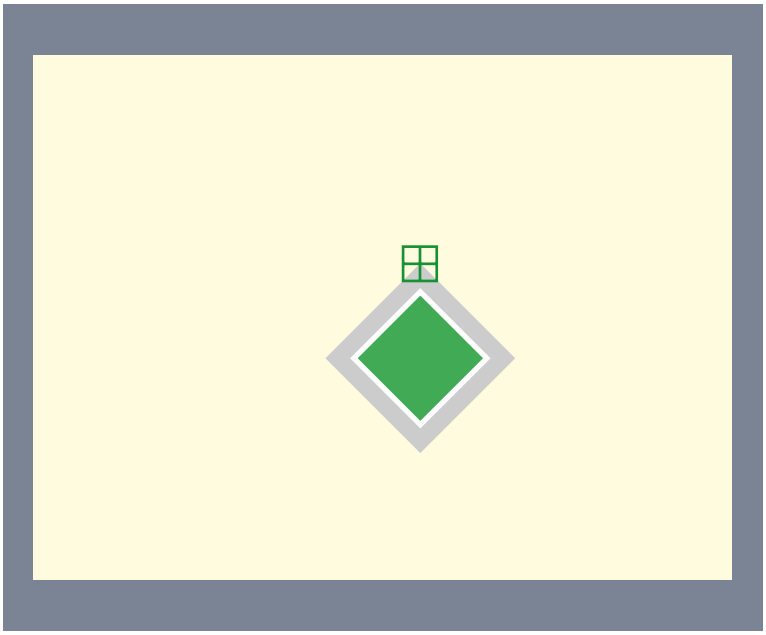
This item can be changed if necessary. When a model is registered, its detection point coordinates are automatically set to the central coordinates of the model. This item can be used to change the detection coordinates to any desired position.
For the detection point, see "11.4 Terminology" (→pg.12), of "User's Manual".

POINT

- After changing the detection coordinates to another position, re-registering the model will change it back to the central coordinates of the model.

1 In the "Item tab" area, tap [Detection point].

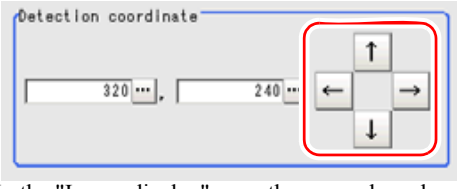
In the "Image display" area, the current detection point is displayed with a cross-shaped cursor.



2 Change the detection coordinates.

Using arrow buttons to change the detection point coordinates:

In the "Detection coordinate" area, tap one of the arrow buttons.

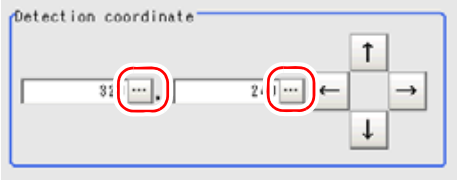


In the "Image display" area, the cross-shaped cursor will move one pixel per tap.
The X and Y coordinate values in the "Detection coordinate" area will also change as the cross-shaped cursor moves.

Specifying values to change the detection point coordinates:

In the "Detection coordinate" area, tap [...] for each of [X] and [Y] to specify a value for your desired detection coordinates.

How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"



The cross-shaped cursor in the "Image display" area will move to the specified coordinate position.

POINT

Tips for position adjustment

- You can easily specify the detection point if you first input approximate coordinate values and then adjust them using arrow buttons in the "Detection coordinate" area. The Zoom function is useful for fine adjustment.
  For the Zoom function, see "1.8 Using Zoom Function" (→pg.24), of "User's Manual".

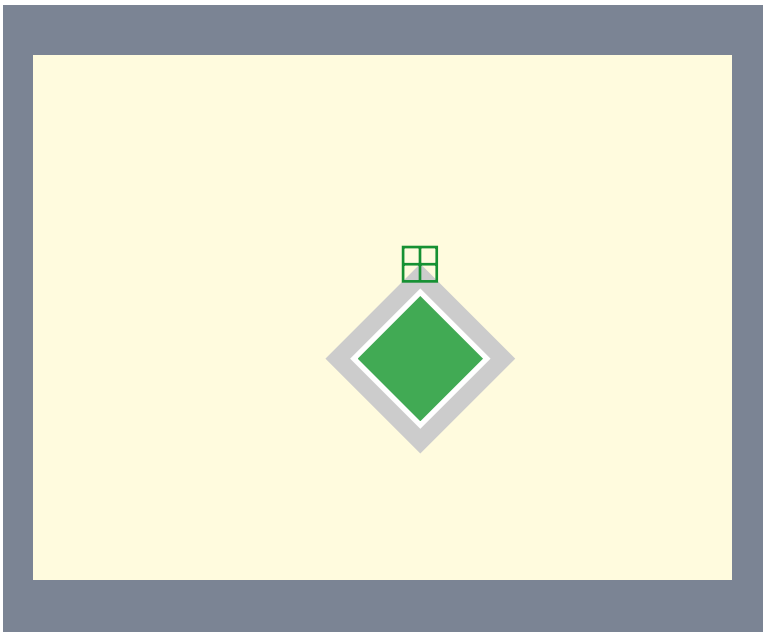
3.13.6 [Ref. Position (ECM Search)]

This item can be changed if necessary. The reference position is automatically set at the same time the measurement region is specified. This item can be used to change the reference position to any desired position.

For the reference position, see "11.4 Terminology" (→pg.12), of "User's Manual".

1 In the "Item tab" area, tap [Reference position].

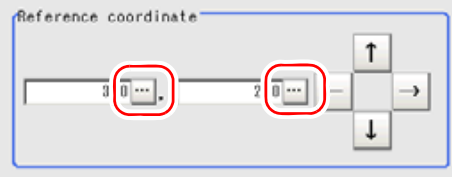
In the "Image display" area, the current reference position is displayed with a cross-shaped cursor.



2 Change the reference position.

In the "Reference coordinate" area, tap [...] for each item and specify values for your desired reference coordinates (the coordinates of the reference position).

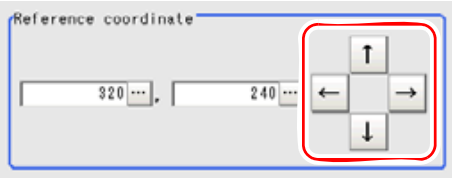
How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"



The cross-shaped cursor in the "Image display" area will move to the specified coordinate position.

Using arrow buttons to change the coordinate position:

In the "Reference coordinate" area, tap one of the arrow buttons.

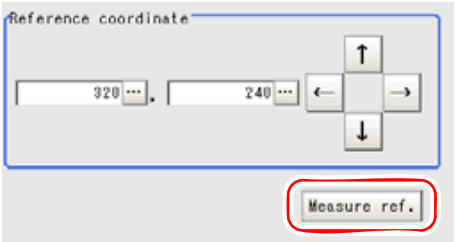


In the "Image display" area, the cross-shaped cursor will move one pixel per tap.

In the "Reference coordinate" area, the reference coordinate values (X, Y) will also change as the cross-shaped cursor moves.

Changing the reference position by measurement:

While the image to be measured is displayed, tap [Measure ref.].



The measurement coordinates are re-calculated and reflected in "Reference coordinate" of the "Reference coordinate" area.

POINT

Tips for position adjustment

- You can easily specify the reference position if you first input approximate coordinate values and then adjust them using arrow buttons in the "Reference coordinate" area. The Zoom function is useful for fine adjustment.
  For the Zoom function, see "1.8 Using Zoom Function" (→pg.24), of "User's Manual".

3.13.7 [Measurement (ECM Search)]

Specify the judgement condition for measurement results. Specify the criteria to judge the measurement result if its X and Y coordinates and its correlation with the model are OK.

1 In the "Item tab" area, tap [Measurement].

2 In the "Measurement condition" area, tap [...] and specify a value for each item.

How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"

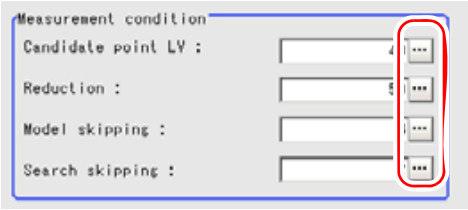


Table: Measure (ECM Search) - Measurement Condition

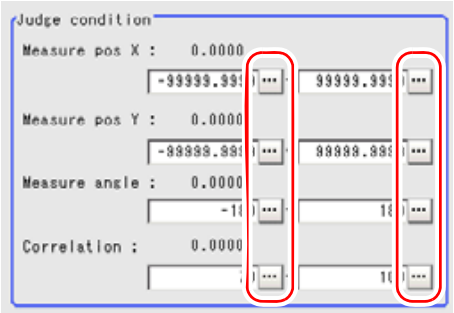
Setting Item	Set Value [Factory Default]	Description
Candidate point LV	0 to 99 [40]	Specify the threshold value with which to detect the model position (candidate point for the measurement coordinates) in a rough search. Specify a smaller value for [Candidate LV] when model search results are unstable.
Reduction	10 to 100 [50]	Specify the percentage to which the input image and the model image are reduced during a search. The smaller the image is reduced, the faster the processing becomes, but search results may be unstable with a smaller image.
Model skipping	1 to 19 [4]	Specify how many pixels should be skipped when performing a rough search for the "rough search model".
Search skipping	1 to 9 [2]	Specify how many pixels are skipped when performing a search for the "measurement region".

[Note 1]: If any of these parameters change after the model is registered, the model needs to be re-registered.
"3.13.2 [Model (ECM Search)]" (→pg.62)

3 When the setting has been changed, tap [Measure] in the "Detail" area to verify whether measurements can be made correctly.

4 In the "Judgement condition" area, tap [...] and input a value for each item.

How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"



POINT

- The values displayed in the individual fields are the measurement results of the displayed image. Take these values into consideration to determine the upper and lower limit values.

Table: Measure (ECM Search) - Judgement Condition

Setting Item		Set Value [Factory Default]	Description
Measure pos X	Upper	-99999.9999 to [99999.9999]	Specify the range of X-axis shifting that is judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Measure pos Y	Upper	-99999.9999 to [99999.9999]	Specify the range of Y-axis shifting that is judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Measure angle	Upper	-180 to [180]	Specify the range of angles that are judged to be OK.
	Lower	[-180] to 180	
Correlation[Note 1]	Upper	0 to [100]	Specify the range of correlation values that are judged to be OK.
	Lower	0 to 100 [70]	

[Note 1]: When the ECM correlation value of the measurement result is 0, the judgement result will be NG regardless of the Measurement settings.

For the subsequent operations, see "3.13.1 Setting up [ECM Search]" (→pg.61).

3.13.8 [Output Parameter (ECM Search)]

Select options for the measured results, namely the coordinates, which are output to the external devices.

Important

- After setting up the measurement, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

1 In the "Item tab" area, tap [Output parameter].

2 Specify a value for each item.

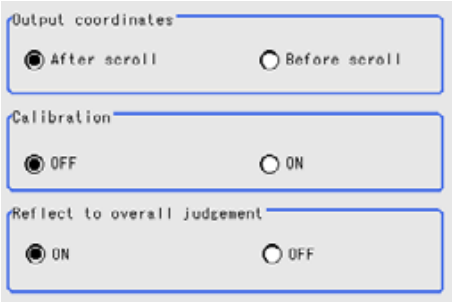


Table: Setting Values for Output Parameter

Setting Options	Set Value [Factory defaults]	Description
Output coordinate	・[After scroll] ・Before scroll	Select whether to output measurement results to external devices before or after the position deflection correction is applied.
Calibration	・[OFF] ・ON	Select whether to output measurement results to external devices by converting them into the coordinates with actual size (calibration: ON) or into the coordinates of camera image (calibration: OFF).
Reflect to overall judgement	・[ON] ・OFF	Select whether to reflect the judgement result of this processing unit to the overall judgement of the scene. ・Selecting "ON" reflects the judgement result of this processing unit on the overall judgement of the scene. ・Selecting "OFF" does not reflect the judgement result of this processing unit on the overall judgement of the scene.

POINT

- For output coordinates and calibration, see "4.6.5 Configuring Coordinates" (→pg.45), of "User's Manual".
- The overall judgement result of the scene is output to the OR signal to be sent via the parallel interface. Also, it is displayed in the "Measurement information display" area in the upper part of the Main screen.
  "10.4.4 Time Chart" (→pg.35), of "User's Manual"
  "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"

For the subsequent operations, see "3.13.1 Setting up [ECM Search]" (→pg.61).

3.13.9 Points on Test Measurement and Adjustment (ECM Search)

In addition to the camera-input image, the registered models and the search coordinates (the cross-shaped cursor) will also be displayed in the "Image display" area.

In the "Detail result" area on the Main screen, you can confirm the following contents in text.
"6.3.2 Displaying Flow and Detail Result" (→pg.12), of "User's Manual"

Table: Text Displayed (ECM Search)

Item	Description
Judge	Judgement result
Correlation	Correlation
Measure pos X	X coordinate of the position where the model is detected
Measure pos Y	Y coordinate of the position where the model is detected
Measure angle	Angle of the position where the model is detected

3.13.10When Using Measurement Results Externally (ECM Search)

Values Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (ECM Search)

Measurement items	Character string	Description
Judge	JG	Judgement result
EC Correlation	CR	Correlation value with the model
Measured coordinate X	X	X coordinate of the position where the model is detected
Measured coordinate Y	Y	Y coordinate of the position where the model is detected
Measure angle	TH	Angle of the position where the model is detected
Magnification MX	MX	X-axis magnification of the detected model
Magnification MY	MY	Y-axis magnification of the detected model
Reference position X	SX	X coordinate of the registered model's reference position
Reference position Y	SY	Y coordinate of the registered model's reference position
Reference angle	ST	Angle of the registered model
Detection point RX	RX	X coordinate of the registered model
Detection point RY	RY	Y coordinate of the registered model

External Reference List

The data types and their numbers that are available to refer from other processing units and external equipment are shown below. For the input method, see "Input Format" in "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (ECM Search)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Correlation	Get only	0 to 100
6	Measured coordinate X	Get only	-99999.9999 to 99999.9999
7	Measured coordinate Y	Get only	-99999.9999 to 99999.9999
8	Measure angle	Get only	-180 to 180
9	Magnification X	Get only	50 to 150
10	Magnification Y	Get only	50 to 150
11	Reference position X	Get only	-99999.9999 to 9999.9999
12	Reference position Y	Get only	-99999.9999 to 9999.9999
13	Reference angle	Get only	-180 to 180
14	Detection point X	Get only	-99999.9999 to 9999.9999
15	Detection point Y	Get only	-99999.9999 to 9999.9999
101	Output coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0:OFF 1:ON
103	Reflect in OR	Set/Get	0:ON 1:OFF
120	Mask size	Set/Get	0: 3x3 1: 5x5 2: 7x7 3: 9x9
121	Edge level	Set/Get	0 to 255
122	Detection point X	Set/Get	-99999.9999 to 9999.9999
123	Detection point Y	Set/Get	-99999.9999 to 9999.9999
124	Reference coordinate X	Set/Get	0 to 99999.9999
125	Reference coordinate Y	Set/Get	0 to 99999.9999
126	Upper limit of the correlation	Set/Get	0 to 100
127	Lower limit of the correlation	Set/Get	0 to 100
128	Upper limit of Position X	Set/Get	-99999.9999 to 99999.9999
129	Lower limit of Position X	Set/Get	-99999.9999 to 99999.9999

Table: External Reference List (ECM Search)

No.	Data Name	Set/Get	Data Range
130	Upper limit of Position Y	Set/Get	-99999.9999 to 99999.9999
131	Lower limit of Position Y	Set/Get	-99999.9999 to 99999.9999
132	Upper limit of the angle	Set/Get	-180 to 180
133	Lower limit of the angle	Set/Get	-180 to 180
134	Candidate LV	Set/Get	0 to 99
135	Model skipping	Set/Get	1 to 9
136	Search skipping	Set/Get	1 to 19
137	Reduction	Set/Get	10 to 100
138	Rotation	Set/Get	0:ON 1:OFF
139	Lower limit of the angle	Set/Get	-180 to 180
140	Upper limit of the angle	Set/Get	-180 to 180
141	Skipping angle	Set/Get	1 to 30
142	Move axis	Set/Get	0:No change 1:XY change 2:X change 3:Y change
143	Upper limit of the move range	Set/Get	50 to 150
144	Lower limit of the move range	Set/Get	50 to 150
145	Skipping width	Set/Get	1 to 99
146	Reverse	Set/Get	0:No Reverse 1:Reverse

3.14 Character Inspection

Using model images registered in a [Model Dictionary], this processing item performs character recognition by correlation searches.

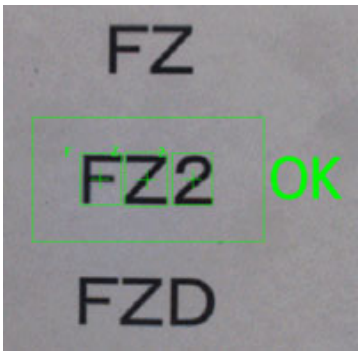
Important

- The Model Dictionary needs to be created in advance. "3.15 Model Dictionary" (→pg.94)

Used for the following case

- When identifying standard character data (check of product model name)

Example) Product type inspection



List of Character Inspection Items

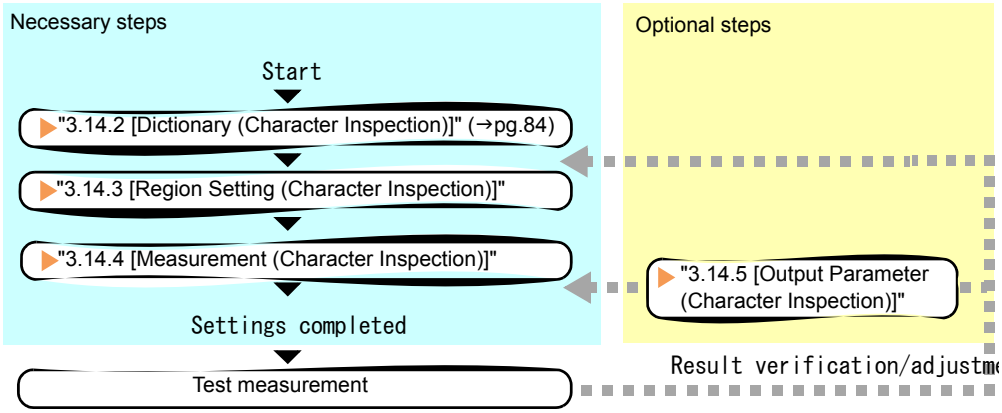
Character Inspection items are explained below.

Table: List of Character Inspection Items

Item Name	Description
Dictionary	This item specifies the processing unit number of the model dictionary to use for character recognition. "3.14.2 [Dictionary (Character Inspection)]" (→pg.84)
Region setting	This item specifies the region to be measured. Instead of measuring the entire input image, narrow the measurement region to shorten the processing time. "3.14.3 [Region Setting (Character Inspection)]" (→pg.85)
Measurement	This item specifies the judgement condition for measurement results. Specify the criteria to judge the measurement result if the X and Y coordinates and the correlation with the model are OK. "3.14.4 [Measurement (Character Inspection)]" (→pg.86)
Output parameter	This item can be changed if necessary. Usually, the factory default value can be used. Use the Output parameter to specify how to treat the coordinate. "3.14.5 [Output Parameter (Character Inspection)]" (→pg.88)

3.14.1 Setting up [Character Inspection]

The setting procedure for [Character Inspection] is as follows:



POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 In the Edit Flow window, tap [Character Inspection].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 The window opens with [Dictionary] selected, so that you select a model dictionary to use for character recognition.

"3.14.2 [Dictionary (Character Inspection)]" (→pg.84)

3 In the "Item tab" area, tap [Region setting] and specify the measurement region.

"3.14.3 [Region Setting (Character Inspection)]" (→pg.85)

4 In the "Item tab" area, tap [Measurement] and specify the judgement condition for OK.

"3.14.4 [Measurement (Character Inspection)]" (→pg.86)

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement parameters, too.

5 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

6 Perform a test measurement.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

7 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"
When "NG" is displayed, verify measurement results and make adjustments if necessary.
"3.14.6 Points on Measurement Test and Adjustment (Character Inspection)" (→pg.89)

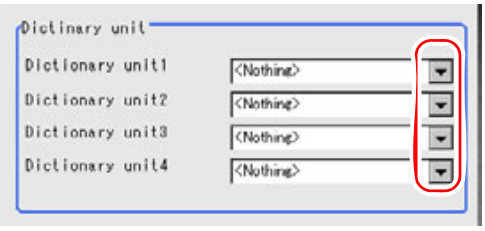
3.14.2 [Dictionary (Character Inspection)]

This item registers the feature image of the measured objects as a model.

1 In the "Item tab" area, tap [Dictionary].

When setting a new model, you do not need to tap [Dictionary].

2 In the "Dictionary unit" area, tap [▼] and select a unit number.



3 If necessary, specify an individual model to use.

1. Tap [▼] and select the dictionary unit to be specified.
   Character strings in the registered index are displayed.

2. Check the character(s) to use.

4 Tap [OK].

The model dictionary to use is set.

For the subsequent operations, see "3.14.1 Setting up [Character Inspection]" (→pg.83).

3.14.3 [Region Setting (Character Inspection)]

This item specifies the measurement region of [Character Inspection] using a rectangle.

1 In the "Item tab" area, tap [Region setting].

2 Tap [Edit].

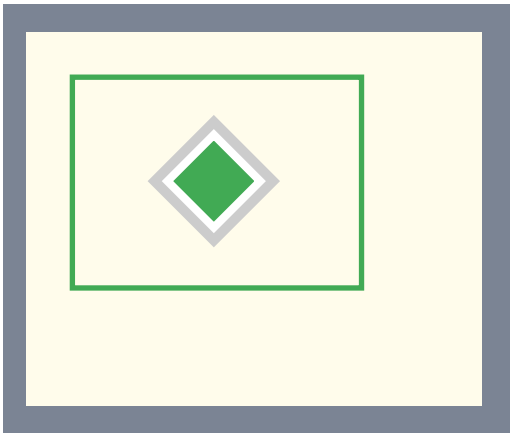
The "Figure setting" area is displayed.

3 Specify a region where the model is searched by using the Drawing tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"

4 In the "Figure setting" area, tap [OK].

The measurement range is registered and displayed in the "Image display" area.



For the subsequent operations, see "3.14.1 Setting up [Character Inspection]" (→pg.83).

3.14.4 [Measurement (Character Inspection)]

Specify the judgement condition for measurement results. Specify the criteria to judge the measurement result if its X and Y coordinates and its correlation with the model are OK.

1 In the "Item tab" area, tap [Measurement].

2 In the "Inspection condition" area, specify a value for each item.

For "Horizontal succession", "Vertical succession", "Rough candidate", and "Detail candidate", tap [...] and input a value for each item. The value can also be adjusted by tapping [<] and [>].

How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"

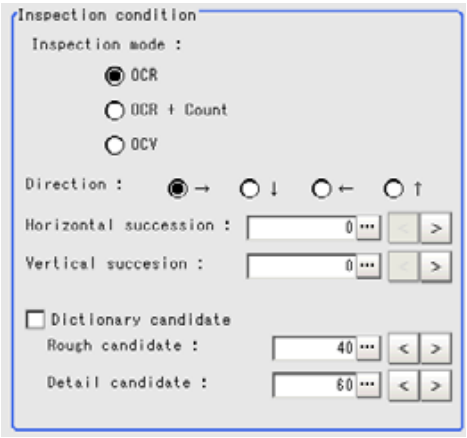


Table: Measurement (Character Inspection) - Inspection Conditions

Setting Item	Set Value [Factory default]	Description
Inspection mode	・[OCR] ・OCR + Count ・OCV	Select the inspection mode of characters. When "OCR" is selected, the judgement is based on the correlation value of the recognition.
Direction	[→] ↓ ← ↑	Select the direction of character reading.
Horizontal succession	[0] to 99	Specify the allowable overlapping range to be read for candidate points. This item is valid when "Direction" is [→] [←].
Vertical succession	[0] to 99	Specify the allowable overlapping range to be read for candidate points. This item is valid when "Direction" is [↓] [↑].
Dictionary candidate	・[Unchecked] (Not used) ・Checked (Used)	Specify whether to use candidate levels specified in the [Model Dictionary] or not.
Rough candidate	0 to 100 [40]	When "Dictionary candidate" is unchecked, specify a value for the rough search candidate level.
Detail candidate	0 to 100 [60]	When "Dictionary candidate" is unchecked, specify a value for the detailed search candidate level.

3 In the "Judgement condition" area, specify a value for each item.

Tap [...] and input values. The value can also be adjusted by tapping [<] and [>].

How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"

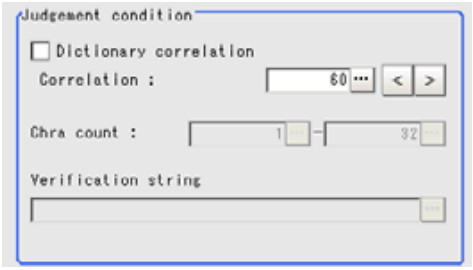


Table: Measurement (Character Inspection) - Judgement Condition

Setting Item		Set Value [Factory default]	Description
Dictionary correlation		・[Unchecked] (Not used) ・Checked (Used)	Specify whether to use the correlation lower limit set in the [Model Dictionary] or not.
	Lower limit of the correlation	0 to 100 [60]	When "Dictionary correlation" is unchecked, specify the correlation lower limit.
Char count	Upper	1 to [32]	When "Inspection mode" is "OCR + Count", specify the upper limit of the judgement condition for the number of characters.
	Lower	[1] to 32	When "Inspection mode" is "OCR + Count", specify the lower limit of the judgement condition for the number of characters.
Verification string		A string with up to 32 characters. [(None)]	When "Inspection mode" is "OCV", specify the verification string.

For the subsequent operations, see "3.14.1 Setting up [Character Inspection]" (→pg.83).

3.14.5 [Output Parameter (Character Inspection)]

Specify how to treat the coordinates to be output to the external devices as measurement results.

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement parameters, too.

1 In the "Item tab" area, tap [Output parameter].

2 Specify a value for each item.

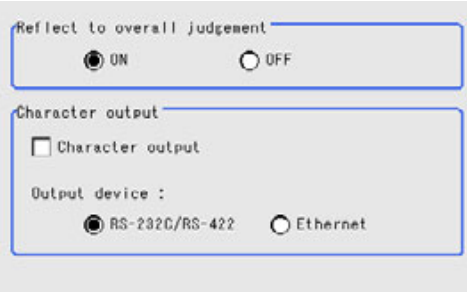


Table: Setting Values for Output Parameters

Setting Item		Set Value [Factory default]	Description
Reflect to overall judgement		・[ON] ・OFF	Specify whether to reflect the judgement result of this processing unit to the overall judgement of the scene. ・Selecting "ON" will reflect the judgement result of this processing unit on the overall judgement of the scene. ・Selecting "OFF" will not reflect the judgement result of this processing unit on the overall judgement of the scene.
Character output	Character output	・[Unchecked] (Not output) ・Checked (Output)	Specify whether to output measurement result strings to an external device.
	Output device	・[RS-232C/RS-422] ・Ethernet	When "Character output" is checked (Output), this specifies the device to which strings are output.

POINT

- The overall judgement result of the scene is output to the OR signal to be sent via the parallel interface. Also, it is displayed in the "Measurement information display" area in the upper part of the Main screen.
  "10.4.4 Time Chart" (→pg.35), of "User's Manual"
  "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"
- Output characters are encoded in ASCII code. This means that other characters than alphanumerical characters and symbols will not be output correctly.

For the subsequent operations, see "3.14.1 Setting up [Character Inspection]" (→pg.83).

3.14.6 Points on Measurement Test and Adjustment (Character Inspection)

In addition to the camera-input image, the registered model and the detection coordinates (the cross-shaped cursor) will also be displayed in the "Image display" area.

In the "Detail result" area on the Main screen, you can confirm the following contents in text.
"6.3.2 Displaying Flow and Detail Result" (→pg.12), of "User's Manual"

Table: Text Displayed (Character Inspection)

Item	Color of display	Description
Judge	OK / unmeasured: Black NG: Red	Judgement result
NG Cause	0: Black Not 0: Red	The following strings are displayed. The larger numbers have priority. 0: OK 1: Correlation value NG 2: Character count NG 4: Verification NG
Char count	When the NG Cause is the character count NG: Red Other NGs: Black	The number of measured characters is displayed.
Read string	When the NG Cause is verification NG: Red Other NGs: Black	A character string read from the target unit is displayed.
Correlation	When the NG Cause for each character is the correlation value NG: Red Other NGs: Black	The correlation values for each character are displayed. Example) When 0123 is read Correlation values: 0(99) 1(56) 2(80) 3(27)

Points on Adjustment

Select the adjustment method referring to the following points.

When the processing speed is slow:

- Reduce the measurement region size in [Region Setting].
  "3.14.3 [Region Setting (Character Inspection)]" (→pg.85)

When the judgement is NG (insufficient memory):

- Reduce the measurement region size in [Region Setting].
  "3.14.3 [Region Setting (Character Inspection)]" (→pg.85)

3.14.7 When Using Measurement Results Externally (Character Inspection)

Values Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.

The measurement items displayed in the sub-menu are explained below.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Value Available in Expression (Character Inspection)

Measurement items	Character string	Description
Judge	JG	Judgement result
Char count	NUM	Character count
NG Cause	NG	NG Cause
For following items, additional expression data with 32 characters is allocated for each character. (N represents the character index.)		
Detect unit number N	CUNO*	Detect unit number for the Nth character
Detect index number N	CINDEX*	Detect index number for the Nth character
Detect model number N	CMODEL*	Detect model number for the Nth character
Detect character code N	CCHAR*	Character code for the Nth character
NG factor	CNG*	NG factor for the Nth character

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Character Inspection)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
1	Char count	Get only	0 to 32
2	NG cause	Get only	0x0000 to 0x0007
103	Reflect in OR	Set/Get	0: ON 1: OFF
120 to 123	Dictionary unit number	Set/Get	-1: OFF 0 to 9999
124	Inspection mode	Set/Get	0: OCR 1: OCR + Count 2: OCV
125	Direction	Set/Get	0: → 1: ↓ 2: ← 3: ↑
126	Character output	Set/Get	0: OFF 1: ON
127	Character output device	Set/Get	0: RS-232C/RS-422 1: Ethernet

Table: External Reference List (Character Inspection)

No.	Data Name	Set/Get	Data Range
129	Horizontal succession	Set/Get	0 to 99
130	Vertical succession	Set/Get	0 to 99
132	Dictionary candidate points LV usage flag	Set/Get	0: Not used 1: Used
133	Rough candidate	Set/Get	0 to 100
134	Detail candidate	Set/Get	0 to 100
135	Dictionary correlation usage flag	Set/Get	0: Not used 1: Used
136	Lower limit of the correlation	Set/Get	0 to 100
137	Upper limit of the number of characters	Set/Get	1 to 32
138	Lower limit of the number of characters	Set/Get	1 to 32
140 to 283	Model usage flag	Set/Get	0: Not used 1: Used
1000 to 1031	Detected unit number	Get only	-1: None, 0 to 9999
1032 to 1063	Detected index number	Get only	0 to 35
1064 to 1095	Detected model number	Get only	0 to 4
1096 to 1127	Detected character code	Get only	0 to 0xFFFF (UTF-16 encoded)
1128 to 1159	Detected NG factor	Get only	0 to 7
1160 to 1191	Correlation	Get only	0 to 100
1192 to 1223	Detected coordinate X	Get only	-99999.9999 to 99999.9999
1224 to 1255	Detected coordinate Y	Get only	-99999.9999 to 99999.9999
1256 to 1287	Detected Angle	Get only	-180 to 180
1288 to 1319	Reference coordinate X	Get only	-99999.9999 to 99999.9999
1320 to 1351	Reference coordinate Y	Get only	-99999.9999 to 99999.9999
1352 to 1383	Reference angle	Get only	-180 to 180

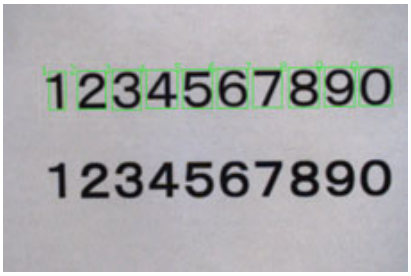
3.15 Model Dictionary

Register the "Search model" to use [Character Inspection].
Model data registered in the [Model Dictionary] can be referred to from multiple [Character Inspection] items in the same scene.

Used for the following case

- When creating the dictionary to be used for Character Inspection and Date Verification

Example) Inspecting printed characters



List of Model Dictionary Items

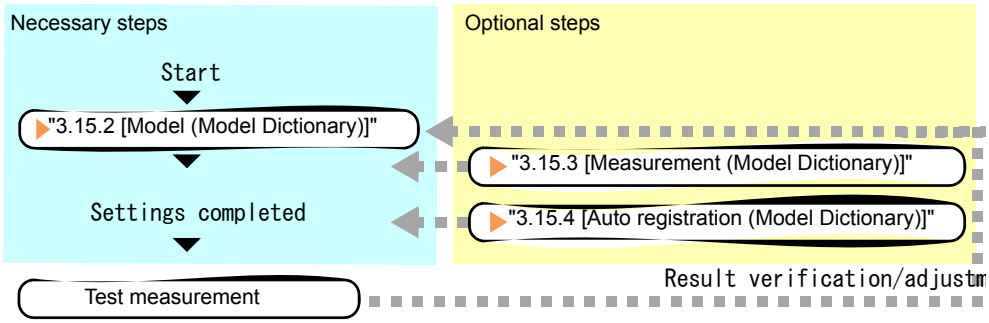
Model Dictionary items are explained below.

Table: List of Model Dictionary Items

Item Name	Description
Model	This item registers the feature images as a model and displays a model list. Model parameter values can be changed as needed to address unstable measurement results or for the faster process. Usually, the factory default value can be used. "3.15.2 [Model (Model Dictionary)]" (→pg.95)
Measurement	This item can be changed if necessary. "3.15.3 [Measurement (Model Dictionary)]" (→pg.100)
Auto registration	This item can be changed if necessary. Usually, the factory default value can be used. Cuts out a model automatically and registers the cut model. "3.15.4 [Auto registration (Model Dictionary)]" (→pg.102)

3.15.1 Setting up [Model Dictionary]

Follow the steps below to set up [Model Dictionary].



POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 In the Edit Flow window, tap [Model Dictionary].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 The window opens with [Model] selected, so that you register the model as a pattern characteristic of the measurement object.

"3.15.2 [Model (Model Dictionary)]" (→pg.95)

3 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

4 Perform a test measurement.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

5 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

When "NG" is displayed, verify measurement results and make adjustments if necessary.

"3.15.5 Points on Measurement Test and Adjustment (Model Dictionary)" (→pg.104)

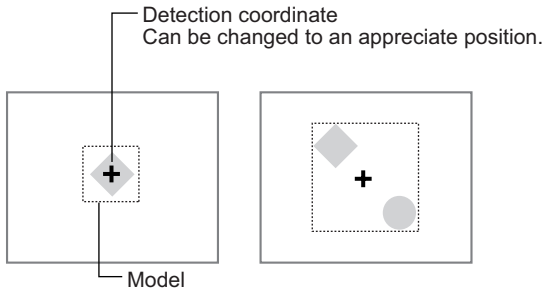
3.15.2 [Model (Model Dictionary)]

This item registers the feature image of the measured objects as a model and displays a model list.

Models can be registered in one of 36 index types (0 to 35), and up to five models can be registered per index.

Important

- When a model is registered, the central coordinates of the model are registered as the detection coordinates (if multiple figures are combined, the central coordinates of the circumscribed rectangle are registered). For this reason, place the measurement object in the correct position when registering a model.



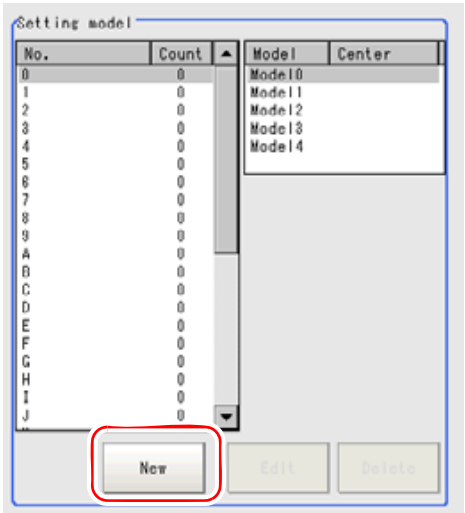
1 In the "Item tab" area, tap [Model].

When setting a new model, you do not have to tap [Model].

2 If necessary, set up the "Model parameter" area.

" Changing Model Parameters" (→pg.99)

3 In the "Setting model" area, select a model and tap [New].



The "Detail" area for model registration is displayed.

4 Specify a region to be registered as a model by using the Drawing tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"

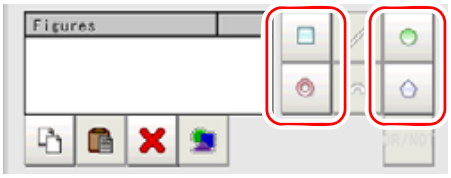


Table: Drawing Tools Available for Model (Model Dictionary)

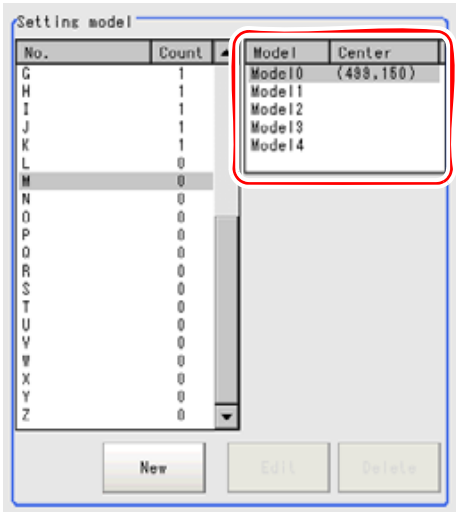
Available objects to be drawn	Drawing Tools
Rectangle	
Circle	
Circumference	
Polygon	

POINT

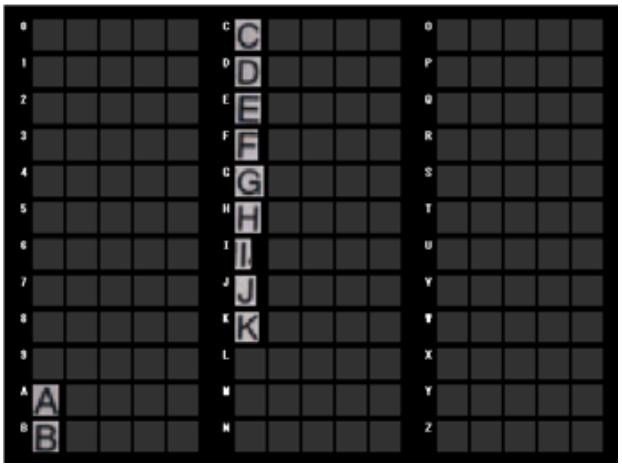
- If the model is an ellipse, its circumscribed rectangle is displayed as the search result of the model.

5 Tap [OK].

The model is registered and its central X and Y coordinate values are displayed in the "Setting model" area.

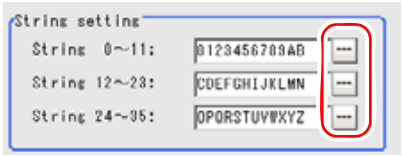


The image specified for the model is displayed in the "Image display" area.



6 To register two or more models, repeat the Steps 3 to 5.

7 In the "String setting" area, tap [...] for each item as necessary.



A software keyboard is displayed.

The number of characters for each string is fixed to 12 characters.

How to input strings:"1.9 Setting Figures" (→pg.25), of "User's Manual"

For the subsequent operations, see "3.15.1 Setting up [Model Dictionary]" (→pg.95).

Changing Model Parameters

This item can be changed if necessary. Usually, the factory default value can be used.
When any settings are changed, verify whether measurements can be performed correctly through actual measurements.

POINT

- For search operations, see "4.6.2 Configuring Search" (→pg.39), of "User's Manual".

1 In the "Model parameter" area, specify a value for each item.

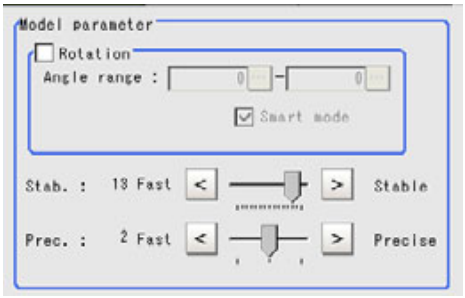


Table: Model - Model Parameter

Setting Item		Set Value [Factory default]	Description
Rotation		・Checked ・[Unchecked]	Specify whether to rotate the image during a search.
Angle range	Upper	-45 to 45 [0]	Specify the upper and lower limits for [Angle range] (rotation angle) during a search. The normal direction is clockwise. Settings must satisfy: The lower limit is equal to or smaller than the upper limit.
	Lower	-45 to 45 [0]	
Smart mode		・[Checked] ・Unchecked	Specify whether or not to enable Smart mode. Checking the [Smart mode] option enables a high-speed rotation search. The stability may be lowered when the model shape aspect ratio is large or when the NOT mask is used.
Stab. (Stability)		1 to 15 [13]	Specify the stability of detection. A larger value increases stability. A smaller value speeds up processing. If lowering stability leads to slower processing, it is likely that many candidates have been detected. In this case, specify a larger value for "Candidate LV" or "Stab.".
Prec. (Precision)		1 to 3 [2]	Specify the position precision of the measurement coordinates. A larger value raises precision, and a smaller value speeds up processing.

1. If necessary, check [Rotation] and specify a value for each rotation item.
   For [Angle range], tap [...] and specify a range for the rotation angle.
   How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

2. The values for "Stab." and [Prec.] can be adjusted by dragging the slider.
   The value can also be adjusted by tapping the buttons at both ends of the slider.

Points on Adjustment

To improve measurement results, make adjustments as described below.
For adjustments, see also "5.4 Points on Adjustment" (→pg.11), of "User's Manual".

When measurement results are unstable

- If the model image consists of detailed figures, specify a larger value for "Stab.".
- If images that should be judged OK based on the model image vary in some degree, specify a smaller value for "Candidate LV".
- When [Rotation] is selected, if the model region shape is complex, uncheck the [Smart mode] option.

When the processing speed is slow

- If the model image is a simple figure or a large figure, specify a smaller value for "Stab.".
- If images that should be judged OK based on the model image have less variation, specify a larger value for "Candidate LV".
- When [Rotation] is selected and the model region shape is simple, check the [Smart mode] option.

For other adjustment methods, see " Shortening Measurement Time by Setting Processing Item" (→pg.11), of "User's Manual".

3.15.3 [Measurement (Model Dictionary)]

This item can be changed if necessary. Usually, the factory default value can be used.

1 In the "Item tab" area, tap [Measurement].

2 In the "Measurement condition" area, specify a value for each item.

In "Correlation", "Rough candidate", and "Detail candidate", tap [...] and input values. The value can also be adjusted by tapping [<] and [>].

How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"

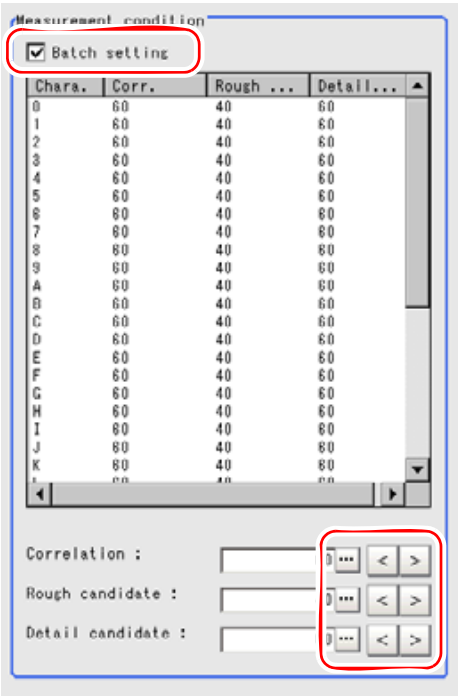


Table: Measurement (Model Dictionary)

Setting Item	Set Value [Factory default]	Description
Batch setting	・[Checked] ・Unchecked	Specify whether to set all measurement parameter values at the same time. ・When checked, the same measurement values are set for all indexes. ・When unchecked, measurement values are set for indexes selected in the list.
Correlation	0 to 100 [60]	Specify the lower limit of the correlation.
Rough candidate	0 to 100 [40]	Specify the threshold value used when detecting candidate points by rough search. Specify a smaller value when model search results are unstable.
Detail candidate	0 to 100 [60]	Specify the threshold value used when detecting candidate points in a detailed search. Only the candidate points higher than this level are extracted as characters.

For the subsequent operations, see "3.15.1 Setting up [Model Dictionary]" (→pg.95).

3.15.4 [Auto registration (Model Dictionary)]

A model is cut out automatically, and the cut model is registered.
Models can be registered in 36 index types (0 to 35), and up to five models can be registered per index.
The registration methods are as follows:

- " Setting up Auto extract region" (→pg.102)
- " Setting Up Auto model region" (→pg.103)

Important

- If five models have already been registered for an index, automatic registration cannot be set.

Setting up Auto extract region

1 In the "Item tab" area, tap [Auto registration].

2 In the "Detail" area, select "Auto extract region".

3 Tap [Edit].

4 Specify the region to register as Auto extract region by using the Drawing tools.
"1.9 Setting Figures" (→pg.25), of "User's Manual"

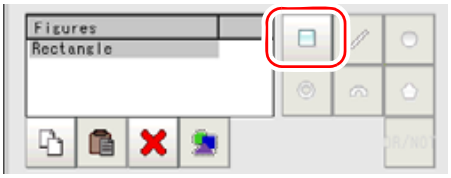


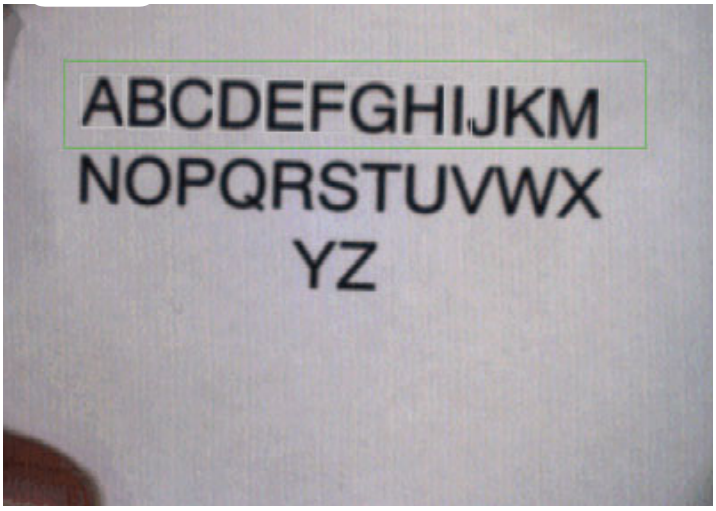
Table: Drawing Tools Available for Auto registration (Model Dictionary)

Available objects to be drawn	Drawing Tools
Rectangle	

5 In the "Figure setting" area, tap [OK].
Auto extract region is registered.

6 Tap [Extract model].

A model is cut out automatically, and, the cutout result (grey borderlined) is displayed in the "Image display" area.



For the subsequent operations, see "3.15.1 Setting up [Model Dictionary]" (→pg.95).

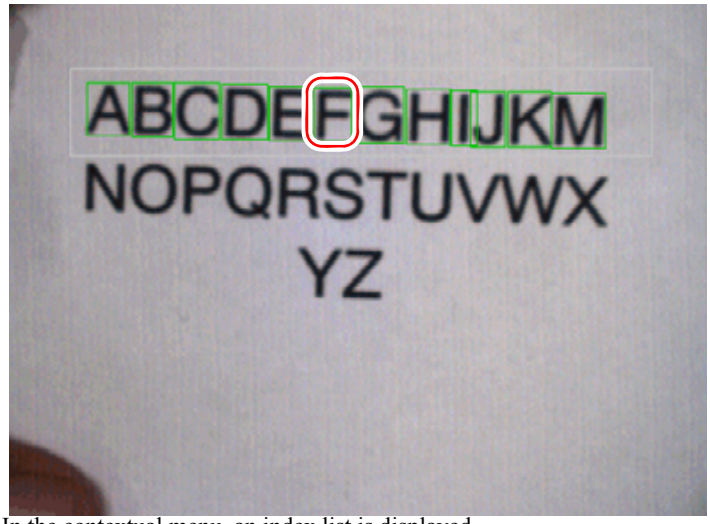
Setting Up Auto model region

1 In the "Item tab" area, tap [Auto registration].

2 In the "Detail" area, select "Auto model region".

3 To adjust a model, tap [Edit] and register the model again.

4 Select a model, and tap model region in the "Image display" area.



In the contextual menu, an index list is displayed.

5 Select an index for each model.

6 Tap [Regist model].

A message which indicates the number of registered models is displayed.

7 Tap [OK].

The model is registered.

For the subsequent operations, see "3.15.1 Setting up [Model Dictionary]" (→pg.95).

Important

- Tapping [Clear model] to switch the setting window clears registered models and Auto extract region.

3.15.5 Points on Measurement Test and Adjustment (Model Dictionary)

In the "Detail result" area on the Main screen, you can confirm the following contents in text.
"6.3.2 Displaying Flow and Detail Result" (→pg.12), of "User's Manual"

Table: Text Displayed (Model Dictionary)

Item	Description
Judge	Judgement result

3.15.6 When Using Measurement Results Externally (Model Dictionary)

Values Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (Model Dictionary)

Measurement items	Character string	Description
Judge	JG	Judgement result

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Model Dictionary)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
121	Rotation	Set/Get	0: OFF 1: ON
122	Upper limit of the angle	Set/Get	-45 to 45
123	Lower limit of the angle	Set/Get	-45 to 45
125	Smart mode	Set/Get	0: OFF 1: ON
126	Stab. (Stability)	Set/Get	1 to 15
127	Prec. (Precision)	Set/Get	1 to 3

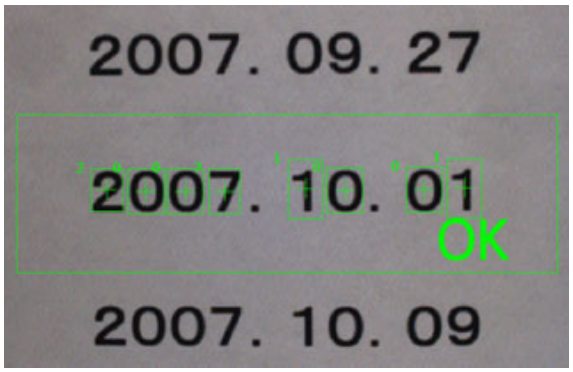
3.16 Date Verification

This processing item creates a verification string from the current date/time and inspects recognized strings.

Used for the following case

- When inspecting date of manufacture

Example) Inspecting date labels to be attached to products



List of Date Verification Items

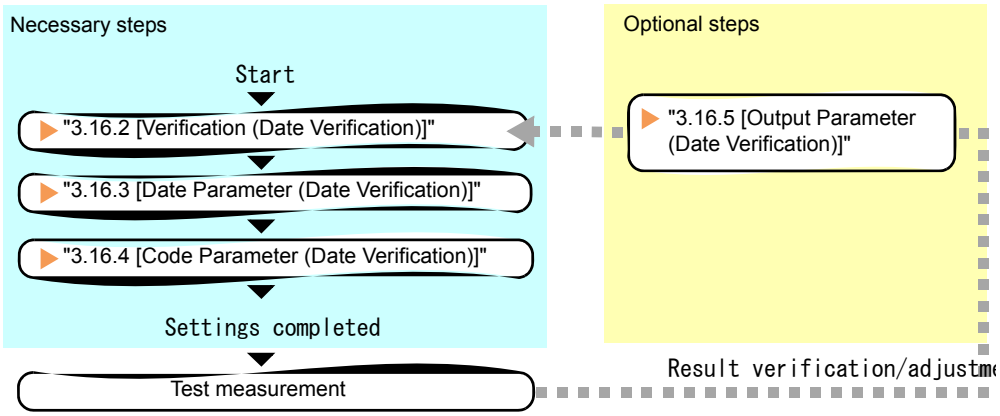
Date Verification items are explained below.

Table: List of Date Verification Items

Item Name	Description
Verification	This item sets parameters of the verification string. "3.16.2 [Verification (Date Verification)]" (→pg.108)
Date parameter	This item sets the date/time to be compared. "3.16.3 [Date Parameter (Date Verification)]" (→pg.110)
Code parameter	This item sets encryption parameters. "3.16.4 [Code Parameter (Date Verification)]" (→pg.112)
Output parameter	This item can be changed if necessary. Usually, the factory default value can be used. Use the Output parameter to specify how to treat the coordinate. "3.16.5 [Output Parameter (Date Verification)]" (→pg.116)

3.16.1 Setting up [Date Verification]

Follow the steps below to set up [Date Verification].



POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 In the Edit Flow window, tap [Date Verification].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area, tap [Verification] and set the parameters for the verification string.

"3.16.2 [Verification (Date Verification)]" (→pg.108)

3 In the "Item tab" area, tap [Date parameter] and set the date /time to be compared.

"3.16.3 [Date Parameter (Date Verification)]" (→pg.110)

4 In the "Item tab" area, tap [Code parameter] and set the code parameter.

"3.16.4 [Code Parameter (Date Verification)]" (→pg.112)

5 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

6 Perform a test measurement.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

7 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

When "NG" is displayed, verify measurement results and make adjustments if necessary.

"3.16.6 Points on Measurement Test and Adjustment (Date Verification)" (→pg.116)

3.16.2 [Verification (Date Verification)]

This item sets the parameters of the verification string.

1 In the "Item tab" area, tap [Verification].

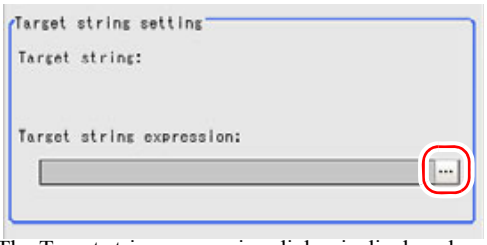
2 In the "OCR unit" area, tap [▼] for "OCR unit" and set the processing unit number of the reference [Model Dictionary].

No reference is made when the setting value is "<Nothing>".

POINT

- Be sure to insert an OCR unit (Character Inspection) before the Date Verification unit.

3 In the "Target string setting" area, tap [...] for "Target string expression".



The Target string expression dialog is displayed.

4 Input Target string expression.

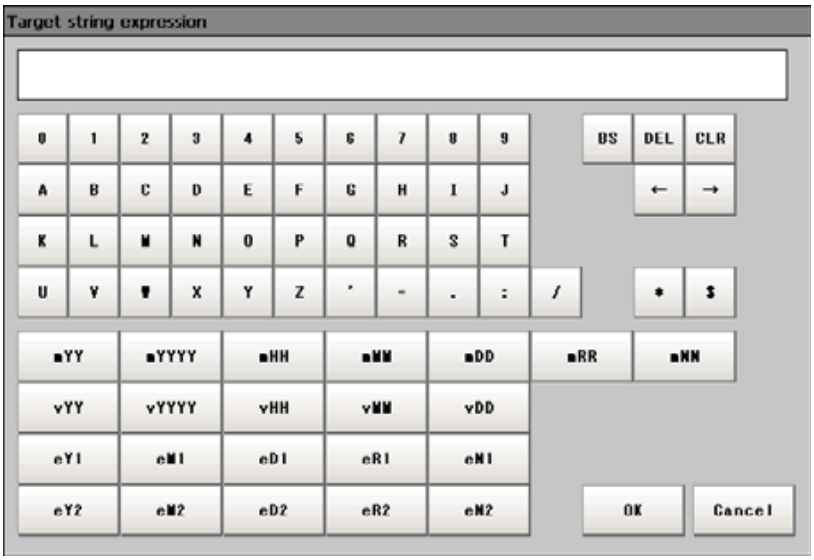


Table: Date Parameter (Date Verification) - Target string expression

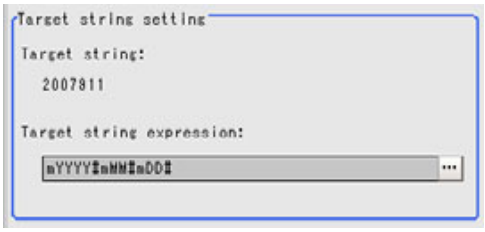
Label	Description
0 to 9	Normal numeric value input
A to Z	Normal alphabet input
‘ - . : /	Normal mark input
*	Character presence judgement
$	Number judgement
mYY	The last two digits of the current year, Western style
mYYYY	Four digits of the current year, Western style
mHH	Two digits of the current year in the Japanese Heisei calendar
mMM	Current month
mDD	Current day
mRR	Current hour
mNN	Current minute
vYY	The last two digits of the year after a set period of time, Western style
vYYYY	Four digits of the year after a set period of time, Western style
vHH	Two digits of the year after a set period of time in the Japanese Heisei calendar
vMM	Month after a set period of time
vDD	Day after a set period of time
eY1	Encrypted year 1
eM1	Encrypted month 1
eD1	Encrypted day 1
eR1	Encrypted hour 1

Table: Date Parameter (Date Verification) - Target string expression

Label	Description
eN1	Encrypted minute 1
eY2	Encrypted year 2
eM2	Encrypted month 2
eD2	Encrypted day 2
eR2	Encrypted hour 2
eN2	Encrypted minute 2

5 Tap [OK].

In "Target string", the target string to be used for measurement is displayed.



For the subsequent operations, see "3.16.1 Setting up [Date Verification]" (→pg.107).

3.16.3 [Date Parameter (Date Verification)]

This item sets the date/time parameters.

1 In the "Item tab" area, tap [Date parameter].

2 In the "Use term setting" area, tap [...] for each item and input values.

The value can also be adjusted by tapping [<] and [>].

How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"

Table: Date Parameter(Date Verification) - Use term setting

Setting Item	Set Value [Factory default]	Description
Year	0 to 99 [0]	Specify a usage period from the current date, when comparison is made with character strings with a usage period limit. Example) When the current date is Oct. 1, 2007 and the usage period is 10 days, the expiration date is Oct. 11, 2007.
Month	0 to 99 [0]	
Day	0 to 999 [0]	

3 In the "Date setting" area, specify a value for each item.

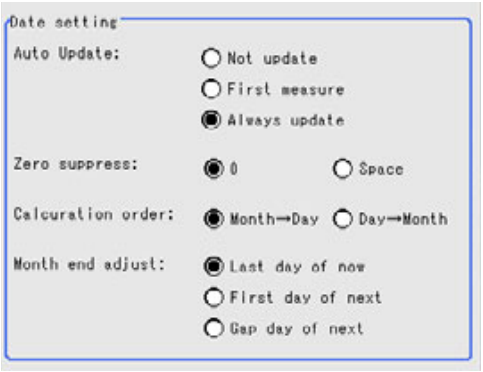


Table: Date Parameter (Date Verification) - Date setting

Setting Item	Set Value [Factory default]	Description
Auto Update	・Not update ・First measure ・[Always update]	Select to update only the year, month, and day. The clock time is always updated. When "Not update" is selected, the date of registration of the processing unit is memorized. And the date can be updated later when performing date update is performed later in the menu. When "First measure" is selected, the date is updated at the first measurement after start. When "Always update" is selected, the date is updated every measurement.
Zero suppress	・[0] ・Space	Select how the tens digits of the month and day are displayed.
Calcuration order	・[Month →Day] ・Day →Month	Select whether to calculate the month first or the day first when the usage period is set. (This affects calculation of end of month.)
Month end adjust	・[Last day of now] ・First day of next ・Gap day of next	Select the adjustment method when the month and day become an invalid month or day as a result of usage period calculation. Example) When the current date is January 31st and the usage period is one month "Last day of now" = February 28 "First day of next" = March 1 "Gap day of next" = March 3

4 In the "Time margin setting" area, tap [...] and specify a value for each item.

The figure number can be specified by tapping [<] [>].

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

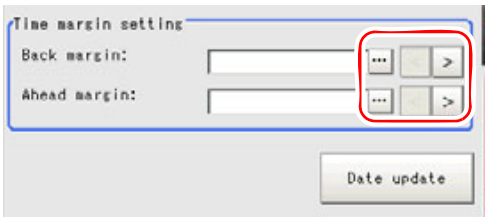


Table: Date Parameter(Date Verification) - Time margin setting

Setting Item	Set Value [Factory default]	Description
Back margin	0 to 99 [0]	Specify allowable time before the current time (in minutes).
Ahead margin	0 to 99 [0]	Specify allowable time after the current time (in minutes).

Tapping [Date Update] updates the date information of the verification string.

For the subsequent operations, see "3.16.1 Setting up [Date Verification]" (→pg.107).

3.16.4 [Code Parameter (Date Verification)]

Set encryption parameters. Exporting (saving) and reading of encrypted files (in the CSV format) is available. Saving an empty file first and then editing and reading it makes the settings easier.

When a date and time such as the date of manufacture is encrypted and printed to avoid easy recognition by the user, encrypted characters can be set (up to four characters) for each date and time.

Example) When October is set as X and 31 is set as CA

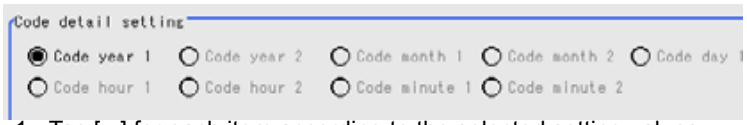
When Target string expression is "eM1#eD1#", the display is "XCA".

Setting in the window

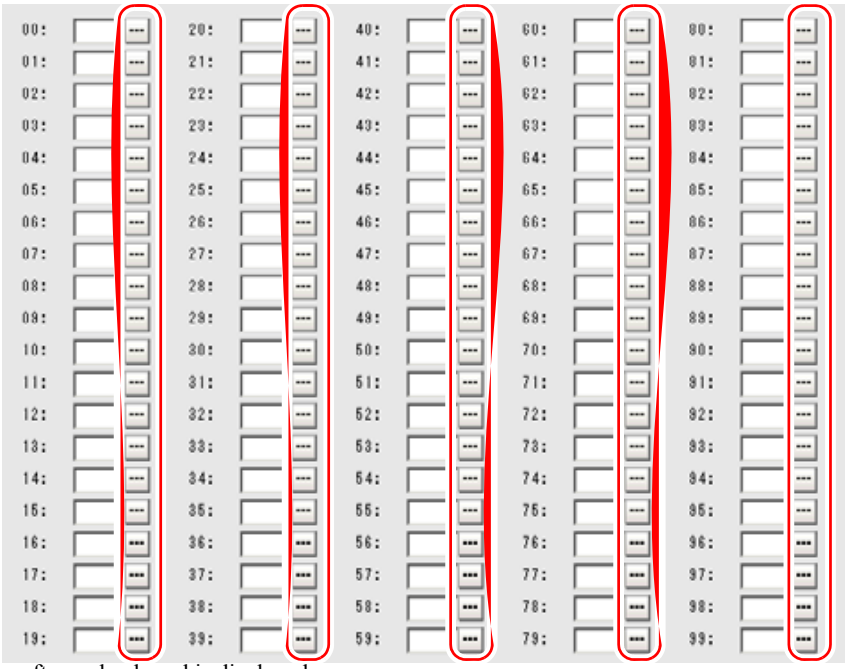
1 In the "Item tab" area, tap [Code parameter].

2 In the "Code flag setting" area, check the flag(s) to use encrypted character strings for the date and time as necessary.

3 In the "Code detail setting" area, set the encrypted string expression for the date and time.



1. Tap [...] for each item according to the selected setting values.
   When selecting "Code year 1"



A software keyboard is displayed.

2. Input a character string.
   Input a character string of up to four characters.
   How to input text: "1.5 Inputting a Text" (→pg.19), of "User's Manual"

For Code month and Code day follow this procedure in the same way.

Setting with encrypted files

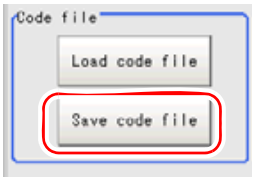
Save an empty encrypted file, and edit the file as a CSV file on a PC, etc, and then read in the file. Encrypted files are complex. Therefore, performing the settings with a PC makes file editing easier with fewer mistakes.

Saving encrypted files

1 In the "Item tab" area, tap [Code parameter].

2 In the "Code flag setting" area, check flag(s) which uses encrypted character strings of date and time if necessary.

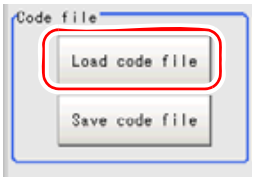
3 In the "Code file" area, tap [Save Code file].



4 In the file selection window, set the storage folder and the file name and tap [OK].
The encrypted file is stored (in CSV format).
For the file format, see " Encrypted file format" (→pg.115).

Reading encrypted files

1. In the "Item tab" area, tap [Code parameter].
2. In the "Code file" area, tap [Save code file].



3. In the file selection window, select the encrypted file (in CSV format) to read and tap [OK].
   The encrypted file is read, and the content is displayed in the window.

Encrypted file format

Code	Year1	Year2	Month1	Month2	Day1	Day2	Hour1	Hour2	Minute1	Minute2
Flag										
0										
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
32										
·										
·										
·										
98										
99										

- The first line shows the "item".
- The second line shows the "usage flag".
  Input "1" when used.

- The third line and subsequent lines contain codes for each number.
  Months and days start from "1".

For the subsequent operations, see "3.16.1 Setting up [Date Verification]" (→pg.107).

3.16.5 [Output Parameter (Date Verification)]

Specify whether to reflect the judgement result to the overall judgement of the scene.

1 In the "Item tab" area, tap [Output parameter].

2 In the "Reflect to overall judgement" area, specify whether to reflect the measurement result to the overall judgement of the scene.

Table: Setting Values for Output Parameters

Setting Item	Set Value [Factory default]	Description
Reflect to overall judgement	・[ON] ・OFF	Select whether to reflect the judgement result of this processing unit to the overall judgement of the scene. ・Selecting "ON" reflects the judgement result of this processing unit on the overall judgement of the scene. ・Selecting "OFF" does not reflect the judgement result of this processing unit on the overall judgement of the scene.

POINT

- The overall judgement result of the scene is output to the OR signal to be sent via the parallel interface. Also, it is displayed in the Measurement Information Display area in the upper part of the Main screen.
  "10.4.4 Time Chart" (→pg.35), of "User's Manual"
  "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"

3.16.6 Points on Measurement Test and Adjustment (Date Verification)

In addition to the camera-input image, the registered model and the detection coordinates (the cross-shaped cursor) will also be displayed in the "Image display" area.

In the "Detail result" area on the Main screen, you can confirm the following contents in text.
"6.3.2 Displaying Flow and Detail Result" (→pg.12), of "User's Manual"

Table: Text Displayed (Date Verification)

Item	Description
Judge	Judgement result
Verification string	Target string setting is displayed.
Read string	A character string read from the target unit is displayed.

3.16.7 When Using Measurement Results Externally (Date Verification)

Values Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (Date Verification)

Measurement items	Character string	Description
Judge	JG	Judgement result

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Date Verification)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
1	Target string	Get only	String with 32 characters or less
2	Read string	Get only	String with 32 characters or less
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	OCR unit number	Set/Get	-1: OFF 0 to 9999
125	Term year	Set/Get	0 to 99
126	Term month	Set/Get	0 to 99
127	Term day	Set/Get	0 to 999

Table: External Reference List (Date Verification)

No.	Data Name	Set/Get	Data Range
128	Auto Update	Set/Get	0: Not update 1: First measure 2: Always update
129	Zero suppress	Set/Get	0:0 1: Space
130	Calcuration order	Set/Get	0: Month → Day 1: Day → Month
131	Month end adjust	Set/Get	0: Last day of now 1: First day of next 2: Gap day of next
132	Back margin	Set/Get	0 to 99
133	Ahead margin	Set/Get	0 to 99
134	Code year 1 flag	Set/Get	0: Not used 1: Used
135	Code year 2 flag	Set/Get	0: Not used 1: Used
136	Code month 1 flag	Set/Get	0: Not used 1: Used
137	Code month 2 flag	Set/Get	0: Not used 1: Used
138	Code day 1 flag	Set/Get	0: Not used 1: Used
139	Code day 2 flag	Set/Get	0: Not used 1: Used
140	Code hour 1 flag	Set/Get	0: Not used 1: Used
141	Code hour 2 flag	Set/Get	0: Not used 1: Used
142	Code minute 1 flag	Set/Get	0: Not used 1: Used
143	Code minute 2 flag	Set/Get	0: Not used 1: Used
160	The encrypted string number	Set/Get	0 to 99
5000	Auto update execute	Get only	0: Success 1: Failure

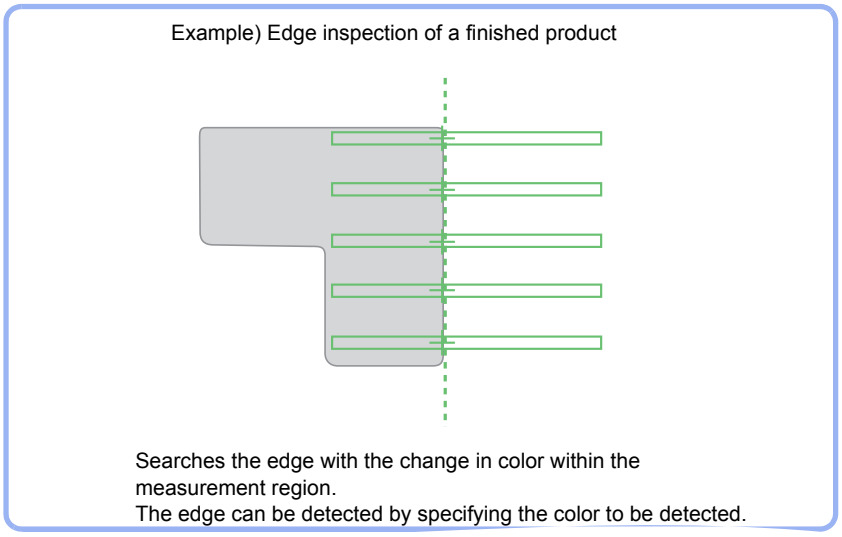
3.17 Scan Edge Position

This processing item detects the position of the measured object by using the change in color within the measurement region. By dividing the measurement region, the following effects can be expected in comparison with ordinary edge position measurement.

- Detailed information, such as the closest point or furthest point from the measurement start point, can be calculated.
- The inclination or degree of unevenness of the measured object can be calculated.

Used for the following case

- When calculating multiple edge positions of the measured object from statistical data



Item List for Scan Edge Position

Scan Edge Position items are explained below.

Table: Item List for Scan Edge Position

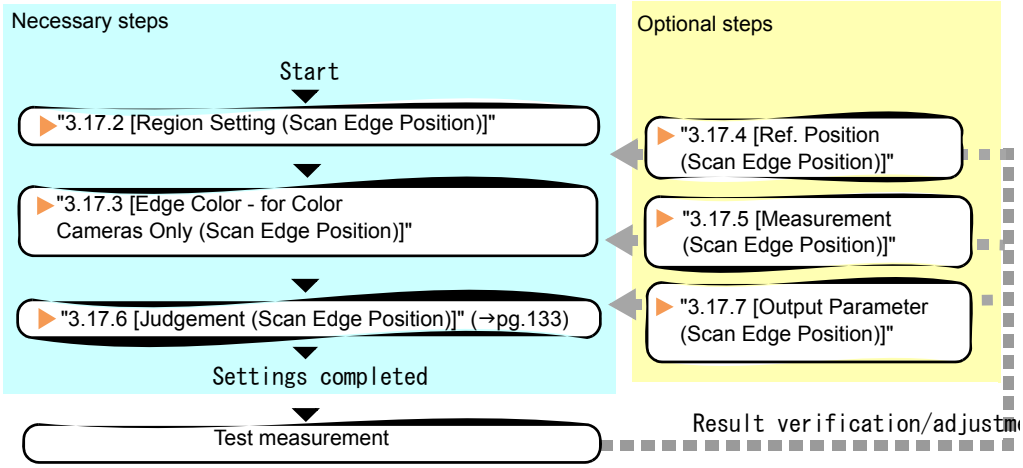
Item Name	Description
Region setting	This item specifies the region to be measured. "3.17.2 [Region Setting (Scan Edge Position)]" (→pg.122)
Edge color specification (for color cameras only)	This item specifies an edge color information to be detected. "3.17.3 [Edge Color - for Color Cameras Only (Scan Edge Position)]" (→pg.124)
Reference position	This item can be changed if necessary. The edge position that was measured when Region Setting was performed is already registered. "3.17.4 [Ref. Position (Scan Edge Position)]" (→pg.126)

Table: Item List for Scan Edge Position

Item Name	Description
Measurement	This item changes the measurement parameters as necessary when the measurement result is unstable. The displayed items are different depending on whether your camera is a color or monochrome camera. Usually, the factory default value can be used. "3.17.5 [Measurement (Scan Edge Position)]" (→pg.128)
Judgement	This item specifies the judgement condition for measurement results. "3.17.6 [Judgement (Scan Edge Position)]" (→pg.133)
Output parameter	This item can be changed if necessary. Usually, the factory default value can be used. Use the Output parameter to specify how to treat the coordinate. "3.17.7 [Output Parameter (Scan Edge Position)]" (→pg.135)

3.17.1 Setting Up [Scan Edge Position]

The setting procedure for [Scan Edge Position] is as follows:



POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 In the Edit Flow window, tap [Scan Edge Position].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area, tap [Region setting] and specify the measurement region.

"3.17.2 [Region Setting (Scan Edge Position)]" (→pg.122)

3 For color cameras, tap [Edge color] in the "Item tab" area and set the basic color to detect as the edge.

"3.17.3 [Edge Color - for Color Cameras Only (Scan Edge Position)]" (→pg.124)

4 Tap [Judgement] in the "Item tab" area, and set the judgement condition for OK.

"3.17.6 [Judgement (Scan Edge Position)]" (→pg.133)

Important

- If you change an output parameter after setting the judgement condition, the measurement result changes. When you change an output parameter, reset the judgement condition as well.

5 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

6 Perform a test measurement.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

7 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

When "NG" is displayed, verify measurement results and make adjustments if necessary.

"3.17.8 Points on Test Measurement and Adjustment (Scan Edge Position)" (→pg.136)

3.17.2 [Region Setting (Scan Edge Position)]

Specify the measurement region for [Scan Edge Position] by using wide straight lines.

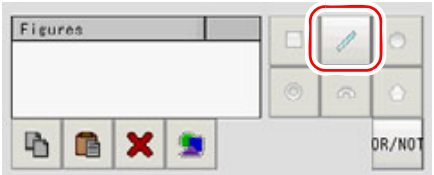
1 In the "Item tab" area, tap [Region setting].

2 When a measurement region is already registered, tap [Edit]. When no measurement region is registered, go to Step 3.

The Figure Setting area is displayed.

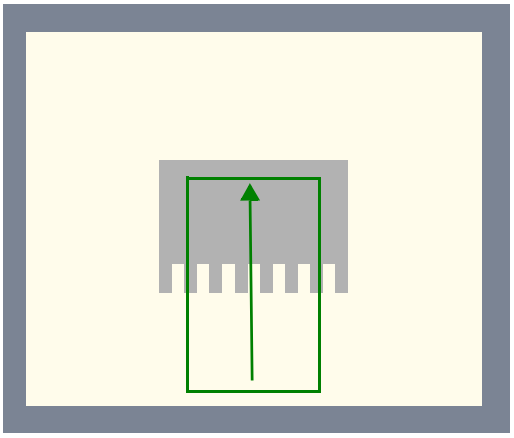
3 Specify the measurement area using Drawing Tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"



4 In the "Figure setting" area, tap [OK].

The measurement range is registered and displayed in the "Image display" area.



5 When necessary, divide the drawn region into several parts.

" Dividing the drawn region into several parts" (→pg.123)

For the subsequent operations, see "3.17.1 Setting Up [Scan Edge Position]" (→pg.121).

Dividing the drawn region into several parts

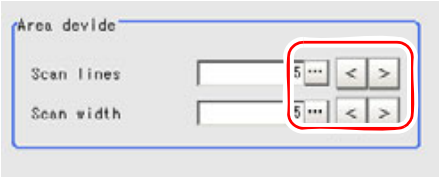
This can be set when changing the number of parts or the width of divided parts of the region.

1 In the "Area divide" area, tap [...] of each item and set values.

You can set it by tapping the left or right button.

How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"

By default, the number of divided areas is 5 and the width for each area is 5.



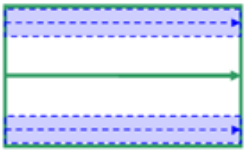
2 In the "Image display" area, the changed figure is redrawn.

The specified region is divided equally into the specified number of areas.

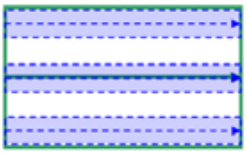
Division of Scan Area

The scan area, when the number of divided areas is 1

The scan area, when the number of divided areas is 2



The scan area, when the number of divided areas is 3



The scan area, when the number of divided areas is 4

3.17.3 [Edge Color - for Color Cameras Only (Scan Edge Position)]

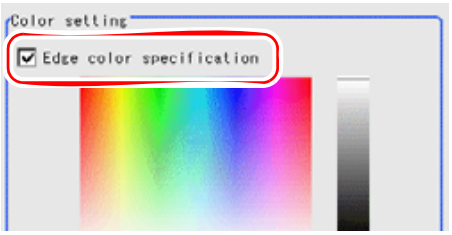
Set the criteria with which to search for an edge.

1 In the "Item tab" area, tap [Edge color].

2 If necessary, check [Edge color specification] in the "Color setting" area.

When checked, the edge will be detected according to the subsequently specified "Edge color" and "Detection mode".

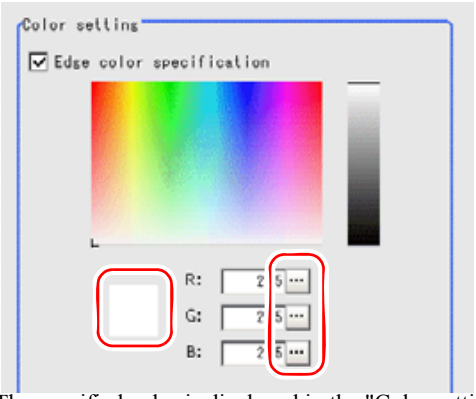
When unchecked, positions in the measurement region where the color changes drastically are detected as edges.



3 Specify the color that is used as the edge (the reference color with which to detect the edge).

In the "Color setting" area, tap [...] for each of [R] (red), [G] (green), and [B] (blue), and input the values respectively.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"



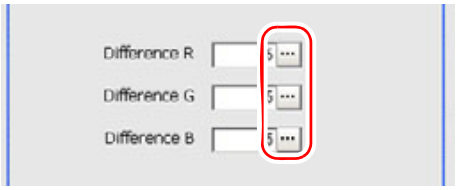
The specified color is displayed in the "Color setting" area.

4 Using the edge color as the reference, specify the allowable color differences for detecting the edges.

In the "Color setting" area, tap [...] for each of [Difference R], [Difference G], and [Difference B], and input the values respectively. The larger the "Difference" values, the larger the color range that is used to detect the edge.

The default value of each "Difference" is "5".

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"



5 Select an edge detection method in [Detection mode].

Table: Edge Color (Scan Edge Position)

Setting Item	Set Value [Factory default]	Description
Detection mode	・[Color IN] ・Color OUT	This item detects the area between the specified edge color and other colors where color change occurs as the edge. The detecting direction is from the start point to the end point of the straight line that is specified in [Region Setting]. ・Color IN This is the mode in which the position where colors other than the specified edge color start to change to the specified edge color is detected as the edge. ・Color OUT This is the mode in which the position where the specified edge color starts to change to colors other than the specified edge color is detected as the edge.

For the subsequent operations, see "3.17.1 Setting Up [Scan Edge Position]" (→pg.121).

3.17.4 [Ref. Position (Scan Edge Position)]

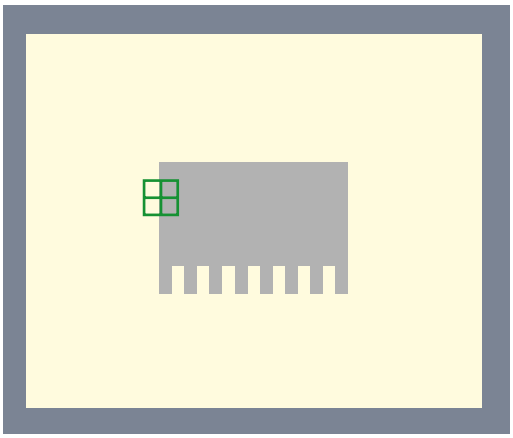
This item can be changed if necessary. The reference position is automatically set at the same time the measurement region is specified. This item can be used to change the reference position to any desired position.

POINT

- After changing the reference position to any desired position, re-registering the measurement region will automatically change it back to the default position.

1 In the "Item tab" area, tap [Ref.position].

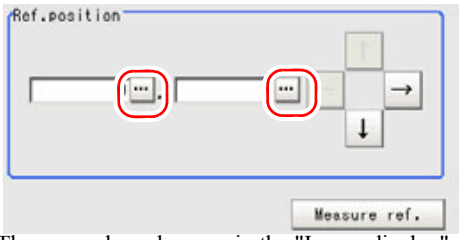
In the "Image display" area, the current reference position is displayed with a cross-shaped cursor.



2 Change the reference position.

In the "Ref.position" area, tap [...] for each item and input the values for your desired reference coordinates (the coordinates of the reference position).

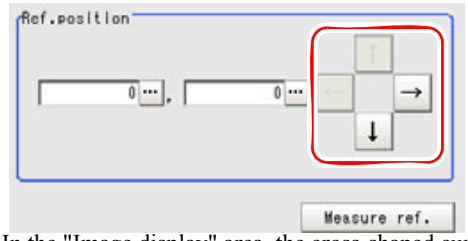
How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"



The cross-shaped cursor in the "Image display" area will move to the specified coordinate position.

Using arrow buttons to change the reference position:

In the "Ref.position" area, tap one of the arrow buttons.



In the "Image display" area, the cross-shaped cursor will move one pixel per tap.

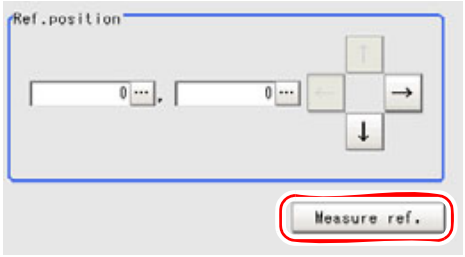
In the "Ref.position" area, the reference coordinate values (X, Y) will also change as the cross-shaped cursor moves.

POINT

Points on Position Adjustment

- You can easily specify the coordinates if you first input approximate coordinate values and then adjust them by moving the cross-shaped cursor in the "Image display" area. The Zoom function is useful for fine adjustment.
  For the Zoom function, see "1.8 Using Zoom Function" (→pg.24), of "User's Manual".

3 When the measurement parameter has been changed, tap [Measure ref.].

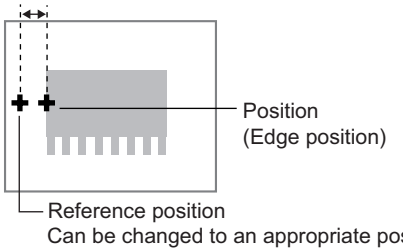


The edge position is re-calculated using the modified parameter and reflected in the "Ref.position" area.

POINT

Since the reference position can be changed, it is useful for measuring distance from a specific position.

- Confirm the reference position of the currently displayed image, and then change it to an appropriate position. A positional check can be performed by calculating the difference between the reference position and the measured position using an expression.



After changing the reference position to any desired position, changing the measurement region will automatically change it back to the default position.

3.17.5 [Measurement (Scan Edge Position)]

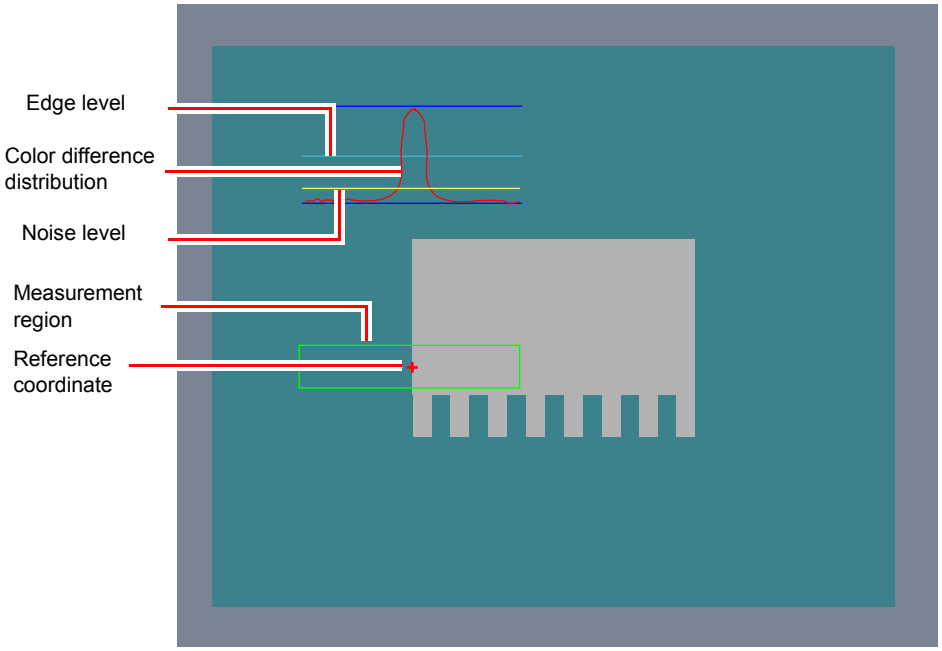
This item can be changed if necessary. Usually, the factory default value can be used. After changing a setting, check whether measurement can be done properly by performing an actual measurement.

POINT

- For the mechanism of edge image measurement processing, see "4.6.3 Edge Measurement" (→pg.42), of "User's Manual".

1 In the "Item tab" area, tap [Measurement].

The edge profile of the measurement region is displayed in the "Image display" area.



2 Set the value of each item in the "Display area" area.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

You can set the "Display area No." by tapping the left or right button.

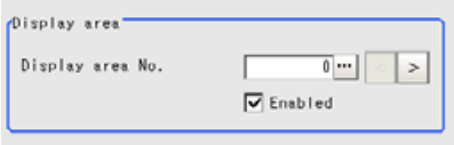


Table: Measurement (Scan Edge Position) - Display Area

Setting Item	Set Value [Factory default]	Description
Display area No.	[0] to 99	Specify the part for which the edge profile is displayed. It should be a sequential number decided when the region was divided.
Enabled	・ Checked ・ Unchecked [As defined in the region settings]	Specify enabled/disabled for the displayed area. When "Enabled" is unchecked, measurement is not performed.

3 Set the value of each item in the "Measurement" area.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

[Edge No.] can be specified by tapping [<] and [>].

The values for [Edge level] and [Edge color level] can be adjusted by dragging the slider or by tapping the buttons at both ends of the slider.

For color cameras:

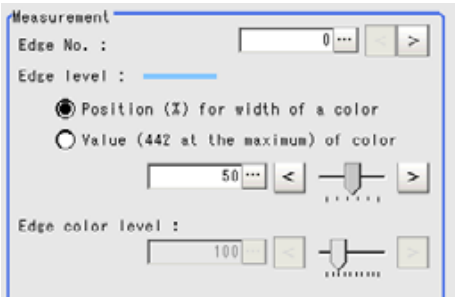


Table: Measurement (Scan Edge Position)

Setting Item	Set Value [Factory default]	Description
Edge No.	[0] to 99	Specify the number of the edge to be extracted. Edge numbers are assigned to the detected edges, starting with 0 from the start point to the end point in the direction of the arrow of the measurement region.
Edge level	・Position (%) for width of a color 0 to 100[50] ・Value of color 0 to 442[20]	Specify a color difference level with which the edge is detected. "4.6.3 Edge Measurement" (→pg.42), of "User's Manual"
Edge color level	0 to 442 [100]	Specify a level to remove colors other than the color specified in [Edge color] to enhance the edge color. This option is enabled only when the [Edge color specification] is checked in [Edge color]. "3.17.3 [Edge Color - for Color Cameras Only (Scan Edge Position)]" (→pg.124)

For monochrome cameras:

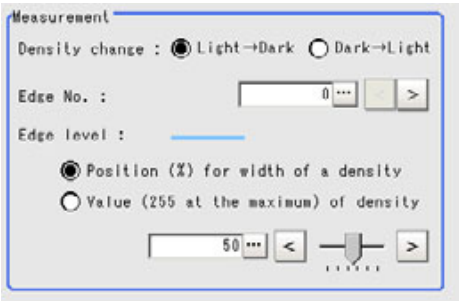


Table: Measurement (Scan Edge Position)

Setting Item	Set Value [Factory default]	Description
Density change	[Light → Dark] Dark → Light	Select whether a black-to-white change or a white-to-black change should be recognized as a density change in the specified region.
Edge No.	[0] to 99	Specify the number of the edge to be extracted. Edge numbers are assigned to the detected edges, starting with 0 from the start point to the end point in the direction of the arrow of the measurement region.
Edge level	・ Position (%) for width of a density 0 to 100[50] ・ Value of density 0 to 255[20]	Select the density change level to be detected as edges. "4.6.3 Edge Measurement" (→pg.42), of "User's Manual"

4 Tap [...] of each item in the "Noise removal" area, and set values.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

The value for [Noise level] can be adjusted by dragging the slider or by tapping the buttons at both ends of the slider.

The [Noise width] value can also be adjusted by tapping [<] and [>].

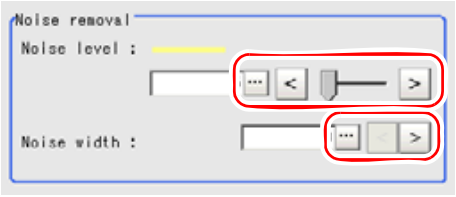


Table: Measurement (Scan Edge Position) - Noise Removal

Setting Item	Set Value [Factory default]	Description
Noise level	0 to 442 [5]	Specify the noise level for judging the presence/absence of an edge. The maximum and minimum values of color differences in the edge detection region are obtained and, if the difference is lower than the noise level, no edges will be detected. If the detection is affected by noise, increase this value. " Noise Level" (→pg.43), of "User's Manual"
Noise width	[0] to 9999	Specify the noise width. When there are two edges higher than the edge level and the distance between them is less than the noise width, these two edges are treated as noise. If the detection is affected by noise, increase this value. " Noise Width" (→pg.43), of "User's Manual"

5 In the "Approximate line" area, specify the point to be used for the calculation for approximate lines.

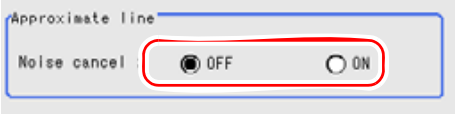


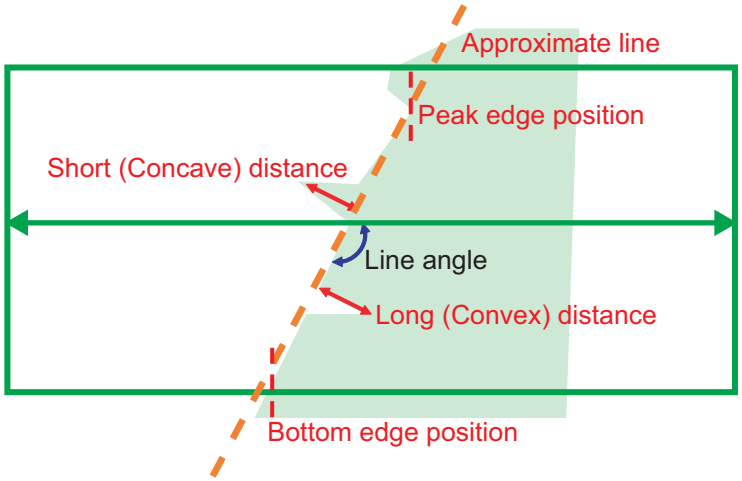
Table: Measurement (Scan Edge Position) - Approximate Line

Setting Item	Set Value [Factory default]	Description
Noise cancel	・ ON ・ [OFF]	This item calculates an approximate straight line by excluding the points with large deviation among the measured points. The approximate straight line is calculated by using all the measured points.

For the subsequent operations, see "3.17.1 Setting Up [Scan Edge Position]" (→pg.121).

3.17.6 [Judgement (Scan Edge Position)]

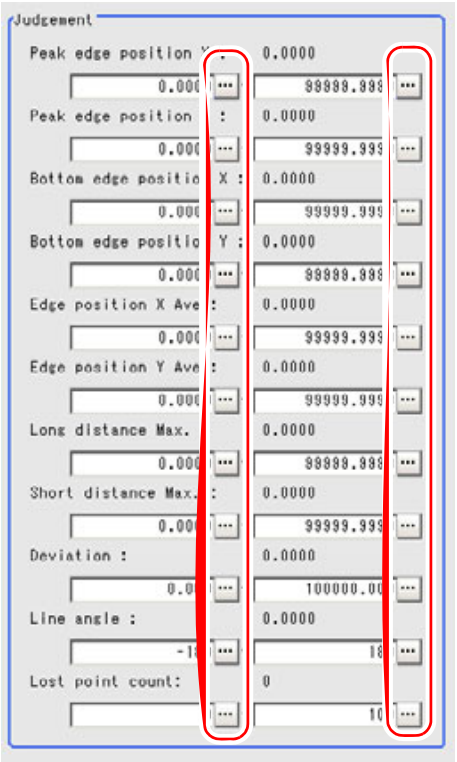
Specify the range to be judged as OK.



1 In the "Item tab" area, tap [Judgement].

2 In the "Judgement" area, tap [...] and input a value for each item.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"



POINT

- The values displayed in the individual fields are the measurement results of the displayed image. Take these values into consideration to determine the upper and lower limits.

Table: Measurement (Scan Edge Position) - Judgement

Setting Item		Set Value [Factory default]	Description
Peak edge position X	Upper	-99999.9999 to [99999.9999]	Specify the upper and lower limits of the peak edge position X judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Peak edge position Y	Upper	-99999.9999 to [99999.9999]	Specify the upper and lower limits of the peak edge position Y judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Bottom edge position X	Upper	-99999.9999 to [99999.9999]	Specify the upper and lower limits of the bottom edge position X judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Bottom edge position Y	Upper	-99999.9999 to [99999.9999]	Specify the upper and lower limits of the bottom edge position Y judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Edge position X Ave.	Upper	-99999.9999 to [99999.9999]	Specify the upper and lower limits of the average edge position X judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Edge position Y Ave.	Upper	-99999.9999 to [99999.9999]	Specify the upper and lower limits of the average edge position Y judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Long distance Max.	Upper	0 to [dist (X_MAX, Y_MAX)]	Specify the upper and lower limits of the Long distance maximum judged to be OK.
	Lower	[0] to dist (X_MAX, Y_MAX)	
Long distance Min.	Upper	0 to [dist (X_MAX, Y_MAX)]	Specify the upper and lower limits of the Long distance minimum judged to be OK.
	Lower	[0] to dist (X_MAX, Y_MAX)	
Short distance Max.	Upper	0 to [dist (X_MAX, Y_MAX)]	Specify the upper and lower limits of the Short distance maximum judged to be OK.
	Lower	[0] to dist (X_MAX, Y_MAX)	
Short distance Min.	Upper	0 to [dist (X_MAX, Y_MAX)]	Specify the upper and lower limits of the Short distance minimum judged to be OK.
	Lower	[0] to dist (X_MAX, Y_MAX)	
Deviation	Upper	0 to [dist (X_MAX, Y_MAX)]	Specify the upper and lower limits of the deviation judged to be OK.
	Lower	[0] to dist (X_MAX, Y_MAX)	
Line angle	Upper	-180 to [180]	Specify the upper and lower limits of the line angle judged to be OK.
	Lower	[-180] to 180	
Lost point count	Upper	0 to [100]	Specify the upper and lower limits of the lost point count judged to be OK.
	Lower	[0] to 100	

*dist(X_MAX,Y_MAX)=sqrt(X_MAX*X_MAX+Y_MAX*Y_MAX)

3.17.7 [Output Parameter (Scan Edge Position)]

Specify how to treat the coordinates to be output to the external devices as measurement results.

Important

- If you change an output parameter after setting judgement condition, measurement result changes. When you change an output parameter, reset judgement condition as well.

1 In the "Item tab" area, tap [Output parameter].

2 Specify a value for each item.

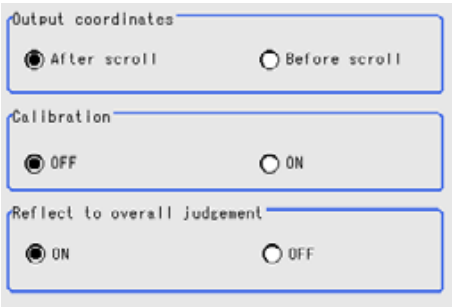


Table: Setting Values for Output Parameters

Setting Item	Set Value [Factory default]	Description
Output coordinates	・[After scroll] ・Before scroll	Select which coordinate values should be output to the external device as measurement results, values before scroll or values after scroll.
Calibration	・[OFF] ・ON	Select which coordinate values should be output to the external device as measurement results, values converted to the actual dimension (Calibration: ON) or values in the camera image (Calibration: OFF).
to overall judgement	・[ON] ・OFF	Select whether to reflect the judgement result of this processing unit to the overall judgement of the scene. ・Selecting "ON" reflects the judgement result of this processing unit on the overall judgement of the scene. ・Selecting "OFF" does not reflect the judgement result of this processing unit on the overall judgement of the scene.

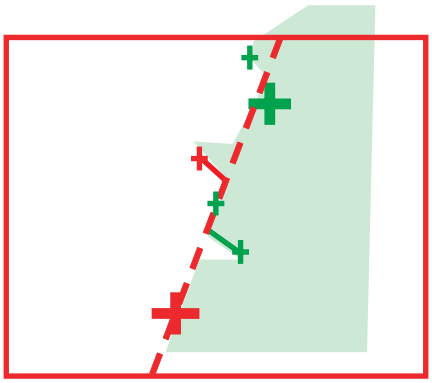
POINT

- For output coordinates and calibration, see "4.6.5 Configuring Coordinates" (→pg.45), of "User's Manual".
- The overall judgement result of the scene is output to the OR signal to be sent via the parallel interface. Also, it is displayed in the "Measurement information display" area in the upper part of the Main screen.
  "10.4.4 Time Chart" (→pg.35), of "User's Manual"
  "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"

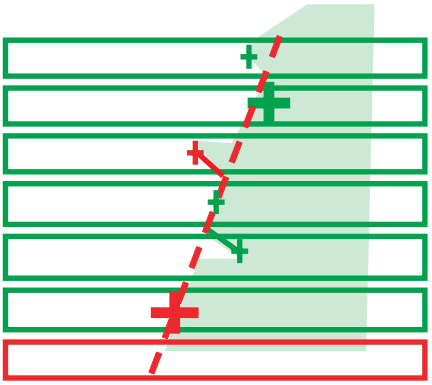
For the subsequent operations, see "3.17.1 Setting Up [Scan Edge Position]" (→pg.121).

3.17.8 Points on Test Measurement and Adjustment (Scan Edge Position)

In addition to the camera input image, the measured region, a graphic display of the measured results, and the edge position (the cross-shaped cursor) are also displayed as results in the "Image display" area.



Edge position display (Sub image 0)



Display of edge position in each divided part (Sub image 1)

In the "Detail result" area on the Main screen, you can confirm the following contents in text.
"6.3.2 Displaying Flow and Detail Result" (→pg.12), of "User's Manual"

Table: Contents of Text (Scan Edge Position)

Item	Description
Judge	Judgement result
Peak edge position X	X-coordinate of the edge that is furthest from the start point of the measurement region
Peak edge position Y	Y-coordinate of the edge that is furthest from the start point of the measurement region
Bottom edge position X	X-coordinate of the edge that is closest from the start point of the measurement region
Bottom edge position Y	Y-coordinate of the edge that is closest from the start point of the measurement region
Edge position X Ave.	The average of X-coordinates of all the edges

Table: Contents of Text (Scan Edge Position)

Item	Description
Edge position Y Ave.	The average of Y-coordinates of all the edges
Long distance Max.	The maximum distance between the approximate straight line and the edge position (plus direction)
Short distance Max.	The minimum distance between the approximate straight line and the edge position (minus direction)
Deviation	Deviations in concavity and convexity
Line angle	The straight line's inclination against the measurement region does not include 180, which is displayed as -180.
Lost point count	Number of parts for which the detection of edges have failed

Points on Adjustment

Select the adjustment method referring to the following points.

When the edge cannot be detected satisfactorily

- Set up the options in [Measurement].
  "3.17.5 [Measurement (Scan Edge Position)]" (→pg.128)
- Specify the edge color in [Edge color].
  "3.17.3 [Edge Color - for Color Cameras Only (Scan Edge Position)]" (→pg.124)

When noise is detected as an edge

- Specify a higher value for [Noise level] and [Noise width] in [Measurement].
  "3.17.5 [Measurement (Scan Edge Position)]" (→pg.128)

3.17.9 When Using Measurement Results Externally (Scan Edge Position)

Values Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expressions (Scan Edge Position)

Measurement items	Character string	Description
Judge	JG	Judgement result
Peak edge position X	PEAKX	X-coordinate of the edge that is the furthest from the start point of the measurement region

Table: Values Available in Expressions (Scan Edge Position)

Measurement items	Character string	Description
Peak edge position Y	PEAKY	Y-coordinate of the edge that is the furthest from the start point of the measurement region
Bottom edge position X	BOTTOMX	X-coordinate of the edge that is the closest from the start point of the measurement region
Bottom edge position Y	BOTTOMY	Y-coordinate of the edge that is the closest from the start point of the measurement region
Edge position X Ave.	X	The average of X-coordinates of all the edges
Edge position Y Ave.	Y	The average of Y-coordinates of all the edges
Long distance Max.	PMAXD	The maximum distance between the approximate straight line and edge position (plus direction)
Long distance Min.	PMIND	The minimum distance between the approximate straight line and the edge position (plus direction)
Short distance Max.	BMAXD	The maximum distance between the approximate straight line and the edge position (minus direction)
Short distance Min.	BMIND	The minimum distance between the approximate straight line and the edge position (minus direction)
Deviation	DEV	Deviations of concavity and convex
Line angle	TH	The straight line's inclination against the measurement region does not include 180, which is displayed as -180.
Lost point count	LOST	Number of parts for which the detection of edges have failed
Linear coefficient A	A	A in the expression for the approximate straight line AX+BY+C=0.
Linear coefficient B	B	B in the expression for the approximate straight line AX+BY+C=0.
Linear coefficient C	C	C in the expression for the approximate straight line AX+BY+C=0.
Reference coordinate X	SX	X-coordinate of the reference coordinates
Reference coordinate Y	SY	Y-coordinate of the reference coordinates

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference Data List (Scan Edge Position)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
1	Peak edge position X	Set/Get	0 to 99999.9999

Table: External Reference Data List (Scan Edge Position)

No.	Data Name	Set/Get	Data Range
2	Peak edge position Y	Set/Get	0 to 99999.9999
3	Bottom edge position X	Set/Get	0 to 99999.9999
4	Bottom edge position Y	Set/Get	0 to 99999.9999
5	Edge position X Ave.	Set/Get	-1 to 99999.9999
6	Edge position Y Ave.	Set/Get	-1 to 99999.9999
7	Long distance Max.	Set/Get	-1 to dist (X_MAX,Y_MAX)
8	Long distance Min.	Set/Get	-1 to dist (X_MAX,Y_MAX)
9	Short distance Max.	Set/Get	-1 to dist (X_MAX,Y_MAX)
10	Short distance Min.	Set/Get	-1 to dist (X_MAX,Y_MAX)
11	Deviation	Set/Get	-1 to dist (X_MAX,Y_MAX)
12	Line angle	Set/Get	-180 to 180
13	Lost point count	Set/Get	0 to 100
14	Linear coefficient A	Set/Get	-99999.9999 to 99999.9999
15	Linear coefficient B	Set/Get	-99999.9999 to 99999.9999
16	Linear coefficient C	Set/Get	-99999.9999 to 99999.9999
17	Reference coordinate X	Get only	0 to 99999.9999
18	Reference coordinate Y	Get only	0 to 99999.9999
101	Output coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Edge color specification	Set/Get	0: OFF 1: ON
121	Edge color R	Set/Get	0 to 255
122	Edge color G	Set/Get	0 to 255
123	Edge color B	Set/Get	0 to 255
124	Defference R	Set/Get	0 to 127
125	Defference G	Set/Get	0 to 127
126	Defference B	Set/Get	0 to 127
127	Detection mode	Set/Get	0: Color IN 1: Color OUT
129	Reference coordinate X	Set/Get	0 to 99999.9999
130	Reference coordinate Y	Set/Get	0 to 99999.9999
131	Edge No.	Set/Get	0 to 99
132	Edge level	Set/Get	0 to 100
133	Noise level	Set/Get	0 to 442

Table: External Reference Data List (Scan Edge Position)

No.	Data Name	Set/Get	Data Range
134	Noise width	Set/Get	0 to 9999
135	Edge color level	Set/Get	0 to 442
136	Upper limit of the maximum edge position X	Set/Get	-99999.9999 to 99999.9999
137	Lower limit of the maximum edge position X	Set/Get	-99999.9999 to 99999.9999
138	Upper limit of the maximum edge position Y	Set/Get	-99999.9999 to 99999.9999
139	Lower limit of the maximum edge position Y	Set/Get	-99999.9999 to 99999.9999
140	Upper limit of the minimum edge position X	Set/Get	-99999.9999 to 99999.9999
141	Lower limit of the minimum edge position X	Set/Get	-99999.9999 to 99999.9999
142	Upper limit of the minimum edge position Y	Set/Get	-99999.9999 to 99999.9999
143	Lower limit of the minimum edge position Y	Set/Get	-99999.9999 to 99999.9999
144	Upper limit of the average edge position X	Set/Get	-99999.9999 to 99999.9999
145	Lower limit of the average edge position X	Set/Get	-99999.9999 to 99999.9999
146	Upper limit of the average edge position Y	Set/Get	-99999.9999 to 99999.9999
147	Lower limit of the average edge position Y	Set/Get	-99999.9999 to 99999.9999
148	Upper limit of the long distance maximum	Set/Get	0 to dist (X_MAX,Y_MAX)
149	Lower limit of the long distance minimum	Set/Get	0 to dist (X_MAX,Y_MAX)
150	Upper limit of the song distance minimum	Set/Get	0 to dist (X_MAX,Y_MAX)
151	Lower limit of the short distance minimum	Set/Get	0 to dist (X_MAX,Y_MAX)
152	Upper limit of the deviation	Set/Get	0 to dist (X_MAX,Y_MAX)
153	Lower limit of the deviation	Set/Get	0 to dist (X_MAX,Y_MAX)
154	Upper limit of the line angle	Set/Get	-180 to 180
155	Lower limit of the line angle	Set/Get	-180 to 180
156	Upper limit of the lost point count	Set/Get	0 to 100
157	Lower limit of the lost point count	Set/Get	0 to 100

Table: External Reference Data List (Scan Edge Position)

No.	Data Name	Set/Get	Data Range
158	Monochrome edge detection mode	Set/Get	0: Light → Dark 1: Dark → Light
159	Edge level absolute value	Set/Get	0 to 442
160	Edge level specification mode	Set/Get	0: % 1: Absolute value
161	Clockwise/Counter clockwise	Set/Get	0: Clockwise 1: Counterclockwise
162	Scan lines	Set/Get	1 to 100
163	Scan width	Set/Get	1 to 200
164	Display Area	Set/Get	0 to 99
165	Noise cancel	Set/Get	0: OFF 1: ON

*dist(X_MAX,Y_MAX)=sqrt(X_MAX*X_MAX+Y_MAX*Y_MAX)

3.18 Scan Edge Width

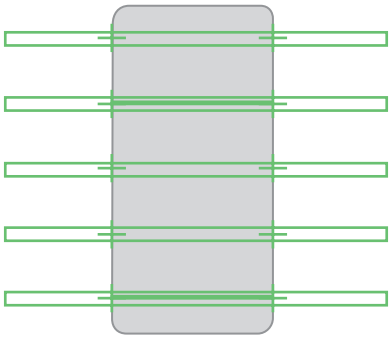
This processing item detects the position of the measured object by using the change in color within the measurement region. By dividing the measurement region, you can get the following values.

- Specific width of the work
- Average width of the work

Used for the following cases

- When getting several widths of a measuring object

Example) Width inspection of



Searches the edge by the change in color within the measurement region.
The edge can be detected by specifying the color to be detected.

- When getting width of a measured object
  Using a formula, the width of a measured object can be calculated with the difference between two edge positions.

Item List for Scan Edge Width

Scan Edge Width items are explained below.

Table: Item List for Scan Edge Width

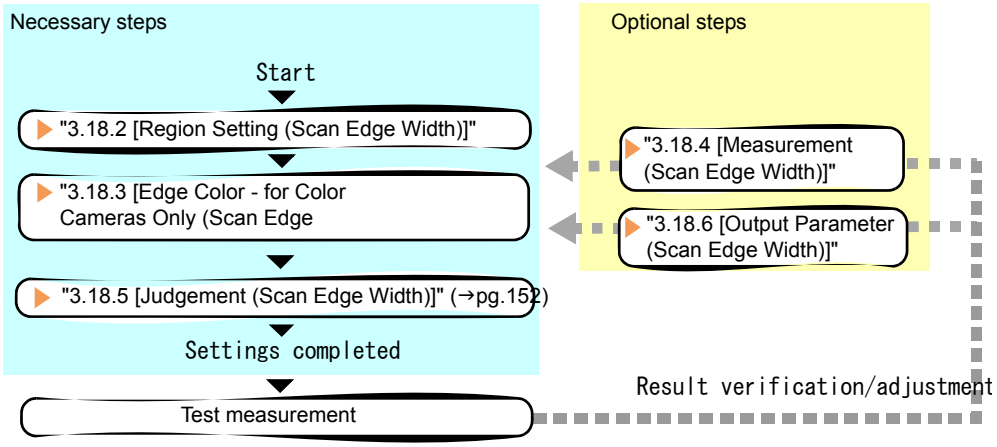
Item Name	Description
Region setting	This item specifies the region to be measured. "3.18.2 [Region Setting (Scan Edge Width)]" (→pg.144)
Edge color specification (for color cameras only)	This item specifies an edge color information to be detected. "3.18.3 [Edge Color - for Color Cameras Only (Scan Edge Width)]" (→pg.146)

Table: Item List for Scan Edge Width

Item Name	Description
Measurement	This item changes the measurement parameter as necessary when the measurement result is unstable. The displayed items are different depending on whether your camera is a color or monochrome camera. Usually, the factory default value can be used. "3.18.4 [Measurement (Scan Edge Width)]" (→pg.148)
Judgement	This item specifies the judgement condition for measurement results. "3.18.5 [Judgement (Scan Edge Width)]" (→pg.152)
Output parameter	This item can be changed if necessary. Usually, the factory default value can be used. Use the Output parameter to specify how to treat the coordinate. "3.18.6 [Output Parameter (Scan Edge Width)]" (→pg.153)

3.18.1 Setting Up [Scan Edge Width]

The setting procedure for [Scan Edge Width] is as follows:



POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 In the Edit flow window, tap [Scan Edge Width].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area, tap [Region setting] and specify the measurement region.

"3.18.2 [Region Setting (Scan Edge Width)]" (→pg.144)

3 In the "Item tab" area, tap [Edge color] to specify the reference color to be detected as the edge.

"3.18.3 [Edge Color - for Color Cameras Only (Scan Edge Width)]" (→pg.146)

4 Tap [Judgement] in the "Item Tab" area, and set the judgement condition for OK.

"3.18.4 [Measurement (Scan Edge Width)]" (→pg.148)

Important

- If you change an output parameter after setting judgement condition, measurement result changes. When you change an output parameter, reset judgement condition as well.

5 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

6 Perform a test measurement.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

7 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

When "NG" is displayed, verify measurement results and make adjustments if necessary.

"3.18.7 Points on Test Measurement and Adjustment (Scan Edge Width)" (→pg.154)

3.18.2 [Region Setting (Scan Edge Width)]

Specify the measurement region of [Scan Edge Width] by using a wide straight line.

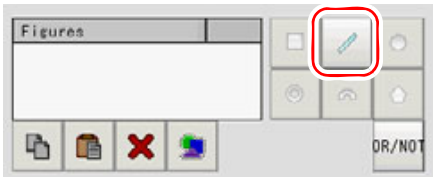
1 In the "Item tab" area, tap [Region setting].

2 When a measurement region is already registered, tap [Edit]. When no measurement region is registered, go to the Step 3.

The "Figure Setting" area is displayed.

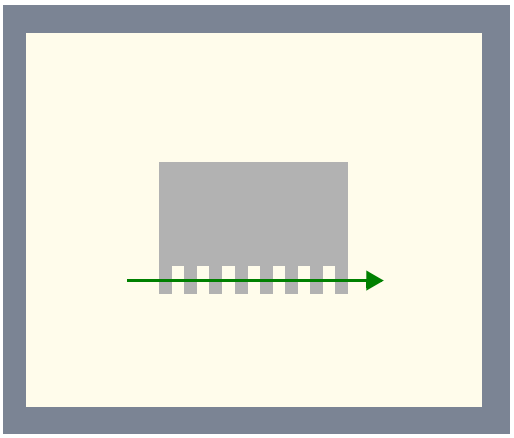
3 Specify the measurement area using Drawing Tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"



4 In the "Figure setting" area, tap [OK].

The measurement range is registered and displayed in the "Image display" area.



5 When necessary, divide the drawn region into several parts.

" Dividing the drawn region into several parts" (→pg.145)

For the subsequent operations, see "3.18.1 Setting Up [Scan Edge Width]" (→pg.143).

Dividing the drawn region into several parts

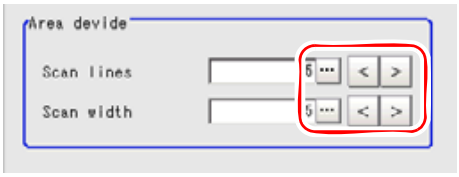
This can be set when changing the number or the width of divided parts of the region.

1 In the "Area divide" area, tap [...] of each item and set values.

You can set it by tapping left or right button.

How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"

By default, the "Scan lines" is 5 and the "Scan width" is 5.



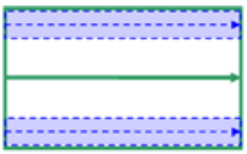
2 In the "Image display" area, the figure with the change is redrawn.

The specified region is divided equally into the specified number for "Scan lines".

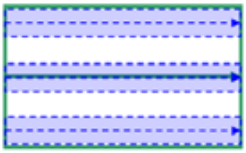
Division of Scan Area

The scan area, when the number is 1

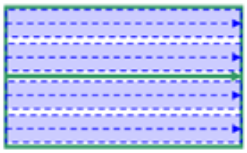
The scan area, when the number is 2



The scan area, when the number is 3



The scan area, when the number is 4



3.18.3 [Edge Color - for Color Cameras Only (Scan Edge Width)]

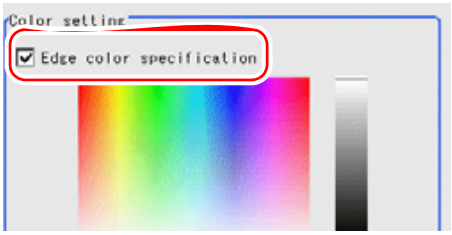
Set the criteria with which to search for an edge.

1 In the "Item tab" area, tap [Edge color].

2 If necessary, check "Edge color specification" in the "Color setting" area.

When checked, the edge will be detected according to the subsequently specified "Edge color" and "Detection mode".

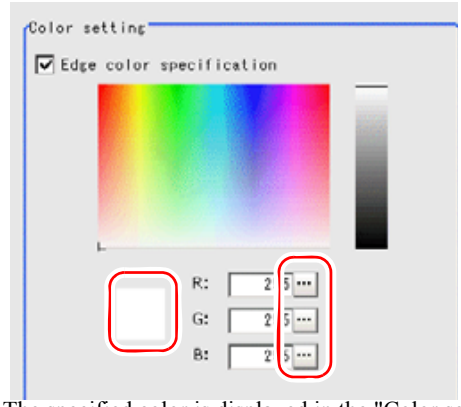
When unchecked, positions in the measurement region where the color changes drastically are detected as an edges.



3 Specify the color that is used as the edge (the reference color with which to detect the edge).

In the "Color setting" area, tap [...] for each of [R] (red), [G] (green), and [B] (blue), and input the values respectively.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"



The specified color is displayed in the "Color setting" area.

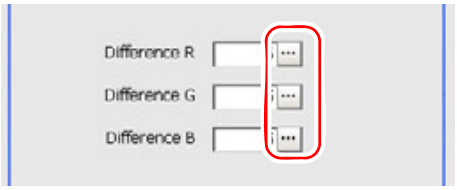
4 Using the edge color as the reference, specify the allowable color difference for detecting the edges.

In the "Color setting" area, tap [...] for each of [Difference. R], [Difference. G], and [Difference. B], and specify values respectively.

The larger the "Difference" values, the larger the color range that is used to detect the edge.

The default value of each "Difference" is "5".

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"



5 Select an edge detection method in "Detection mode".

Table: Edge Color (Scan Edge Width)

Setting Item	Set Value [Factory default]	Description
Detection mode	・[Color IN] ・Color OUT	This item detects the area between the specified edge color and other colors where color change occurs as the edge. The detecting direction is from the start point to the end point of the straight line that is specified in [Region Setting]. ・Color IN This is the mode in which the position where colors other than the specified edge color start to change to the specified edge color is detected as the edge. ・Color OUT This is the mode in which the position where the specified edge color starts to change to colors other than the specified edge color is detected as the edge.

For the subsequent operations, see "3.18.1 Setting Up [Scan Edge Width]" (→pg.143).

3.18.4 [Measurement (Scan Edge Width)]

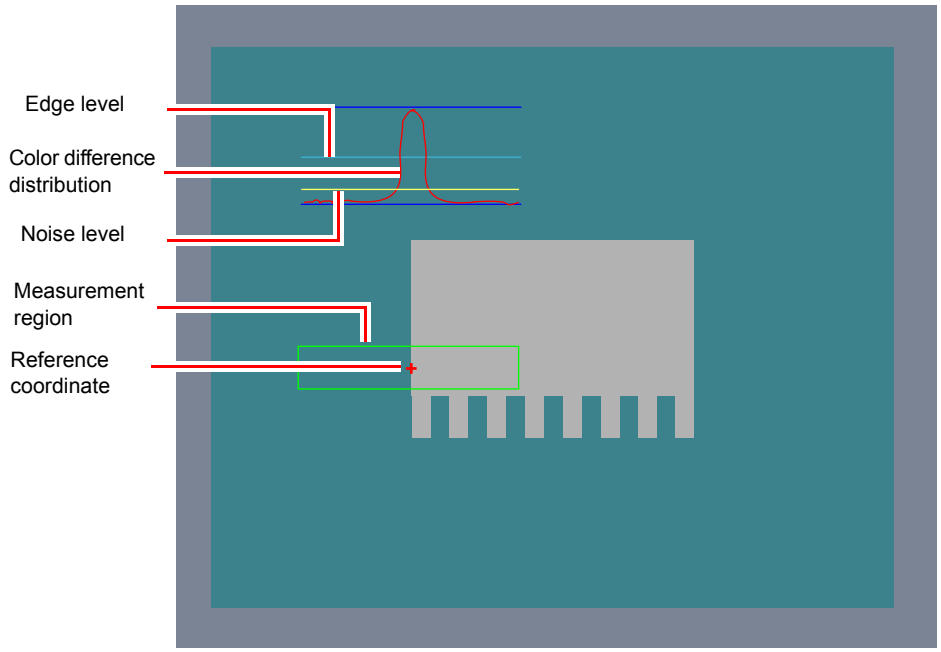
This item can be changed if necessary. Usually, the factory default value can be used.
When any settings have been changed, verify whether measurements can be performed correctly through actual measurement.

POINT

- For the mechanism of edge image measurement processing, see "4.6.3 Edge Measurement" (→pg.42), of "User's Manual".

1 In the "Item tab" area, tap [Measurement].

The edge profile of the measurement region is displayed in the "Image display" area.



2 Set the value of each item in the "Display area" area.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

You can set the "Display area No." by tapping left or right button.

Table: Measurement (Scan Edge Width) - Display Area

Setting Item	Set Value [Factory default]	Description
Display area No.	[0] to 99	This item uses the scanning area of which edge profile is displayed.
Enabled	・ Checked ・ Unchecked [As defined in the region settings]	Specify enable/disable of the divided area. When "Enabled" is unchecked, measurement is not performed.
	・ [Forward area] ・ Reverse area	Select the edge for which a cross-shaped cursor is displayed. Forward area: The edge is scanned in the direction from the start point to the end point in the region specified by wide straight lines. Reverse area: The edge is scanned in the direction from the end point to the start point in the region specified by wide straight lines.

3 Set the value of each item in the "Measurement" area.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

The values for [Edge level] and [Edge color level] can be adjusted by dragging the slider or by tapping the buttons at both ends of the slider.

For color cameras:

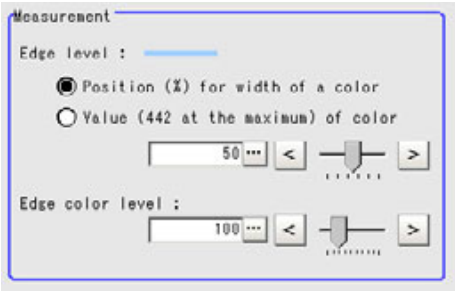


Table: Measurement (Scan Edge Width)

Setting Item	Set Value [Factory default]	Description
Edge level	・Position (%) for width of a color 0 to 100[50] ・Value of color 0 to 442[20]	Select a color difference level with which the edge is detected. "4.6.3 Edge Measurement" (→pg.42), of "User's Manual"
Edge color level	0 to 442 [100]	Specify a level to remove colors other than the color specified in [Edge color] to enhance the edge color. This option can be specified only if the [Edge color specification] is checked in [Edge color]. "3.18.3 [Edge Color - for Color Cameras Only (Scan Edge Width)]" (→pg.146)

For monochrome cameras:

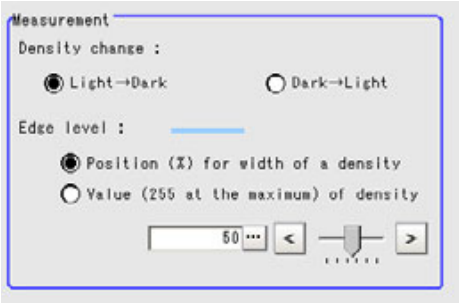


Table: Measurement (Scan Edge Width)

Setting Item	Set Value [Factory default]	Description
Density change	[Light ➞ Dark] Dark ➞ Light	Select whether a black-to-white change or a white-to-black change should be recognized as a density change in the specified region.
Edge level	・ Position (%) for width of a density 0 to 100[50] ・ Value of density 0 to 255[20]	Select the density change level to be detected as edges. "4.6.3 Edge Measurement" (➞pg.42), of "User's Manual"

4 Tap [...] of each item in the "Noise removal" area, and set values.

How to input a value: "1.4 Inputting a Value" (➞pg.18), of "User's Manual"

The value for [Noise level] can be adjusted by dragging the slider or by tapping the buttons at both ends of the slider.

The [Noise width] value can also be adjusted by tapping [<] and [>].

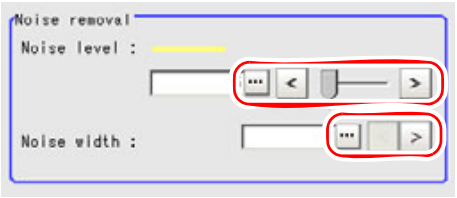


Table: Measurement (Scan Edge Width) - Noise Removal

Setting Item	Set Value [Factory default]	Description
Noise level	0 to 442 [5]	Specify the noise level for judging the presence/absence of an edge. The maximum and minimum values of color differences in the edge detection region are obtained and, if the difference is lower than the noise level, no edges will be detected. If the detection is affected by noise, increase this value. " Noise Level" (➞pg.43), of "User's Manual"
Noise width	0 to 9999 [0]	Specify the noise width. When there are two edges higher than the edge level and the distance between them is less than the noise width, these two edges are treated as noise. If the detection is affected by noise, increase this value. " Noise Width" (➞pg.43), of "User's Manual"

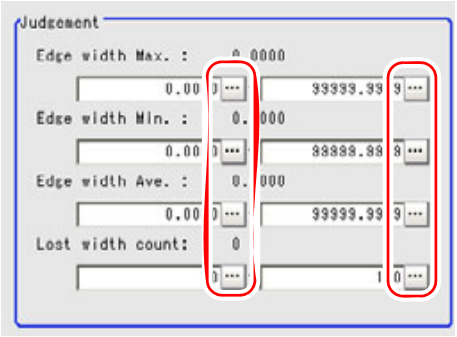
3.18.5 [Judgement (Scan Edge Width)]

Specify the range to be judged as OK.

1 In the "Item tab" area tap [Judgement] .

2 In the "Judgement" area, tap [...] and input a value for each item.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"



POINT

- The values displayed in the individual fields are the measurement results of the displayed image. Take these values into consideration to determine the upper and lower limits.

Table: Judgement Condition (Scan Edge Width)

Setting Item		Set Value [Factory default]	Description
Edge width Max.	Upper	0 to [dist (X_MAX,Y_MAX)]	Specify the upper and lower limits of the maximum width judged to be OK.
	Lower	[0] to dist (X_MAX,Y_MAX)	
Edge width Min.	Upper	0 to [dist (X_MAX,Y_MAX)]	Specify the upper and lower limits of the minimum width judged to be OK.
	Lower	[0] to dist (X_MAX,Y_MAX)	
Edge width Ave.	Upper	0 to [dist (X_MAX,Y_MAX)]	Specify the upper and lower limits of the average width judged to be OK.
	Lower	[0] to dist (X_MAX,Y_MAX)	
Lost width count	Upper	0 to [100]	Specify the upper and lower limits of the lost width count judged to be OK.
	Lower	[0] to 100	

dist(X_MAX,Y_MAX)=sqrt(X_MAX*X_MAX+Y_MAX*Y_MAX)

For the subsequent operations, see "3.18.1 Setting Up [Scan Edge Width]" (→pg.143).

3.18.6 [Output Parameter (Scan Edge Width)]

Specify how to treat the coordinates to be output to the external devices as measurement results.

Important

- If you change an output parameter after setting judgement condition, measurement result changes. When you change an output parameter, reset judgement condition as well.

1 In the "Item tab" area, tap [Output parameter].

2 Specify a value for each item.

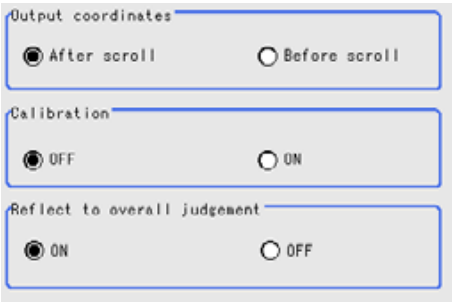


Table: Setting Values for Output Parameters

Setting Item	Set Value [Factory default]	Description
Output coordinates	・[After scroll] ・Before scroll	Select which coordinate values should be output to the external device as measurement results, values before scroll or values after scroll.
Calibration	・[OFF] ・ON	Select which coordinate values should be output to the external device as measurement results, values converted to the actual dimension (Calibration: ON) or values in the camera image (Calibration: OFF).
Reflect to overall Judgement	・[ON] ・OFF	Select whether to reflect the judgement result of this processing unit to the overall judgement of the scene. ・Selecting "ON" reflects the judgement result of this processing unit on the overall judgement of the scene. ・Selecting "OFF" does not reflect the judgement result of this processing unit on the overall judgement of the scene.

POINT

- For output coordinates and calibration, see "4.6.5 Configuring Coordinates" (→pg.45), of "User's Manual".
- The overall judgement result of the scene is output to the OR signal to be sent via the parallel interface. Also, it is displayed in the "Measurement information display" area in the upper part of the Main screen.
  "10.4.4 Time Chart" (→pg.35), of "User's Manual"
  "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"

For the subsequent operations, see "3.18.1 Setting Up [Scan Edge Width]" (→pg.143).

3.18.7 Points on Test Measurement and Adjustment (Scan Edge Width)

In addition to the camera-input image, the measurement region and the edge position (the cross-shaped cursor) will also be displayed in the "Image display" area.

In the "Detail result" area on the Main screen, you can confirm the following contents in text.
"6.3.2 Displaying Flow and Detail Result" (→pg.12), of "User's Manual"

Table: Content of Text (Scan Edge Width)

Item	Description
Judge	Judgement result
Edge width Max.	The maximum value of edge width
Edge width Min.	The minimum value of edge width
Edge width Ave.	The average value of all the edge widths
Lost width count	The number of the scanned areas for which the detection of width failed

Points on Adjustment

Select the adjustment method referring to the following points.

When the edge cannot be detected satisfactorily

- Set up the options in [Measurement].
  "3.18.4 [Measurement (Scan Edge Width)]" (→pg.148)
- Specify the edge color in [Edge color].
  "3.18.3 [Edge Color - for Color Cameras Only (Scan Edge Width)]" (→pg.146)

When noise is detected as an edge

- Specify a higher value for [Noise level] and [Noise width] in [Measurement].
  "3.18.4 [Measurement (Scan Edge Width)]" (→pg.148)

3.18.8 When Using Measurement Results Externally (Scan Edge Width)

Values Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expressions (Scan Edge Width)

Measurement items	Character string	Description
Judge	JG	Judgement result
Edge width Max.	MAXW	The maximum value of edge width
Edge width Min.	MINW	The minimum value of edge width
Edge width Ave.	AVEW	The average value of all the edge widths
Lost width count	LOST	The number of the scanned areas for which the detection of width failed

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference Data List (Scan Edge Width)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
1	Edge width Max.	Set/Get	0 to dist (X_MAX, Y_MAX)
2	Edge width Min.	Set/Get	0 to dist (X_MAX, Y_MAX)
3	Edge width Ave.	Set/Get	0 to dist (X_MAX, Y_MAX)
4	Lost width count	Set/Get	0 to 100
102	Calibration	Set/Get	0: OFF, 1: ON
103	Reflect to overall Judgement	Set/Get	0: ON, 1: OFF
120	Edge color specification	Set/Get	0: OFF, 1: ON
121	Edge color R	Set/Get	0 to 255
122	Edge color G	Set/Get	0 to 255
123	Edge color B	Set/Get	0 to 255
124	Difference. R	Set/Get	0 to 127
125	Difference. G	Set/Get	0 to 127

Table: External Reference Data List (Scan Edge Width)

No.	Data Name	Set/Get	Data Range
126	Difference. B	Set/Get	0 to 127
127	Detection mode	Set/Get	0: Color IN, 1: Color OUT
129	Edge level	Set/Get	0 to 100
130	Noise level	Set/Get	0 to 442
131	Noise width	Set/Get	0 to 9999
132	Edge color level	Set/Get	0 to 442
133	Upper limit of the maximum width	Set/Get	0 to dist (X_MAX, Y_MAX)
134	Lower limit of the maximum width	Set/Get	0 to dist (X_MAX, Y_MAX)
135	Upper limit of the minimum width	Set/Get	0 to dist (X_MAX, Y_MAX)
136	Lower limit of the minimum width	Set/Get	0 to dist (X_MAX, Y_MAX)
137	Upper limit of the average width	Set/Get	0 to dist (X_MAX, Y_MAX)
138	Lower limit of the average width	Set/Get	0 to dist (X_MAX, Y_MAX)
139	Upper limit of the lost width count	Set/Get	0 to 100
140	Lower limit of the lost width count	Set/Get	0 to 100
141	Monochrome edge detection mode	Set/Get	0: Light → Dark, 1: Dark → Light
142	Edge level absolute value	Set/Get	0 to 442
143	Edge level specification mode	Set/Get	0: %, 1: Absolute value
145	Scan lines	Set/Get	1 to 100
146	Scan width	Set/Get	1 to 200
147	Display Area	Set/Get	1 to 99
148	Display Area (Direction)	Set/Get	0: Forward, 1: Reverse

* dist (X_MAX,Y_MAX) = sqrt (X_MAX*X_MAX+Y_MAX*Y_MAX)

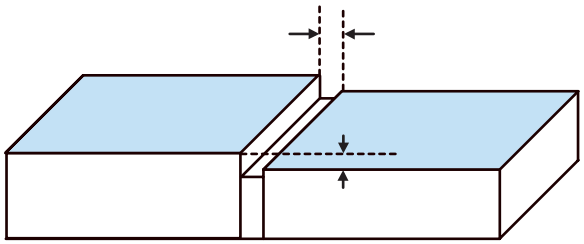
3.19 3D Edge Position

This processing item is for 3D measurement only.
This processing item measures the edge position X/Y/Z by stereo measurement.

Used for the following case

- When obtaining the 3D edge coordinates of a measured object

Example) Measure the clearance/step of an assembled structure



List of 3D Edge Position Items

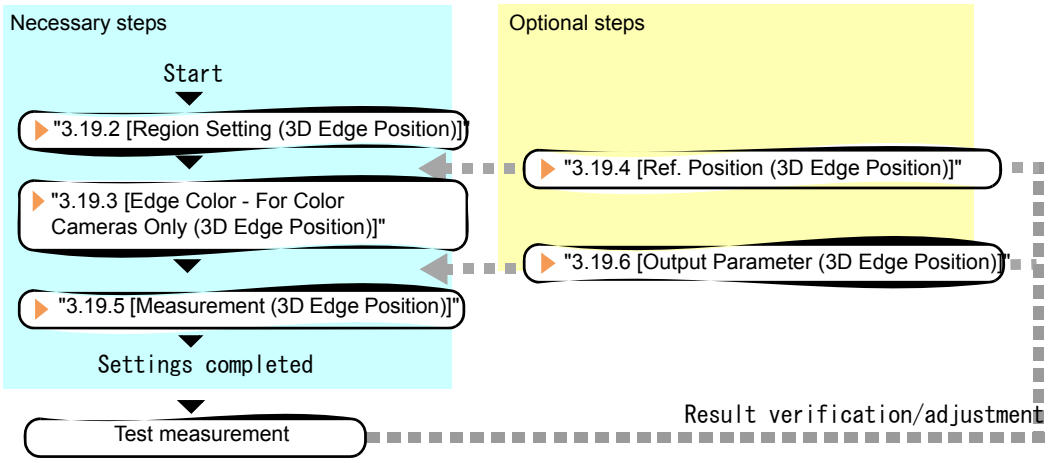
3D Edge Position items are explained below.

Table: List of 3D Edge Position Items

Item Name	Description
Region setting	This item specifies the region to be measured. "3.19.2 [Region Setting (3D Edge Position)]" (→pg.160)
Edge color specification (for color cameras only)	This item specifies an edge color information to be detected. "3.19.3 [Edge Color - For Color Cameras Only (3D Edge Position)]" (→pg.163)
Ref.position	This item can be changed if necessary. "3.19.4 [Ref. Position (3D Edge Position)]" (→pg.165)
Measurement	This item specifies the judgement condition for measurement results. Measurement values can be changed as needed to address unstable measurement results. The displayed items are different depending on whether your system is a color or monochrome camera. Usually, the factory default value can be used. "3.19.5 [Measurement (3D Edge Position)]" (→pg.167)
Output parameter	This item can be changed if necessary. Usually, the factory default value can be used. Use the Output parameter to specify how to treat the coordinates. "3.19.6 [Output Parameter (3D Edge Position)]" (→pg.172)

3.19.1 Setting up [3D Edge Position]

The setting procedure for [3D Edge Position] is as follows:



POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 In the Edit Flow window, tap [3D Edge Position].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area, tap [Region setting] and specify the measurement region.

"3.19.2 [Region Setting (3D Edge Position)]" (→pg.160)

3 In the "Item tab" area, tap [Edge color] to specify the reference color to be detected as the edge.

"3.19.3 [Edge Color - For Color Cameras Only (3D Edge Position)]" (→pg.163)

4 In the "Item tab" area, tap [Measurement] and specify the judgement condition for OK.

"3.19.5 [Measurement (3D Edge Position)]" (→pg.167)

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement parameters, too.

5 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

6 Perform a test measurement.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

7 Verify measurement results.

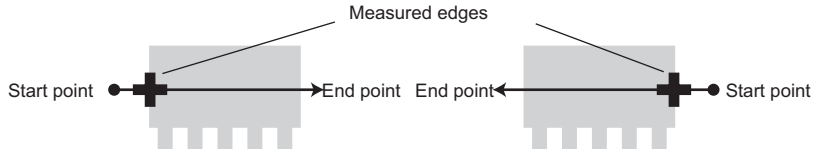
"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"
When "NG" is displayed, verify measurement results and make adjustments if necessary.
"3.19.7 Points on Measurement Test and Adjustment (3D Edge Position)" (→pg.173)

3.19.2 [Region Setting (3D Edge Position)]

Use a wide line to specify the measurement region for [3D Edge Position].

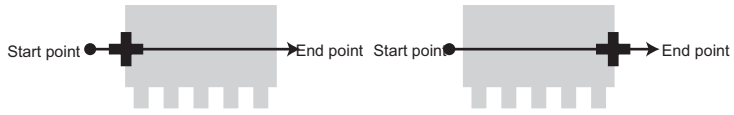
POINT

- Measurement results differ depending on the positions of the starting point and end point of the measurement region.
  When setting up the measurement region, attention should be paid to the edge detecting direction.



Drawing the line from left to right and from right to left will lead to different measured edges.

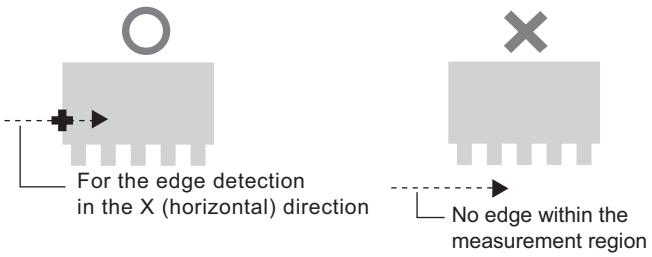
- When performing edge detection according to the specified edge color, measurement results vary depending on the edge detection mode even if the direction of the measurement region is the same.
  For monochrome cameras, changing measurement parameter "Density change" to "Light → Dark" or "Dark → Light" will lead to different measurement results.



For "Specifying Color IN" edge measurement mode

For "Specifying Color OUT" edge measurement mode

- Measurement cannot be performed if there is no edge within the measurement region. When determining the size and position of the measurement region, take into account the movement range of the measured object.



- The direction of the drawn arrow can be changed by tapping [ ] in the "Detail" area.
- Use the Zoom function if the measurement region is too small to identify the direction of the arrow.
  For the Zoom function, see "1.8 Using Zoom Function" (→pg.24), of "User's Manual".

1 In the "Item tab" area, tap [Region setting].

2 In the "Range of height measurement" area, tap [...] for each item and specify a height range of measurement.

Tap [...] for "Range [mm]" and specify values.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

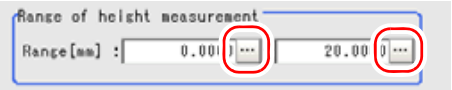


Table: Region Setting (3D Edge Position)

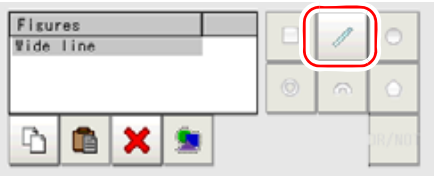
Setting Item		Set Value [Factory default]	Description
Range [mm]	Upper	-99999.9999 to 99999.9999 [0.0000]	Specify the range of height measurement.
	Lower	-99999.9999 to 99999.9999 [20.0000]	

3 When a measurement region is already registered, tap [Edit]. When no measurement region is registered, go to the Step 4.

The "Figure setting" area is displayed.

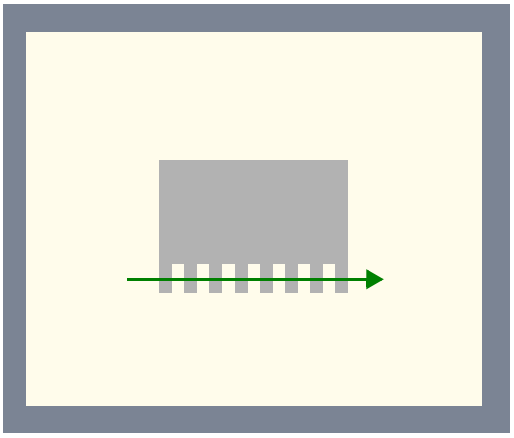
4 Specify the measurement area using the Drawing Tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"



5 In the "Figure setting" area, tap [OK].

The measurement range is registered and displayed in the "Image display" area.



For the subsequent operations, see "3.19.1 Setting up [3D Edge Position]" (→pg.159).

3.19.3 [Edge Color - For Color Cameras Only (3D Edge Position)]

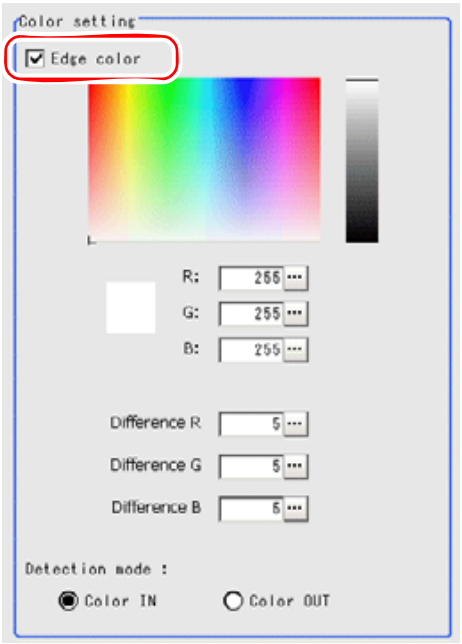
Set the criteria to use to search for an edge.

1 In the "Item tab" area, tap [Edge color].

2 If necessary, check "Edge color" in the "Color setting" area.

When checked, the edge will be detected according to the subsequently specified "Edge color" and "Detection mode".

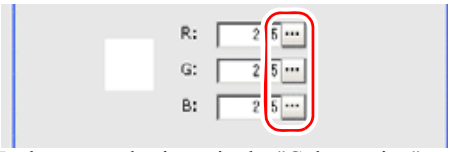
When unchecked, positions in the measurement region where the color changes drastically are detected as an edge.



3 Specify the color that is used as the edge (the reference color to be used to detect the edge).

In the "Color setting" area, tap [...] for "R" (red), "G" (green), and "B" (blue), and specify a value for each color.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"



Each target color is set in the "Color setting" area.

POINT

- In the "Image display" area, you can specify the color area you want to detect by dragging the cursor from the upper left corner to the lower right corner of that area.

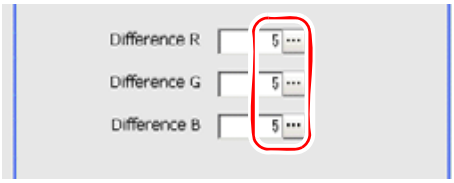
4 Specify the allowable color difference for detecting the edge, using the edge color as the reference.

In the Color Specification Setting area, tap [...] for each of "Difference R", "Difference G", and "Difference B", and specify a value respectively.

The larger the "Difference" values, the larger the color range that is used to detect the edge.

The default value of each "Difference" is "5".

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"



5 Select an edge detection method in "Detection mode".

Table: Edge Color (3D Edge Position)

Setting Item	Set Value [Factory default]	Description
Detection mode	・[Color IN] ・Color OUT	This item detects the area between the specified edge color and other colors where color change occurs as the edge. The detecting direction is from the start point to the end point of the straight line specified in "Region Setting". ・Color IN This is the mode in which the position where colors other than the specified edge color start to change to the specified edge color is detected as the edge. ・Color OUT This is the mode in which the position where the specified edge color starts to change to colors other than the specified edge color is detected as the edge.

For the subsequent operations, see "3.19.1 Setting up [3D Edge Position]" (→pg.159).

3.19.4 [Ref. Position (3D Edge Position)]

This item can be changed if necessary. The reference measurement is executed at the same time as the measurement region is specified, with the reference position set automatically. This item can be used to change the reference position to any desired position.

For the reference position, see "11.4 Terminology" (→pg.12), of "User's Manual".

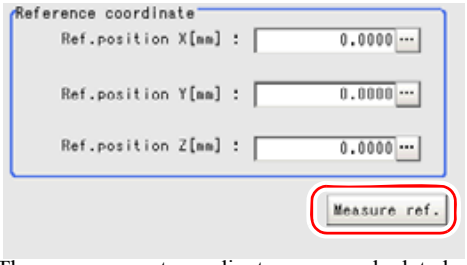
1 In the "Item tab" area, tap [Ref.position].

2 Set the reference position.

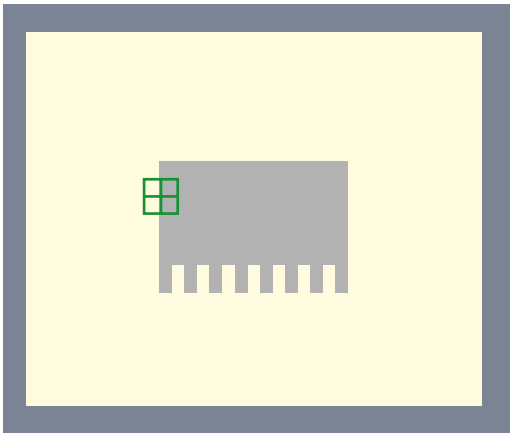
There are two methods to set the reference position: by performing the reference measurement while the image to be measured is displayed, or by specifying the reference coordinates directly.

Measuring the image to set the reference position

While the image to be measured is displayed, tap [Measure ref.].



The measurement coordinates are re-calculated, and the cross-shaped cursor is displayed in the "Reference coordinate" area.

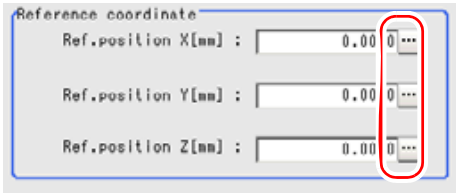


Specifying the reference coordinates directly

Specify values for "Ref. position X", "Ref. position Y", and "Ref. position Z".

In the Reference Coordinate area, tap [...] for each item and specify values for your desired reference coordinates (the coordinates of the reference position).

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"



POINT

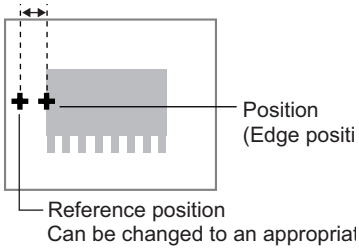
- Note the following when the reference coordinates are specified directly:
  - The cross-shaped cursor will not be displayed in the "Reference coordinate" area.

- Although the X-, Y-, and Z-coordinates shown on the screen are the input values (mm), the X- and Y-coordinates which are referenced as measurement coordinates in result display processing items, etc. are the X- and Y-coordinate values (in pixels) on the Camera 0-side or Camera 2-side. These coordinate values do not change even if the reference coordinate values change.

POINT

Since the reference position can be changed, it is useful for measuring distance from a specific position.

- Confirm the reference position of the currently displayed image, and then change it to an appropriate position. A positional check can be performed by calculating the difference between the reference position and the measured position using an expression.



After changing the reference position to any desired position, changing the measurement region will automatically change it back to the default position.

About the 3D Camera Switching Button

- The window display can be changed by tapping the 3D Camera Switching button. For the 3D Camera Switching button, see " 3D Processing Item Window" (→pg.13), of "User's Manual".

3.19.5 [Measurement (3D Edge Position)]

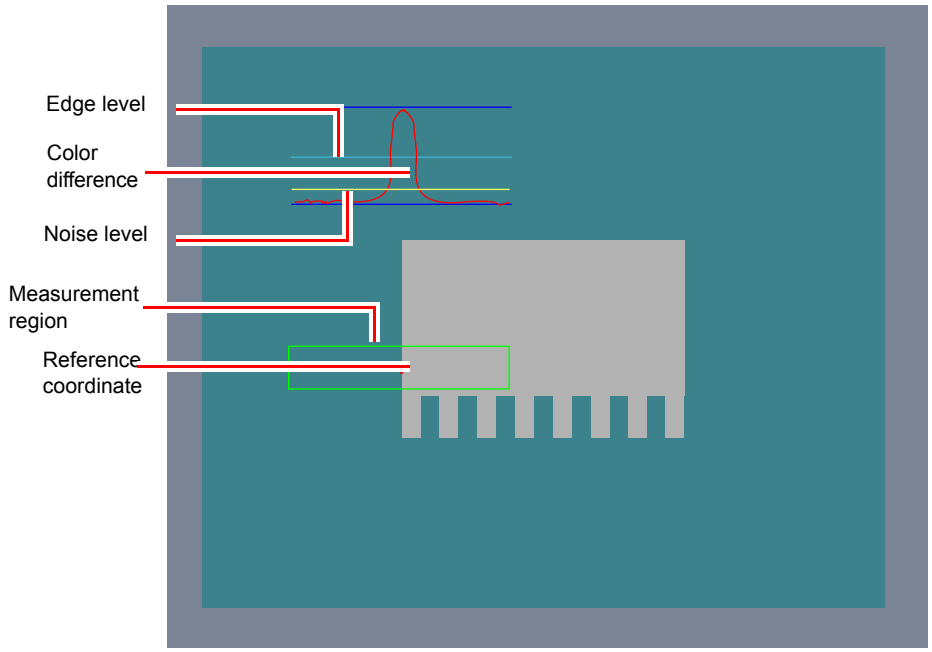
Specify the range to be judged as OK.

POINT

- For the mechanism of edge image measurement processing, see "4.6.3 Edge Measurement" (→pg.42), of "User's Manual".

1 In the "Item tab" area, tap [Measurement].

The edge profile of the measurement region is displayed in the "Image display" area.



2 If necessary, specify a value for each item in the Measurement Condition area.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

"Edge No." can be specified by tapping [<] and [>].

The values for "Edge level" and "Edge color level" can be specified by dragging the slider or by tapping the buttons at both ends of the slider.

For color cameras:

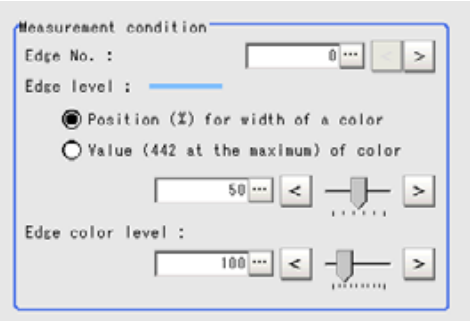


Table: Measurement (3D Edge Position)

Setting Item	Set Value [Factory default]	Description
Edge No.	0 to 99 [0]	Specify the number of the edge to be extracted. Edge numbers are assigned to the detected edges, starting with 0 from the start point to the end point in the direction of the arrow of the measurement region.
Edge level	・Position (%) for width of a color 0 to 100[50] ・Value of color 0 to 442[20]	Specify a color difference level with which the edge is detected. "4.6.3 Edge Measurement" (→pg.42), of "User's Manual"
Edge color level	0 to 442 [100]	Specify a level to remove colors other than the color specified in [Edge color] to enhance the edge color. This option can be specified only if the "Edge Color" is checked in [Edge color]. "3.19.3 [Edge Color - For Color Cameras Only (3D Edge Position)]" (→pg.163)

For monochrome cameras:

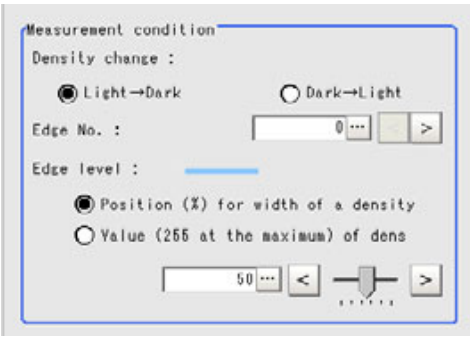


Table: Measurement (3D Edge Position)

Setting Item	Set Value [Factory default]	Description
Density change	・[Light → Dark] ・Dark → Light	Select whether a black-to-white change or a white-to-black change should be recognized as a density change in the specified region.
Edge No.	0 to 99 [0]	Specify the number of the edge to be extracted. Edge numbers are assigned to the detected edges, starting with 0 from the start point to the end point in the direction of the arrow of the measurement region.
Edge level	・Position (%) for width of a color 0 to 100[50] ・Value (255 at the maximum) of dens 0 to 442[20]	Select a color difference level with which the edge is detected. "4.6.3 Edge Measurement" (→pg.42), of "User's Manual"

3 If necessary, in the Noise Removal area, tap [...] and specify a value for each item.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

The value for "Noise level" can be adjusted by dragging the slider or tapping the buttons at both ends of the slider.

The "Noise width" value can also be adjusted by tapping [<] and [>].

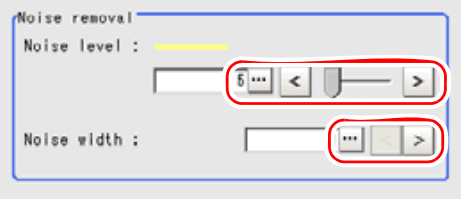


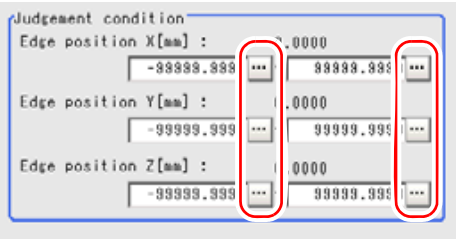
Table: Measurement (3D Edge Position) - Noise Removal

Setting Item	Set Value [Factory default]	Description
Noise level	0 to 442 [5]	Specify the noise level for judging the presence/absence of an edge. The maximum and minimum values of color differences in the edge detection region are obtained, and if the difference is lower than the noise level, no edges will be detected. If the detection is affected by noise, increase this value. " Noise Level" (→pg.43), of "User's Manual"
Noise width	0 to 9999 [0]	Specify the noise width. When there are two edges higher than the edge level and the distance between them is less than the noise width, these two edges are treated as noise. If the detection is affected by noise, increase this value. " Noise Width" (→pg.43), of "User's Manual"

4 When the setting has been changed, tap [Measure] in the Detail area to verify whether measurements can be made correctly.

5 In the "Judgement condition" area, tap [...] and input a value for each item.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"



POINT

- The values displayed in the individual fields are the measurement results of the displayed image. Take these values into consideration to determine the upper and lower limits.
- The window display can be changed by tapping the 3D Camera Switching button during setting. For the 3D Camera Switching button, see " 3D Processing Item Window" (→pg.13), of "User's Manual".

Table: Measurement (3D Edge Position) - Judgement Condition

Setting Item		Set Value [Factory default]	Description
Edge position X	Upper	-99999.9999 to [99999.9999]	Specify the range of X-axis shifting that is judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Edge position Y	Upper	-99999.9999 to [99999.9999]	Specify the range of Y-axis shifting that is judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Edge position Z	Upper	-99999.9999 to [99999.9999]	Specify the Z-axis shifting range to be judged as OK.
	Lower	[-99999.9999] to 99999.9999	

For the subsequent operations, see "3.19.1 Setting up [3D Edge Position]" (→pg.159).

3.19.6 [Output Parameter (3D Edge Position)]

Specify how to treat the coordinates to be output to the external device as measurement results.

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement parameters, too.

1 In the Item Tab area, tap [Output parameter].

2 Specify a value for each item.

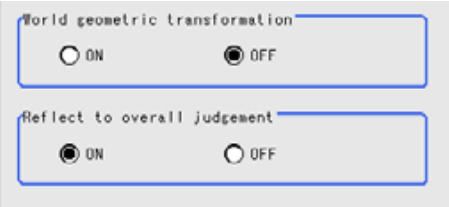


Table: Setting Values for Output Parameters

Setting Item	Set Value [Factory default]	Description
World geometric transformation	・ON ・[OFF]	Select whether to output measurement results to external devices whether in coordinates converted to the actual size (World geometric transformation: ON) or by converting them into the coordinates of camera image (World geometric transformation: OFF).
Reflect to overall judgement	・[ON] ・OFF	Select whether to reflect the judgement result of this processing unit to the overall judgement of the scene. ・Selecting "ON" reflects the judgement result of this processing unit on the overall judgement of the scene. ・Selecting "OFF" does not reflect the judgement result of this processing unit on the overall judgement of the scene.

POINT

- For world geometric transformer, see "4.6.6 Configuring 3D measurement" (→pg.46), of "User's Manual".
- The overall judgement result of the scene is output to the OR signal to be sent via the parallel interface. Also, it is displayed in the Measurement Information Display area in the upper part of the Main screen.
  "10.4.4 Time Chart" (→pg.35), of "User's Manual"
  "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"

For the subsequent operations, see "3.19.1 Setting up [3D Edge Position]" (→pg.159).

3.19.7 Points on Measurement Test and Adjustment (3D Edge Position)

In addition to the image from the camera, the measurement region and the edge position (the cross-shaped cursor) will also be displayed in the "Image display" area.

In the "Detail result" area on the Main screen, you can confirm the following contents in text.
"6.3.2 Displaying Flow and Detail Result" (→pg.12), of "User's Manual"

Table: Text Displayed (3D Edge Position)

Item	Description
Judge	Judgement result
Edge position X	X coordinate of the measured edge position
Edge position Y	Y coordinate of the measured edge position
Edge position Z	Z-coordinate of the measured edge position

Points on Adjustment

Select the adjustment method referring to the following points.

When the edge cannot be detected satisfactorily

- Set up the options in [Measurement].
  "3.19.5 [Measurement (3D Edge Position)]" (→pg.167)
- Specify the edge color in [Edge color].
  "3.19.3 [Edge Color - For Color Cameras Only (3D Edge Position)]" (→pg.163)

When noise is detected as an edge

- Specify a higher value for "Noise level" or "Noise width" in [Measurement].
  "3.19.5 [Measurement (3D Edge Position)]" (→pg.167)

3.19.8 When Using Measurement Results Externally (3D Edge Position)

Values Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (3D Edge Position)

Measurement items	Character string	Description
Judge	JG	Judgement result
Edge position X-coordinate	XR	X-coordinate of the measured 3D edge position
Edge position Y coordinate	YR	Y-coordinate of the measured 3D edge position
Edge position Z Coordinate	ZR	Z-coordinate of the measured 3D edge position

Table: Values Available in Expression (3D Edge Position)

Measurement items	Character string	Description
Reference coordinate X	SX	Reference X coordinate
Reference coordinate Y	SY	Reference Y coordinate
Reference coordinate Z	SZ	Reference Z Coordinate

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (3D Edge Position)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Edge position X coordinate	Get only	-99999.9999 to 99999.9999
6	Edge position Y coordinate	Get only	-99999.9999 to 99999.9999
7	Edge position Z Coordinate	Get only	-99999.9999 to 99999.9999
8	Reference coordinate X	Get only	-99999.9999 to 99999.9999
9	Reference coordinate Y	Get only	-99999.9999 to 99999.9999
10	Reference coordinate Z	Get only	-99999.9999 to 99999.9999
103	Reflect in OR	Set/Get	O: ON 1: OFF
120	World geometric transformation	Set/Get	O: ON 1: OFF
121	Upper limit of the height measurement range	Set/Get	-99999.9999 to 99999.9999
122	Lower limit of the height measurement range	Set/Get	-99999.9999 to 99999.9999
140	Edge color specification	Set/Get	0: OFF 1: ON
141	R	Set/Get	0 to 255
142	G	Set/Get	0 to 255
143	B	Set/Get	0 to 255
144	Dev. R	Set/Get	0 to 255
145	Dev. G	Set/Get	0 to 255
146	Dev. B	Set/Get	0 to 255
147	Detection mode	Set/Get	0: Color IN 1: Color OUT
150	Reference coordinate X	Set/Get	-99999.9999 to 99999.9999
151	Reference coordinate Y	Set/Get	-99999.9999 to 99999.9999

Table: External Reference List (3D Edge Position)

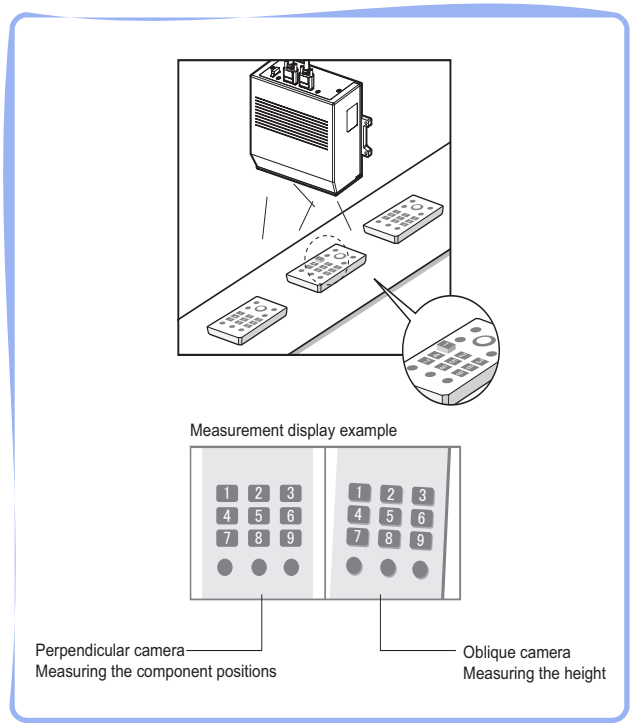
No.	Data Name	Set/Get	Data Range
152	Reference coordinate Z	Set/Get	-99999.9999 to 99999.9999
153	Edge No.	Set/Get	0 to 99
154	Edge mode	Set/Get	0: Width of a color 1: Value of a color
155	Edge level (Edge mode=0)	Set/Get	0 to 100
156	Edge color level	Set/Get	0 to 442
157	Density change	Set/Get	0: Light → Dark 1: Dark → Light
158	Noise level	Set/Get	0 to 442
159	Noise width	Set/Get	0 to 9999
160	Upper limit of the edge position X	Set/Get	-99999.9999 to 99999.9999
161	Lower limit of the edge position X	Set/Get	-99999.9999 to 99999.9999
162	Upper limit of the edge position Y	Set/Get	-99999.9999 to 99999.9999
163	Lower limit of the edge position Y	Set/Get	-99999.9999 to 99999.9999
164	Upper limit of the edge position Z	Set/Get	-99999.9999 to 99999.9999
165	Lower limit of the edge position Z	Set/Get	-99999.9999 to 99999.9999
170	Edge level (Edge mode=1)	Set/Get	For color cameras: 0 to 442 For monochrome cameras: 0 to 255

3.20 3D Search

This processing item is for 3D measurement only.
This processing item registers the feature images as a model and then finds the most similar part to the model from the input images to detect 3D coordinates.

Used for the following case

- When identifying the shape of measurement objects (for detecting defects or foreign matters)



List of 3D Search Items

3D Search items are explained below.

Table: List of 3D Search Items

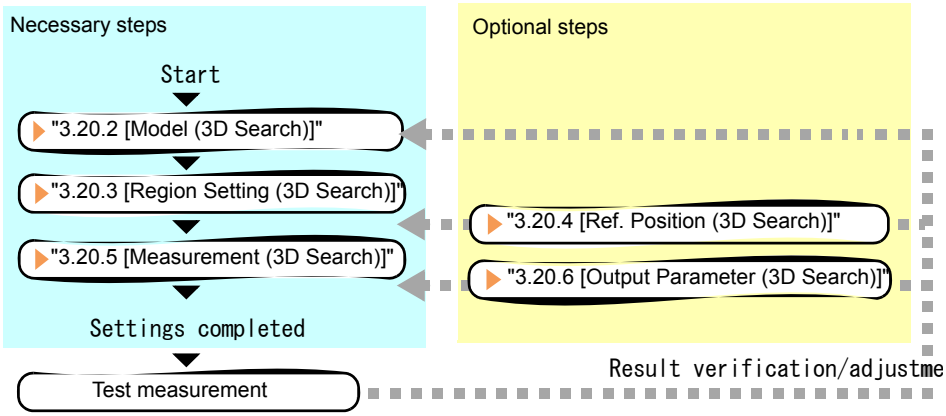
Item Name	Description
Model	This item registers the pattern characteristic of the measurement image as a model. Model parameter values can be changed as needed to address unstable measurement results for the faster process. Usually, the factory default value can be used. "3.20.2 [Model (3D Search)]" (→pg.180)
Region setting	This item specifies the region to be measured. Instead of measuring the entire input image, narrowing the measurement area shortens the processing time. "3.20.3 [Region Setting (3D Search)]" (→pg.184)

Table: List of 3D Search Items

Item Name	Description
Ref.position	This item can be changed if necessary. Specify the reference position within the camera's field of view. "3.20.4 [Ref. Position (3D Search)]" (→pg.185)
Measurement	This item specifies the judgement condition for measurement results. Specify the criteria to judge the measurement result if its X/Y/Z-coordinates and its correlation with the model are OK. "3.20.5 [Measurement (3D Search)]" (→pg.187)
Output parameter	This item can be changed if necessary. Usually, the factory default value can be used. Use the Output parameter to specify how to treat the coordinates. "3.20.6 [Output Parameter (3D Search)]" (→pg.189)

3.20.1 Setting up [3D Search]

The setting procedure for [3D Search] is as follows:



POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 In the Edit Flow window, tap [3D Search].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 The window opens with [Model] selected, to register the model as a pattern characteristic of the measurement object.

"3.20.2 [Model (3D Search)]" (→pg.180)

3 In the "Item tab" area, tap [Region setting] and specify the measurement region.

"3.20.3 [Region Setting (3D Search)]" (→pg.184)

4 In the "Item tab" area, tap [Measurement] and specify the judgement condition for OK.

"3.20.5 [Measurement (3D Search)]" (→pg.187)

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement parameters, too.

5 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

6 Perform a test measurement.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

7 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

When "NG" is displayed, verify measurement results and make adjustments if necessary.

"3.20.7 Points on Measurement Test and Adjustment (3D Search)" (→pg.190)

3.20.2 [Model (3D Search)]

Register the pattern characteristic of the measurement object as a model.

1 In the "Item tab" area, tap [Model].

When setting a new model, you do not have to tap [Model].

2 If necessary, set up the "Model parameter" area.

" Changing Model Parameters" (→pg.182)

3 Specify a region to be registered as a model by using the Drawing tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"

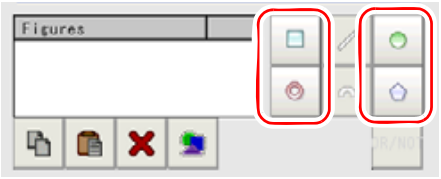


Table: Drawing Tools Available for Model (3D Search)

Available objects to be drawn	Drawing Tools
Rectangle	
Circle	
Circumference	
Polygon	

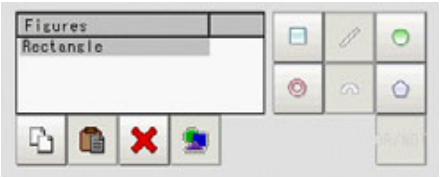
POINT

- If the model is an ellipse, the circumscribed rectangle is displayed as the model on the 3D search result.

4 To save the registered model image, check the "Save registered model" option.

5 Tap [OK].

The model is registered.



POINT

- 'Registered model image' refers to the image saved when a model is registered. Saving a registered model image allows you to modify model parameters using that registered model image even when the actual measurement object is not present. Note that the scene data size increases when a registered model image is saved.

For the subsequent operations, see "3.20.1 Setting up [3D Search]" (→pg.179).

Changing Model Parameters

This item can be changed if necessary. Usually, the factory default value can be used.
When any settings have been changed, verify whether measurements can be performed correctly through actual measurement.

POINT

- For of search operations, see "4.6.2 Configuring Search" (→pg.39), of "User's Manual".

1 In the "Model parameter" area, specify a value for each item.

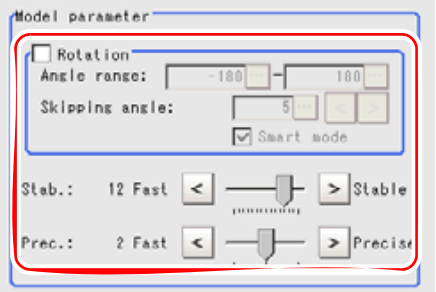


Table: Model - Model Parameter

Setting Item	Set Value [Factory default]	Description
Rotation	・Checked ・[Unchecked]	This item specifies whether to rotate the image during a search.

Table: Model - Model Parameter

Setting Item		Set Value [Factory default]	Description
Angle range	Upper	-180 to [180]	Specify the upper and lower limits for [Angle range] (rotation angle) during a search. The normal direction is clockwise. Settings must satisfy: lower limit = upper limit.
	Lower	[-180] to 180	
Skipping angle		1 to 30 [5]	Specify the stepping angle (in degrees) by which the model is rotated to create rotated models. A smaller angle increases stability, but slows down the processing.
Smart mode		・[Checked] ・Unchecked	Specify whether or not to enable Smart mode. Checking the "Smart mode" option enables a high-speed rotation search. The stability may be lowered when the model shape aspect ratio is large or when the NOT mask is used.
Stab. (Stability)		1 to 15 [9] (for camera with more than 640 by 480 pixels) [12] (for camera with 640 by 480 pixels or less)	Specify the stability of detection. A larger value increases stability. A smaller value speeds up processing. If lowering stability leads to slower processing, it is likely that many candidates have been detected. In this case, specify a larger value for "Candidate LV" or "Stab.".
Prec. (Precision)		1 to 3 [2]	Specify the position precision of the measurement coordinates. A larger value increases precision, and a smaller value speeds up processing.

1. If necessary, check "Rotation" and specify a value for each rotation item.
   For "Angle range" and "Skipping angle", tap [...] and specify a range of the rotation angle.
   How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"
   The "Skipping angle" value can be adjusted by tapping [<] or [>].
2. The values for "Stab." and "Prec." can be specified by dragging the slider.
   The value can also be adjusted by tapping the buttons at both ends of the slider.

Points on Adjustment

To improve measurement results, make adjustments as described below.
For adjustments, see also "5.4 Points on Adjustment" (→pg.11), of "User's Manual".

When measurement results are unstable

- If the model image consists of detailed figures, specify a larger value for "Stab.".
- If images that should be judged OK based on the model image vary in some degree, specify a smaller value for "Candidate LV".
- If the measurement results are unstable only when [Rotation] is selected, specify a smaller value for "Skipping angle".
- When "Rotation" is selected, if the model region shape is complex, uncheck the "Smart mode" option.

When the processing speed is slow

- If the model image is a simple figure or a large figure, specify a smaller value for "Stab.".
- If images that should be judged OK based on the model image have less variation, specify a larger value for "Candidate LV".
- When "Rotation" is selected and the model image is a simple figure, specify a larger value for "Skipping angle".
- When "Rotation" is selected and the model region shape is simple, check the "Smart mode" option.

For other adjustment methods, see " Shortening Measurement Time by Setting Processing Item" (→pg.11), of "User's Manual".

3.20.3 [Region Setting (3D Search)]

Use the rectangle to set up the measurement region for [3D search].

1 In the "Item tab" area, tap [Region setting].

2 In the "Range of height measurement" area, tap [...] for each item and specify a height range of measurement.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

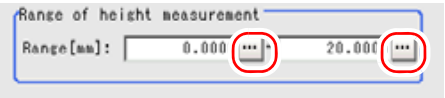
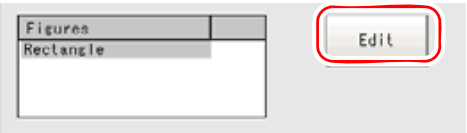


Table: Region Setting - Height Measurement Condition

Setting Item		Set Value [Factory default]	Description
Range	Upper	-99999.9999 to 99999.9999 [0.0000]	Specify a height range of measurement.
	Lower	-99999.9999 to 99999.9999 [20.0000]	

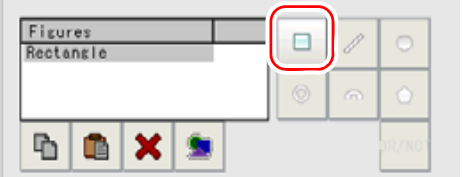
3 Tap [Edit].



The Figure Setting area is displayed.

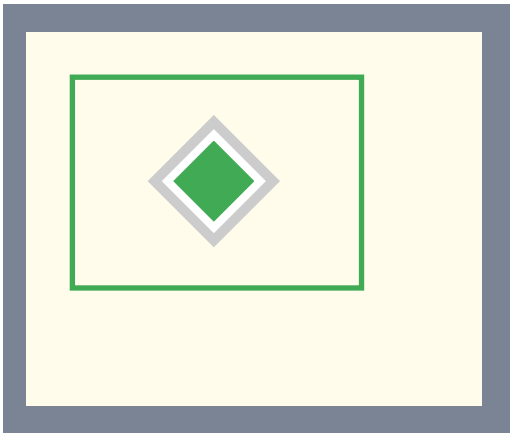
4 Specify a region where the model is searched by using the Drawing tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"



5 In the "Figure setting" area, tap [OK].

The measurement range is registered and displayed in the "Image display" area.



For the subsequent operations, see "3.20.1 Setting up [3D Search]" (→pg.179).

3.20.4 [Ref. Position (3D Search)]

This item can be changed if necessary. The reference measurement is executed at the same time the measurement region is specified, with the reference position set automatically. This item can be used to change the reference position to any desired position.
For the reference position, see "11.4 Terminology" (→pg.12), of "User's Manual".

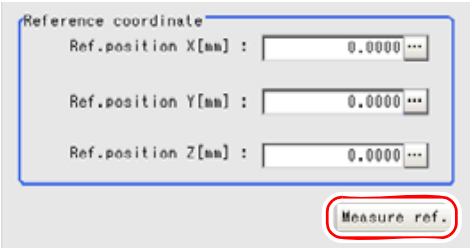
1 In the "Item tab" area, tap [Ref.position].

2 Set the reference position.

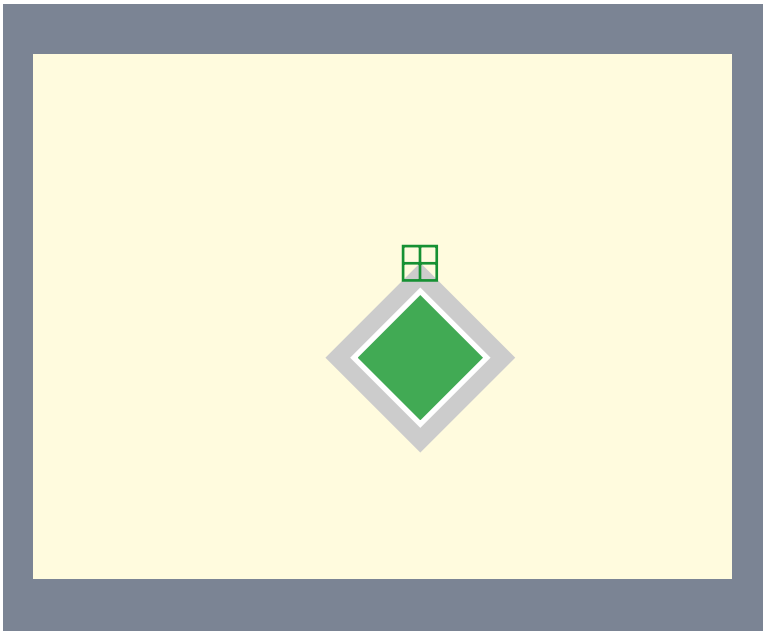
There are two methods to set the reference position: performing the reference measurement while the image to be measured is displayed, or specifying the reference coordinates directly.

Measuring the image to set the reference position

While the image to be measured is displayed, tap [Measure ref.].



The measurement coordinates are re-calculated, and the cross-shaped cursor will be displayed in the "Reference coordinate" area.

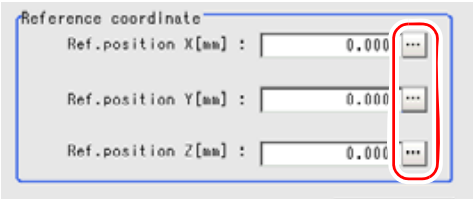


Specifying the reference coordinates directly

Specify a value for "Ref. position X", "Ref. position Y", and "Ref. position Z".

In the Reference Coordinate area, tap [...] for each item and specify values for your desired reference coordinates (the coordinates of the reference position).

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"



POINT

- Note the following when the reference coordinates are specified directly:
  - The cross-shaped cursor will not be displayed in the "Reference coordinate" area.

- Although the X-, Y-, and Z-coordinates in the window show the input values (mm), X- and Y-coordinates which are referenced as measurement coordinates from result display processing item, etc. are the X- and Y-coordinate values (in pixels) on the camera-0 side or camera-2 side. These coordinate values will not change even when reference coordinate values change.

3.20.5 [Measurement (3D Search)]

Specify the judgement condition for measurement results. Measurement conditions can be changed in order to address unstable measurement results or to increase the processing speed. For judgement conditions, specify the criteria to judge the coordinates (X, Y, Z) of the measurement results and their corresponding measurement values on the model as OK.

1 In the "Item tab" area, tap [Measurement].

2 In the "Measurement condition" area, tap [...] of "Candidate LV" and input values.

The value can also be adjusted by tapping [<] and [>].

How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"

Table: Measurement (3D Search)

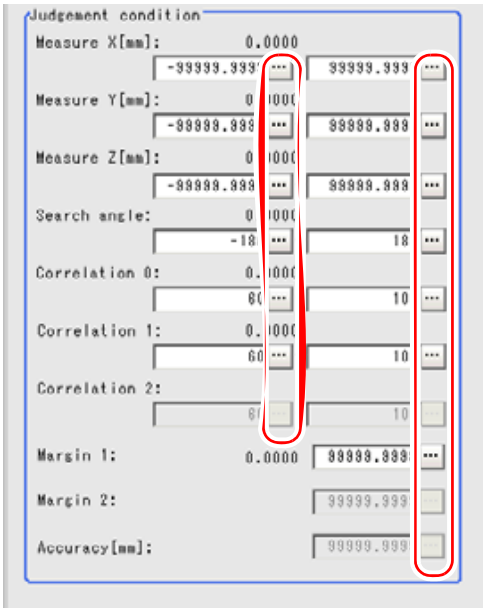
Setting Item	Set Value [Factory default]	Description
Candidate LV	0 to 100 [70]	Specify the threshold value with which to detect candidate points in a rough search. Specify a smaller value when model search results are unstable.

3 When the setting has been changed, tap [Measure] in the Detail area to verify whether measurements can be made correctly.

After the measurements, the results are reflected on the values in the "Judgement condition" area.

4 In the "Judgement condition" area, tap [...] and input a value for each item.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"



POINT

- The values displayed in the individual fields are the measurement results of the displayed image. Take these values into consideration to determine the upper and lower limits.

Table: Measurement Parameter (3D Search) - Judgement Condition

Setting Item		Set Value [Factory default]	Description
Measure X	Upper	-99999.9999 to [99999.9999]	Specify the range of X-axis shifting that is judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Measure Y	Upper	-99999.9999 to [99999.9999]	Specify the range of Y-axis shifting that is judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Measure Z	Upper	-99999.9999 to [99999.9999]	Specify the Z-axis shifting range to be judged as OK.
	Lower	[-99999.9999] to 99999.9999	
Search angle	Upper	-180 to [180]	Specify the range of angles that are judged to be OK.
	Lower	[-180] to 180	
Correlation 0 (Note 1)	Upper	0 to [100]	Specify the range of correlation values that are judged to be OK.
	Lower	0 to 100 [60]	

Table: Measurement Parameter (3D Search) - Judgement Condition

Setting Item		Set Value [Factory default]	Description
Correlation 1 (Note 1)	Upper	0 to [100]	Specify the range of correlation values that are judged to be OK.
	Lower	0 to 100 [60]	
Correlation 2 (Note 1)	Upper	0 to [100]	Specify the range of correlation values that are judged to be OK. This value can only be set when three cameras are connected.
	Lower	0 to 100 [60]	
Margin 1	Upper	0 to [99999.9999]	Allowable deviation for camera 1 relative to camera 0. Specify the allowable value for the relative camera shift that may occur after 3D coordinates are set.
Margin 2	Upper	0 to [99999.9999]	Allowable deviation for camera 2 relative to camera 0. Specify the allowable value for the relative camera shift that may occur after 3D coordinates are set.
Accuracy	Upper	0 to [99999.9999]	Specify this item only when three cameras are connected. Specify the allowable difference when the same coordinates are measured with both camera 0+1 and camera 0+2.

[Note 1]: When the Correlation value of the measurement result is 0, the judgement result will be NG regardless of the Measurement settings.

For the subsequent operations, see "3.20.1 Setting up [3D Search]" (→pg.179).

3.20.6 [Output Parameter (3D Search)]

Specify how to treat the coordinates to be output to the external device as measurement results.

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement parameters, too.

1 In the Item Tab area, tap [Output parameter].

2 Specify a value for each item.

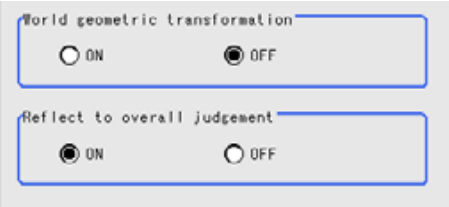


Table: Setting Values for Output Parameters

Setting Item	Set Value [Factory default]	Description
World geometric transformation	・ON ・[OFF]	Select whether to output measurement results to external devices whether in coordinates converted to the actual size (World geometric transformation: ON) or by converting them into the coordinates of camera image (World geometric transformation: OFF).
Reflect to overall judgement	・[ON] ・OFF	Select whether to reflect the judgement result of this processing unit to the overall judgement of the scene. ・Selecting "ON" reflects the judgement result of this processing unit on the overall judgement of the scene. ・Selecting "OFF" does not reflect the judgement result of this processing unit on the overall judgement of the scene.

POINT

- For world geometric transformer, see "4.6.6 Configuring 3D measurement" (→pg.46), of "User's Manual".
- The overall judgement result of the scene is output to the OR signal to be sent via the parallel interface. Also, it is displayed in the Measurement Information Display area in the upper part of the Main screen.
  "10.4.4 Time Chart" (→pg.35), of "User's Manual"
  "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"

For the subsequent operations, see "3.20.1 Setting up [3D Search]" (→pg.179).

3.20.7 Points on Measurement Test and Adjustment (3D Search)

In addition to the image from the camera, the registered model region and the detection coordinates (the cross-shaped cursor) will be displayed in the "image display" area.

In the "Detail result" area on the Main screen, you can confirm the following contents in text.
"6.3.2 Displaying Flow and Detail Result" (→pg.12), of "User's Manual"

When two cameras are connected

Table: Text Displayed (3D Search)

Item	Description
Judge	Judgement result
Measure X	X coordinate of the position where the model is detected
Measure Y	Y coordinate of the position where the model is detected
Measure Z	Z coordinate of the position where the model is detected
Angle	Angle of the position where the model is detected
Correlation 0	Correlation value with the model (camera 0)
Correlation 1	Correlation value with the model (camera 1)
Margin 1	Shift amount of camera 1 relative to camera 0

When three cameras are connected

Table: Text Displayed (3D Search)

Item	Description
Judge	Judgement result
Measure X	X coordinate of the position where the model is detected
Measure Y	Y coordinate of the position where the model is detected
Measure Z	Z coordinate of the position where the model is detected
Angle	Angle of the position where the model is detected
Correlation 0	Correlation value with the model (camera 0)
Correlation 1	Correlation value with the model (camera 1)
Correlation 2	Correlation value with the model (camera 2)
Margin 1	Shift amount of camera 1 relative to camera 0
Margin 2	Shift amount of camera 2 relative to camera 0
Accuracy	Difference made when the same coordinates are measured with two systems of camera 0+1 and camera 0+2

Points on Adjustment

Select the adjustment method referring to the following points.

When 3D search fails (executing 3-D searching of other positions)

Make adjustments as follows to improve search precision:

- Specify a larger value for "Prec.".
  " Changing Model Parameters" (→pg.182)

When the processing speed is slow

- Reduce the measurement region size in [Region setting].
  "3.20.3 [Region Setting (3D Search)]" (→pg.184)

- In [Model], reduce the size of the region registered as the model.
  "3.20.2 [Model (3D Search)]" (→pg.180)

In addition, adjust other options in the "Model parameter" area of [Model].
" Points on Adjustment" (→pg.183)

When the judgement is NG (insufficient memory):

- Reduce the measurement region size in [Region setting].
  "3.20.3 [Region Setting (3D Search)]" (→pg.184)

Reduce the amount of information necessary for measurements by making the following adjustment in the Model Parameter area of [Model].

- Set "Stab." or "Skipping angle" to a value closer to the factory default.
- Specify a smaller value for "Prec.".
  " Changing Model Parameters" (→pg.182)

POINT

- If lowering "Stab." leads to slower processing, it is likely that many candidates have been detected. In this case, specify a larger value for "Candidate LV" or "Stab."

3.20.8 When Using Measurement Results Externally (3D Search)

Values Available in Expression

When this processing unit is selected in the unit area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (3D Search)

Measurement items	Character string	Description
Judge	JG	Judgement result
Measure X	XR	X coordinate of the position where the model is detected
Measure Y	YR	Y coordinate of the position where the model is detected
Measure Z	ZR	Z coordinate of the position where the model is detected
Reference coordinate X	SX	X coordinate of the registered model's reference position
Reference coordinate Y	SY	Y coordinate of the registered model's reference position
Reference coordinate Z	SZ	Z coordinate of the reference position of the registered model
Search angle	TH	Angle of the registered model
Correlation 0	CR0	Correlation value 0 with the model (Camera0)
Correlation 1	CR1	Correlation value 1 with the model (Camera1)

Table: Values Available in Expression (3D Search)

Measurement items	Character string	Description
Correlation 2	CR2	Correlation value 2 with the model (Camera2)
Margin 1	MG1	Shift amount of camera 1 relative to camera 0
Margin 2	MG2	Shift amount of camera 2 relative to camera 0
Accuracy	AC	Difference made when the same coordinates are measured with two systems of camera 0+1 and camera 0+2

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (3D Search)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0 No judgement (unmeasured) 1: Judgement result OK -1: Judgement resultNG
5	Measure X	Get only	-99999.9999 to 99999.9999
6	Measure Y	Get only	-99999.9999 to 99999.9999
7	Measure Z	Get only	-99999.9999 to 99999.9999
8	Reference coordinate X	Get only	-99999.9999 to 99999.9999
9	Reference coordinate Y	Get only	-99999.9999 to 99999.9999
10	Reference coordinate Z	Get only	-99999.9999 to 99999.9999
11	Angle	Get only	-180 to 180
15	Correlation 0	Get only	0 to 100
25	Correlation 1	Get only	0 to 100
35	Correlation 2	Get only	0 to 100
45	Margin 1	Get only	0 to 99999.9999
46	Margin 2	Get only	0 to 99999.9999
47	Accuracy	Get only	0 to 99999.9999
103	Reflect in OR	Set/Get	O: ON 1: OFF
120	World geometric transformation	Set/Get	O: ON 1: OFF
121	Upper limit of the height measurement range	Set/Get	-99999.9999 to 99999.9999
122	Lower limit of the height measurement range	Set/Get	-99999.9999 to 99999.9999
141	Rotation	Set/Get	0: OFF 1: ON
142	Upper limit of the angle	Set/Get	-180 to 180

Table: External Reference List (3D Search)

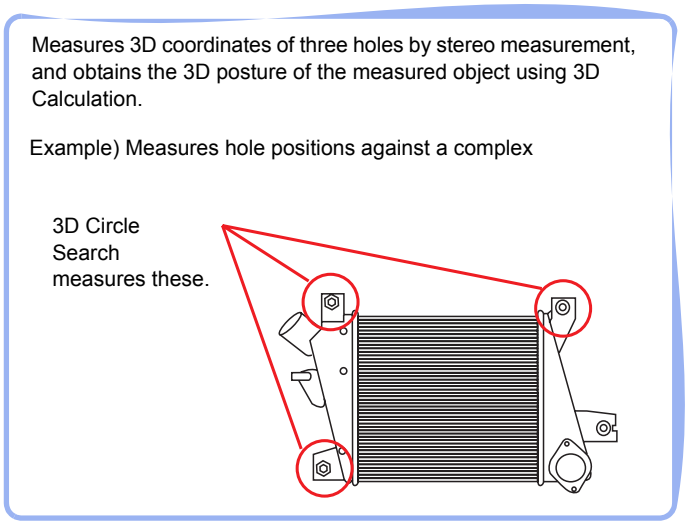
No.	Data Name	Set/Get	Data Range
143	Lower limit of the angle	Set/Get	-180 to 180
144	Skipping angle	Set/Get	1 to 30
145	Smart mode	Set/Get	0: OFF 1: ON
147	Stab. (Stability)	Set/Get	1 to 15
148	Prec. (Precision)	Set/Get	1 to 3
149	Reference coordinate X	Set/Get	-99999.9999 to 99999.9999
150	Reference coordinate Y	Set/Get	-99999.9999 to 99999.9999
151	Reference coordinate Z	Set/Get	-99999.9999 to 99999.9999
152	Candidate LV	Set/Get	0 to 100
153	Upper limit of Position X	Set/Get	-99999.9999 to 99999.9999
154	Lower limit of Position X	Set/Get	-99999.9999 to 99999.9999
155	Upper limit of Position Y	Set/Get	-99999.9999 to 99999.9999
156	Lower limit of Position Y	Set/Get	-99999.9999 to 99999.9999
157	Upper limit of Position Z	Set/Get	-99999.9999 to 99999.9999
158	Lower limit of Position Z	Set/Get	-99999.9999 to 99999.9999
159	Upper limit of the angle	Set/Get	-180 to 180
160	Lower limit of the angle	Set/Get	-180 to 180
161	Upper limit of correlation 0	Set/Get	0 to 100
162	Lower limit of correlation 0	Set/Get	0 to 100
163	Upper limit of correlation 1	Set/Get	0 to 100
164	Lower limit of correlation 1	Set/Get	0 to 100
165	Upper limit of correlation 2	Set/Get	0 to 100
166	Lower limit of correlation 2	Set/Get	0 to 100
167	Upper limit of margin 1	Set/Get	0 to 99999.9999
168	Upper limit of margin 2	Set/Get	0 to 99999.9999
169	Upper limit of the accuracy evaluated value	Set/Get	0 to 99999.9999

3.21 3D Circle Search

This processing item is for 3D measurement only.
This processing item searches the input image for a circle to measure, and measures the correlation value (similarity) and 3D coordinates.

Used for the following case

- When obtaining the 3D posture (x, y, z, θ, ϕ, and ψ) of a measured object



List of 3D Circle Search Items

3D Circle Search items are explained below.

Table: List of 3D Circle Search Items

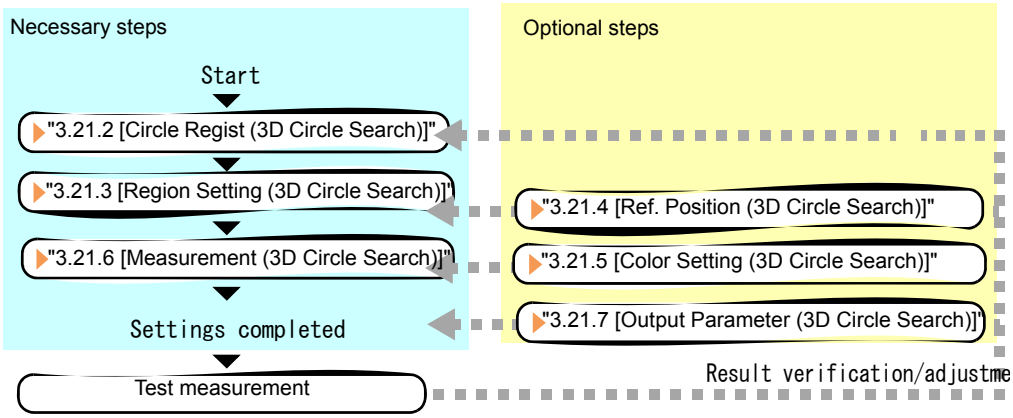
Item Name	Description
Edge extraction	This item registers the size of the circle to search for. "3.21.2 [Circle Regist (3D Circle Search)]" (→pg.198)
Region setting	This item specifies the region to be measured. Instead of measuring the entire input image, narrowing the measurement area shortens the processing time. "3.21.3 [Region Setting (3D Circle Search)]" (→pg.199)
Color Setting	This item specifies the circle color. Specify whether the circle color is darker or lighter than the background. Do not set this item if the color is not determined to be black or white. "3.21.5 [Color Setting (3D Circle Search)]" (→pg.202)
Ref.position	This item can be changed if necessary. Usually, the central position of the registered region is specified as the reference position. "3.21.4 [Ref. Position (3D Circle Search)]" (→pg.201)

Table: List of 3D Circle Search Items

Item Name	Description
Measurement	This item specifies the judgement condition for measurement results. "3.21.6 [Measurement (3D Circle Search)]" (→pg.203)
Output parameter	This item can be changed if necessary. Usually, the factory default value can be used. Use the Output parameter to specify how to treat the coordinates. "3.21.7 [Output Parameter (3D Circle Search)]" (→pg.205)

3.21.1 Setting up [3D Circle Search]

The setting procedure for [3D Circle Search] is as follows:



POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1. In the Edit Flow window, tap [3D Circle Search].
   The ProcItem Setting window is displayed.
   "1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2. The window opens with [Edge extraction] selected, and register a search circle.
   "3.21.2 [Circle Regist (3D Circle Search)]" (→pg.198)

3. In the "Item tab" area, tap [Region setting] and specify the measurement region.
   "3.21.3 [Region Setting (3D Circle Search)]" (→pg.199)

4. In the "Item tab" area, tap [Measurement] and specify the judgement condition for OK.
   "3.21.6 [Measurement (3D Circle Search)]" (→pg.203)

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement parameters, too.

5 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

6 Perform a test measurement.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

7 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

When "NG" is displayed, verify measurement results and make adjustments if necessary.

"3.21.8 Points on Measurement Test and Adjustment (3D Circle Search)" (→pg.207)

3.21.2 [Circle Regist (3D Circle Search)]

This item registers the size of the circle to search for.

1 In the "Item tab" area, tap [Circle regist].

When setting a new circle, you do not need to tap [Circle regist].

2 Specify the range to search by using the Drawing tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"

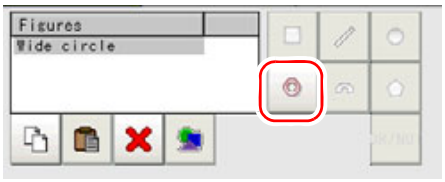


Table: Drawing Tools Available for Model Registration (3D Circle Search)

Available objects to be drawn	Drawing Tools
Circumference	

3 In the "Figure setting" area, tap [OK].

The circle to search for is registered.

4 If necessary, tap [Edge extraction] to specify values.

" Extracting Edges" (→pg.199)

For the subsequent operations, see "3.21.1 Setting up [3D Circle Search]" (→pg.197).

Extracting Edges

This item can be changed if necessary. Use this item when specifying the edge extraction parameters.

1 In the "Item tab" area, tap [Edge extraction].

2 In the "Edge extraction setting" area, tap [...] or [▼] for each of the following items and specify a value respectively.

The "Edge extraction level" value can be specified by dragging the slider or tapping one of the buttons at both ends of the slider.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

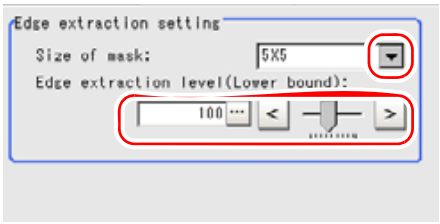


Table: Model Registration (3D Circle Search) - Edge Extraction Setting

Setting Item	Set Value [Factory default]	Description
Size of mask	・3x3 ・[5x5] ・7x7 ・9x9	Select the range of pixels which are used to extract the edge. With a larger mask size, search is less affected by variation in pixels.
Edge extraction level (Lower bound)	0 to 255 [100]	Specify the background suppressing level for an image of which the edge is extracted. Adjust the edge level when the edge is hard to see, due to low contrast with the background, or when unnecessary background noise should be removed.

3.21.3 [Region Setting (3D Circle Search)]

Use a rectangle to specify the measurement region for [3D Circle Search].

1 In the "Item tab" area, tap [Region setting].

2 In the "Range of height measurement" area, tap [...] for each item and specify a height range of measurement.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

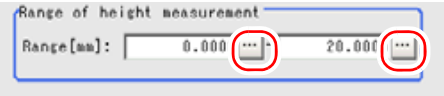


Table: Region Setting - Height Measurement Condition

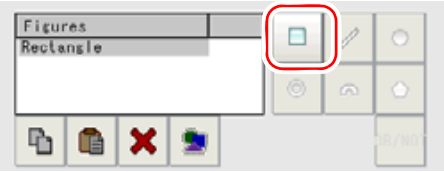
Setting Item		Set Value [Factory default]	Description
Range	Upper	-99999.9999 to 99999.9999 [0.0000]	Specify a height range of measurement.
	Lower	-99999.9999 to 99999.9999 [20.0000]	

3 Tap [Edit].

The Figure Setting area is displayed.

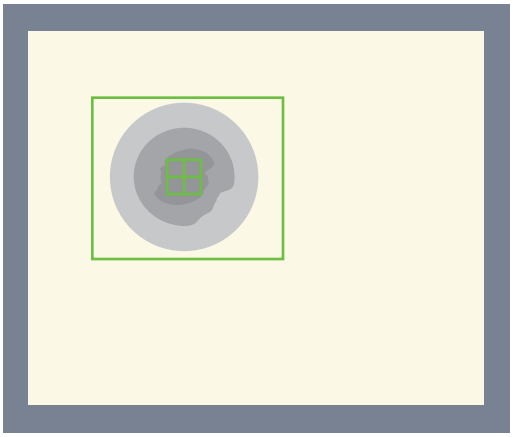
4 Specify a region where the model is searched by using the Drawing tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"



5 In the "Figure setting" area, tap [OK].

The measurement range is registered and displayed in the "Image display" area.



For the subsequent operations, see "3.21.1 Setting up [3D Circle Search]" (→pg.197).

3.21.4 [Ref. Position (3D Circle Search)]

This item can be changed if necessary. The reference measurement is executed at the same time as the measurement region is specified, with the reference position set automatically. This item can be used to change the reference position to any desired position.
For the reference position, see "11.4 Terminology" (→pg.12), of "User's Manual".

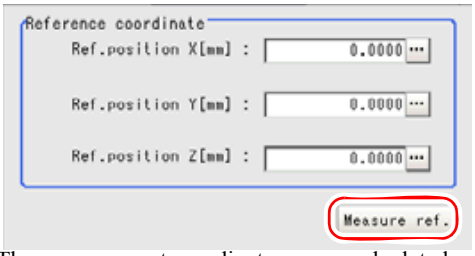
1 In the "Item tab" area, tap [Ref.position].

2 Set the reference position.

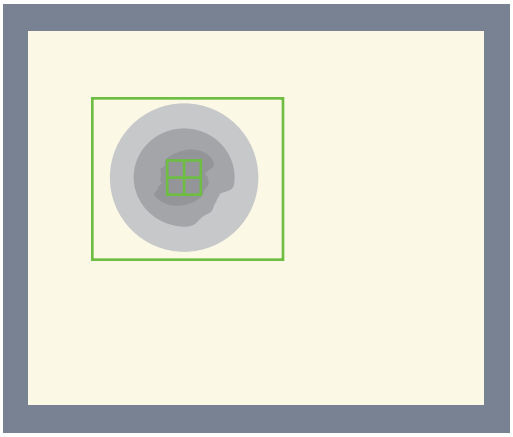
There are two methods to set the reference position: by performing the reference measurement while the image to be measured is displayed, or by specifying the reference coordinates directly.

Measuring the image to set the reference position

While the image to be measured is displayed, tap [Measure ref.].



The measurement coordinates are re-calculated, and the cross-shaped cursor is displayed in the "Reference coordinate" area.



Specifying the reference coordinates directly

Specify values for "Ref. position X", "Ref. position Y", and "Ref. position Z".
In the Reference Coordinate area, tap [...] for each item and specify values for your desired reference coordinates (the coordinates of the reference position).
How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

POINT

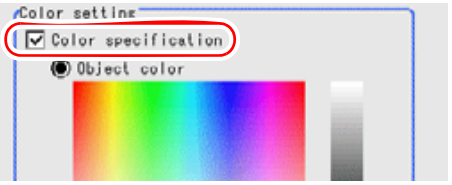
- Note the following when the reference coordinates are specified directly:
  - The cross-shaped cursor will not be displayed in the "Reference coordinate" area.
  - Although the X-, Y-, and Z-coordinates shown on the screen are the input values (mm), the X- and Y-coordinates which are referenced as measurement coordinates in result display processing items, etc. are the X- and Y-coordinate values (in pixels) on the Camera 0-side or Camera 2-side. These coordinate values do not change even if the reference coordinate values change.

3.21.5 [Color Setting (3D Circle Search)]

Set the circle color and background color. Specify whether the circle color is darker or lighter than the background color.

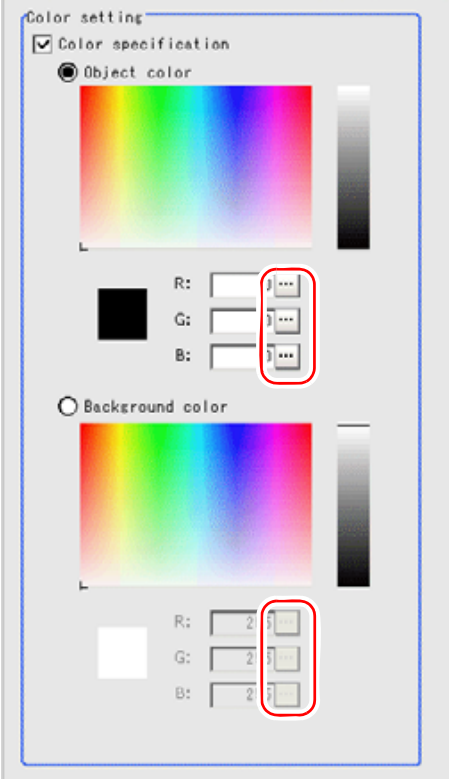
1 In the "Item tab" area, tap [Color Setting].

2 If necessary, check "Color specification" in the "Color setting" area.



3 Specify a color.

In the "Color setting" area, tap [...] for "R" (red), "G" (green), and "B" (blue), and specify a value for each color. Specify the circle color and the background color separately.
How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"



Each target color is set in the "Color setting" area.

POINT

- In the "Image display" area, you can specify the color area you want to detect by dragging the cursor from the upper left corner to the lower right corner of that area.

3.21.6 [Measurement (3D Circle Search)]

Specify the judgement condition for measurement results.

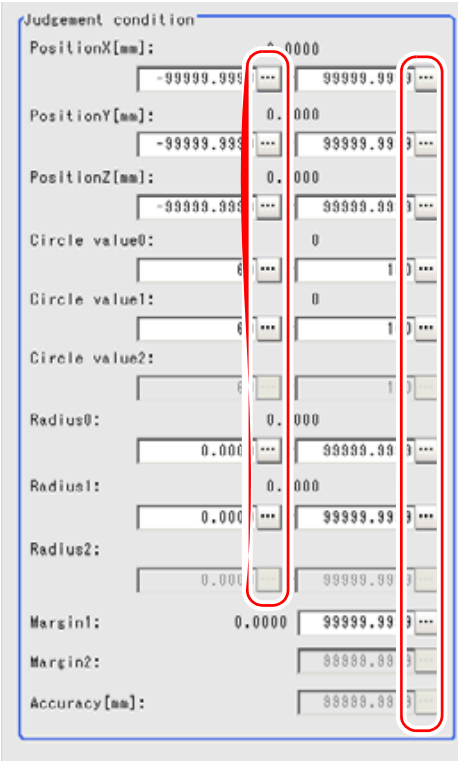
1 In the "Item tab" area, tap [Measurement].

2 When the setting has been changed, tap [Measure] in the "Detail" area to verify whether measurements can be made correctly.

After the measurements, the results are reflected on the values in the "Judgement condition" area.

3 In the "Judgement condition" area, tap [...] and input a value for each item.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"



POINT

- The values displayed in the individual fields are the measurement results of the displayed image. Take these values into consideration to determine the upper and lower limits.

Table: Measurement (3D Circle Search) - Judgement Condition

Setting Item		Set Value [Factory default]	Description
Position X	Upper	-99999.9999 to [99999.9999]	Specify the upper and lower limits for judging the 3D X-coordinate.
	Lower	[-99999.9999] to 99999.9999	
Position Y	Upper	-99999.9999 to [99999.9999]	Specify the upper and lower limits for judging the 3D Y-coordinate.
	Lower	[-99999.9999] to 99999.9999	
Position Z	Upper	-99999.9999 to [99999.9999]	Specify the upper and lower limits for judging the 3D Z-coordinate.
	Lower	[-99999.9999] to 99999.9999	

Table: Measurement (3D Circle Search) - Judgement Condition

Setting Item		Set Value [Factory default]	Description
Circle value 0	Upper	60 to [100]	Specify the upper and lower limits for judging the camera 0 image circle evaluated value.
	Lower	[60] to 100	
Circle value 1	Upper	60 to [100]	Specify the upper and lower limits for judging the camera 1 image circle evaluated value.
	Lower	[60] to 100	
Circle value 2	Upper	60 to [100]	Specify the upper and lower limits for judging the camera 2 image circle evaluated value. (Settable only when three cameras are connected)
	Lower	[60] to 100	
Radius 0	Upper	0 to [99999.9999]	Specify the upper and lower limits for judging the radius on the camera 0 image.
	Lower	[0] to 99999.9999	
Radius 1	Upper	0 to [99999.9999]	Specify the upper and lower limits for judging the radius on the camera 1 image.
	Lower	[0] to 99999.9999	
Radius 2	Upper	0 to [99999.9999]	Specify the upper and lower limits for judging the radius on the camera 2 image. (Settable only when three cameras are connected)
	Lower	[0] to 99999.9999	
Margin 1	Upper	0 to [99999.9999]	Specify the upper limit for judging the vertical length to the epipolar line of camera 1.
Margin 2	Upper	0 to [99999.9999]	Specify the upper limit for judging the vertical length to the epipolar line of camera 2. (Settable only when three cameras are connected)
Accuracy	Upper	0 to [99999.9999]	Specify the upper limit for judging the accuracy evaluated value. (Settable only when three cameras are connected)

For the subsequent operations, see "3.21.1 Setting up [3D Circle Search]" (→pg.197).

3.21.7 [Output Parameter (3D Circle Search)]

Specify how to treat the coordinates to be output to the external device as measurement results.

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement parameters, too.

1 In the Item Tab area, tap [Output parameter].

2 Specify a value for each item.

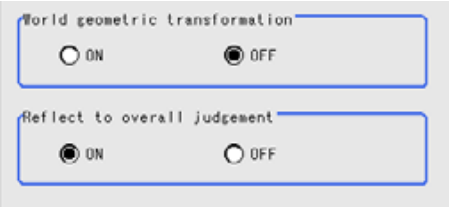


Table: Setting Values for Output Parameters

Setting Item	Set Value [Factory default]	Description
World geometric transformation	・ON ・[OFF]	Select whether to output measurement results to external devices whether in coordinates converted to the actual size (World geometric transformation: ON) or by converting them into the coordinates of camera image (World geometric transformation: OFF).
Reflect to overall judgement	・[ON] ・OFF	Select whether to reflect the judgement result of this processing unit to the overall judgement of the scene. ・Selecting "ON" reflects the judgement result of this processing unit on the overall judgement of the scene. ・Selecting "OFF" does not reflect the judgement result of this processing unit on the overall judgement of the scene.

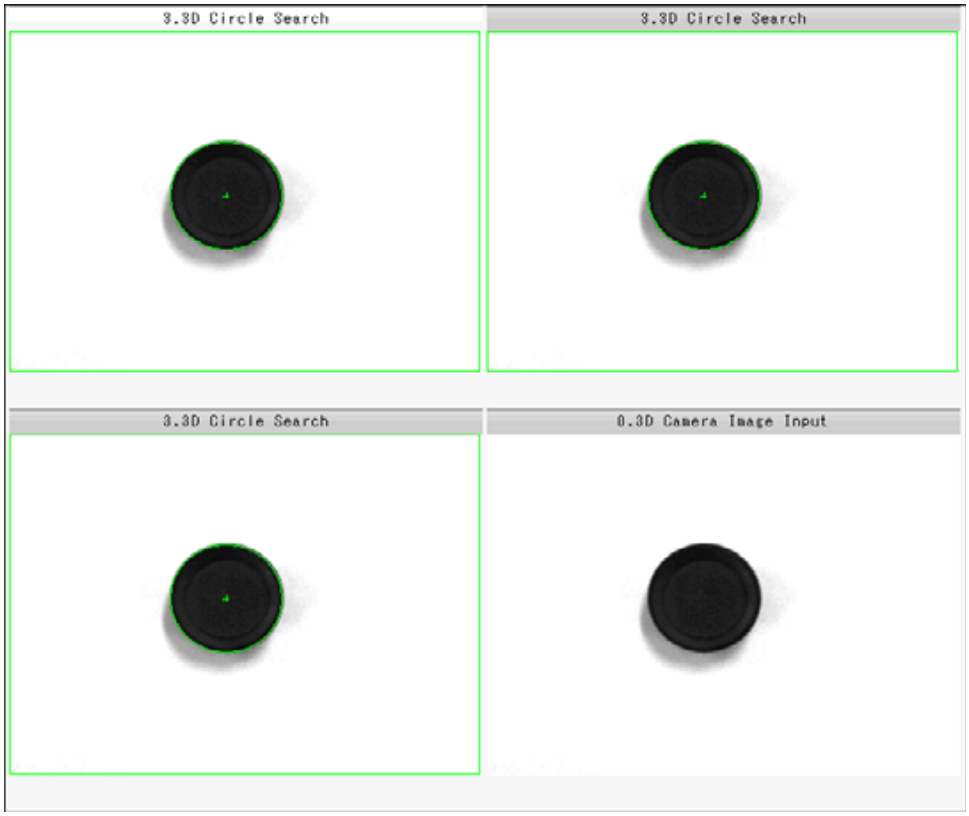
POINT

- For world geometric transformer, see "4.6.6 Configuring 3D measurement" (→pg.46), of "User's Manual".
- The overall judgement result of the scene is output to the OR signal to be sent via the parallel interface. Also, it is displayed in the Measurement Information Display area in the upper part of the Main screen.
  "10.4.4 Time Chart" (→pg.35), of "User's Manual"
  "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"

For the subsequent operations, see "3.21.1 Setting up [3D Circle Search]" (→pg.197).

3.21.8 Points on Measurement Test and Adjustment (3D Circle Search)

In addition to the image from the camera, the registered model region and the search coordinates (cross-shaped cursor) will also be displayed in the "Image display" area.



In the "Detail result" area on the Main screen, you can confirm the following contents in text.
"6.3.2 Displaying Flow and Detail Result" (→pg.12), of "User's Manual"

When two cameras are connected

Table: Text Displayed (3D Circle Search)

Item	Description
Judge	Judgement result
Measured coordinate X	X-coordinate of the position where the search circle is detected
Measured coordinate Y	Y-coordinate of the position where the search circle is detected
Measured coordinate Z	Z-coordinate of the position where the search circle is detected
Circle value 0	Circle evaluated value in camera 0or 2 image
Circle value 1	Circle evaluated value in camera 1or 3 image
Radius 0	Radius in camera 0or 2 image
Radius 1	Radius in camera 1or 3 image

Table: Text Displayed (3D Circle Search)

Item	Description
Margin 1	Allowable deviation for camera 1 relative to camera 0. This item specifies the allowable value for the relative camera shift that may occur after 3D coordinates are set.

When three cameras are connected

Table: Text Displayed (3D Circle Search)

Item	Description
Judge	Judgement result
Measured coordinate X	X coordinate of the position where the search circle is detected
Measured coordinate Y	Y coordinate of the position where the search circle is detected
Measured coordinate Z	Z coordinate of the position where the search circle is detected
Circle value 0	Camera 0 image circle evaluated value
Circle value 1	Camera 1 image circle evaluated value
Circle value 2	Camera 2 image circle evaluated value
Radius 0	Radius on the camera 0 image
Radius 1	Radius on the camera 1 image
Radius 2	Radius in camera 2 image
Margin 1	Allowable deviation for camera 1 relative to camera 0
Margin 2	Allowable deviation for camera 2 relative to camera 0
Accuracy	Specify this item only when three cameras are connected. This item represents the allowable difference when the same coordinates are measured with two systems: camera 0+1 and camera 0+2.

3.21.9 When Using Measurement Results Externally (3D Circle Search)

Values Available in Expression

When this processing unit is selected in the unit area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (3D Circle Search)

Measurement items	Character string	Description
Judge	JG	Judgement result
Measured coordinate X	XR	X coordinate of the position where the model is detected

Table: Values Available in Expression (3D Circle Search)

Measurement items	Character string	Description
Measured coordinate Y	YR	Y coordinate of the position where the model is detected
Measured coordinate Z	ZR	Z coordinate of the position where the model is detected
Reference coordinate X	SX	X coordinate of the reference position of the registered model
Reference coordinate Y	SY	Y coordinate of the reference position of the registered model
Reference coordinate Z	SZ	Z coordinate of the reference position of the registered model
Circle value 0	CR0	Circle evaluated value in camera 0
Radius 0	R0	Radius of camera 0 circle
Circle value 1	CR1	Circle evaluated value in camera 1
Radius 1	R1	Radius of camera 0 circle
Circle value 2	CR2	Circle evaluated value in camera 2
Radius 2	R2	Radius of camera 0 circle
Margin 1	MG1	Shift amount of camera 1 relative to camera 0
Margin 2	MG2	Shift amount of camera 2 relative to camera 0
Accuracy	AC	Difference made when the same coordinates are measured with two systems of camera 0+1 and camera 0+2

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (3D Circle Search)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Measured coordinate X	Get only	-99999.9999 to 99999.9999
6	Measured coordinate Y	Get only	-99999.9999 to 99999.9999
7	Measured coordinate Z	Get only	-99999.9999 to 99999.9999
8	Reference coordinate X	Get only	-99999.9999 to 99999.9999
9	Reference coordinate Y	Get only	-99999.9999 to 99999.9999
10	Reference coordinate Z	Get only	-99999.9999 to 99999.9999
15	Circle value 0	Get only	0 to 100
18	Radius of circle R0	Get only	-99999.9999 to 99999.9999
25	Circle value 1	Get only	0 to 100

Table: External Reference List (3D Circle Search)

No.	Data Name	Set/Get	Data Range
28	Radius of circle R1	Get only	-99999.9999 to 99999.9999
35	Circle value 2	Get only	0 to 100
38	Radius of circle R2	Get only	-99999.9999 to 99999.9999
45	Margin 1	Get only	0 to 99999.9999
46	Margin 2	Get only	0 to 99999.9999
47	Accuracy	Get only	0 to 99999.9999
103	Reflect in OR	Set/Get	O: ON 1: OFF
120	World geometric transformation	Set/Get	O: ON 1: OFF
121	Upper limit of the height measurement range	Set/Get	-99999.9999 to 99999.9999
122	Lower limit of the height measurement range	Set/Get	-99999.9999 to 99999.9999
140	Reference coordinate X	Set/Get	-99999.9999 to 99999.9999
141	Reference coordinate Y	Set/Get	-99999.9999 to 99999.9999
142	Reference coordinate Z	Set/Get	-99999.9999 to 99999.9999
143	Edge color specification	Set/Get	0: NO 1: YES
144	Circle color R	Set/Get	0 to 255
145	Circle color G	Set/Get	0 to 255
146	Circle color B	Set/Get	0 to 255
147	Background color R	Set/Get	0 to 255
148	Background color G	Set/Get	0 to 255
149	Background color B	Set/Get	0 to 255
150	Mask size	Set/Get	0: 3x3 1: 5x5 2: 7x7 3: 9x9
151	Edge extraction level (lower limit)	Set/Get	0 to 255
153	Upper limit of 3D position X	Set/Get	-99999.9999 to 99999.9999
154	Lower limit of 3D position X	Set/Get	-99999.9999 to 99999.9999
155	Upper limit of 3D position Y	Set/Get	-99999.9999 to 99999.9999
156	Lower limit of 3D position Y	Set/Get	-99999.9999 to 99999.9999

Table: External Reference List (3D Circle Search)

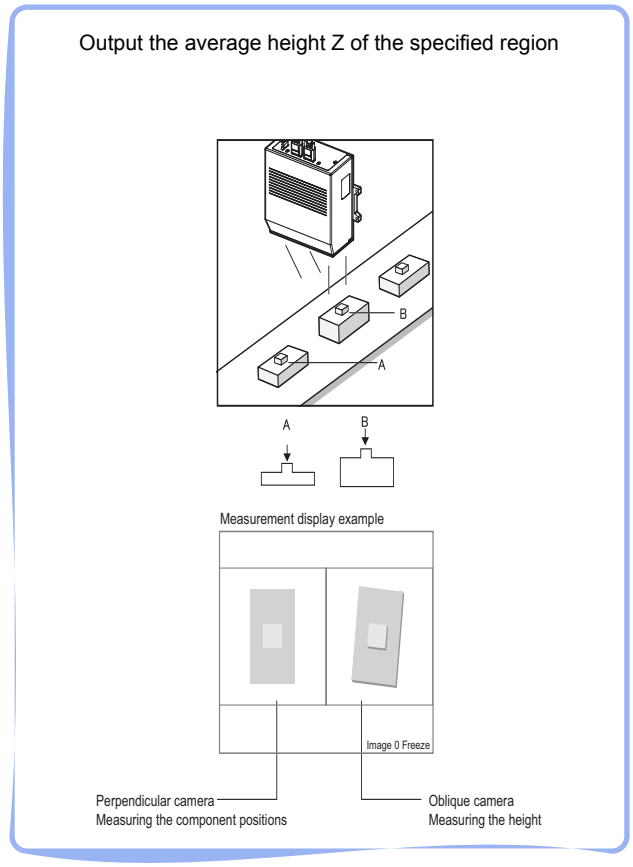
No.	Data Name	Set/Get	Data Range
157	Upper limit of 3D position Z	Set/Get	-99999.9999 to 99999.9999
158	Lower limit of 3D position Z	Set/Get	-99999.9999 to 99999.9999
159	Upper limit of camera 0 circle evaluated value	Set/Get	0 to 100
160	Lower limit of camera 0 circle evaluated value	Set/Get	0 to 100
161	Upper limit of camera 1 circle evaluated value	Set/Get	0 to 100
162	Lower limit of camera 1 circle evaluated value	Set/Get	0 to 100
163	Upper limit of camera 2 circle evaluated value	Set/Get	0 to 100
164	Lower limit of camera 2 circle evaluated value	Set/Get	0 to 100
165	Upper limit of radius 0	Set/Get	0 to 99999.9999
166	Lower limit of radius 0	Set/Get	0 to 99999.9999
167	Upper limit of radius 1	Set/Get	0 to 99999.9999
168	Lower limit of radius 1	Set/Get	0 to 99999.9999
169	Upper limit of radius 2	Set/Get	0 to 99999.9999
170	Lower limit of radius 2	Set/Get	0 to 99999.9999
171	Upper limit of the camera 1 margin	Set/Get	0 to 99999.9999
172	Upper limit of the camera 2 margin	Set/Get	0 to 99999.9999
173	Upper limit of the accuracy evaluated value	Set/Get	0 to 99999.9999

3.22 3D Height

This processing item is for 3D measurement only.
This processing item obtains the average height of the specified rectangle region by stereo measurement.

Used for the following case

- When measuring the height of a measured object



List of 3D Height Items

3D Height items are explained below.

Table: List of 3D Height Items

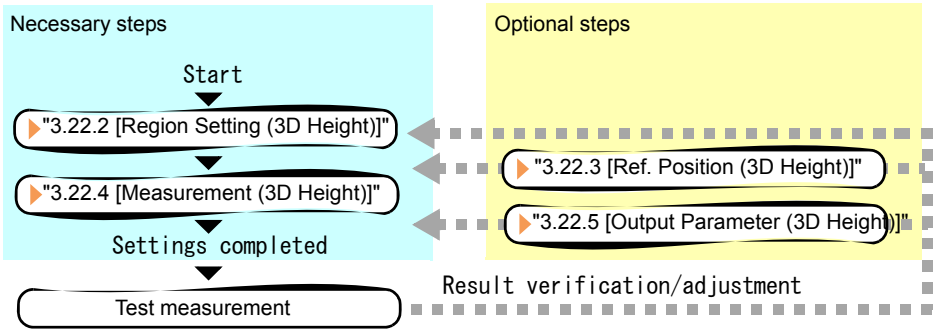
Item Name	Description
Region setting	This item registers a model to search for. "3.22.2 [Region Setting (3D Height)]" (→pg.214)

Table: List of 3D Height Items

Item Name	Description
Ref.position	This item can be changed if necessary. Specify the reference position within the camera's field of view. "3.22.3 [Ref. Position (3D Height)]" (→pg.216)
Measurement	This item specify the judgement condition for measurement results. Specify the criteria to judge the measurement result if its X/Y/Z-coordinates and its correlation with the model are OK. "3.22.4 [Measurement (3D Height)]" (→pg.218)
Output parameter	This item can be changed if necessary. Usually, the factory default value can be used. Use the Output parameter to specify how to treat the coordinates. "3.22.5 [Output Parameter (3D Height)]" (→pg.220)

3.22.1 Setting up [3D Height]

The setting procedure for [3D Height] is as follows:



POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 In the Edit Flow window, tap [3D Height].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 The window opens with [Region setting] selected and register the characteristics of the measurement target as a model.

"3.22.2 [Region Setting (3D Height)]" (→pg.214)

3 In the "Item tab" area, tap [Measurement] and specify the judgement condition for OK.

"3.22.4 [Measurement (3D Height)]" (→pg.218)

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement parameters, too.

4 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

5 Perform a test measurement.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

6 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

When "NG" is displayed, verify measurement results and make adjustments if necessary.

"3.22.6 Points on Measurement Test and Adjustment (3D Height)" (→pg.221)

3.22.2 [Region Setting (3D Height)]

Registers a model to search for. Use a rectangle to specify the measurement region for [3D Height].

1 In the "Item tab" area, tap [Region setting].

2 In the "Range of height measurement" area, tap [...] for each item and specify a height range of measurement.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

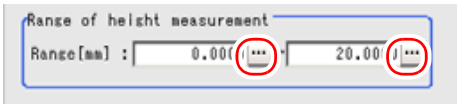


Table: Region Setting (3D Height) - Height Measurement Condition

Setting Item		Set Value [Factory default]	Description
Range	Upper	-99999.9999 to 99999.9999 [0.0000]	Specify a height range of measurement.
	Lower	-99999.9999 to 99999.9999 [20.0000]	

3 In the "Model parameter" area, specify a value for "Stab." and "Prec." by dragging the slider.

Fine adjustment can be made by tapping one of the buttons at the ends of the slider.

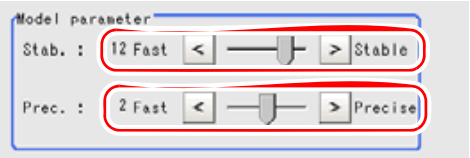
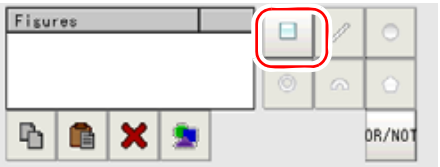


Table: Region Setting (3D Height)

Setting Item	Set Value [Factory default]	Description
Stab. (Stability)	1 to 15 ・Cameras with 640x480 pixels or less: [12] ・Cameras with more than 640x480 pixels: [9]	Specify the stability of detection. A larger value increases stability. A smaller value speeds up processing. If lowering stability leads to slower processing, it is likely that many candidates have been detected. In this case, specify a larger value for "Candidate LV" or "Stab.".
Prec. (Precision)	1 to 3 [2]	Specify the position precision of the measurement coordinates. A larger value increases precision, and a smaller value speeds up processing.

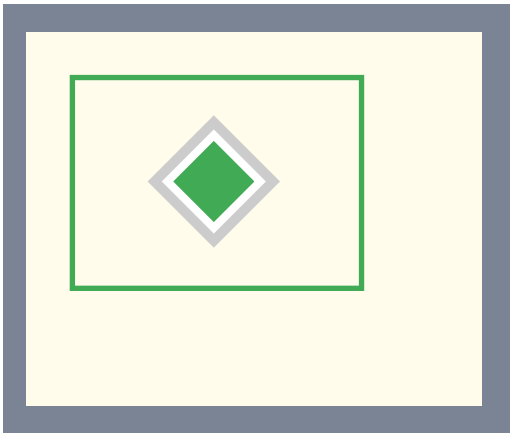
4 Specify the measurement area using the Drawing Tools.

"1.9 Setting Figures" (→pg.25), of "User's Manual"



5 In the "Figure setting" area, tap [OK].

The measurement range is registered and displayed in the "Image display" area.



For adjustments, see also "5.4 Points on Adjustment" (→pg.11), of "User's Manual".

Points on Adjustment

To improve measurement results, make adjustments as described below.
For adjustments, see also "5.4 Points on Adjustment" (→pg.11), of "User's Manual".

When measurement results are unstable

- If the model image consists of detailed figures, specify a larger value for "Stab.".

When the processing speed is slow

- If the model image is a simple figure or a large figure, specify a smaller value for "Stab.".

For other adjustment methods, see " Shortening Measurement Time by Setting Processing Item" (→pg.11), of "User's Manual".

For the subsequent operations, see "3.22.1 Setting up [3D Height]" (→pg.213).

3.22.3 [Ref. Position (3D Height)]

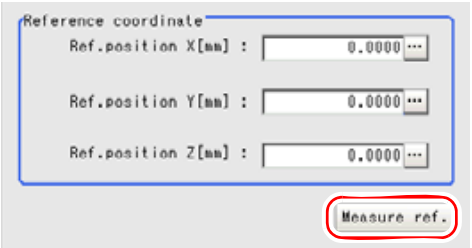
This item can be changed if necessary. The reference measurement is executed at the same time the measurement region is specified, with the reference position set automatically. This item can be used to change the reference position to any desired position.
For the reference position, see "11.4 Terminology" (→pg.12), of "User's Manual".

1 In the "Item tab" area, tap [Ref.position].

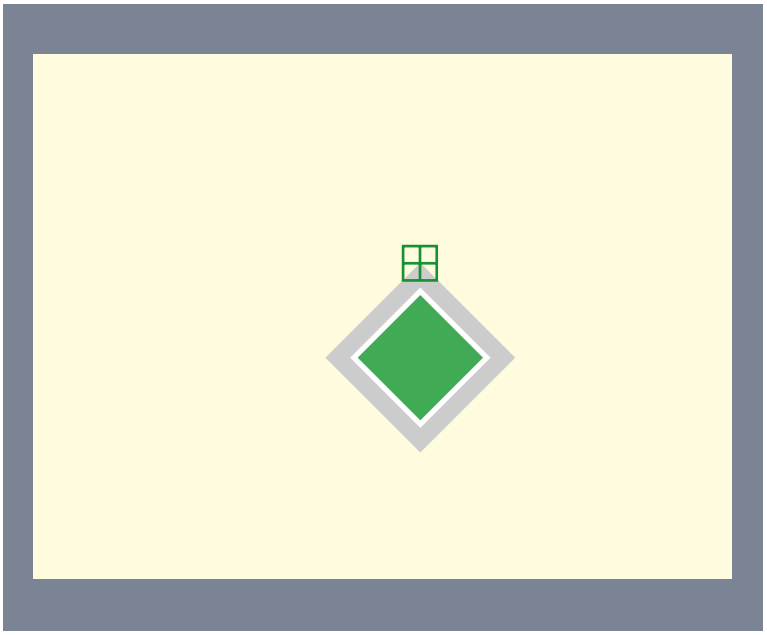
2 Set the reference position.
There are two methods to set the reference position: performing the reference measurement while the image to be measured is displayed, or specifying the reference coordinates directly.

Measuring the image to set the reference position

While the image to be measured is displayed, tap [Measure ref.].



The measurement coordinates are re-calculated, and the cross-shaped cursor will be displayed in the "Reference coordinate" area.

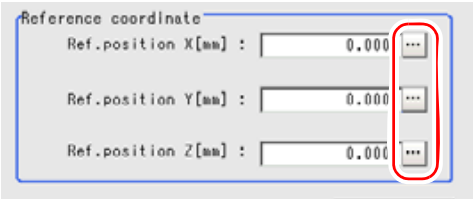


Specifying the reference coordinates directly

Specify a value for "Ref. position X", "Ref. position Y", and "Ref. position Z".

In the Reference Coordinate area, tap [...] for each item and specify values for your desired reference coordinates (the coordinates of the reference position).

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"



POINT

- Note the following when the reference coordinates are specified directly:
  - The cross-shaped cursor will not be displayed in the "Reference coordinate" area.

- Although the X-, Y-, and Z-coordinates in the window show the input values (mm), X- and Y-coordinates which are referenced as measurement coordinates from result display processing item, etc. are the X- and Y-coordinate values (in pixels) on the camera-0 side or camera-2 side. These coordinate values will not change even when reference coordinate values change.

3.22.4 [Measurement (3D Height)]

Specify the judgement condition for measurement results. Specify the criteria to judge the measurement results of X, Y, and Z coordinates and their correlation with the model as OK.

1 In the "Item tab" area, tap [Measurement].

2 In the "Detail" area, tap [...] for "Candidate LV" and specify a value.

The value can also be adjusted by tapping [<] and [>].
How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"

Table: Measurement (3D Height)

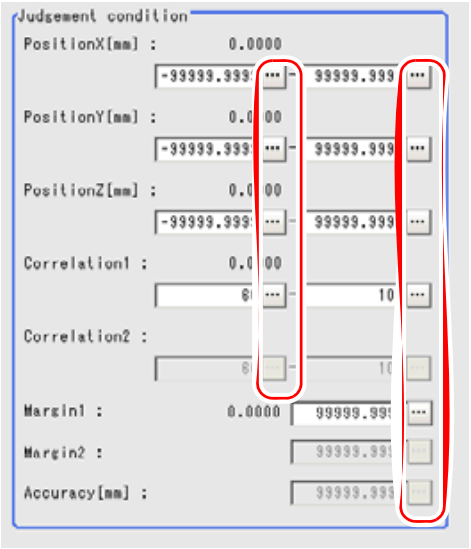
Setting Item	Set Value [Factory default]	Description
Candidate LV	0 to 100 [70]	Specify the threshold value with which to detect candidate points in a rough search. Specify a smaller value when model search results are unstable.

3 When the setting has been changed, tap [Measure] in the "Detail" area to verify whether measurements can be made correctly.

After the measurements, the results are reflected on the values in the "Judgement condition" area.

4 In the "Judgement condition" area, tap [...] and input a value for each item.

How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"



POINT

- The values displayed in the individual fields are the measurement results of the displayed image. Take these values into consideration to determine the upper and lower limits.

Table: Measurement (3D Height) - Judgement Condition

Setting Item		Set Value [Factory default]	Description
Position X	Upper	-99999.9999 to [99999.9999]	Specify the range of X-axis shifting that is judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Position Y	Upper	-99999.9999 to [99999.9999]	Specify the range of Y-axis shifting that is judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Position Z	Upper	-99999.9999 to [99999.9999]	Specify the range of Z-axis shifting that is judged to be OK.
	Lower	[-99999.9999] to 99999.9999	
Correlation 1 (Note 1)	Upper	0 to [100]	Specify the range of correlation values that are judged to be OK.
	Lower	0 to 100 [60]	
Correlation 2 (Note 1)	Upper	0 to [100]	Specify the range of correlation values that are judged to be OK. This can only be set when three cameras are connected.
	Lower	0 to 100 [60]	

Table: Measurement (3D Height) - Judgement Condition

Setting Item		Set Value [Factory default]	Description
Margin 1	Upper	0 to [9999.9999]	Allowable deviation for camera 1 relative to camera 0. This item specifies the allowable value for the relative camera shift that may occur after 3D coordinates are set.
Margin 2	Upper	0 to [9999.9999]	Allowable deviation for camera 2 relative to camera 0. This item specifies the allowable value for the relative camera shift that may occur after 3D coordinates are set.
Accuracy	Upper	0 to [9999.9999]	Set only when three cameras are connected. This item specifies the allowable difference when the same coordinates are measured with both camera 0+1 and camera 0+2.

[Note 1]: When the Correlation value of the measurement result is 0, the judgement result will be NG regardless of the Measurement settings.

For the subsequent operations, see "3.22.1 Setting up [3D Height]" (→pg.213).

3.22.5 [Output Parameter (3D Height)]

Specify how to treat the coordinates to be output to the external device as measurement results.

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement parameters, too.

1 In the Item Tab area, tap [Output parameter].

2 Specify a value for each item.

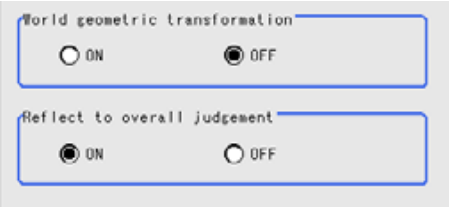


Table: Setting Values for Output Parameters

Setting Item	Set Value [Factory default]	Description
World geometric transformation	・ON ・[OFF]	Select whether to output measurement results to external devices whether in coordinates converted to the actual size (World geometric transformation: ON) or by converting them into the coordinates of camera image (World geometric transformation: OFF).
Reflect to overall judgement	・[ON] ・OFF	Select whether to reflect the judgement result of this processing unit to the overall judgement of the scene. ・Selecting "ON" reflects the judgement result of this processing unit on the overall judgement of the scene. ・Selecting "OFF" does not reflect the judgement result of this processing unit on the overall judgement of the scene.

POINT

- For world geometric transformer, see "4.6.6 Configuring 3D measurement" (→pg.46), of "User's Manual".
- The overall judgement result of the scene is output to the OR signal to be sent via the parallel interface. Also, it is displayed in the Measurement Information Display area in the upper part of the Main screen.
  "10.4.4 Time Chart" (→pg.35), of "User's Manual"
  "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"

For the subsequent operations, see "3.22.1 Setting up [3D Height]" (→pg.213).

3.22.6 Points on Measurement Test and Adjustment (3D Height)

In addition to the image from the camera, the registered model and the detection coordinates (the cross-shaped cursor) will also be displayed in the "Image display" area.

In the "Detail result" area on the Main screen, you can confirm the following contents in text.
"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

When two cameras are connected

Table: Text Displayed (3D Height)

Item	Description
Judge	Judgement result
Position X [mm]	X coordinate of the position where the model is detected
Position Y [mm]	Y coordinate of the position where the model is detected
Position Z [mm]	Z coordinate of the position where the model is detected
Correlation 1	Correlation value with the model (camera 1)
Margin 1	Shift amount of camera 1 relative to camera 0

When three cameras are connected

Table: Text Displayed (3D Height)

Item	Description
Judge	Judgement result
Measured coordinate X	X coordinate of the position where the model is detected
Measured coordinate Y	Y coordinate of the position where the model is detected
Measure Z	Z coordinate of the position where the model is detected
Correlation 1	Correlation value with the model (camera 1)
Correlation 2	Correlation value with the model (camera 2)
Margin 1	Shift amount of camera 1 relative to camera 0
Margin 2	Shift amount of camera 2 relative to camera 0
Accuracy	Difference made when the same coordinates are measured with two systems of camera 0+1 and camera 0+2

Points on Adjustment

Select the adjustment method referring to the following points.

When the judgement is NG

- Confirm whether the oblique camera image is correctly searched.
- Confirm whether the measurement coordinates are displayed within the height measurement range. When the measurement coordinates are outside of the measurement range, re-specify the height measurement range.

When search fails (searching other positions)

Make adjustments as follows to improve search precision:

- Specify a larger value for [Prec.].
  "3.22.2 [Region Setting (3D Height)]" (→pg.214)

When the processing speed is slow

- Reduce the measurement region size in [Region Setting].
  "3.22.2 [Region Setting (3D Height)]" (→pg.214)

In addition, adjust other options of [Region setting].
" Points on Adjustment" (→pg.216)

POINT

- If lowering "Stab." leads to slower processing, it is likely that many candidates have been detected. In this case, specify a larger value for "Candidate LV" or "Stab."

3.22.7 When Using Measurement Results Externally (3D Height)

Values Available in Expression

When this processing unit is selected in the unit area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (3D Height)

Measurement items	Character string	Description
Judge	JG	Judgement result
Measured coordinate X	XR	X coordinate of the position where the model is detected
Measured coordinate Y	YR	Y coordinate of the position where the model is detected
Measure Z	ZR	Z coordinate of the position where the model is detected
Reference coordinate X	SX	X coordinate of the registered model
Reference coordinate Y	SY	Y coordinate of the registered model
Reference coordinate Z	SZ	Z coordinate of the registered model
Correlation 1	CR1	Correlation value of the camera 1 image
Correlation 2	CR2	Correlation value of the camera 2 image
Margin 1	MG1	Shift amount of camera 1 relative to camera 0
Margin 2	MG2	Shift amount of camera 2 relative to camera 0
Accuracy	AC	Difference made when the same coordinates are measured with two systems of camera 0+1 and camera 0+2

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (3D Height)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	X-coordinate measurement result	Get only	-99999.9999 to 99999.9999
6	Y-coordinate measurement result	Get only	-99999.9999 to 99999.9999
7	Z-coordinate measurement result	Get only	-99999.9999 to 99999.9999
8	Reference coordinate X	Get only	-99999.9999 to 99999.9999
9	Reference coordinate Y	Get only	-99999.9999 to 99999.9999
10	Reference coordinate Z	Get only	-99999.9999 to 99999.9999
11	Correlation 1	Get only	0 to 100
12	Correlation 2	Get only	0 to 100
13	Margin 1	Get only	0 to 99999.9999
14	Margin 2	Get only	0 to 99999.9999
15	Accuracy	Get only	0 to 99999.9999
103	Reflect in OR	Set/Get	O: ON 1: OFF
120	World geometric transformation	Set/Get	O: ON 1: OFF
121	Upper limit of the height measurement range	Set/Get	-99999.9999 to 99999.9999
122	Lower limit of the height measurement range	Set/Get	-99999.9999 to 99999.9999
140	Stab. (Stability)	Set/Get	1 to 15
141	Prec. (Precision)	Set/Get	1 to 3
142	Reference coordinate X	Set/Get	-99999.9999 to 99999.9999
143	Reference coordinate Y	Set/Get	-99999.9999 to 99999.9999
144	Reference coordinate Z	Set/Get	-99999.9999 to 99999.9999
145	Candidate LV	Set/Get	0 to 100
146	Upper limit of the edge position X	Set/Get	-99999.9999 to 99999.9999
147	Lower limit of the edge position X	Set/Get	-99999.9999 to 99999.9999

Table: External Reference List (3D Height)

No.	Data Name	Set/Get	Data Range
148	Upper limit of the edge position Y	Set/Get	-99999.9999 to 99999.9999
149	Lower limit of the edge position Y	Set/Get	-99999.9999 to 99999.9999
150	Upper limit of the edge position Z	Set/Get	-99999.9999 to 99999.9999
151	Lower limit of the edge position Z	Set/Get	-99999.9999 to 99999.9999
152	Upper limit of correlation 1	Set/Get	0 to 100
153	Lower limit of correlation 1	Set/Get	0 to 100
154	Upper limit of correlation 2	Set/Get	0 to 100
155	Lower limit of correlation 2	Set/Get	0 to 100
156	Upper limit of margin 1	Set/Get	0 to 99999.9999
157	Upper limit of margin 2	Set/Get	0 to 99999.9999
158	Upper limit of the accuracy evaluated value	Set/Get	0 to 99999.9999

4

Chapter 4 - Measurement Support

This chapter explains how to set expressions and how to get or see data.

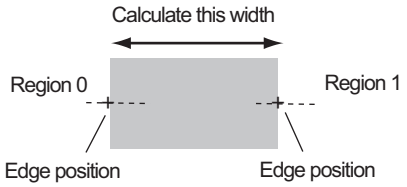
4.1 Calculation 1
4.3 Set Unit Data 1
4.2 Get Unit Data 1
4.4 Set Unit Figure 5
4.5 Elapsed Time 1
4.6 Wait 1
4.7 Trend Monitor 1
4.8 Data Logging 15
4.9 3D Calculation 23

4.1 Calculation

Used for the following case

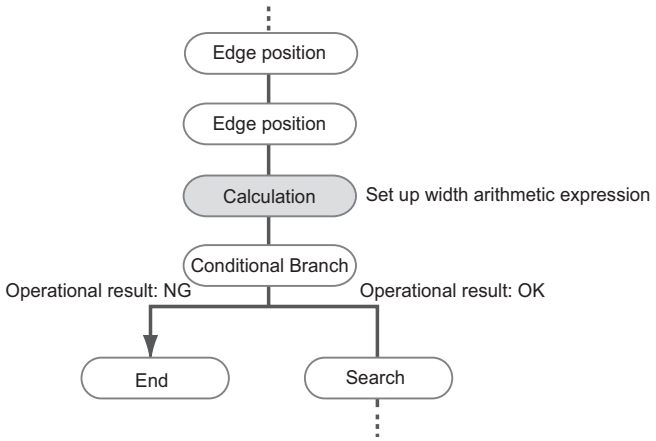
- When changing measurement contents by using Expression results

Example)Calculating the width of the measurement object
Width calculation can be performed by first calculating two edge positions and setting up the arithmetic expression which is used to calculate the edge position difference.



Width = the edge position of Area 0 - the edge position of Area 1

By combining Calculation and Conditional Branch, the following measurement contents can be changed based on the operational result.



- When performing calculation by using the calculation results of other units.

4.1.1 Setting up [Calculation]

Calculates by the following procedure.

POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 Tap [Calculation] in the Edit Flow window.

The ProcItem Setting window is displayed.

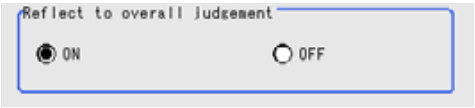
"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area, tap [Setting] and set up expressions.

Up to 8 expressions can be set up in a single unit.

For details, see "4.1.2 [Expression setting (Calculation)]" (→pg.2).

3 In the "Item tab" area, tap [Output parameter] and specify the setting.



For details, see "4.1.3 [Output Parameter (Calculation)]" (→pg.5).

4 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

4.1.2 [Expression setting (Calculation)]

In one single unit, up to 8 expressions (Calculation0 to Calculation7) can be set up.

POINT

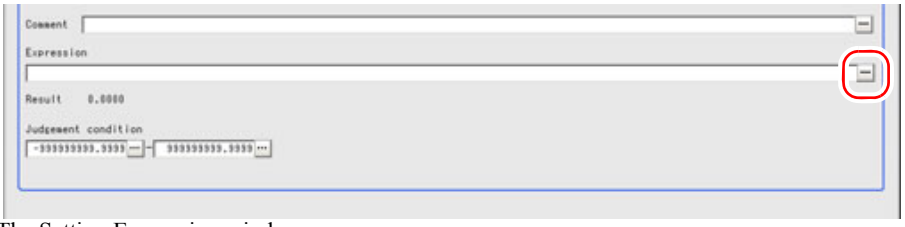
- When you need to output Calculation results to external devices, please set up Calculation related with output results in Unit after "Calculation" by Edit Flow. Expression results cannot be output to external devices when you only set up expressions. "Chapter 6 - Result Output" (→pg.1)

1 In the "Item tab" area, tap [Setting].

2 In the "Expression setting" area, tap [No.] of an expression from the list.

The expression and its No. will be displayed in a list.

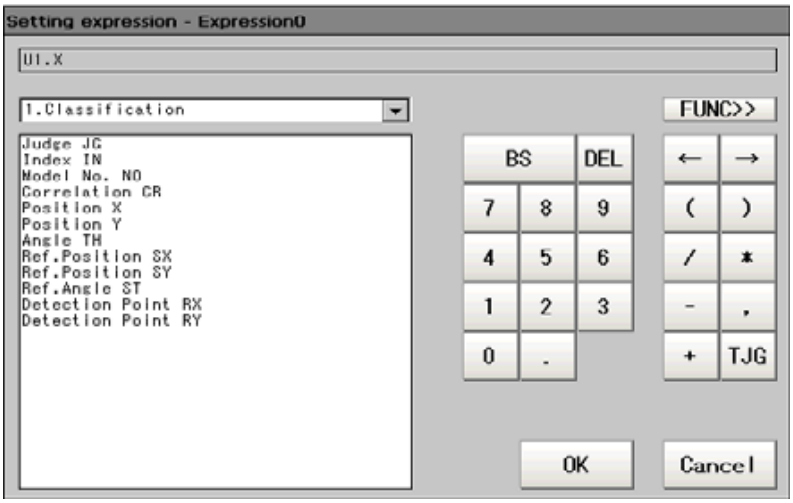
3 Tap the [...] button on the right side of expression.



The Setting Expression window appears.

4 Specify an expression.

For how to specify an expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).
For more information about the Setting Expression window, see the "4.1.5 How to Display Setting Expression Window" (→pg.8)



5 After this, tap [OK].

After verification, the window will be Closed.

POINT

- When an expression is not properly set up, an Error message will be displayed. Please verify the expression by following" Precautions" (→pg.7).

6 Tap [...] for "Comment" and input an explanation of the expression.

How to input text:"1.5 Inputting a Text" (→pg.19), of "User's Manual"

7 Set up the upper limit and the lower limit for "Judgement condition".

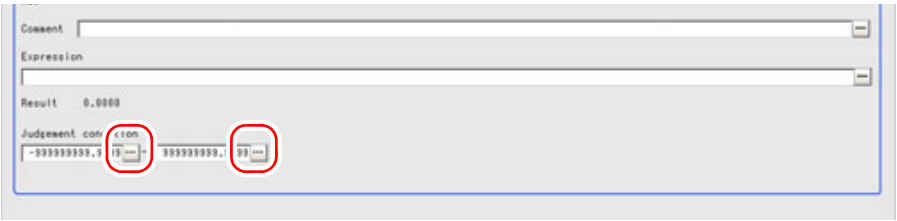


Table: Setting (Calculation) - Expression Setting - Judgement Condition

Setting Item		Set Value [Factory default:	Description
Judgement condition	Upper	-999999999.9999 to [999999999.9999]	The judgement condition for expression. Specify the upper value for OK.
	Lower	[-999999999.9999] to 999999999.9999	The judgement condition for expression. Specify the lower value for OK.

8 Repeat the Steps 2 to 7 and specify expressions.

For the subsequent operations, see "4.1.1 Setting up [Calculation]" (→pg.1).

4.1.3 [Output Parameter (Calculation)]

Specify whether to reflect the judgement result to the overall judgement of the scene.

1 In the "Item tab" area, tap [Output parameter].

2 In the "Reflect to overall judgement" area, specify whether to reflect the measurement result to the overall judgement of the scene.

Table: Setting Values for Output Parameters

Setting Item	Set Value [Factory default]	Description
Reflect to overall judgement	・[ON] ・OFF	Select whether to reflect the judgement result of this processing unit to the overall judgement of the scene. ・Selecting "ON" reflects the judgement result of this processing unit on the overall judgement of the scene. ・Selecting "OFF" does not reflect the judgement result of this processing unit on the overall judgement of the scene.

POINT

- The overall judgement result of the scene is output to the OR signal to be sent via the parallel interface. Also, it is displayed in the Measurement Information Display area in the upper part of the Main screen.
  "10.4.4 Time Chart" (→pg.35), of "User's Manual"
  "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"

For the subsequent operations, see "4.1.1 Setting up [Calculation]" (→pg.1).

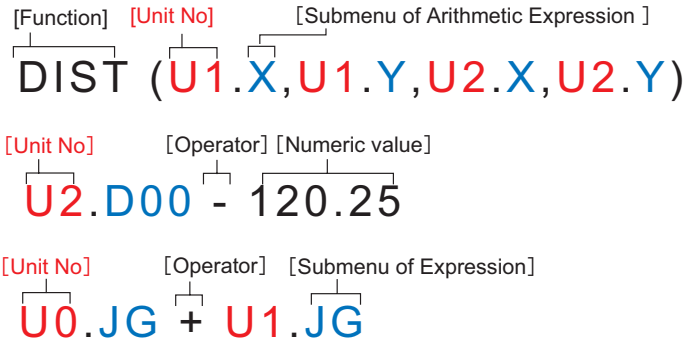
4.1.4 Structure and Creation of Expression

The expression is composed of unit value, numeric number, function and operators.
For more information about the Setting Expression window, see the "4.1.5 How to Display Setting Expression Window" (→pg.8)

- Unit Value
  You can use set value and Value in the unit." Setting up Unit Value" (→pg.10)
- Numeric Number
  Any value can be input." Setting up Numeric Number/Operator" (→pg.11)

- Expression
  Addition (+), Subtraction (-), Multiplication (*), and divide (/).
- Function
  Use the preset functions. " Setting up Function" (→pg.12)

Arithmetic expression is shown as follows.



Important

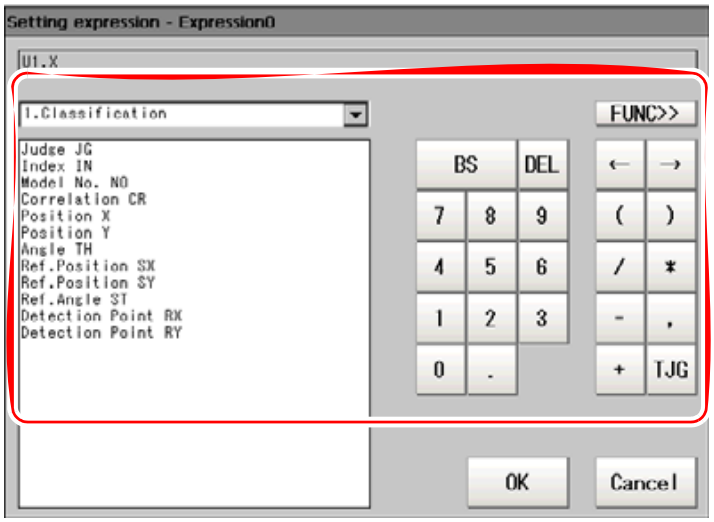
- The items that you can use depend on the Setting Expression window that you open.
  - Calculation Mode
    All the items can be used.
  - Value Mode
    Only the "Numeric Number" and "Operator" can be used. [Unit Value] and [Func.] cannot be used.

1 In the "Expression display" area, tap the position where you need to input value and move the cursor there.

2 Input setting items (Unit value, numeric number, operators, and function).

- " Setting up Unit Value" (→pg.10)
- " Setting up Numeric Number/Operator" (→pg.11)

• " Setting up Function" (→pg.12)



POINT

- The Judge can also be used by the expression (OK/NG).
  "4.1.6 Examples for Expression" (→pg.15)

3 Repeat the above steps to set up the expression.

The expression that you set up will be displayed in the area where the expression is displayed in the upper part of the window.

4 After this, tap [OK].

After verification, the window will be closed.

POINT

- When an expression is not properly set up, an Error message will be displayed. Please verify the expression by following " Precautions" (→pg.7).

Precautions

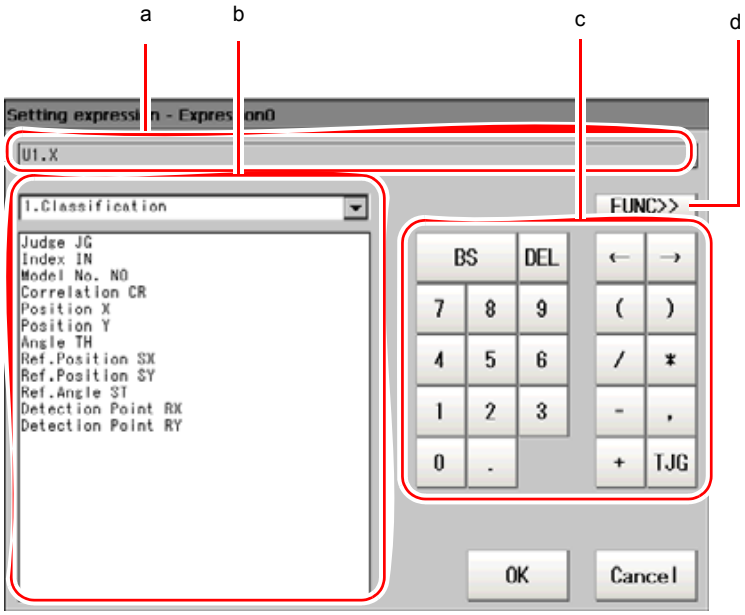
When the expression doesn't meet the following requirements, Error message will be displayed when tapping [OK].

- Unit value, numeric number, function, or TJG settings should be followed before/behind operators.
- The expression should start with TJG/unit value/numeric number/function and end with TJG/unit value/numeric number/function.
  Operators/comma "," should not be placed at the start and end of the expression.
- Operators cannot be inputted successively.
- TJG/Unit value/function can not be inputted successively.
- The left and right brackets "( )" should be used together.
- Please ensure to Set up Function operand.

4.1.5 How to Display Setting Expression Window

Important

- The items that you can use depend on the Setting Expression window that you open.
  - Calculation Mode
    All the items can be used.
  - Value Mode
    Only [Numeric Number] and [Operator] can be used. The [Unit Value] / [Func.] cannot be used.



a The "Expression display" area

Used to set up expressions.

b The "Unit" area

Select area that processing item values have been set up in an unit. By tapping one item in the sub-menu, you can add this item to the "Expression display" area.

" Setting up Unit Value" (→pg.10)

c The "General button" area

The general buttons that are used to edit the expression. Numeric number and operators can be input here.

Table: Expression setting (the "General button" area)

Button	Type	Description
BS	-	Deletes the items in the front of the cursor in the "Expression display" area.
DEL	-	Deletes the items behind the cursor in the "Expression display" area.
0 to 9	Numeric Number	Numeric numbers will be displayed. By tapping, they will be displayed at the cursor position in the "Expression display" area.
.	Signs	After being tapped, the "." will be displayed at the cursor position in the "Expression display" area.
←	Move	Each tap will make the cursor in the "Expression display" area go left one position.
→	Move	Each tap will make the cursor in the "Expression display" area go right one position.
(	Signs	Used to set off the expression. Used in pairs with ")". Tapping this symbol, "(" will be displayed in the "Expression display" area.
)	Signs	Used to set off the expression. Used in pairs with "(". Tapping this symbol, ")" will be displayed in the "Expression display" area.
/	Operator	Division for real numbers. After being tapped, "/" will be displayed at the cursor position in the "Expression display" area.
*	Operator	Multiplication. After being tapped, "*" will be displayed at the cursor position in the "Expression display" area.
-	Operator	Subtraction. After being tapped, "-" will be displayed at the cursor position in the "Expression display" area.
,	Signs	After being tapped, the comma "," will be displayed at the cursor position in the "Expression display" area.
+	Operator	Addition. After being tapped, "+" will be displayed at the cursor position in the "Expression display" area.
TJG	-	Obtains the overall judgement result for all the units lying ahead of Unit No. in which an expression has been set up. For more information, see" When you use the accumulated judgement result in the expression" (→pg.15)

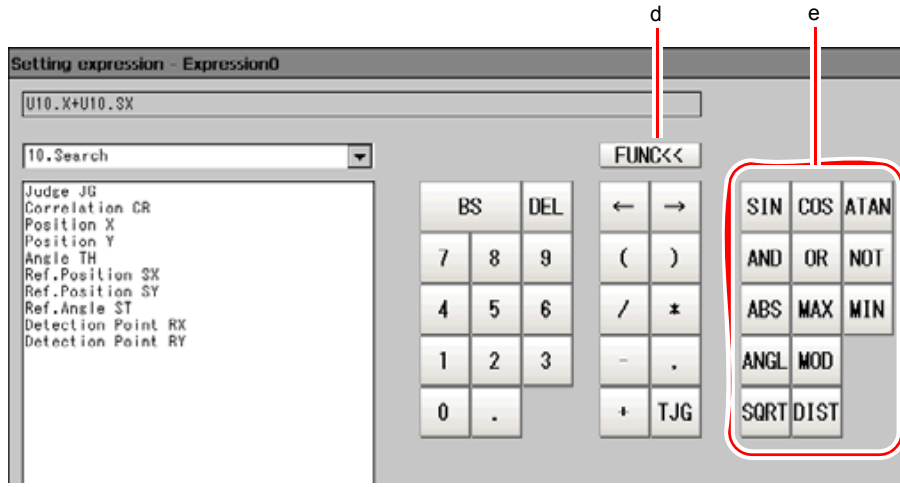
" Setting up Numeric Number/Operator" (→pg.11)

d [Func.]

Display/hide the "Function button" area.

● The "Function button" area

Used to input functions." Setting up Function" (→pg.12)



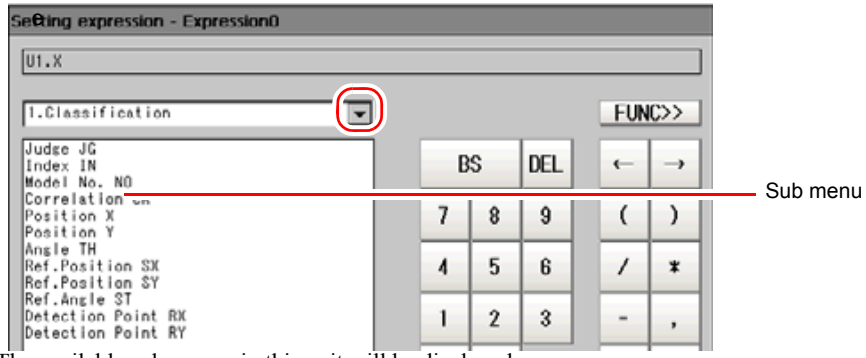
Setting up Unit Value

Use measurement results of the unit that has been set up in the currently edited scene to calculate.

Tapping [▼] displays the unit No. and name that have been set up in the currently displayed scene.

Please select the unit, and Expression items from sub-menus.

1 Tap [▼] and select a unit name.



The available sub-menus in this unit will be displayed.

2 Tap the sub-menu.

Its contents will be mapped in the "Expression display" area.

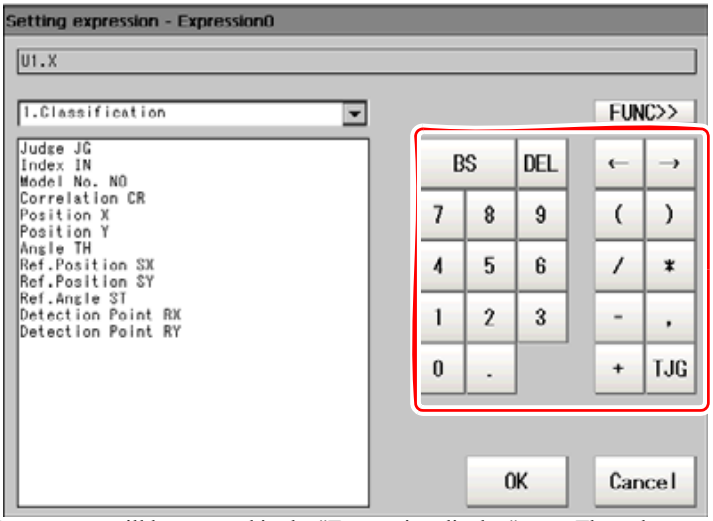
POINT

- The sub-menu varies depending on the unit to be selected. For more information, see [When Using Measurement Results Externally], [Value Available in Expression].

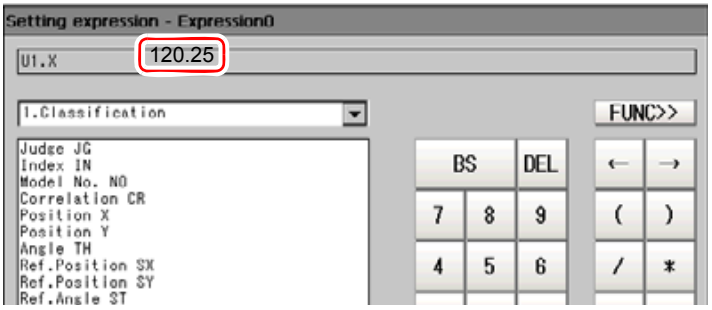
Setting up Numeric Number/Operator

Any value and operator can be entered.

1 Tap the numeric number button or operator button.



Its contents will be mapped in the "Expression display" area. The value range that can be set up is within -999999999.9999 to 999999999.9999.

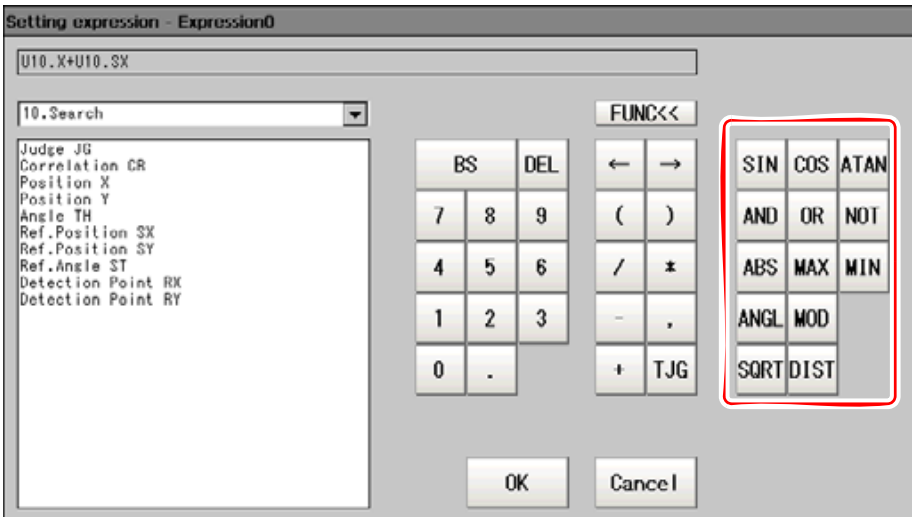


Setting up Function

Set up Expression function.

Display/hide the "Function button" area by tapping [Func].

1 Tap the desired function button.



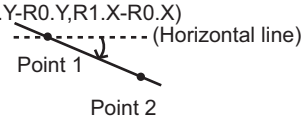
The selected function will be displayed in the "Expression display" area.

The cursor will move behind the selected function.

Table: Function List

Function	Description
SIN (equation)	MAX (Operand1, Operand2) Angle in [degree].
COS (equation)	MAX (Operand1, Operand2) Angle in [degree].
ATAN (Y-axis component, X-axis component)	Calculates the arc tangent of Y axis component/X axis component. The result will be returned in arc within $-\pi$ to π. (Example) When calculating the Angle produced by the horizontal line and the straight line that joins the gravity of zone 0 and zone 1 ATAN (R1.Y-R0.Y, R1.X-R0.X) When both operands equal 0, the result 0 will be returned. And NG will be displayed.
AND (Operand 1, Operand 2)	Calculates the logical product. When one of two operands equals 0, the result 0 will be returned. For the rest part, -1 will be returned.
OR (Operand 1, Operand 2)	Calculates the logical OR. When both operands equal 0, the result 0 will be returned. For the rest part, -1 will be returned.
NOT (operand)	Calculates the logical NOT. When the operands equal 0, the result -1 will be returned. For the rest part, 0 will be returned.
ABS (operand)	Calculates the absolute value.
MAX (Operand 1, Operand 2)	The larger of two operands will be returned.
MIN (Operand 1, Operand 2)	The smaller of two operands will be returned.

Table: Function List

Function	Description
ATGL (Y-axis component, X-axis component)	Calculates the angle made by the straight line that connects two points (center of gravity/center of a model). Calculates the Angle against the horizontal line. The result will be returned within -180 to 180. (Example) When calculating the angle produced by the straight lines that join the gravity of Area 0 and that of Area 1 ANGL(R1.Y-R0.Y,R1.X-R0.X)  When both the two operands are equal to 0, "0" will be returned, and the judge will become NG.
MOD (divisor, dividend)	Calculates the remainder when dividing the dividend with the divisor. To calculate the remainder, first circle off a decimal, if this is the case, to a whole number then calculate. The result is the integer remainder after division of dividend by an integer divisor. (Example) MOD (13.4) ... . Result: 1 (the remainder when dividing 13 by 4) MOD (25.68,6.99) ... Result: 5 (the remainder when dividing 26 by 7)
SQRT (operand)	Calculates the square root. When the operand is a minus, the function returns 0. And NG will be displayed.
DIST (X-Coordinate of first point, Y-Coordinate of first point, X-Coordinate of second point, Y-Coordinate of second point)	Calculates the distance between two points (center of gravity/center of a model). (Example) When calculating the distance between the gravity of Area 0 and that of Area 1 DIST(R0.X,R0.Y,R1.X,R1.Y) The following calculation will be performed internally. $\sqrt{(R1.X-R0.X)^2+(R1.Y-R0.Y)^2}$

2 Set up the operand (mandatory).

"(" /")", ",", etc, can be input by tapping the button in the "General button" area.

When you use other unit value as the operand

Select and set up from the "Unit" area.

" Setting up Unit Value" (→pg.10)

When you manually input value to the operand

Tap the digits button and set up.

" Setting up Numeric Number/Operator" (→pg.11)

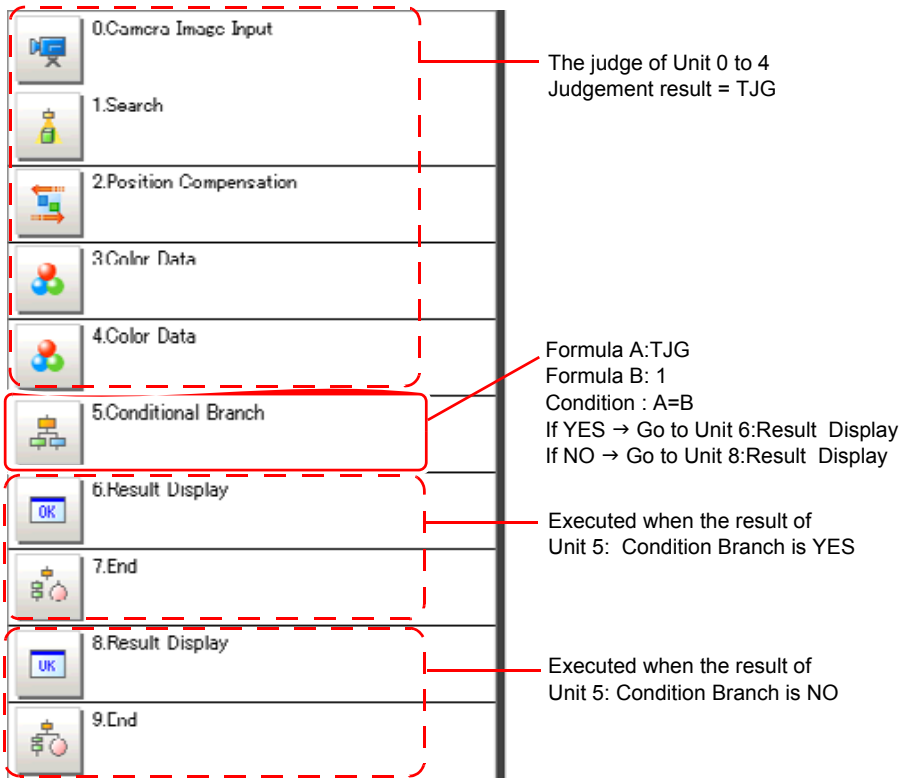
4.1.6 Examples for Expression

When you use the accumulated judgement result in the expression

Obtain the overall judgement result for all the units lying ahead of Unit No. in which an expression has been set up. Use when you need to perform branch to the measurement based on the measurement results.

For example, perform condition branching based on the overall judgement result by Unit 0 to 4.

Sample Display



1 Set up the [Conditional Branch] in Unit 5. Set up the following expressions in Expression A and B respectively.

- Expression A:TJG

  Get the overall judgement result of Unit0 to Unit4. Output the following overall result based on the judgement result of Unit0 to Unit4.

Table: TJG Result List

Result of Unit0 to Unit4	Output TJG
All the unit's judgement result are OK	1
The judgement result of one or more unit are NG	-1

- Expression B: 1
  Set up the value that will be compared with the value of A (TJG value).

2 Set the condition of the expression to "A = B".

Take A = B, namely TJG = 1, as the condition, as a sequence, if all the judgement result of Unit 0 to 4 are OK, then the condition judgement result will be YES

3 Set up the Branch target respectively.

If "Yes", continue to Unit 6; If "No", continue to Unit 8.

When you use the unit judgement result (JG) in expression

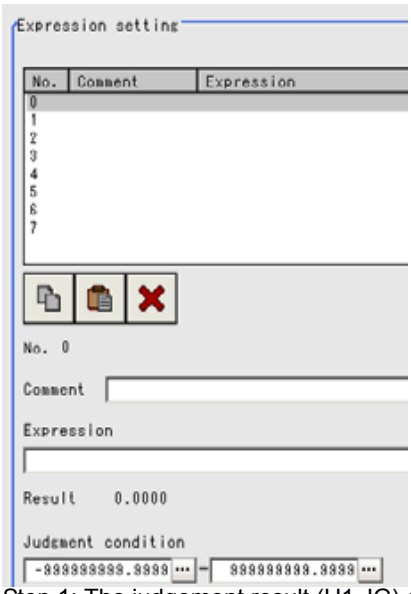
The following 2-step procedure should be performed when you use the unit judgement result in expression.

Step 1: make Judge based on the Judgement conditions defined for each unit.

The result "1" (OK) or "-1" (NG) will be output in Result.

Step 2:The output expression result from Step 1 is judged based on the upper limit and the lower limit for judgement.

Example 1: use the judgement result of Unit 1



Step 1: The judgement result (U1.JG) of Unit 1 are used in expression.

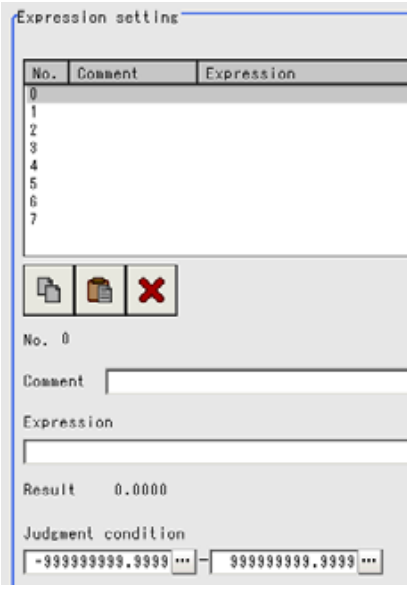
According to the Judgement condition of unit 1, "Result" will display "1: OK" or "-1: NG".

Step2: Based on the upper limit and the lower limit for judgement, the Expression result (U1.JG) of Step 1 will be judged.

To specify the setting to decide that expression is OK only when the result of Step 1 is OK, you must specify "1" to both the upper limit and the lower limit for judgement.

Example 2: use the judgement result of Unit 0 and Unit 1 together

When both Unit 0 and Unit 1 are OK, the Expression Judge will be OK.



Step 1: The result by adding the judgement result (U0.JG, U1.JG) of Unit 0 and Unit 1 is used in the expression.

The result that is produced by adding the Judge value (1: OK/-1: NG) based on the judgement conditions of unit 0 and the Judge value (1: OK/-1: NG) based on the judgement conditions of unit 1 is displayed in "Result".

Step2: The Expression result of Step 1 is judged based on the upper limit and the lower limit for judgement.

When "2" is specified for both the upper limit and the lower limit for judgement, the expression judgement is OK when both units 0 and 1 are judged as OK.

Table: Judgement result of the expression when the judgement result of both Unit 0 and 1 are used

Judge of Unit 0 (Judge value)	Judge of Unit 1 (Judge value)	Expression result (Sum of the judgement result of Unit 0 and of Unit 1)	Judgement result of expression
OK (1)	OK (1)	2	OK
NG (-1)	OK (1)	0	NG
OK (1)	NG (-1)	0	NG
NG (-1)	NG (-1)	-2	NG

Using Judgement of other expressions

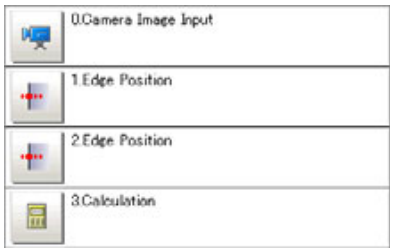
Up to 8 expressions can be set up in one single unit.

The value of other expressions in the same unit can also be used.

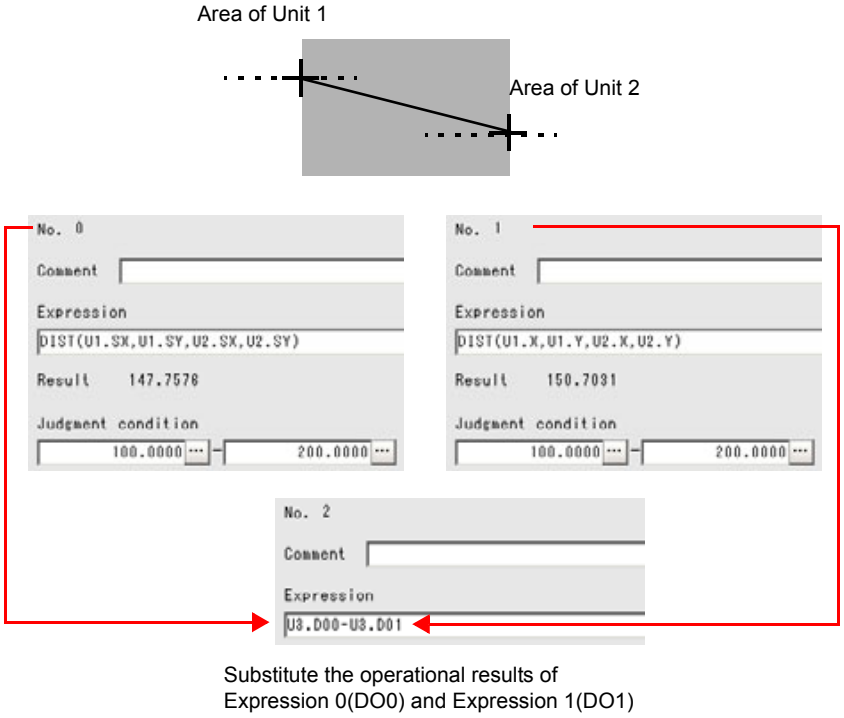
Since Expression results obtained by the expression are displayed as DO0 to DO7 and Judgement result of expression are displayed as J00 to J07, the setup by Unit No/Expression Result should be performed for "U3. DO0" (Expression result of Expression 1 that is set up in Processing Item "Expression" of Unit3).

" Value Available in Expression" (→pg.20)

For the following scene



Example1: In the edge area, calculate the distance of the reference and that of the measurement results, and output the difference between these two distances.



Substitute the operational results of
Expression 0(DO0) and Expression 1(DO1)

Set up expressions according to the following requirements.

- Expression 0.DIST(U1.SX,U1.SY,U2.SX,U2.SY)
  The equation that is used to the calculate the distance between the reference positions of Unit1 and Unit2.
  You can use the function DIST to calculate the distance between these two points. " Setting up Function" (→pg.12)
- Expression 1: DIST(U1.X,U1.Y,U2.X,U2.Y)
  The equation that is used to the calculate the distance between the measurement position of unit 1 and that of unit 2.
  You can use the function DIST to calculate the distance between these two points. " Setting up Function" (→pg.12)

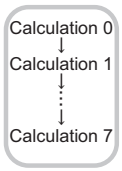
- Expression 2: U3.DO1-U3.DO0
  (Unit 3: Expression "Expression 1" - Unit 3: Expression "Expression 0"
  The equation that is used to calculate the difference between the operational result of Operation 1 and that of Operation 0 of unit 3 (in this case, Operation).

POINT

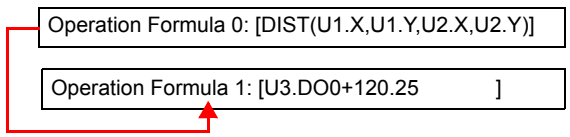
Calculating Order of Expressions

- If you want to use the equation which is used for the Expression of other operational results, please substitute a higher Expression No. for the former No.. Otherwise, the operational result obtained by instituting the former Expression No. will be used for the substitution.

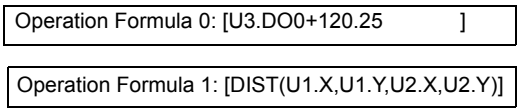
Calculating order



Calculate the distance between the two points in the inspection region in

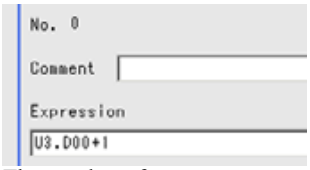


When you substitute these equations with each other



Since the calculation of operation formula 0 is earlier than operation formula 1,the last operation result of operation formula 1 will be substituted into U3 D01

Example 2: Calculate the number of measurement



The number of measurement can be obtained by adding "1" to the operation code NO..

POINT

- When calculation results are cleared or the power is turned off, U3.DO0 will be initialized to be "0", and the number of measurement will also be reset.

4.1.7 When Using Measurement Results Externally (Expression)

Value Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The items and contents displayed in the sub-menu are shown in the following table.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (Calculation)

Measurement items	Character string	Description
Judge	JG	Judgement result
Expression result of Expression 0	DO0	Results of the expression that is set up in Expression0
Expression result of Expression 1	DO1	Results of the expression that is set up in Expression 1
Expression result of Expression 2	DO2	Results of the expression that is set up in Expression 2
Expression result of Expression 3	DO3	Results of the expression that is set up in Expression 3
Expression result of Expression 4	DO4	Results of the expression that is set up in Expression 4
Expression result of Expression 5	DO5	Results of the expression that is set up in Expression 5
Expression result of Expression 6	DO6	Results of the expression that is set up in Expression 6
Expression result of Expression 7	DO7	Results of the expression that is set up in Expression 7
Judgement result of Expression 0	J00	Judgement result of the expression that is set up in Expression 0 (1: OK, -1: NG)
Judgement result of Expression 1	J01	Judgement result of the expression that is set up in Expression 1 (1: OK, -1: NG)
Judgement result of Expression 2	J02	Judgement result of the expression that is set up in Expression 2 (1: OK, -1: NG)
Judgement result of Expression 3	J03	Judgement result of the expression that is set up in Expression 3 (1: OK, -1: NG)
Judgement result of Expression 4	J04	Judgement result of the expression that is set up in Expression 4 (1: OK, -1: NG)
Judgement result of Expression 5	J05	Judgement result of the expression that is set up in Expression 5 (1: OK, -1: NG)
Judgement result of Expression 6	J06	Judgement result of the expression that is set up in Expression 6 (1: OK, -1: NG)
Judgement result of Expression 7	J07	Judgement result of the expression that is set up in Expression 7 (1: OK, -1: NG)

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in the "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Calculation)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5 to 12	Results of the expression that is set up in Expression 0 to 7	Get only	CAL_MIN to CAL_MAX
13 to 20	Judgement result of the expression that is set up in Expression 0 to 7	Get only	0: Unmeasured 1: OK -1: NG
103	Reflect in overall judge	Set/Get	0: ON 1: OFF
120	Judgement Upper Limit of Expression 0	Set/Get	-999999999.9999 to 999999999.9999
121	Judgement Lower Limit of Expression 0	Set/Get	-999999999.9999 to 999999999.9999
122	Judgement Upper Limit of Expression 1	Set/Get	-999999999.9999 to 999999999.9999
123	Judgement Lower Limit of Expression 1	Set/Get	-999999999.9999 to 999999999.9999
124	Judgement Upper Limit of Expression 2	Set/Get	-999999999.9999 to 999999999.9999
125	Judgement Lower Limit of Expression 2	Set/Get	-999999999.9999 to 999999999.9999
126	Judgement Upper Limit of Expression 3	Set/Get	-999999999.9999 to 999999999.9999
127	Judgement Lower Limit of Expression 3	Set/Get	-999999999.9999 to 999999999.9999
128	Judgement Upper Limit of Expression 4	Set/Get	-999999999.9999 to 999999999.9999
129	Judgement Lower Limit of Expression 4	Set/Get	-999999999.9999 to 999999999.9999
130	Judgement Upper Limit of Expression 5	Set/Get	-999999999.9999 to 999999999.9999
131	Judgement Lower Limit of Expression 5	Set/Get	-999999999.9999 to 999999999.9999
132	Judgement Upper Limit of Expression 6	Set/Get	-999999999.9999 to 999999999.9999
133	Judgement Lower Limit of Expression 6	Set/Get	-999999999.9999 to 999999999.9999

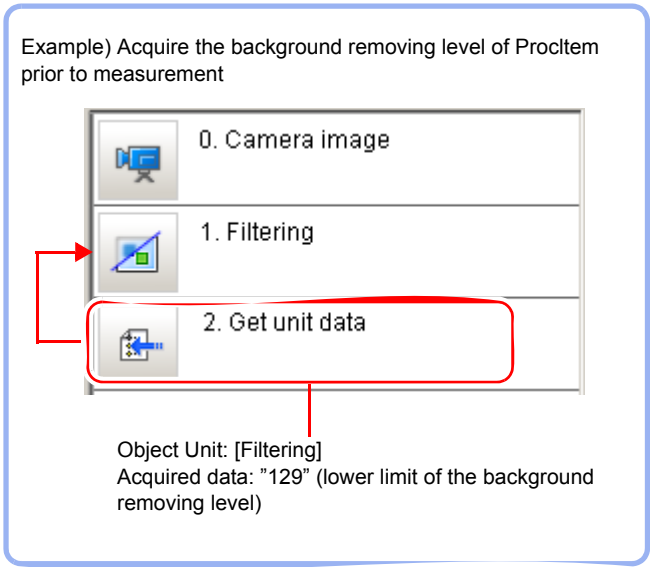
Table: External Reference List (Calculation)

No.	Data Name	Set/Get	Data Range
134	Judgement Upper Limit of Expression 7	Set/Get	-999999999.9999 to 999999999.9999
135	Judgement Lower Limit of Expression 7	Set/Get	-999999999.9999 to 999999999.9999

4.2 Get Unit Data

Used for the following case

- When get unit data (setting parameters etc.) set in a scene during measurement



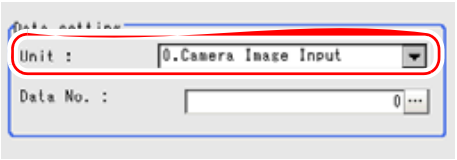
4.2.1 Setting up [Get Unit Data]

1 In the Edit Flow window, tap [Get unit data].

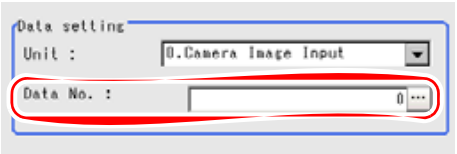
The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User’s Manual"

2 In the "Data setting" area, tap [▼] for "Unit" and specify a target unit.



3 Tap [...] for "Data No." and specify the desired data No..



Different Processing Item will be designated different data No.. For more information, see "When Using Measurement Results Externally", "External Reference List" of each Processing Item.
For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"

4 Perform a measurement test.
"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

5 Verify measurement results.
"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"
When NG is displayed, please measure again and make Adjust if necessary.

4.2.2 When Using Measurement Results Externally (Get Unit Data)

Value Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window,the items that can be Expression will be displayed in a sub-menu.
The items and contents displayed in the sub-menu are shown in the following table.
For how to set up expression, see"4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (Get Processing Unit Data)

Measurement items	Character string	Description
Judge	JG	The latest judgement result of the processing unit
Data	DT	Get Unit Data

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in the "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Get Processing Unit Data)

No.	Data Name	Set/Get	Description
0	Judgement	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Data	Get only	-999999999.9999 to 999999999.9999

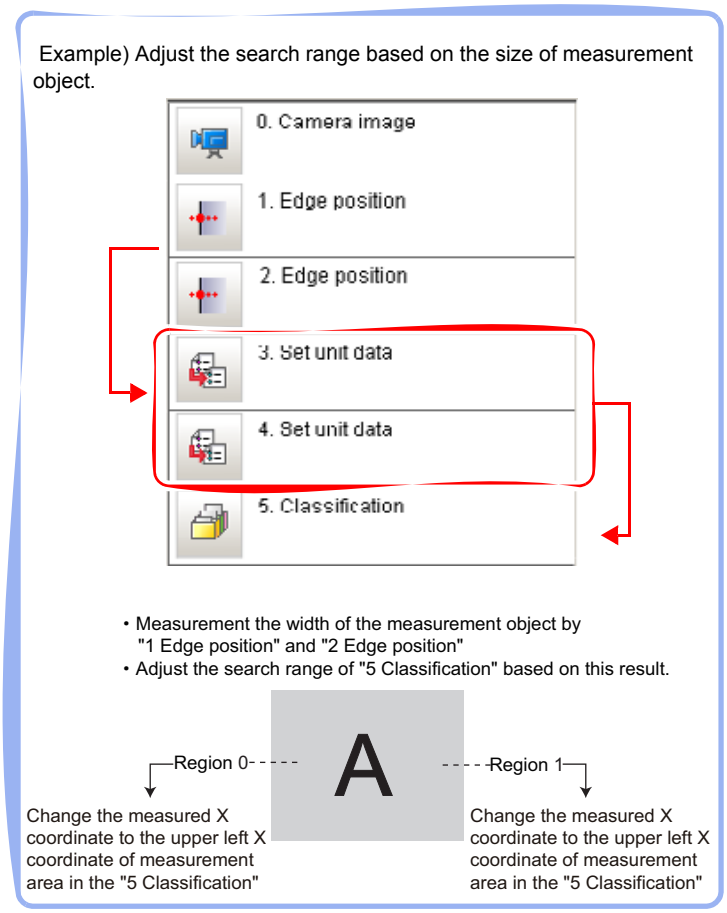
Table: External Reference List (Get Processing Unit Data)

No.	Data Name	Set/Get	Description
120	Target unit	Set/Get	0 to 9999
121	Target data No.	Set/Get	0 to 99999

4.3 Set Unit Data

Used for the following case

- When modifying Processing Item data (setting parameters etc.) set in a scene during measurement



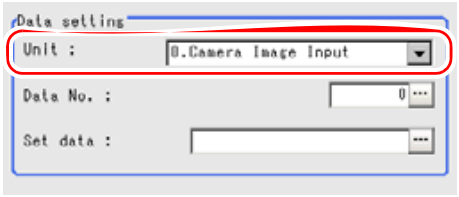
4.3.1 Setting up [Set unit data]

1 In the Edit Flow window, tap [Set unit data].

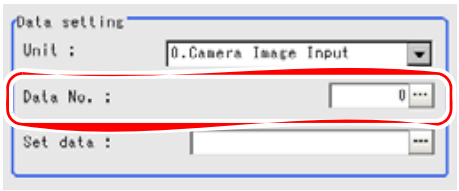
The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Data setting" area, tap [▼] for "Unit" and specify a target unit.



3 Tap [...] for "Data No." and set up the target data number.

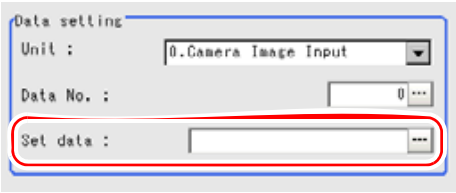


Different Processing Item will be designated different data No.. For more information, see "When Using Measurement Results Externally", "External Reference List" of each Processing Item.

For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"

4 Specify a new expression.

1. Tap the [...] button to the right of "Set data".



The Setting Expression window appears.

2. Specify an expression.

For how to specify an expression, see "4.1.4 Structure and Creation of Expression" (→pg.5)

5 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

6 Perform a measurement test.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

7 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

When NG is displayed, please measure again and make Adjust if necessary.

4.3.2 When Using Measurement Results Externally (Set Unit Data)

Value Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The items and contents displayed in the sub-menu are shown in the following table.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Value Available in Expression (Set Processing Unit Data)

Measurement items	Character string	Description
Judge	JG	The latest judgement result of the processing unit
Set Data	DT	Expression result of Set data (expression)

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in the "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Set Processing Unit Data)

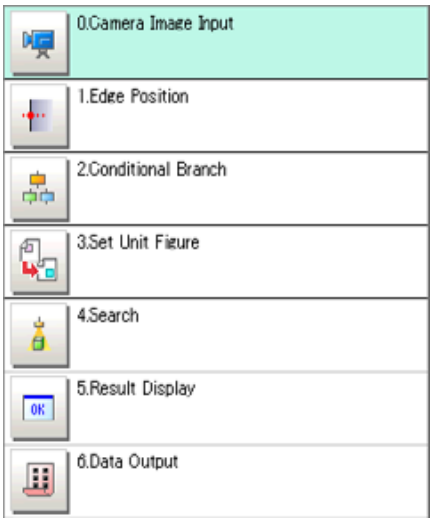
No.	Data Name	Set/Get	Description
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Data	Get only	-999999999.9999 to 999999999.9999
120	Target unit	Set/Get	0 to 9999
121	Target data No.	Set/Get	0 to 99999

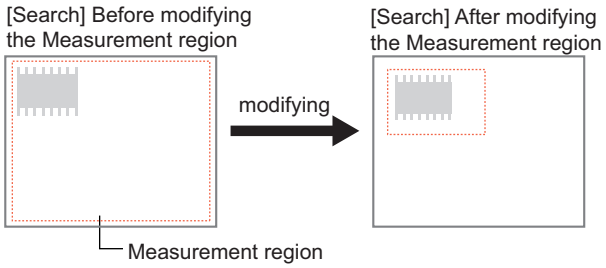
4.4 Set Unit Figure

Used for the following case

- When modifying figure information (model, measurement region, etc.) of a processing unit set in the scene

Example) Adjust the search measurement region based on the results of edge position measurement.





POINT

- Do not insert the following processing items between the [Set Unit Figure] unit and the target processing unit.
  - Camera Image Input
  - Camera Switching
  - Filtering
  - Position Compensation

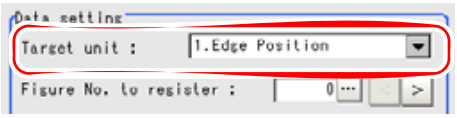
4.4.1 Setting up [Set Unit Figure]

1 In the Edit Flow window, tap [Set Unit Figure].

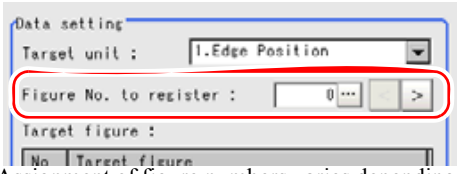
The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Data setting" area, tap [▼] for "Target unit" and specify a target unit.



3 Tap [...] for "Figure No. to register" and specify a figure number for modification.



Assignment of figure numbers varies depending on Processing Items. The following table shows the Register figure Numbers assigned to each Processing Item.

Table: List of Register Figure Numbers

Processing Item	Figure No.	Item
Filtering	0	Region setting
Position Compensation	0	Region setting
Color Data	0	Region setting
Search	0	Model
	1	Region Setting (Measurement Region)
Flexible Search	0	Model (Model 0)
	1	Model (Model 1)
	2	Model (Model 2)
	3	Model (Model 3)
	4	Model (Model 4)
	5	Region Setting (Measurement Region)
Edge Position	0	Region setting
Edge Pitch	0	Region setting
Defect	0	Region setting
Fine matching	0	Model
Circle Angle	0	Region setting

Table: List of Register Figure Numbers

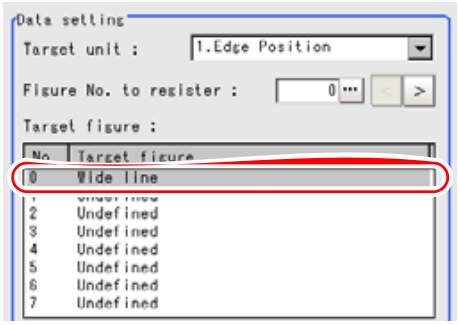
Processing Item	Figure No.	Item
Classification	0	Model (Index 0: Model 0)
	1	Model (Index 0: Model 1)
	2	Model (Index 0: Model 2)
	3	Model (Index 0: Model 3)
	4	Model (Index 0: Model 4)
	5	Model (Index 1: Model 0)
	6	Model (Index 1: Model 1)
	:	:
	179	Model (Index 35: Model 4)
	180	Region Setting (Measurement Region)
Area Gravity	0	Region setting
Labeling	0	Region setting
ECM search	0	Model - Edit
	1	Region Setting (Measurement Region)
	2	Model - Mask
	3	Error model - Edit
	4	Error model - Mask
3D Edge Position	0	Region setting
	2	Region settings for Camera 1 or Camera 2 [Note 1]
3D Search	0	Allocate Model
	1	Region Setting (Measurement Region)
3D Circle Search	0	Circle setting (circumference)
	1	Region Setting (Measurement Region)
	2	Color setting
3D Height	0	Region setting
	1	Search region settings for Camera 1 or Camera 2 [Note 1]

[Note 1]: The set value will be invalid, since the value is updated whenever a measurement is performed.

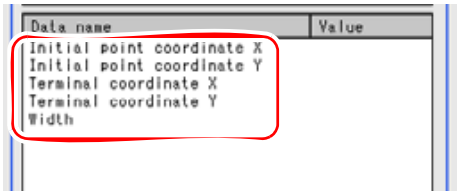
How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

4 Tap the target figure number you want to set.

The figure number can be specified by tapping [<] [>].

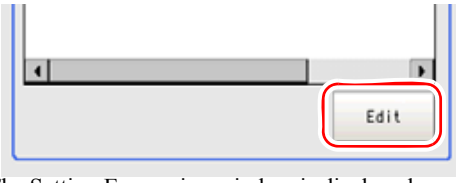


5 Tap a data name to be modified.



6 Specify a new expression.

1. Tap [Edit] for [Set data] to set up an expression.



The Setting Expression window is displayed.

2. Specify an expression.

For how to specify an expression, see "4.1.4 Structure and Creation of Expression" (→pg.5)

3. Repeat the setting of the expression when necessary.

7 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

8 Perform a measurement test.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

9 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

When NG is displayed, check the measurement again and make adjustments if necessary.

4.4.2 When Using Measurement Results Externally (Set Unit Figure)

Values Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.
For how to specify an expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (Set Unit Figure)

Measurement items	Character string	Description
Judge	JG	The latest judgement result of the processing unit
Number of data items	DNO	Number of setup data items
Data 0	DT0	Expression result of setup data 0
Data 1	DT1	Expression result of setup data 1
Data 2	DT2	Expression result of setup data 2
Data 3	DT3	Expression result of setup data 3
Data 4	DT4	Expression result of setup data 4
Data 5	DT5	Expression result of setup data 5
Data 6	DT6	Expression result of setup data 6
Data 7	DT7	Expression result of setup data 7
Data 8	DT8	Expression result of setup data 8
Data 9	DT9	Expression result of setup data 9
Data 10	DT10	Expression result of setup data 10
Data 11	DT11	Expression result of setup data 11
Data 12	DT12	Expression result of setup data 12
Data 13	DT13	Expression result of setup data 13
Data 14	DT14	Expression result of setup data 14
Data 15	DT15	Expression result of setup data 15
Data 16	DT16	Expression result of setup data 16
Data 17	DT17	Expression result of setup data 17
Data 18	DT18	Expression result of setup data 18
Data 19	DT19	Expression result of setup data 19

External Reference List

The data types and their numbers that are available to refer from other processing units and external equipment are shown below. For the input method, see "Input Format" in "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Set Unit Figure)

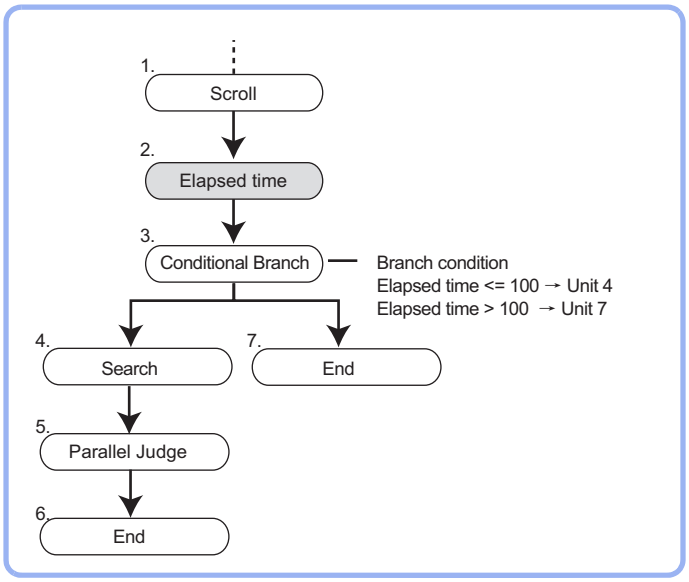
No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5 to 24	Data 0 to 19	Get only	-999999999.9999 to 999999999.9999
120	Target unit	Set/Get	0 to 9999
121	Registration figure No.	Set/Get	0 to 999
122	Target figure No.	Set/Get	0 to 7
123	Number of setup data items	Get only	0 to 20

4.5 Elapsed Time

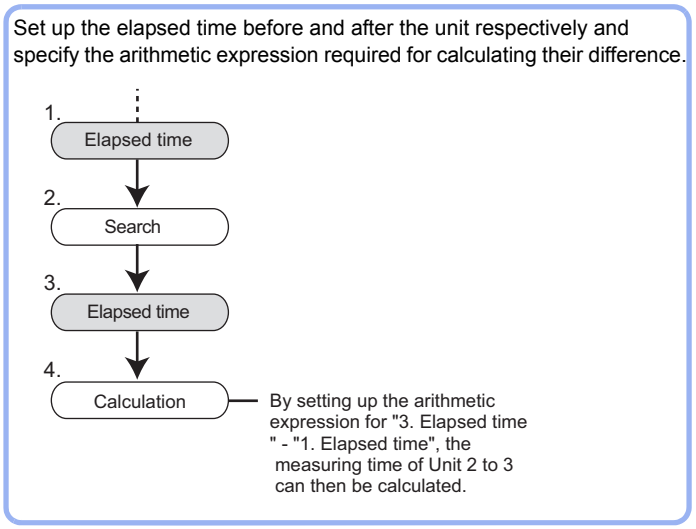
Calculate the elapsed time in milliseconds after the measurement starts.
You can add this Processing Item to a scene, without property setup.

Used for the following case

- When combining with the Conditional Branch after the specified processing time has elapsed:



- When calculating the processing time of a unit:



POINT

- The Elapsed time can be verified on the Main screen.

- Main screen (the ADJUST window): Detail results in the "Control" area
  b. the "Measurement Information" area in "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"
- Main screen (the RUN window): Detail results in the "Control" area
  "6.3.2 Displaying Flow and Detail Result" (→pg.12), of "User's Manual"

4.5.1 When Using Measurement Results Externally (Elapsed Time)

Value Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The items and contents displayed in the sub-menu are shown in the following table.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Value Available in Expression (Elapsed Time)

Measurement items	Character string	Description
Judge	JG	The latest judgement result of the processing unit
Elapsed Time	TM	Elapsed time from measurement start (ms)

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in the "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

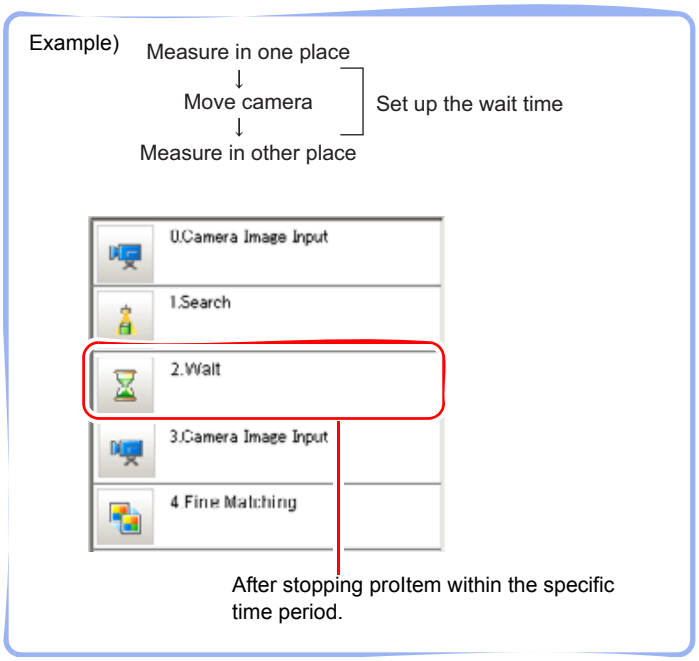
Table: External Reference List (Elapsed Time)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Elapsed Time	Get only	0 to 999999

4.6 Wait

Used for the following case

- When pausing the measurement process and making the ongoing processing to enter into the standby state for a specific period



4.6.1 Setting up [Wait]

1 In the Edit Flow window, tap [Wait].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Waiting time" area, tap [...] to select the waiting time.

For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"

Please specify the time in ms.

And the allowable range is 0 to 9999.

3 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

4 Perform a measurement test.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

5 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

POINT

- The Waiting time can be verified in the "Detail" area of the Main screen.
  - Main screen (the ADJUST window): Processing time in the "Measurement information display" area
    b. "Measurement information display" area in "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"
  - Main screen (the RUN window): Detailed result in the "Control" area
    "6.3.2 Displaying Flow and Detail Result" (→pg.12), of "User's Manual"

4.6.2 When Using Measurement Results Externally (Wait)

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in the "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Wait)

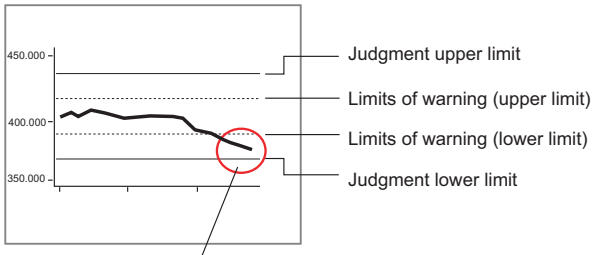
No.	Data Name	Set/Get	Data Range
120	Waiting time	Set/Get	0 to 9999 (ms)

4.7 Trend Monitor

Allows the information about measurement results to be displayed on the monitor.

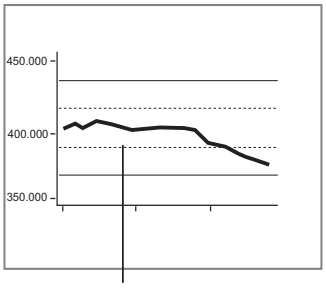
Used for the following case

- When requiring to avoid excessive defective products



By setting up the Warning range, "Warning" message can be displayed to safeguard against frequent NG message, which will then be fed back to the preceding process.

- When analyzing NG reason



Displays the measured value vs time characteristic.Saves up to 1,000 Measurement results.

List of Trend Monitor Items

Trend Monitor items are explained below.

Table: List of Trend Monitor Items

Item Name	Description
Measurement	This item selects the measurement values you want to display on the trend monitor. "4.7.2 [Measurement (Trend Monitor)]" (→pg.3)
Display range	pThis item secifies the display range. You can scroll the graph up and down or zoom in/out to view a desired size. "4.7.3 [Display Range (Trend Monitor)]" (→pg.3)

Table: List of Trend Monitor Items

Item Name	Description
Judgement	This item specifies the judgement conditions for OK, and the warning range to call attention to before NGs occur frequently. "4.7.4 [Judgement Condition (Trend Monitor)]" (→pg.8)
NG display	This item displays maximum 36 errors returned when the judgement result is NG. "4.7.5 [NG Display (Trend Monitor)]" (→pg.10)
Data save	This item saves the measurement results recorded in the trend monitor to USB memory. "4.7.6 [Data Save (Trend Monitor)]" (→pg.11)
Output parameter	This item can be changed if necessary. Usually, the factory default value can be used. Specify whether to reflect the judgement result to the overall judgement of the scene. "4.7.7 [Output Parameter (Trend Monitor)]" (→pg.12)

4.7.1 Setting up [Trend Monitor]

Set up trend monitor as follows.

POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 In the Edit Flow window, tap [Trend monitor].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area, tap [Measurement] to specify an expression used for displaying measurement values on the trend monitor.

"4.7.2 [Measurement (Trend Monitor)]" (→pg.3)

3 In the "Item tab" area, tap [Display range] to specify a measurement value range to be displayed on the trend monitor.

"4.7.3 [Display Range (Trend Monitor)]" (→pg.3)

4 In the "Item tab" area, tap [Judgement] to specify judgement conditions for OK and a warning range that should be called attention to before NGs occur frequently.

"4.7.4 [Judgement Condition (Trend Monitor)]" (→pg.8)

5 In the "Item tab" area, tap [Data save] to perform setting and save the data.

"4.7.6 [Data Save (Trend Monitor)]" (→pg.11)

6 In the "Item tab" area, tap [Output parameter] to perform necessary settings.
"4.7.7 [Output Parameter (Trend Monitor)]" (→pg.12)

7 Tap [OK].
After confirmation, the ProcItem Setting window will be closed.

8 Perform a measurement test.
"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

9 Verify measurement results.
"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"
When NG is displayed, please measure again and make Adjust if necessary.
"4.7.5 [NG Display (Trend Monitor)]" (→pg.10)

4.7.2 [Measurement (Trend Monitor)]

Select the Value to be displayed on the trend monitor. The Value can be set up with the expression.
Each unit may have a separate trend monitor.

1 In the "Item tab" area, tap [Measurement].

2 In the "Expression" area, tap [...] for "Measurement data".

Expression setting screen appears.

3 Specify an expression.
For how to specify an expression, see"4.1.4 Structure and Creation of Expression" (→pg.5).

When setting up [Unit], please select the unit number which is processed before [Trend Monitor] is processed. Even if the unit number is after [Trend Monitor], the figure will still not be displayed.

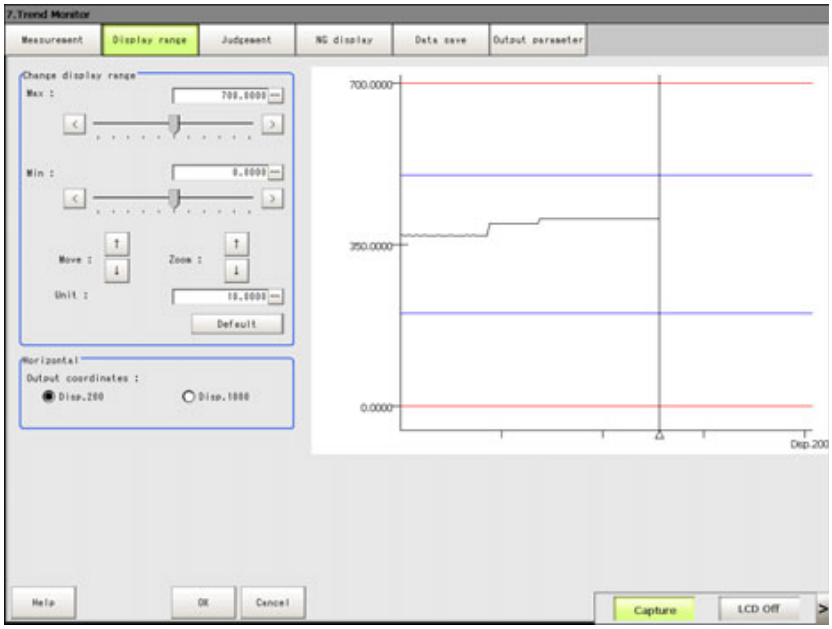
For the subsequent operations, see "4.7.1 Setting up [Trend Monitor]" (→pg.2).

4.7.3 [Display Range (Trend Monitor)]

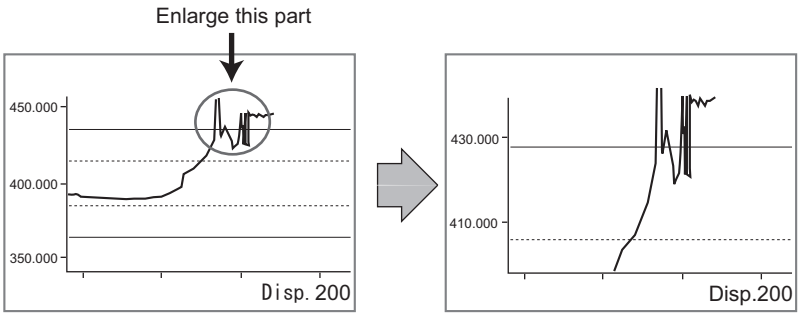
If what you want to see is not on the screen, scroll the graph up and down or zoom in/out.
In addition, you can change the number of horizontally displayed results between 200 and 1000.

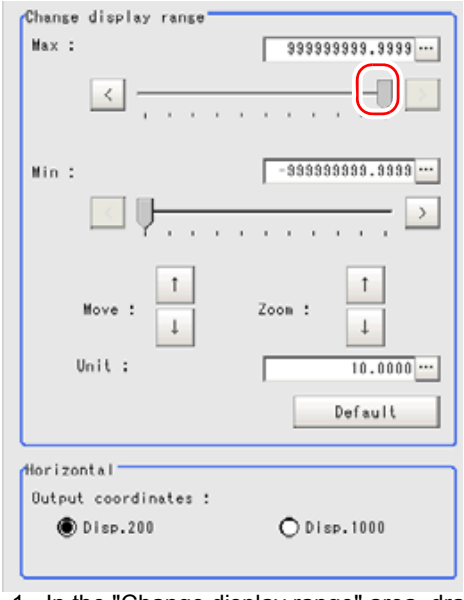
1 In the "Item tab" area, tap [Display range].

A graph is displayed in the "Image display" area.



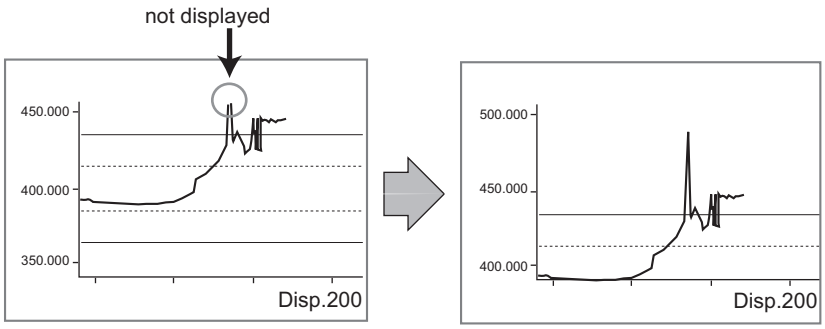
Specifying the top (Max) and the bottom (Min) of the graph to change the displayed range

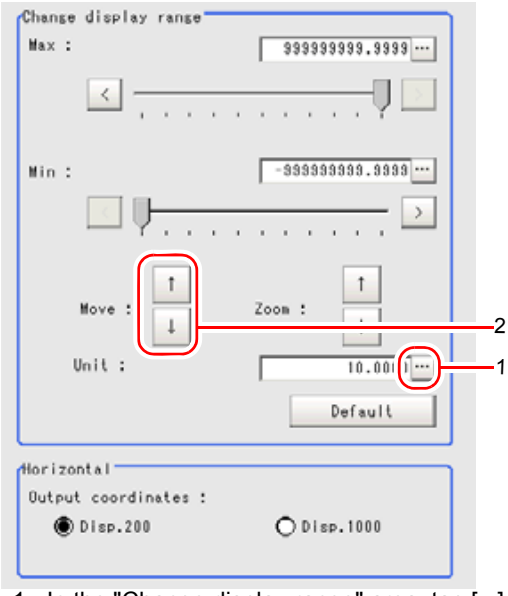




1. In the "Change display range" area, drag the slider for "Max" to a preferred value.
   The value can also be specified by tapping one of the buttons at both ends of the slider or tapping [...].
   How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"
   The specified maximum value becomes the top of the graph displayed in the "Image display" area.
2. In the "Change display range" area, tap an arrow of [Zoom:] to zoom in/out the graph.

Moving up and down the graph itself

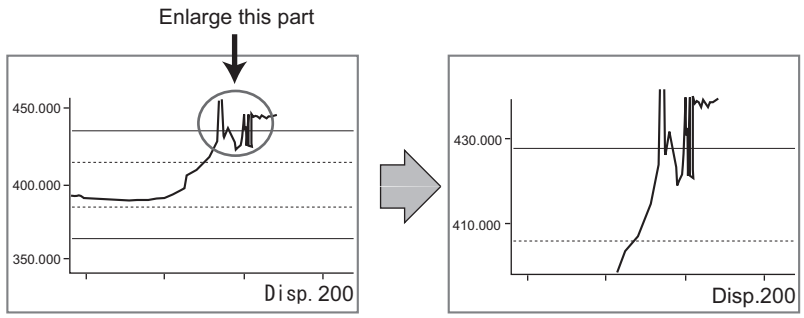


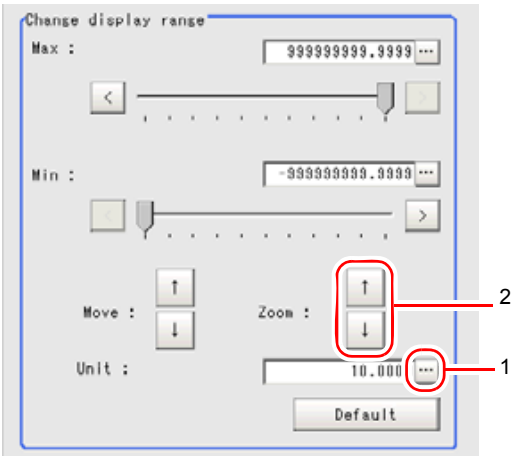


1. In the "Change display range" area, tap [...] for "Unit" and specify how many units per tap when moving the graph.
2. In the "Change display range" area, tap one of the arrow buttons of "Move" to move the graph.
   In the "Image display" area, the graph will move accordingly.
   The scale will also change as the graph moves.

Zooming in/out the graph

Example) Enlarging a part where measurement results were unstable:



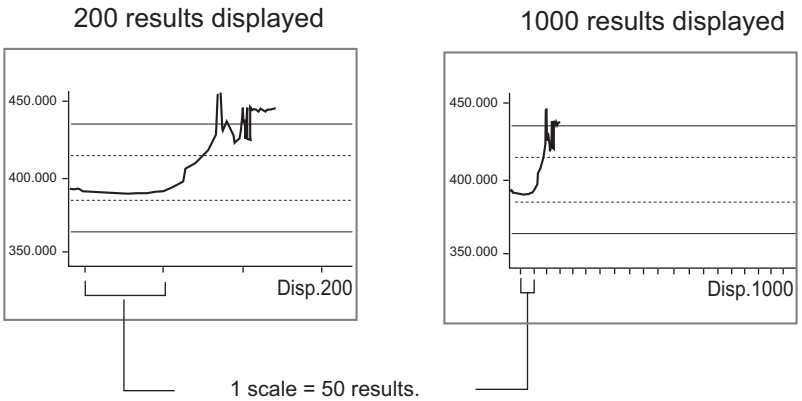


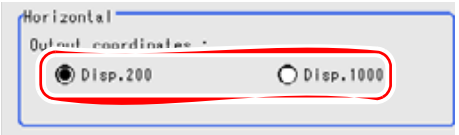
1. In the "Change display range" area, tap [...] for "Unit" and specify how many units per tap when enlarging the graph.
2. In the "Change display range" area, tap one of the arrow buttons "Zoom" to enlarge the graph.
   In the "Image display" area, the graph is displayed in an enlarged view.
   The scale will also change as the graph moves.

Setting the optimum range automatically

1. In the "Change display range" area, tap [Default].
   The optimum range including the maximum and minimum values of the input data is displayed.
   If two or more data inputs are not available, a message that prompts for input will appear.
   Tap [Default] after performing measurement twice or more.

Changing the horizontal display range (the number of displayed results)



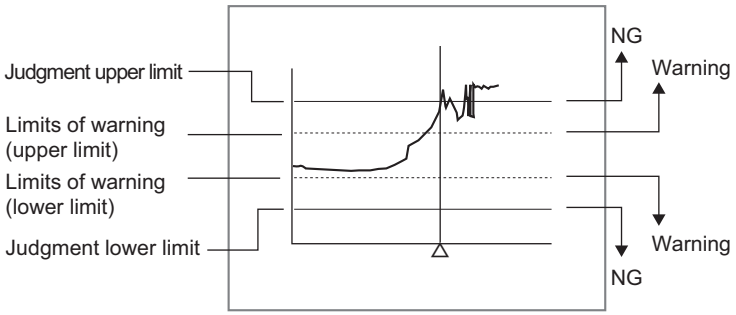


1. In the "Horizontal" area, select the number of results displayed in the horizontal direction.
   The graph is displayed with the specified number of results.

For the subsequent operations, see "4.7.1 Setting up [Trend Monitor]" (→pg.2).

4.7.4 [Judgement Condition (Trend Monitor)]

Set up the OK conditions for deciding a Judge measurement results and the NG Limits of warning.



POINT

- When warning occurs, the word "Limits of Warning" will be displayed on the screen.
  The event that is alarmed can also be output to the external devices only if you properly set up "Parallel Judge" and the expression that is used to output measurement results (warning) of the trend monitor.

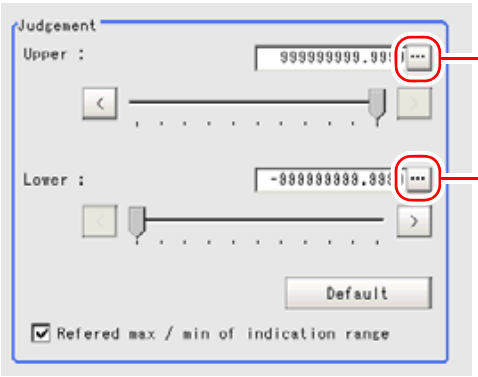
1 In the "Item tab" area, tap [Judgement].

2 In the "Judgement" area, specify values for "Upper" and "Lower".

Table: Judgement (Trend Monitor) - Judgement

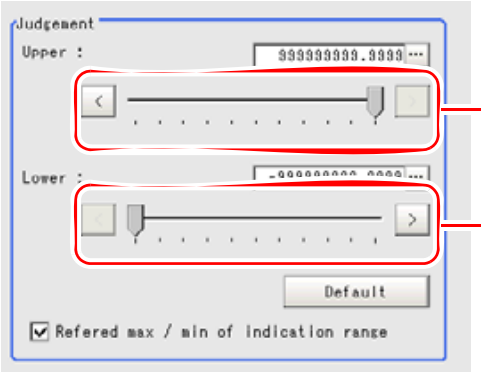
Setting Item	Set Value [Factory Default]	Description
Upper	-999999999.9999 to [999999999.9999]	Specify the range where the measurement result is judged to be OK.
Lower	[-999999999.9999] to 999999999.9999	
Referred max / min of indication range	・[Checked] ・Unchecked	When checked, the judgement range that can be set by [Upper] and [Lower] becomes the same as the [Max] and [Min] values set in [Display range].

Specifying values in the "Judgement" area



1. Tap [...] for "Upper" and specify a value.
   For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual"
   The Upper line in the figure will move.
2. To set up the "Lower" in the same way with "Upper".

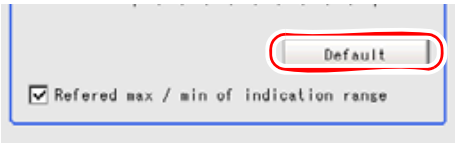
Adjust the graph in the "Image display" area, referring to the lines representing the upper and lower limits.



1. In the "Judgement" area, drag the slider or tap one of the buttons at both ends of the slider to specify a value for "Upper".
   The image Upper line will move.
   The value of the "Upper" in the "Detail" area will also change accordingly.

2. To set up the "Lower" in the same way with "Upper".

Setting the optimum range automatically



1. In the "Judgement" area, tap [Default].
   The optimum range including the maximum and minimum values of the input data is displayed.
   If two or more data inputs are not available, a message that prompts for input will appear. Tap [Default] after performing measurement twice or more.

3 In the "Warning" area, specify values for "Upper" and "Lower".

How to specify values for the "Warning" area is the same as for the "Judgement" area.

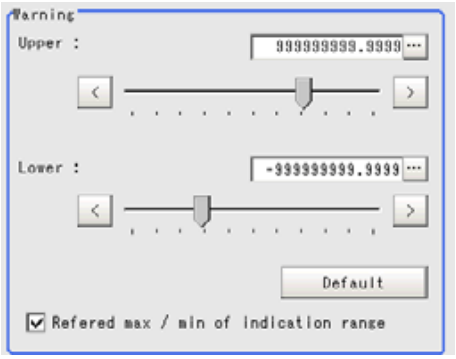


Table: Judgement (Trend Monitor) - Warning

Setting Item	Set Value [Factory Default]	Description
Upper	-999999999.9999 to [999999999.9999]	Specify the warning range to call attention to before NGs occur frequently.
Lower	[-999999999.9999] to 999999999.9999	
Referred max / min of indication range	・ [Checked] ・ Unchecked	When checked, the judgement range that can be set by "Upper" and "Lower" becomes the same as the "Max" and "Min" values set in [Display range].

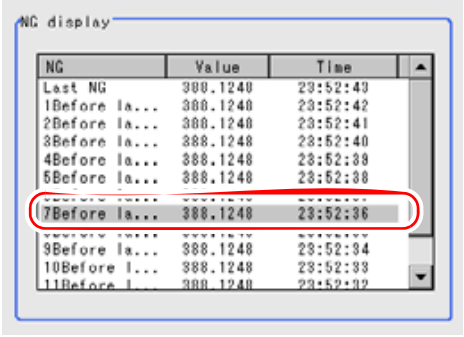
For the subsequent operations, see "4.7.1 Setting up [Trend Monitor]" (→pg.2).

4.7.5 [NG Display (Trend Monitor)]

Displays maximum 36 errors returned when the judgement result is NG.

1 In the "Item tab" area, tap [NG display].

2 In the "NG display" area, tap an NG result to be displayed.



The measurement values and time are displayed.
In the "Image display" area, a vertical line is displayed at the position an NG result occurs, indicating where in the graph NG results occur.

4.7.6 [Data Save (Trend Monitor)]

The measured data of the trend monitor can also be saved in the USB device. Since the data can be saved in the CSV format, it can be edited on the PC.
The data to be saved includes all the statistical data, the value and their time when NG is displayed (up to 36), and the value on the curve (up to 1,000).

Important

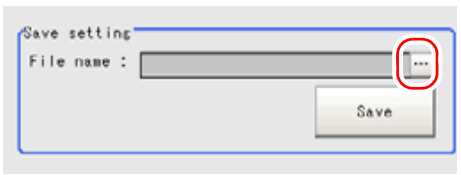
- Please insert USB memory first before saving data.
  For the position of the USB connector, see the Instruction Manual.

POINT

- For more information about the measured data to be saved, see " Measured Data (CSV Format)" (→pg.23), of "User's Manual"

1 In the "Item tab" area, tap [Data save].

2 In the "Save setting" area, tap [...] for "File name".



File Specification screen appears.

3 In the File Setting window, specify a file in which to save data and tap [OK].

POINT

- Single-byte alphanumeric characters are used for File name.
- Prior to naming the file, please enter the date (for example: 0410.CSV).

4 In the "Save setting" area, tap [Save].

The measurement data is saved to USB memory.

For the subsequent operations, see "4.7.1 Setting up [Trend Monitor]" (→pg.2).

4.7.7 [Output Parameter (Trend Monitor)]

Specify whether to reflect the judgement result to the overall judgement of the scene.

1 In the "Item tab" area, tap [Output parameter].

2 In the "Reflect to overall judgement" area, specify whether to reflect the measurement result to the overall judgement of the scene.

Table: Setting Values for Output Parameters

Setting Item	Set Value [Factory default]	Description
Reflect to overall judgement	・[ON] ・OFF	Select whether to reflect the judgement result of this processing unit to the overall judgement of the scene. ・Selecting "ON" reflects the judgement result of this processing unit on the overall judgement of the scene. ・Selecting "OFF" does not reflect the judgement result of this processing unit on the overall judgement of the scene.

POINT

- The overall judgement result of the scene is output to the OR signal to be sent via the parallel interface. Also, it is displayed in the Measurement Information Display area in the upper part of the Main screen.
  "10.4.4 Time Chart" (→pg.35), of "User's Manual"
  "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"

For the subsequent operations, see "4.7.1 Setting up [Trend Monitor]" (→pg.2).

4.7.8 When Using Measurement Results Externally (Trend Monitor)

Value Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (Trend Monitor)

Measurement items	Character string	Description
Judge	JG	Judgement result
Measurement	DT	Latest Measured value
Warning	WN	Warning(0: OFF, 1: ON)
Maximum	MX	Max. Value during saving
Minimum	MN	Min. Value during saving
Average	AV	Average Value during saving
Deviation	DV	Deviation of Value during saving
Measure count	MC	Measure count s since the beginning of the measurement
NG count	NC	NG counts within the measurement counts
Warning count	WC	The warning counts of the measurement counts

External Reference List

The data types and their numbers that are available to refer from other processing units and external equipment are shown below. For the input method, see "Input Format" in "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Trend Monitor)

No.	Data Name	Set/Get	Data Range
0	Jjudge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Measurement	Get only	-999999999.9999 to 999999999.9999
6	Warning	Get only	0: OFF, 1: ON
7	Maximum	Get only	-999999999.9999 to 999999999.9999
8	Minimum	Get only	-999999999.9999 to 999999999.9999
9	Average	Get only	-999999999.9999 to 999999999.9999
10	Deviation	Get only	-999999999.9999 to 999999999.9999
11	Measurement count	Get only	0 to 999999999

Table: External Reference List (Trend Monitor)

No.	Data Name	Set/Get	Data Range
12	NG count	Get only	0 to 999999999
13	Warning count	Get only	0 to 999999999
103	Reflect in OR	Set/Get	0: ON 1: OFF
121	Upper limit of the judgement	Set/Get	-999999999.9999 to 999999999.9999
122	Lower limit of the judgement	Set/Get	-999999999.9999 to 999999999.9999
123	Upper limit of the warning	Set/Get	-999999999.9999 to 999999999.9999
124	Lower limit of the warning	Set/Get	-999999999.9999 to 999999999.9999
125	Upper limit of the display range	Set/Get	-999999999.9999 to 999999999.9999
126	Lower limit of the display range	Set/Get	-999999999.9999 to 999999999.9999
127	Unit	Set/Get	1 to 1000000
128	Horizontal	Set/Get	0: Display 200 results 1: Display 1000 results

4.8 Data Logging

Used to save measured data to the memory and USB memory.

Important

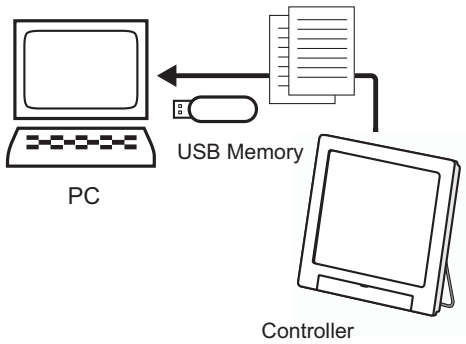
- To output data, the Logging setting needs to be set to [Only NG] or [All].
  "7.2 Setting up Logging Condition [Logging setting]" (→pg.7), of "User's Manual"
- For the measurement with Adjustment window, output is executed only when output is enabled by the following method during the measurement.
  - Check [Output] of [Test Measurement] in the "Control" area.

  When the measurement is executed in the RUN window, output is executed regardless of the external output setting.
- If [Image Logging] option is set Data logging setting, you can conveniently verify both measured data and image data.
  "7.2 Setting up Logging Condition [Logging setting]" (→pg.7), of "User's Manual"

Used for the following case

- When analyzing by using measured data

Measured data and operational results can be output to the memory device and USB memory device and USB memory, which is then transfrred to the external devices, such as PC.



For how to transfer data into PC, see

- "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual"

4.8.1 Setting up [Data logging]

POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1. In the Edit Flow window, tap [Data logging].
   The ProcItem Setting window is displayed.
   "1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2. In the "Item tab" area, tap [Setting] to set up output data.
   For Details, see "4.8.2 [Setting (Data Logging)]" (→pg.16)

3. In the "Item tab" area, tap [Output format] to specify the format used to output to storage.
   For Details, see "4.8.3 [Output Format (Data logging)]" (→pg.17)

4. Tap [OK].
   After confirmation, the ProcItem Setting window will be closed.

5. In the "Control" area, check "Output" in [Test Measurement setting] to enable output, and perform measurement.
   "6.1 The Flow before Starting the Operation" (→pg.2), of "User's Manual"

6. Verify measurement results.
   "6.2 Display of the RUN Window" (→pg.3), of "User's Manual"
   When NG is displayed, please measure again and make Adjust if necessary.

4.8.2 [Setting (Data Logging)]

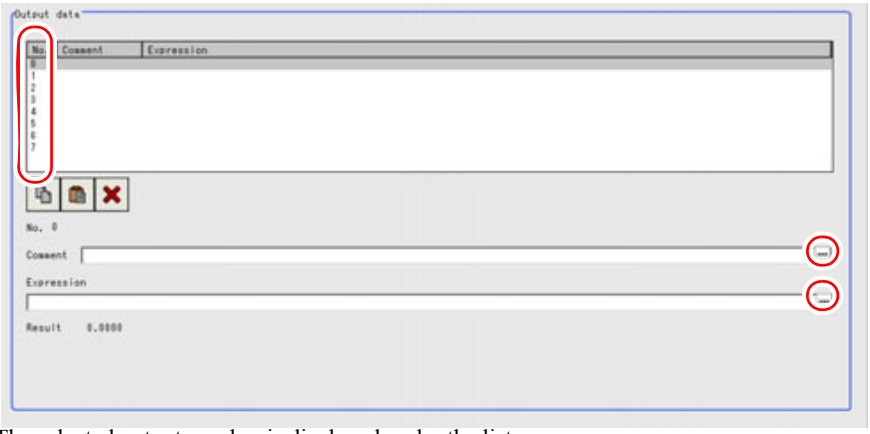
Specify output content using expressions.
Up to eight expressions (0 to 7) can be set for each unit.

POINT

- One [Data Logging] processing item can output eight data items. For instructions on how to output nine or more data items as one record, see "4.8.4 Additional Description" (→pg.20).

1 In the "Item tab" area, tap [Setting].

2 In the list, tap the output No. for which the expression is to be set.



The selected output number is displayed under the list.

3 Tap [...] for "Comment" and input an explanation of the expression.

How to input text: "1.5 Inputting a Text" (→pg.19), of "User's Manual"

4 Tap [...] for "Expression".

The Setting Expression window is displayed.

5 Specify an expression.

"4.1.4 Structure and Creation of Expression" (→pg.5)

6 Repeat the Steps 2 to 3 to set up the output contents for each output No.

For the subsequent operations, see "4.8.1 Setting up [Data logging]" (→pg.16).

4.8.3 [Output Format (Data logging)]

Select the output format.

1 In the "Item tab" area, tap [Output format].

2 If necessary, set up each item.

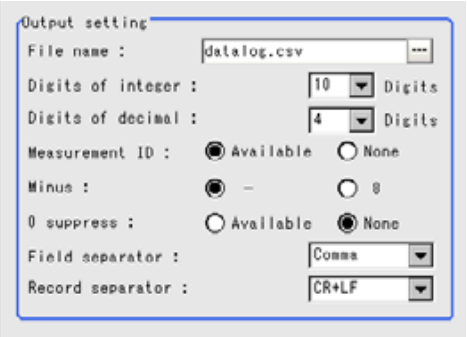


Table: Output Format (Data Logging)

Setting Options	Set Value [Factory defaults]	Description
Digits of integer	1 to [10]	Specify the width of the integer part including the sign. For positive numbers, the plus sign is not output. Example Setting: 4 digits, Data:-5619 The data is output as "-999".
Digits of decimal	0 to [4]	Specify the places of the output digits of decimal. When 0 is selected, the digits of decimal will be rounded.
Measurement ID	・[ON] ・OFF	Select whether to output the measurement ID in the front of the output data. Measurement ID : measurement time YYYY-MM-DD_HH-MM-SS-MS (YYYY: Calendar, MM: Month, DD: Day, HH: Hour, MM: Minute, SS: second, MS: millisecond) Example Measurement time: 11:10:25.500 AM, December 24th, 2007, the measurement ID is -2007-12-24_11-10-25-500.
Minus	・[-] ・8	When a Minus is selected, what is displayed in the sign place.

Table: Output Format (Data Logging)

Setting Options	Set Value [Factory defaults]	Description
0 suppress	・ON ・[OFF]	Select to deal with the blank place to the left side of the output data or not. Yes: Insert 0 into the blank place. No: Insert the space sign into the blank place. Example Digits of integer: 5 places, Digits of decimal: 3 places. When the data is 100.000 no: 00100.000 no: _100.000 (denoting the space)
Field separator	・OFF ・[Comma] ・Tab ・Space ・CR+LF	Select the separator for output data.
Record separator	・OFF ・Comma ・Tab ・Space ・CR+LF	Select the separator each time data is output.

POINT

- Single-byte alphanumeric characters are used for File name.
- Logging data is output in .CSV file, which can be optimally processed on the PC by using the curve and function of Excel.
  "7.1 Analyzing Measured Data with PC" (→pg.2)
- Since the File name of the logged figure also includes the same measurement ID, you can find your desired measured data and figure with the measurement ID.
- The data is output in the ASCII format, which has the following structure.

  Measurement ID,Data1 Data N + delimiter

  Measurement time : YYYY-MM-DD_HH-MM-SS-

  (YYYY: Calendar, MM: Month, DD: Day, HH: Hour, MM: Minute, SS: Second, MS: Million Second)
  Example)
  Measurement time: 11:10:25.500 AM, December 24th, 2007
  Measurement ID is "2007-12-24_11-10-25-500".
- Logging data and figures will be Saved in the destination folder set up by the system.
  "7.2 Setting up Logging Condition [Logging setting]" (→pg.7), of "User's Manual"
  The structure of the destination folder is as follows.
  - Logging data
    \Filename.csv
  - Logging Image
    \YYYY-MM-DD_HH-MM-SS-MS.ifz

  (Examples) when measuring with the following setups,
  Save the results to the destination folder "\USBDisk".
  The File name of Data logging: initial value ("datalog.csv").
  Logging setup: All
  Measurement objects: Scene 0 of Scene Group 0:
  Measuring time: 12:30:45.500 PM, January 1st, 2007.
  - Logging data
    \USBDisk\datalog.csv

- Logging Image
  \USBDisk\2007-01-01_12-30-45-500.ifz

For the subsequent operations, see "4.8.1 Setting up [Data logging]" (→pg.16).

4.8.4 Additional Description

When 1 logging containing 9 or above value is output

Up to 8 Value can be output with one [Data logging] Processing Item. When 1 logging containing 9 or above value is output, the following setup should be performed.

- Registers two or more [Data Logging] units in one scene.(*1)
- The setup of [File name] of [Data logging] should be identical.(*2)
  "7.2 Setting up Logging Condition [Logging setting]" (→pg.7), of "User's Manual"
- Outputs the record separator (CR+LF) at the end of each data output.(*3)

Example) When outputting the Coordinate of the 12 points which are obtained through 2 "Search" as one logging when you measure the sequence of the substrates.

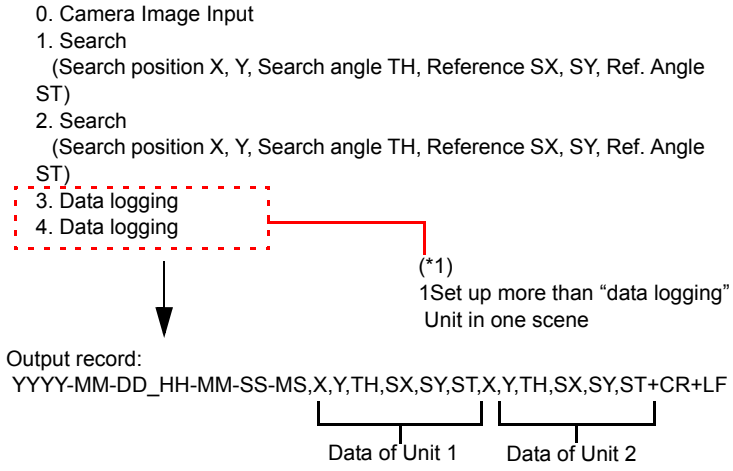


Table: Precautions when outputting more than one data as a logging

[Data logging] setting of Unit 3 Condition Setting		[Data logging] setting of Unit 4		Remarks
<Condition setting>		<Condition Setting>		
Output Target (File name)	datalog.csv	Output Target (File name)	datalog.csv	(*2) path is the same as File name
Digits of integer	8	Digits of integer	8	
Digits of decimal	3	Digits of decimal	3	

Table: Precautions when outputting more than one data as a logging

[Data logging] setting of Unit 3 Condition Setting		[Data logging] setting of Unit 4		Remarks
Measurement ID	ON	Measurement ID	ON	
Minus	-	Minus	-	
0 suppress	No	0 suppress	No	
Field separator	Comma	Field separator	Comma	
Record separator	Comma	Record separator	CR+LF	(*3) add CR + LF to the last data in Unit 4
<Output data>		<Output data>		
Expression 0. U1.X (Search position X) Expression 1. U1.Y (Search position Y) Expression 2. U1.TH (Angle θ) Expression 3. U1.SX (reference X) Expression 4. U1.SX (reference Y) Expression 5. U1.ST (Reference angle) Expression 6. U2.X (Search position X) Expression 7. U2.Y (Search position Y)		Expression 0. U2.TH (Search angle) Expression 1. U2.SX (reference X) Expression 2. U2.SY (reference Y) Expression 3. U2.ST (Reference angle θ)		The data that are not included in Unit 3 will be output as the Expression 0 to 3 of Unit 4

4.8.5 When Using Measurement Results Externally (Data logging)

Value Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.
For how to set up expression, see"4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (Data Logging)

Measurement items	Character string	Description
Judge	JG	Judgment result
Results of Expressions 0 to 7	DO0 to DO7	Expression result of Expression 0 to 7

External Reference List

The data types and their numbers that are available to refer from other processing units and external equipment are shown below. For the input method, see "Input Format" in "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Data Logging)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgment (unmeasured) 1: Judgment result OK -1: Judgment result NG
5 to 12	Results of Expressions 0 to 7	Get only	Calculation results of expressions
120	Measurement ID	Set/Get	0: OFF, 1: ON
121	Digits of integer	Set/Get	1 to10
122	Digits of decimal	Set/Get	0:0 to 4:4
123	Minus	Set/Get	0:-, 1:8
124	Field separator	Set/Get	0: OFF 1: Comma, 2: Tab, 3: Space, 4: CR+LF
125	Record separator	Set/Get	0: OFF, 1: Comma, 2: Tab, 3: Space, 4: CR+LF
126	0 suppress	Set/Get	0: OFF, 1: ON

4.9 3D Calculation

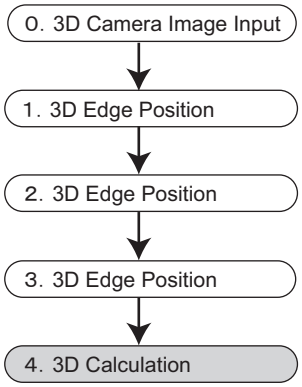
This processing item is for 3D measurement only.

Used for the following cases

- When changing the measurement process by using calculation results

Example) Obtain the measured object's 3D posture to be passed to external devices such as an industrial robot.

Calculate the 3D posture of the measured object using three 3D coordinates obtained by processing items such as [3D Edge Position].



- When performing calculation by using the calculation results of other units.

4.9.1 Setting up [3D Calculation]

The setting procedure for [3D Calculation] is as follows:

POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 In the Edit Flow window, tap [3D Calculation].

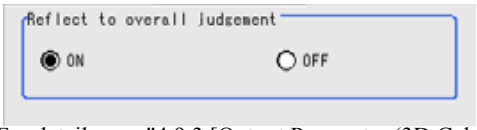
The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area, tap [Setting] and set up expressions.

For details, see "4.9.2 [Setting (3D Calculation)]" (→pg.24).

3 In the "Item tab" area, tap [Output parameter] and specify the setting.



For details, see "4.9.3 [Output Parameter (3D Calculation)]" (→pg.34).

4 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

4.9.2 [Setting (3D Calculation)]

Set up each expression.

POINT

- When you need to output calculation results to an external device, specify the output processing unit after [3D Calculation] in the Edit Flow window. Calculation results cannot be output to external devices when you only set up expressions. "Chapter 6 - Result Output" (→pg.1)

1 In the "Item tab" area, tap [Setting].

2 In the "3D Expression" area, tap [▼] and select a calculation method

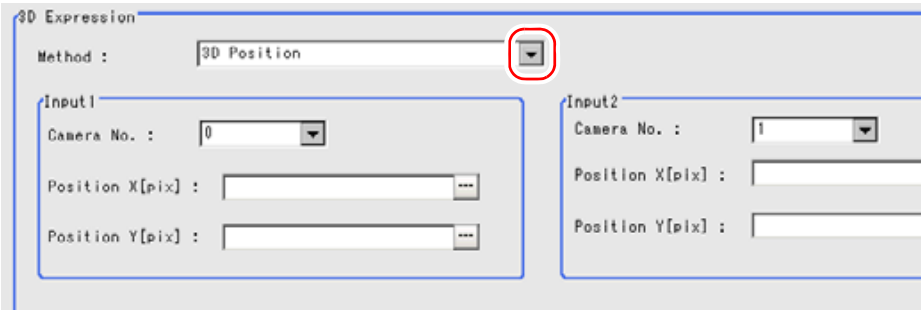


Table: Setting (3D Calculation) - 3D Expression - Method

Setting Item	Set Value [Factory Default]	Description
Method	[3D Position]	The X-/Y-/Z-coordinates (mm) are calculated based on the X-/Y-coordinates obtained from each camera.
	3D world coordinates position	Coordinates are converted from the camera coordinate system into a world coordinate system. World coordinates are calculated using the parameters from [World coordinates] in [3D Camera Image Input].
	3D posture	X/Y/Z/θ/ϕ/ψ are calculated from X/Y/Z for each of the 3 points. For X/Y/Z, the center of each point is calculated, and for θ/ϕ/ψ, the plane slope is calculated using plane equations.
	3D posture shift	The deviation between X/Y/Z for the 3 points on the measurement image and X/Y/Z for the 3 points in the model is calculated (the positional relationship between two given planes, each including 3 points).

3 Set up expressions with each calculation method.

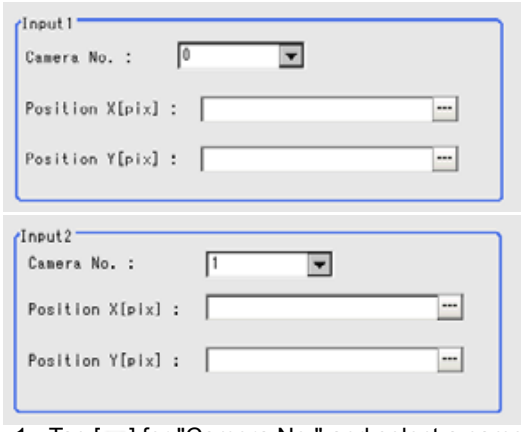
- " 3D Position" (→pg.26)
- " 3D World Coordinates Position" (→pg.28)
- " 3D Posture" (→pg.30)
- " 3D Posture Shift" (→pg.33)

For the subsequent operations, see "4.9.1 Setting up [3D Calculation]" (→pg.23).

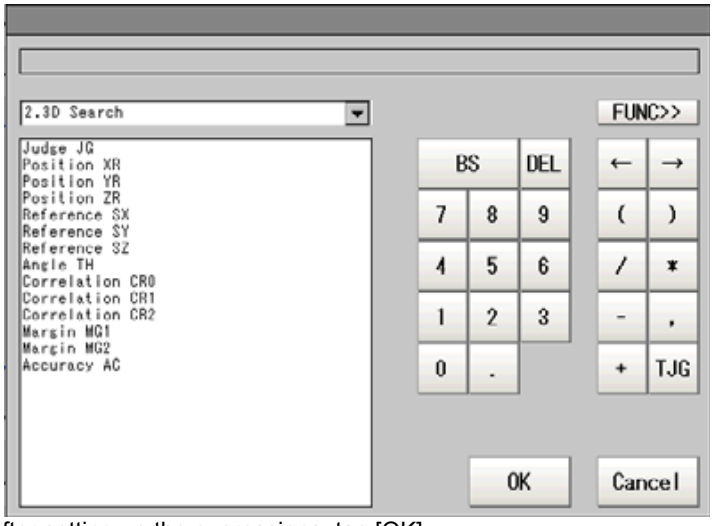
3D Position

1 Select "3D Position" as "Method".

2 In the "Input1" and "Input2" areas, specify a value for each item.



1. Tap [▼] for "Camera No." and select a camera to be used for measurement.
2. Tap [...] for "Position X" and "Position Y".
   The Setting Expression window is displayed.
3. Specify an expression.
   For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).
   For the Setting Expression window, see "4.1.5 How to Display Setting Expression Window" (→pg.8).

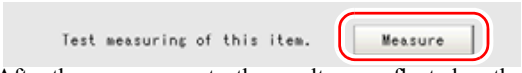


4. After setting up the expressions, tap [OK].
   The Setting Expression window closes.

POINT

- If an error message appears, an expression is not correctly set up. Check the expressions again, referring to " Precautions" (→pg.7).

3 When the setting has been changed, tap [Measure] in the "Detail" area to verify whether measurements can be made correctly.



After the measurements, the results are reflected on the values in the "Judgement condition" area.

4 In the "Judgement condition" area, tap [...] and input a value for each item.

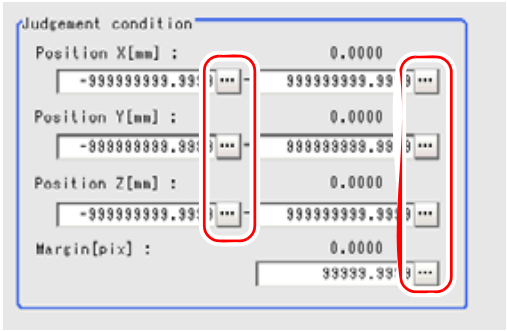


Table: Setting (3D Calculation) - 3D Expression - Judgement Condition

Setting Item		Set Value [Factory Default]	Description
Position X (mm)	Upper	-999999999.9999 to [999999999.9999]	Judgement condition for the calculation result of the X-coordinate. Specify the upper/lower limit to be judged as OK.
	Lower	[-999999999.9999] to 999999999.9999	
Position Y (mm)	Upper	-999999999.9999 to [999999999.9999]	Judgement condition for the calculation result of the Y-coordinate. Specify the upper/lower limit to be judged as OK.
	Lower	[-999999999.9999] to 999999999.9999	
Position Z (mm)	Upper	-999999999.9999 to [999999999.9999]	Judgement condition for the calculation result of the Z-coordinate. Specify the upper/lower limit to be judged as OK.
	Lower	[-999999999.9999] to 999999999.9999	
Margin (pix)		0 to [99999.999]	Judgement condition for the camera deviation. Specify a value to be judged as OK.

3D World Coordinates Position

1 Select "3D world coordinates position" as "Method".

2 In "Camera mode", select a camera combination used for measurements.

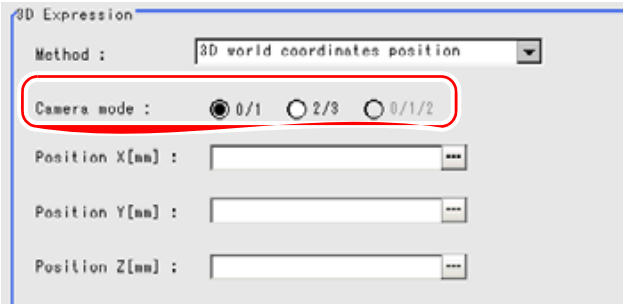
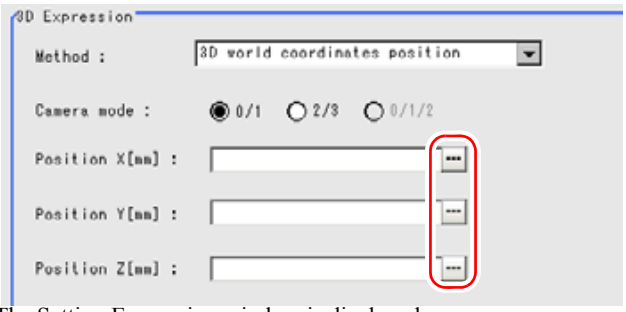


Table: Setting (3D Calculation) - 3D World Coordinates Position

Setting Item	Set Value [Factory Default]	Description
Camera mode	・ [0 / 1] ・ 2 / 3 ・ 0/1/2	Select a camera combination used for measurements: ・ 0 / 1 Combination of camera 0 and camera 1. ・ 2 / 3 Combination of camera 2 and camera 3. ・ 0/1/2 Combination of 3 cameras: camera 0, camera 1, and camera 2.

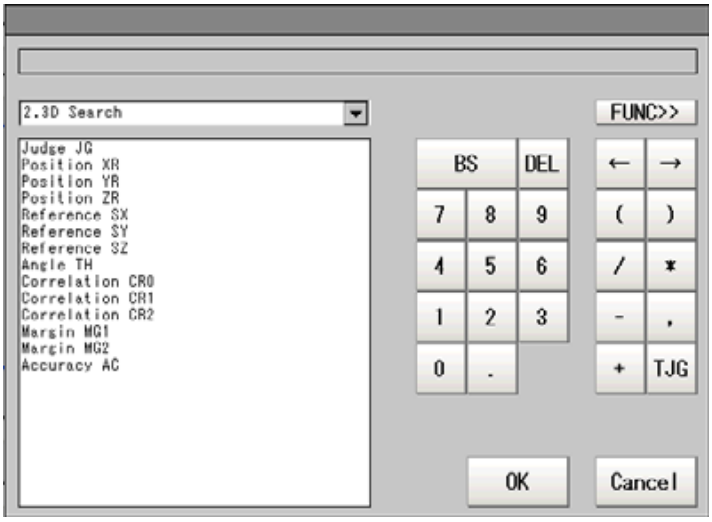
3 Tap [...] for "Position X", "Position Y", and "Position Z".



The Setting Expression window is displayed.

4 Specify an expression.

For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).
For the Setting Expression window, see "4.1.5 How to Display Setting Expression Window" (→pg.8).



5 After setting up the expressions, tap [OK].

The Setting Expression window closes.

POINT

- If an error message appears, an expression is not correctly set up. Check the expressions again, referring to " Precautions" (→pg.7).

6 When the setting has been changed, tap [Measure] in the "Detail" area to verify whether measurements can be made correctly.

After the measurements, the results are reflected on the values in the "Judgement condition" area.

7 In the "Judgement condition" area, tap [...] and input a value for each item.

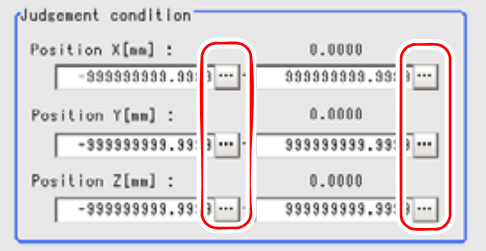


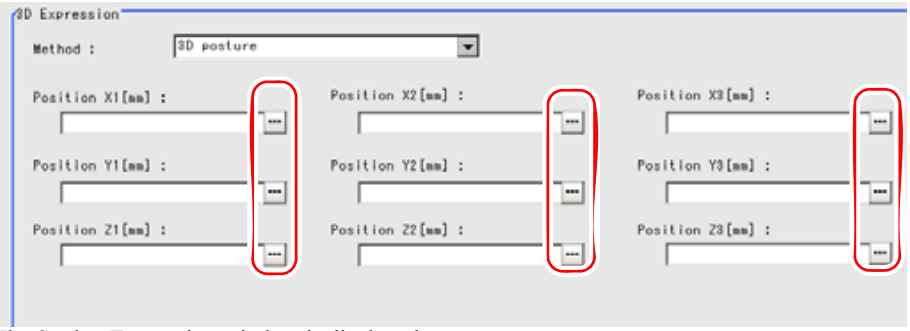
Table: Setting (3D Calculation) - 3D World Coordinates Position - Judgement Condition

Setting Item		Set Value [Factory Default]	Description
Position X (mm)	Upper	-999999999.9999 to [999999999.9999]	Judgement condition for the calculation result of the X-coordinate. Specify the upper/lower limit to be judged as OK.
	Lower	[-999999999.9999] to 999999999.9999	
Position Y (mm)	Upper	-999999999.9999 to [999999999.9999]	Judgement condition for the calculation result of the Y-coordinate. Specify the upper/lower limit to be judged as OK.
	Lower	[-999999999.9999] to 999999999.9999	
Position Z (mm)	Upper	-999999999.9999 to [999999999.9999]	Judgement condition for the calculation result of the Z-coordinate. Specify the upper/lower limit to be judged as OK.
	Lower	[-999999999.9999] to 999999999.9999	

3D Posture

1 Select "3D posture" as "Method".

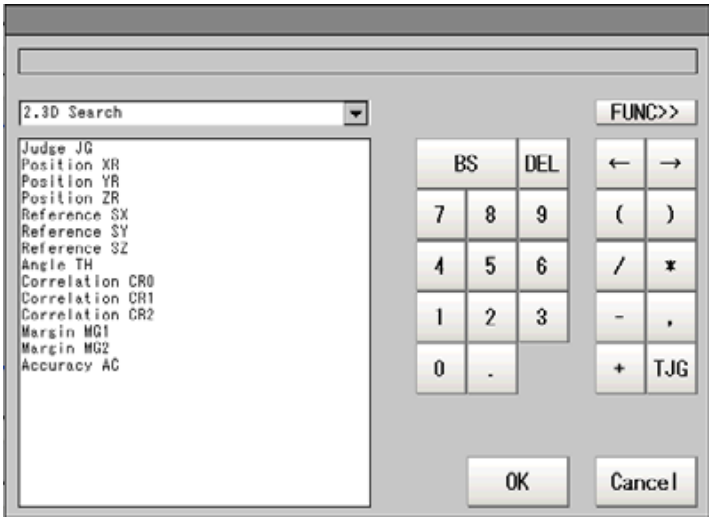
2 Tap [...] for "Position X", "Position Y", and "Position Z".



The Setting Expression window is displayed.

3 Specify an expression.

For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).
For the Setting Expression window, see "4.1.5 How to Display Setting Expression Window" (→pg.8).



4 After setting up the expressions, tap [OK].

The Setting Expression window closes.

POINT

- If an error message appears, an expression is not correctly set up. Check the expressions again, referring to " Precautions" (→pg.7).

5 When the setting has been changed, tap [Measure] in the "Detail" area to verify whether measurements can be made correctly.

After the measurements, the results are reflected on the values in the "Judgement condition" area.

6 In the "Judgement condition" area, tap [...] and input a value for each item.

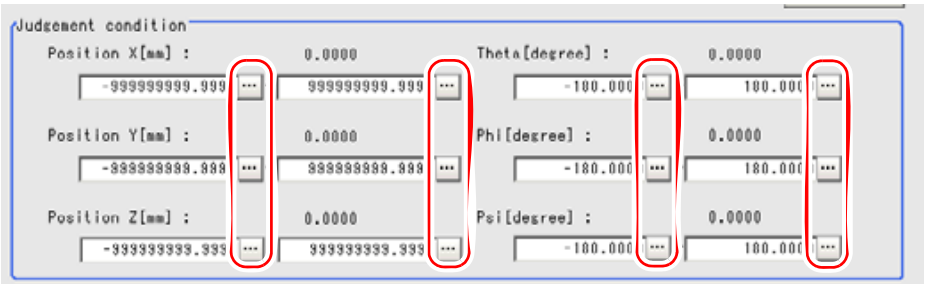


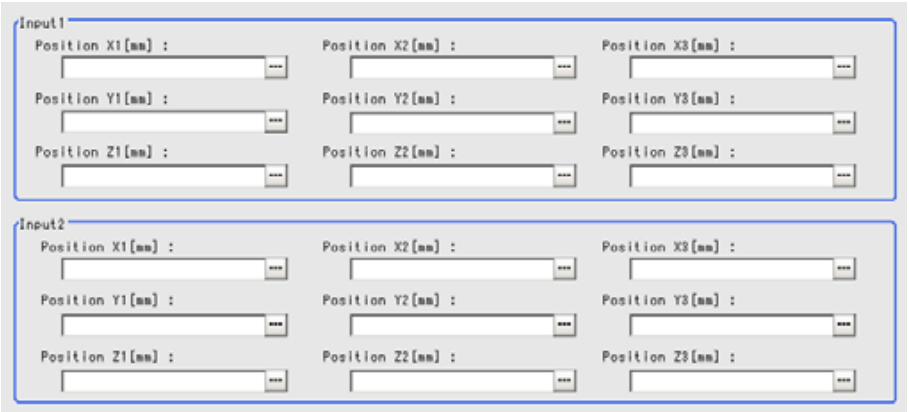
Table: Setting (3D Calculation) - 3D Posture - Judgement Condition

Setting Item		Set Value [Factory Default]	Description
Position X (mm)	Upper	-999999999.9999 to [999999999.9999]	Judgement condition for the calculation result of the X-coordinate. Specify the upper/lower limit to be judged as OK.
	Lower	[-999999999.9999] to 999999999.9999	
Position Y (mm)	Upper	-999999999.9999 to [999999999.9999]	Judgement condition for the calculation result of the Y-coordinate. Specify the upper/lower limit to be judged as OK.
	Lower	[-999999999.9999] to 999999999.9999	
Position Z (mm)	Upper	-999999999.9999 to [999999999.9999]	Judgement condition for the calculation result of the Z-coordinate. Specify the upper/lower limit to be judged as OK.
	Lower	[-999999999.9999] to 999999999.9999	
Theta (degree)	Upper	-180 to [180]	Judgement condition for the calculation result of the angle θ. Specify the upper/lower limit to be judged as OK.
	Lower	[-180] to 180	
Phi (degree)	Upper	-180 to [180]	Judgement condition for the calculation result of the angle ϕ. Specify the upper/lower limit to be judged as OK.
	Lower	[-180] to 180	
Psi (degree)	Upper	-180 to [180]	Judgement condition for the calculation result of the angle ψ. Specify the upper/lower limit to be judged as OK.
	Lower	[-180] to 180	

3D Posture Shift

1 Select "3D posture shift" as "Method".

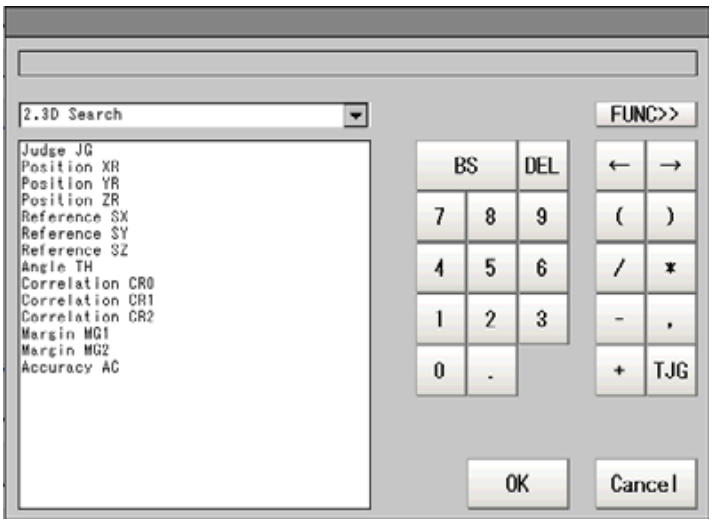
2 In "Input1" and "Input2" areas, tap [...] for each item.



The Setting Expression window is displayed.

3 Specify an expression.

For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).
For the Setting Expression window, see "4.1.5 How to Display Setting Expression Window" (→pg.8).



4 After setting up the expressions, tap [OK].

The Setting Expression window closes.

POINT

- If an error message appears, an expression is not correctly set up. Check the expressions again, referring to " Precautions" (→pg.7).

5 When the setting has been changed, tap [Measure] in the "Detail" area to verify whether measurements can be made correctly.

After the measurements, the results are reflected on the values in the "Judgement condition" area.

6 In the "Judgement condition" area, tap [...] and input a value for each item.

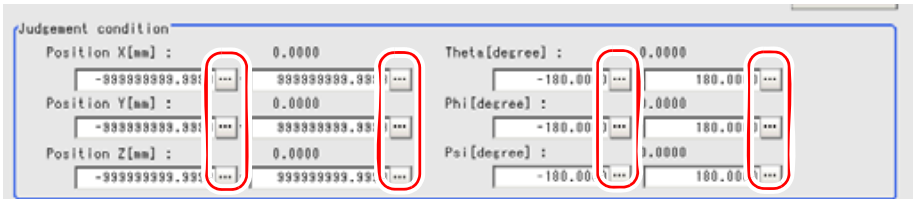


Table: Setting (3D Calculation) - 3D Posture Shift - Judgement Condition

Setting Item		Set Value [Factory Default]	Description
Position X (mm)	Upper	-999999999.9999 to [999999999.9999]	Judgement condition for the calculation result of the X-coordinate. Specify the upper/lower limit to be judged as OK.
	Lower	[-999999999.9999] to 999999999.9999	
Position Y (mm)	Upper	-999999999.9999 to [999999999.9999]	Judgement condition for the calculation result of the Y-coordinate. Specify the upper/lower limit to be judged as OK.
	Lower	[-999999999.9999] to 999999999.9999	
Position Z (mm)	Upper	-999999999.9999 to [999999999.9999]	Judgement condition for the calculation result of the Z-coordinate. Specify the upper/lower limit to be judged as OK.
	Lower	[-999999999.9999] to 999999999.9999	
Theta (degree)	Upper	-180 to [180]	Judgement condition for the calculation result of the angle θ. Specify the upper/lower limit to be judged as OK.
	Lower	[-180] to 180	
Phi (degree)	Upper	-180 to [180]	Judgement condition for the calculation result of the angle ϕ. Specify the upper/lower limit to be judged as OK.
	Lower	[-180] to 180	
Psi (degree)	Upper	-180 to [180]	Judgement condition for the calculation result of the angle ψ. Specify the upper/lower limit to be judged as OK.
	Lower	[-180] to 180	

4.9.3 [Output Parameter (3D Calculation)]

Specify whether to reflect the judgement result to the overall judgement of the scene.

1 In the "Item tab" area, tap [Output parameter].

2 In the "Reflect to overall judgement" area, specify whether to reflect the measurement result to the overall judgement of the scene.

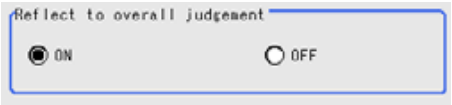


Table: Setting Values for Output Parameters

Setting Item	Set Value [Factory default]	Description
Reflect to overall judgement	・[ON] ・OFF	Select whether to reflect the judgement result of this processing unit to the overall judgement of the scene. ・Selecting "ON" reflects the judgement result of this processing unit on the overall judgement of the scene. ・Selecting "OFF" does not reflect the judgement result of this processing unit on the overall judgement of the scene.

POINT

- The overall judgement result of the scene is output to the OR signal to be sent via the parallel interface. Also, it is displayed in the Measurement Information Display area in the upper part of the Main screen.
  "10.4.4 Time Chart" (→pg.35), of "User's Manual"
  "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"

For the subsequent operations, see "4.9.1 Setting up [3D Calculation]" (→pg.23).

4.9.4 When Using Measurement Results Externally (3D Calculation)

Values Available in Expression

When this processing unit is selected in the unit area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

For "3D Position"

Table: Values Available in Expression (3D Calculation)

Measurement items	Character string	Description
Judge	JG	Overall judgement result

Table: Values Available in Expression (3D Calculation)

Measurement items	Character string	Description
Position X result	D1X	Calculation result of X-coordinate
Position Y result	D1Y	Calculation result of Y-coordinate
Position Z result	D1Z	Calculation result of Z-coordinate
Margin	MG	Calculation result of camera shift amount
Position X judge	J1X	Judgement result of X-coordinate
Position Y judge	J1Y	Judgement result of Y-coordinate
Position Z judge	J1Z	Judgement result of Z-coordinate
Judgement result	JMG	Judgement result of camera shift amount

For "3D world coordinates position"

Table: Values Available in Expression (3D Calculation)

Measurement items	Character string	Description
Judge	JG	Overall judgement result
Position X result	D2X	Calculation result of X-coordinate
Position Y result	D2Y	Calculation result of Y-coordinate
Position Z result	D2Z	Calculation result of Z-coordinate
Position X judge	J2X	Judgement result of X-coordinate
Position Y judge	J2Y	Judgement result of Y-coordinate
Position Z judge	J2Z	Judgement result of Z-coordinate

For "3D posture"

Table: Values Available in Expression (3D Calculation)

Measurement items	Character string	Description
Judge	JG	Overall judgement result
Position X result	D3X	Calculation result of X-coordinate
Position Y result	D3Y	Calculation result of Y-coordinate
Position Z result	D3Z	Calculation result of Z-coordinate
Theta θ result	D3T	Calculation result of angle θ
Phi ϕ result	D3PHI	Calculation result of angle ϕ
Psi ψ result	D3PSI	Calculation result of angle ψ
Position X judge	J3X	Judgement result of X-coordinate
Position Y judge	J3Y	Judgement result of Y-coordinate
Position Z judge	J3Z	Judgement result of Z-coordinate
Theta θ judge	J3T	Judgement result of angle θ

Table: Values Available in Expression (3D Calculation)

Measurement items	Character string	Description
Phi ϕ judge	J3PHI	Judgement result of angle ϕ
Psi ψ judge	J3PSI	Judgement result of angle ψ

For "3D posture shift"

Table: Values Available in Expression (3D Calculation)

Measurement items	Character string	Description
Judge	JG	Overall judgement result
Position X result	D4X	Calculation result of X-coordinate
Position Y result	D4Y	Calculation result of Y-coordinate
Position Z result	D4Z	Calculation result of Z-coordinate
Theta θ result	D4T	Calculation result of angle θ
Phi ϕ result	D4PHI	Calculation result of angle ϕ
Psi ψ result	D4PSI	Calculation result of angle ψ
Position X judge	J4X	Judgement result of X-coordinate
Position Y judge	J4Y	Judgement result of Y-coordinate
Position Z judge	J4Z	Judgement result of Z-coordinate
Theta θ judge	J4T	Judgement result of angle θ
Phi ϕ judge	J4PHI	Judgement result of angle ϕ
Psi ψ judge	J4PSI	Judgement result of angle ψ

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

For "3D Position"

Table: External Reference List (3D Calculation)

No.	Data Name	Set/Get	Data Range
0	Overall judgement result	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Position X result	Get only	-99999.9999 to 99999.9999
6	Position Y result	Get only	-99999.9999 to 99999.9999
7	Position Z result	Get only	-99999.9999 to 99999.9999
8	Camera shift amount result	Get only	-99999.9999 to 99999.9999

Table: External Reference List (3D Calculation)

No.	Data Name	Set/Get	Data Range
15	Position X judge	Get only	-99999.9999 to 99999.9999
16	Position Y judge	Get only	-99999.9999 to 99999.9999
17	Position Z judge	Get only	-99999.9999 to 99999.9999
18	Judgement result of camera shift amount	Get only	-99999.9999 to 99999.9999
103	Reflect in OR	Set/Get	0: ON 1: OFF
140	Expression	Set/Get	0: 3D position 1: 3D world coordinates position 2: 3D posture 3: 3D posture shift
150	Input1: Camera No	Set/Get	0 to 3
151	Input2: Camera No1	Set/Get	0 to 3
152	Distortion compensation coordinates	Set/Get	・Coordinates before distortion compensation ・Coordinates after distortion compensation
160	X-coordinate: Upper limit of the judgement condition	Set/Get	-999999999.9999 to 999999999.9999
161	X-coordinate: Lower limit of the judgement condition	Set/Get	-999999999.9999 to 999999999.9999
162	Y-coordinate: Upper limit of the judgement condition	Set/Get	-999999999.9999 to 999999999.9999
163	Y-coordinate: Lower limit of the judgement condition	Set/Get	-999999999.9999 to 999999999.9999
164	Z-coordinate: Upper limit of the judgement condition	Set/Get	-999999999.9999 to 999999999.9999
165	Z-coordinate: Lower limit of the judgement condition	Set/Get	-999999999.9999 to 999999999.9999
166	Upper limit for the camera shift amount	Set/Get	0 to 99999.999

For "3D world coordinates position"

Table: External Reference List (3D Calculation)

No.	Data Name	Set/Get	Data Range
0	Overall judgement result	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
21	Position X result	Get only	-99999.9999 to 99999.9999
22	Position Y result	Get only	-99999.9999 to 99999.9999
23	Position Z result	Get only	-99999.9999 to 99999.9999
24	Position X judge	Get only	-99999.9999 to 99999.9999
25	Position Y judge	Get only	-99999.9999 to 99999.9999

Table: External Reference List (3D Calculation)

No.	Data Name	Set/Get	Data Range
26	Position Z judge	Get only	-99999.9999 to 99999.9999
103	Reflect in OR	Set/Get	0: ON 1: OFF
140	Expression	Set/Get	0: 3D position 1: 3D world coordinates position 2: 3D posture 3: 3D posture shift
200	Camera mode	Set/Get	0: 0/1 1:2/3
210	X-coordinate: Upper limit of the judgement condition	Set/Get	-999999999.9999 to 999999999.9999
211	X-coordinate: Lower limit of the judgement condition	Set/Get	-999999999.9999 to 999999999.9999
212	Y-coordinate: Upper limit of the judgement condition	Set/Get	-999999999.9999 to 999999999.9999
213	Y-coordinate: Lower limit of the judgement condition	Set/Get	-999999999.9999 to 999999999.9999
214	Z-coordinate: Upper limit of the judgement condition	Set/Get	-999999999.9999 to 999999999.9999
215	Z-coordinate: Lower limit of the judgement condition	Set/Get	-999999999.9999 to 999999999.9999

For "3D posture"

Table: External Reference List (3D Calculation)

No.	Data Name	Set/Get	Data Range
0	Overall judgement result	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
31	Position X result	Get only	-99999.9999 to 99999.9999
32	Position Y result	Get only	-99999.9999 to 99999.9999
33	Position Z result	Get only	-99999.9999 to 99999.9999
34	Theta θ result	Get only	-180 to 180
35	Phi ϕ result	Get only	-180 to 180
36	Psi ψ result	Get only	-180 to 180
37	Position X judge	Get only	-99999.9999 to 99999.9999
38	Position Y judge	Get only	-99999.9999 to 99999.9999
39	Position Z judge	Get only	-99999.9999 to 99999.9999
40	Theta θ judge	Get only	-180 to 180
41	Phi ϕ judge	Get only	-180 to 180
42	Psi ψ judge	Get only	-180 to 180

Table: External Reference List (3D Calculation)

No.	Data Name	Set/Get	Data Range
103	Reflect in OR	Set/Get	0: ON 1: OFF
140	Expression	Set/Get	0: 3D position 1: 3D world coordinates position 2: 3D posture 3: 3D posture shift
310	X-coordinate: Upper limit of the judgement condition	Set/Get	-999999999.9999 to 999999999.9999
311	X-coordinate: Lower limit of the judgement condition	Set/Get	-999999999.9999 to 999999999.9999
312	Y-coordinate: Upper limit of the judgement condition	Set/Get	-999999999.9999 to 999999999.9999
313	Y-coordinate: Lower limit of the judgement condition	Set/Get	-999999999.9999 to 999999999.9999
314	Z-coordinate: Upper limit of the judgement condition	Set/Get	-999999999.9999 to 999999999.9999
315	Z-coordinate: Lower limit of the judgement condition	Set/Get	-999999999.9999 to 999999999.9999
316	Theta θ : Upper limit of the judgement condition	Set/Get	-180 to 180
317	Theta θ : Lower limit of the judgement condition	Set/Get	-180 to 180
318	Phi ϕ : Upper limit of the judgement condition	Set/Get	-180 to 180
319	Phi ϕ : Lower limit of the judgement condition	Set/Get	-180 to 180
320	Psi ψ : Upper limit of the judgement condition	Set/Get	-180 to 180
321	Psi ψ : Lower limit of the judgement condition	Set/Get	-180 to 180

For "3D posture shift"

Table: External Reference List (3D Calculation)

No.	Data Name	Set/Get	Data Range
0	Overall judgement result	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
51	Position X result	Get only	-99999.9999 to 99999.9999
52	Position Y result	Get only	-99999.9999 to 99999.9999
53	Position Z result	Get only	-99999.9999 to 99999.9999
54	Theta θ result	Get only	-180 to 180
55	Phi ϕ result	Get only	-180 to 180

Table: External Reference List (3D Calculation)

No.	Data Name	Set/Get	Data Range
56	Psi ψ result	Get only	-180 to 180
57	Position X judge	Get only	-99999.9999 to 99999.9999
58	Position Y judge	Get only	-99999.9999 to 99999.9999
59	Position Z judge	Get only	-99999.9999 to 99999.9999
60	Theta θ judge	Get only	-180 to 180
61	Phi ϕ judge	Get only	-180 to 180
62	Psi ψ judge	Get only	-180 to 180
103	Reflect in OR	Set/Get	0: ON 1: OFF
140	Expression	Set/Get	0: 3D position 1: 3D world coordinates position 2: 3D posture 3: 3D posture shift
410	X-coordinate: Upper limit of the judgement condition	Set/Get	-999999999.9999 to 999999999.9999
411	X-coordinate: Lower limit of the judgement condition	Set/Get	-999999999.9999 to 999999999.9999
412	Y-coordinate: Upper limit of the judgement condition	Set/Get	-999999999.9999 to 999999999.9999
413	Y-coordinate: Lower limit of the judgement condition	Set/Get	-999999999.9999 to 999999999.9999
414	Z-coordinate: Upper limit of the judgement condition	Set/Get	-999999999.9999 to 999999999.9999
415	Z-coordinate: Lower limit of the judgement condition	Set/Get	-999999999.9999 to 999999999.9999
416	Theta θ : Upper limit of the judgement condition	Set/Get	-180 to 180
417	Theta θ : Lower limit of the judgement condition	Set/Get	-180 to 180
418	Phi ϕ : Upper limit of the judgement condition	Set/Get	-180 to 180
419	Phi ϕ : Lower limit of the judgement condition	Set/Get	-180 to 180
420	Psi ψ : Upper limit of the judgement condition	Set/Get	-180 to 180
421	Psi ψ : Lower limit of the judgement condition	Set/Get	-180 to 180

5

Chapter 5 - Branch Control

This chapter describes how to set up branch processing.

5.1 Conditional Branch 1
5.2 DI Branch 1
5.3 End 1

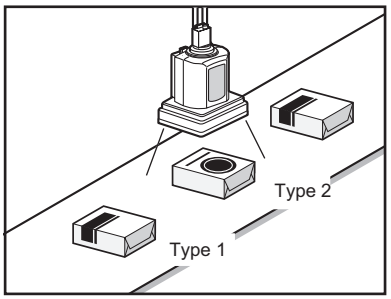
5.1 Conditional Branch

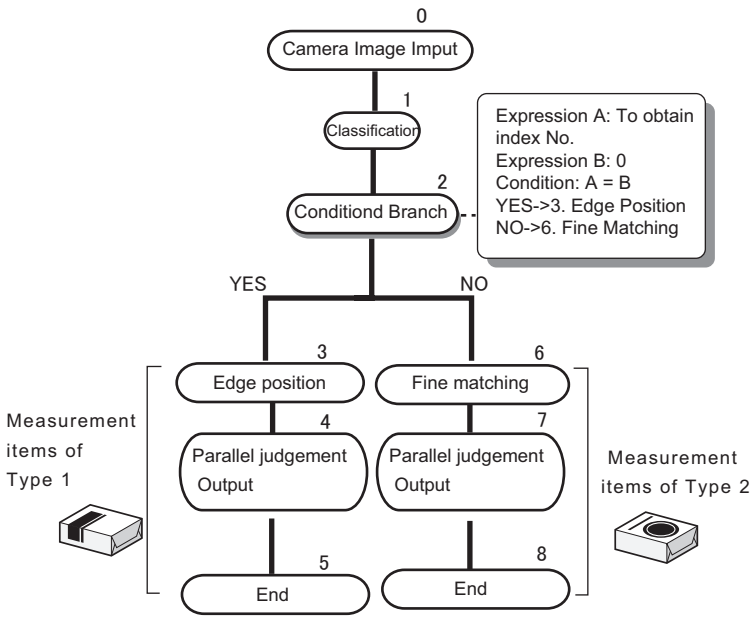
By setting up the expression and conditions, divide the processing items into two parts based on the compared results.

Used for the following case

- When more than two kinds of products on the production line need to be measured separately

Example) Detect the printing quality of candy boxes.





5.1.1 Setting up [Conditional Branch]

Setting contents as follows.

Table: Setting List (Branch)

Item			Description	Set Value [Factory default]
Conditional expression				
	Condition		Select the method to compare A and B. Compare two data that are obtained through these two expression respectively.	・[A=B] ・A ≦ B ・A<B ・A ≧ B ・A>B
	Expression A		Set up the expression that is used to be the basis for branching. Set up the equation through Expression. "4.1.2 "Expression setting (Calculation)"" (gpg.182)	Up to 256 characters
	Expression B			
	Judgement result Destination unit	YES	Select the branching Unit No. when the comparing operational result is correct.	・-1: [End processing] ・0 to 32767: Unit No.
		No	Select the branching Unit No. when the comparing operational result is incorrect.	・-1: [End processing] ・0 to 32767: Unit No.

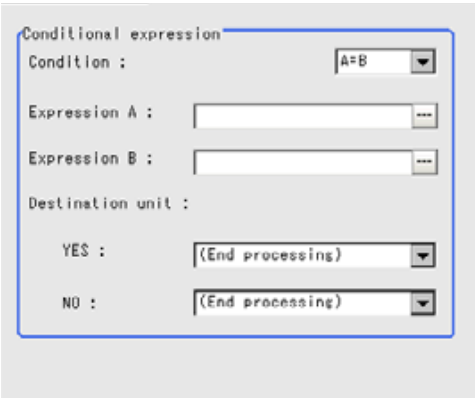
1 In the Edit Flow window, Tap [Conditional Branch].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area, tap [Branch Setting].

3 In the "Conditional expression" area, set up the condition expression.



For Details, see "5.1.2 Setting up Conditions" (→pg.3) External Devices.

4 Set up the branching unit after obtaining the conditional Judge.

1. Tap [▼] for "YES" and select the unit No. to be branched when the value matches the condition expression.
2. Tap [▼] for "NO" and select the unit number to be branched when the value does not match the condition expression.

5 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

6 Perform a measurement test.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

7 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"
When NG is displayed, please measure again and make Adjust if necessary.

Important

- If the unit No. after [Conditional Branch] is not selected at Destination, the repeated measurement may occur.
- To indicate the end of the branching end, please ensure to set up [End] right after the last unit at Destination. "5.3 End" (→pg.1)

POINT

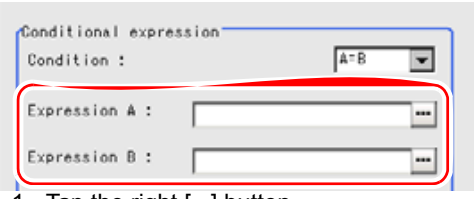
- The judgement result for a processing unit and the overall judgement are determined respectively at the following times.
  - When the measurement of the processing unit is executed
  - When the measurements of all processing units are completed

  The processing unit that is not measured by branching is also cleared when the measurements of all units are completed.

5.1.2 Setting up Conditions

Specify Expression A and B for the branching conditions.

1 Expression A and B should be set separately.



1. Tap the right [...] button.
   The Setting Expression window appears.
2. Set up the expression.
   For the procedure to set up the Expression, see "4.1.4 Structure and Creation of Expression" (→pg.5)

2 Tap [▼] to set up conditions.

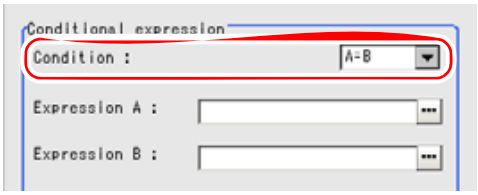


Table: Condition List (Branch)

Condition	Description
A=B	If the operational result of A is equal to that of B, the action will go to the YES unit in the Destination Unit. If not, move to the unit with "NO".
A<=B	If the operational result of A is equal to that of B, or A is lower than B, moves to the unit with "Destination unit" being "YES". If A is larger, move to the unit with "NO".
A<B	If the operational result of A is lower than that of B, moves to the unit with "Destination unit" being "YES". If A is equal to or larger than B, move to the unit with "NO".
A>=B	If the operational result of A is equal to that of B, or A is higher than B, move to the unit with "Destination unit" being "YES". If B is higher, move to the unit with "NO".
A>B	If the operational result of A is larger than that of B, moves to the unit with "Destination unit" being "YES". If A is equal to or lower than B, move to the unit with "NO".

5.1.3 When Using Measurement Results Externally (Conditional Branch)

Value Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The items and contents displayed in the sub-menu are shown in the following table.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (Conditional Branch)

Measurement items	Character string	Description
Judge	JG	Judgement result
Expression A result	D0	Operational result of expression selected in Expression A
Expression B result	D1	Operational result of expression selected in Expression B
Comparison result	RS	Compares the results of the expressions (0: NO, 1 : YES)
Branching Unit No.	BU	Unit No. at Destination based on the compares results of expressions

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in the "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Conditional Branch)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Expression A result	Get only	Up to 256 characters (Operational result of expression selected in Expression A)
6	Expression B result	Get only	Up to 256 characters (Operational result of expression selected in Expression B)
7	Comparison result	Get only	0: NO 1 : YES
8	Branching Unit No.	Get only	0 to 32767
120	Condition type	Set/Get	0: A=B 1: A ≦ B 2: A<B 3: A ≧ B 4: A>B
121	Judge YesThe Destination unit code number	Set/Get	-1: End processing 0 to 32767: unit No.
122	Judge NoThe Destination unit code number	Set/Get	-1: End processing 0 to 32767: unit No.

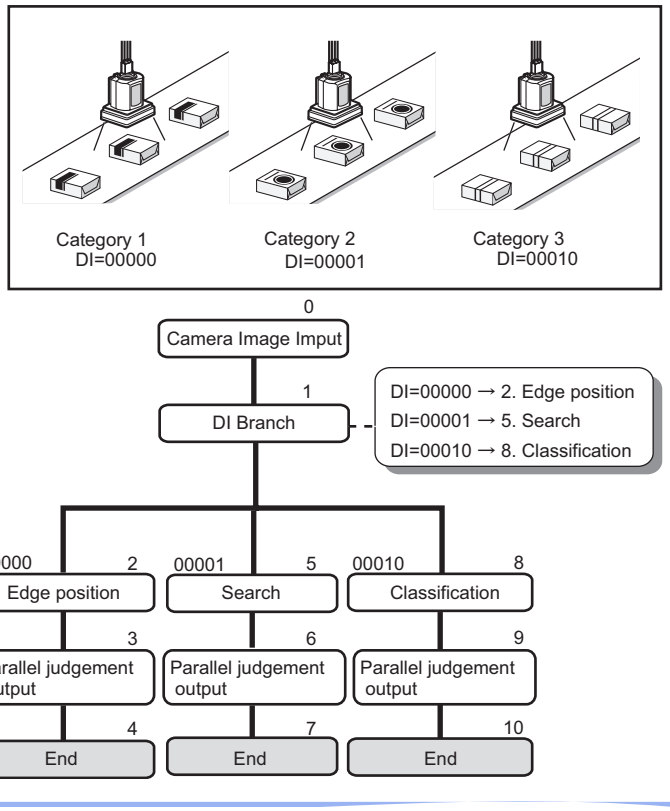
5.2 DI Branch

To branch the next Processing Item based on the information inputted into terminal blocks DI0 to DI4.
Up to 32 branches can be set up.

Used for the following case

- When measuring the products on a production line at every specified time interval

Example) Detect the printing quality of candy different candy boxes.



5.2.1 Setting up [DI Branch]

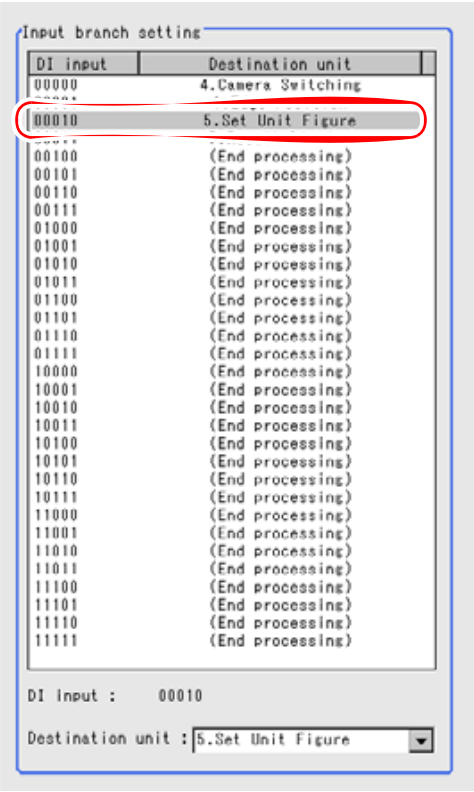
Select the Destination unit. To set up based on the information inputted to DI.

1 In the Edit Flow window, Tap [DI Branch].

The ProcItem Setting window is displayed.
"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area, tap [Setting].

3 In the "Input branch setting" area, tap the DI input from the Input List for which the destination of the branch is to be set up.



"DI Input" (input signal) for the selected unit is displayed in "DI input".

4 Tap [▼] for "Destination unit", and select the destination unit.

Tapping [▼] will allow you to see the current Scene Unit list.

Important

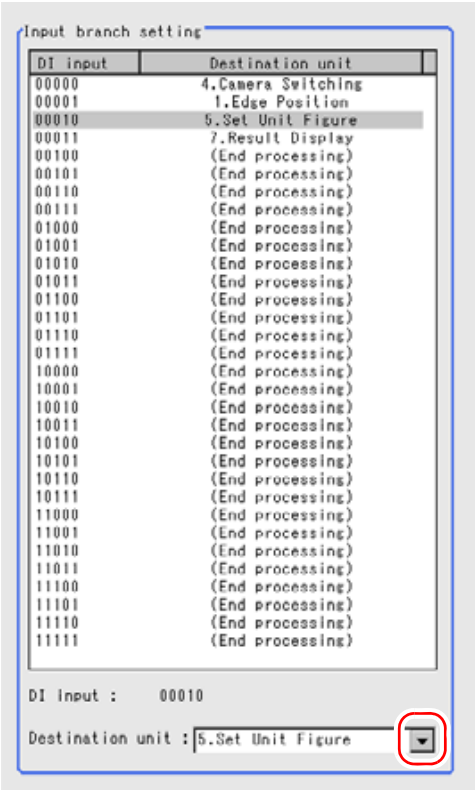
- If the unit No. after [DI Branch] is not selected at destination, the repeated measurement may occur.

POINT

- The judgement result for a processing unit and the overall judgement are determined respectively at the following times.
  - When the measurement of the processing unit is executed

• When the measurements of all processing units are completed

The processing unit that is not measured by branching is also cleared when the measurements of all units are completed.



5 Repeat the Steps 3 to 4 and set up the branching units for other input.

POINT

- Up to 32 (0 to 31) units can be set up in destination.
- The time when the "Input branch" is executed is the time when the controller is actuated by the DI signal.

6 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

7 Perform measurement test.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

8 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

When NG is displayed, please measure again and make Adjust if necessary.

Important

- To indicate the end of the branching end, please ensure to set up "End" right after the last unit at Destination.
  "5.3 End" (→pg.1)

5.2.2 When Using Measurement Results Externally (DI Branch)

Value Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The items and contents displayed in the sub-menu are shown in the following table.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (DI Branch)

Measurement items	Character string	Description
Judge	JG	Judgement result
DI input	DI	DI input No. (00000 to 11111)
Destination Unit No.	BU	Destination No.

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in the "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (DI Branch)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	DI input No.	Get only	No. used to indicate the DI input (00000 to 11111)
6	Unit No. at Destination	Get only	Unit No. at Destination (-1: End processing, 0 to 32767: unit No.)
120 to 151	Destination Unit No. 0 to Destination Unit No. 31	Set/Get	-1: End processing 0 to 9999: unit No.

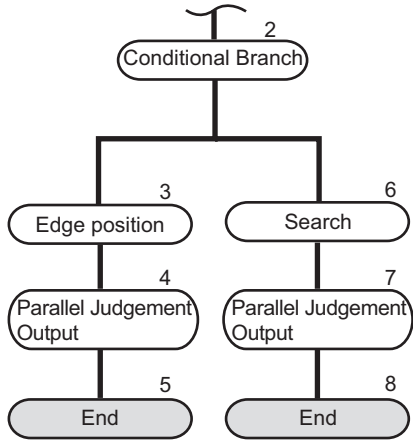
5.3 End

You can only add this Processing Item to the scene without Condition setting.
Please place it at the last unit of each branch.

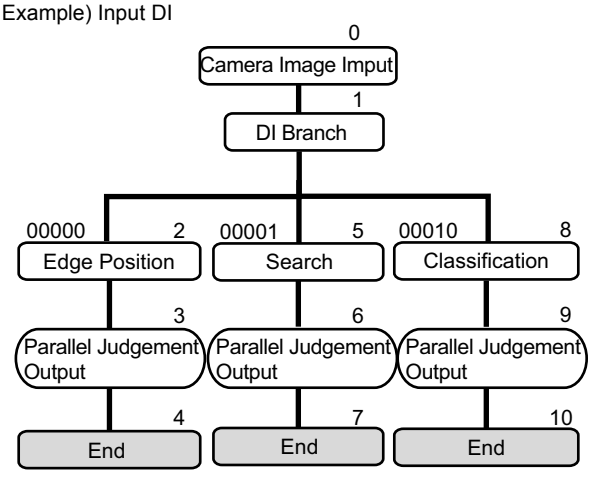
Used for the following case

- When finishing the last Processing Item of a branch

Example) Conditional

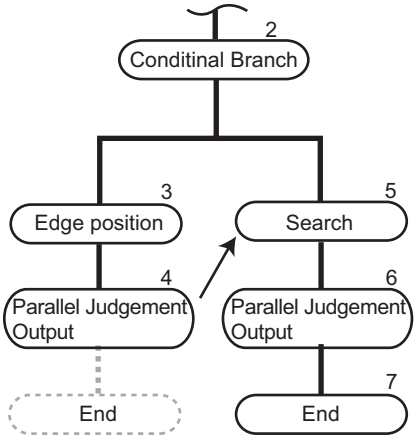


Example) Input DI



POINT

- If [End] is not set up at the end of a branch, the processing in the scene will continue to move to the next unit No. even if the branch has been completed.



6

Chapter 6 - Result Output

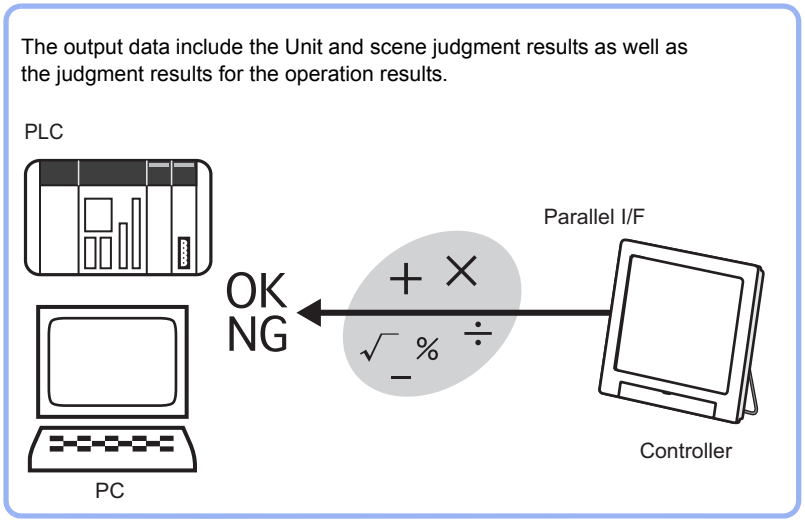
This chapter describes how to output Measurement Results to the external devices

6.1 Parallel Judgement Output 1
6.2 Parallel Data Output 1
6.3 Data Output 1

6.1 Parallel Judgement Output

Used for the following case

- Used when outputting Judge to the external devices such as PLC or PC via the parallel interface.



Important

- When performing measurements in the Adjustment window, the values are only output when output is enabled by the following method during the measurement.
  - In the "Control" area, check "Output" in [Test measurement setting].

  When the measurement is executed in the RUN window, output is executed regardless of the external output setting.
- Even if this Processing Item is not set up in the scene, the overall Judge for the Processing Items that have been set up will still be output via the OR signal from the parallel interface.

6.1.1 Setting up [Parallel Judgement Output]

POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 In the Edit Flow window, tap [Parallel judgement Output].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area, tap [Setting] and set up the output contents.
For Details, see "6.1.2 [Output Data Setting (Parallel Judgement Output)]" (→pg.2).

3 In the "Item tab" area, tap [Output parameter] and specify the setting.
For Details, see "6.1.3 [Output Parameter (Parallel Judgement Output)]" (→pg.3).

4 Tap [OK].
After confirmation, the ProcItem Setting window will be closed.

5 In the "Control" area, check "Output" in [Test measurement setting] to enable the external output, and execute measurement.
"6.1 The Flow before Starting the Operation" (→pg.2), of "User's Manual"

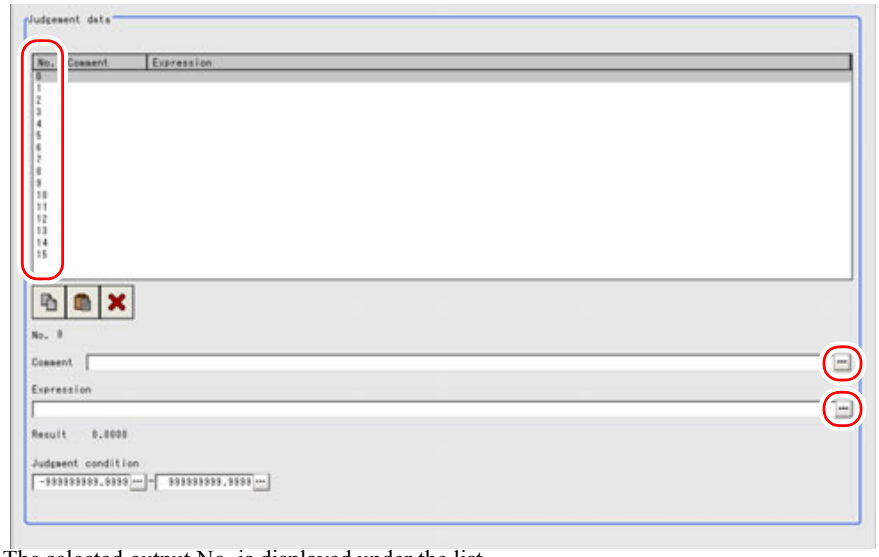
6 Verify measurement results.
"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"
When NG is displayed, please verify measurement results and make Adjust if necessary.

6.1.2 [Output Data Setting (Parallel Judgement Output)]

Use the expression to set up the output data.
Up to 16 output data ranging 0 to 15 can be set up.

1 In the "Item tab" area, tap [Setting].

2 In the list, tap the output No. for which the expression is to be set.



The selected output No. is displayed under the list.

3 Tap [...] for "Comment" and input an explanation of the expression.
How to input text:"1.5 Inputting a Text" (→pg.19), of "User's Manual"

4 Tap [...] for "Expression".

The Setting Expression window appears.

5 Specify an expression.

"4.1.4 Structure and Creation of Expression" (→pg.5)

6 In "Judgement condition", set up the upper limit and the lower limit for judgement.

Table: Parallel Judgement Output - Output data

Setting Options	Set Value [Factory defaults]	Description
Judgement Upper Limit	-999999999.9999 to [999999999.9999]	The judge condition for expression. Specify the upper value when judge is OK.
Judgement Upper Limit	[-999999999.9999] to 999999999.9999	The judge condition for expression. Specify the lower value when judge is OK.

7 Step 2 to 6, set up expressions.

For details, see "6.1.1 Setting up [Parallel Judgement Output]" (→pg.1).

For the subsequent operations, see "6.1.1 Setting up [Parallel Judgement Output]" (→pg.1).

6.1.3 [Output Parameter (Parallel Judgement Output)]

Specify whether to reflect the judgement result to the overall judgement of the scene.

1 In the "Item tab" area, tap [Output parameter].

2 In the "Reflect to overall judgement" area, specify whether to reflect the measurement result to the overall judgement of the scene.

Table: Setting Values for Output Parameters

Setting Item	Set Value [Factory default]	Description
Reflect to overall judgement	・[ON] ・OFF	Select whether to reflect the judgement result of this processing unit to the overall judgement of the scene. ・Selecting "ON" reflects the judgement result of this processing unit on the overall judgement of the scene. ・Selecting "OFF" does not reflect the judgement result of this processing unit on the overall judgement of the scene.

POINT

- The overall judgement result of the scene is output to the OR signal to be sent via the parallel interface. Also, it is displayed in the Measurement Information Display area in the upper part of the Main screen.
  "10.4.4 Time Chart" (→pg.35), of "User's Manual"
  "1.2.1 Main Screen (ADJUST window)" (→pg.4), of "User's Manual"

For the subsequent operations, see "6.1.1 Setting up [Parallel Judgement Output]" (→pg.1).

6.1.4 When Using Measurement Results Externally (Parallel Judgement Output)

Value Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The items and contents displayed in the sub-menu are shown in the following table.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Parallel Judgement Output - Value Available in Expression

Measurement items	Character string	Description
Judge	JG	Judgement result
Data 0 to 15	DO0 to DO15	Output Judgement result for the expression that is set up in Output data 0 to 15
Judge (0 to 15)	J00 to J15	Output Judgement result for the expression that is set up in Output data 0 to 15

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in the "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Parallel judge)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0:No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5 to 20	Data 0 to 15	Get only	-999999999.9999 to 999999999.9999
21 to 36	Judge (0 to 15)	Get only	1: OK -1: NG 0: Unmeasured
103	Reflect in OR	Set/Get	0: ON, 1: OFF
136	Upper limit 0 for judgement	Set/Get	-999999999.9999 to 999999999.9999

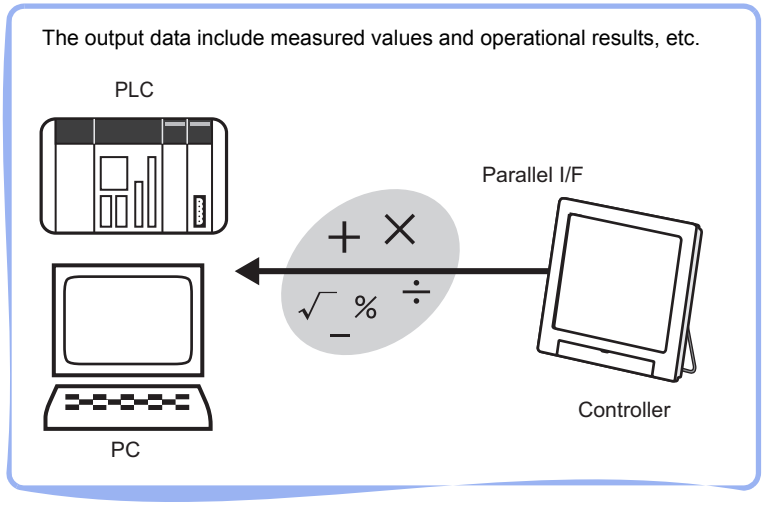
Table: External Reference List (Parallel judge)

No.	Data Name	Set/Get	Data Range
137	Lower limit 0 for judgement	Set/Get	-999999999.9999 to 999999999.9999
138	Upper limit 1 for judgement	Set/Get	-999999999.9999 to 999999999.9999
139	Lower limit 1 for judgement	Set/Get	-999999999.9999 to 999999999.9999
140	Upper limit 2 for judgement	Set/Get	-999999999.9999 to 999999999.9999
141	Lower limit 2 for judgement	Set/Get	-999999999.9999 to 999999999.9999
142	Upper limit 3 for judgement	Set/Get	-999999999.9999 to 999999999.9999
143	Lower limit 3 for judgement	Set/Get	-999999999.9999 to 999999999.9999
144	Upper limit 4 for judgement	Set/Get	-999999999.9999 to 999999999.9999
145	Lower limit 4 for judgement	Set/Get	-999999999.9999 to 999999999.9999
146	Upper limit 5 for judgement	Set/Get	-999999999.9999 to 999999999.9999
147	Lower limit 5 for judgement	Set/Get	-999999999.9999 to 999999999.9999
148	Upper limit 6 for judgement	Set/Get	-999999999.9999 to 999999999.9999
149	Lower limit 6 for judgement	Set/Get	-999999999.9999 to 999999999.9999
150	Upper limit 7 for judgement	Set/Get	-999999999.9999 to 999999999.9999
151	Lower limit 7 for judgement	Set/Get	-999999999.9999 to 999999999.9999
152	Upper limit 8 for judgement	Set/Get	-999999999.9999 to 999999999.9999
153	Lower limit 8 for judgement	Set/Get	-999999999.9999 to 999999999.9999
154	Upper limit 9 for judgement	Set/Get	-999999999.9999 to 999999999.9999
155	Lower limit 9 for judgement	Set/Get	-999999999.9999 to 999999999.9999
156	Upper limit 10 for judgement	Set/Get	-999999999.9999 to 999999999.9999
157	Lower limit 10 for judgement	Set/Get	-999999999.9999 to 999999999.9999
158	Upper limit 11 for judgement	Set/Get	-999999999.9999 to 999999999.9999
159	Lower limit 11 for judgement	Set/Get	-999999999.9999 to 999999999.9999
160	Upper limit 12 for judgement	Set/Get	-999999999.9999 to 999999999.9999
161	Lower limit 12 for judgement	Set/Get	-999999999.9999 to 999999999.9999
162	Upper limit 13 for judgement	Set/Get	-999999999.9999 to 999999999.9999
163	Lower limit 13 for judgement	Set/Get	-999999999.9999 to 999999999.9999
164	Upper limit 14 for judgement	Set/Get	-999999999.9999 to 999999999.9999
165	Lower limit 14 for judgement	Set/Get	-999999999.9999 to 999999999.9999
166	Upper limit 15 for judgement	Set/Get	-999999999.9999 to 999999999.9999
167	Lower limit 15 for judgement	Set/Get	-999999999.9999 to 999999999.9999

6.2 Parallel Data Output

Used for the following case

- Used when outputting Judge to the external devices such as PLC or PC via the parallel interface.



Important

- When performing measurements in the Adjustment window, the values are only output when output is enabled by the following method during the measurement.
  - In the "Control" area, check "Output" in [Test measurement setting].

  When the measurement is executed in the RUN window, output is executed regardless of the external output setting.
- Even if this Processing Item is not set up in the scene, the overall Judge for the Processing Items that have been set up will still be output via the OR signal from the parallel interface.

6.2.1 Setting up [Parallel Data Output]

POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

1 In the Edit Flow window, tap [Parallel Data Output].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area, tap [Setting] and set up the output contents.
For Details, see "6.2.2 [Output Data Setting (Parallel Data Output)]" (→pg.2).

3 In the "Item tab" area, tap [Output format] and select [Format] in the "Output setting" area.

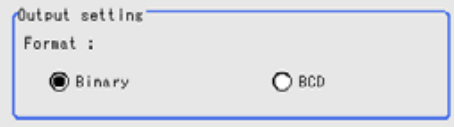


Table: Output format (Parallel data)

Set Value [Factory defaults]	Description
Binary	Data are outputted in the binary form of 2's complement. For 2's complement, see "11.4 Terminology" (→pg.12), of "User's Manual".
BCD	Data are outputted with 4 digits representing 1 decimal and 16 digits representing the sign and 3-place integers. ・ 15 to 12 digits Sign. (positive: 0000, negative: 1111) ・ 11 to 0 digits With 4 digits representing 1 decimal, a value that has the digits position of 10 to the 6th power can be represented (27 to 24 digits: the 7th digits position) to - (3 to 0 digits: the first digits position)

4 Tap [OK].
After confirmation, the ProcItem Setting window will be closed.

5 In the "Control" area, check "Output" in [Test measurement setting] to enable the external output, and execute measurement.
"6.1 The Flow before Starting the Operation" (→pg.2), of "User's Manual"

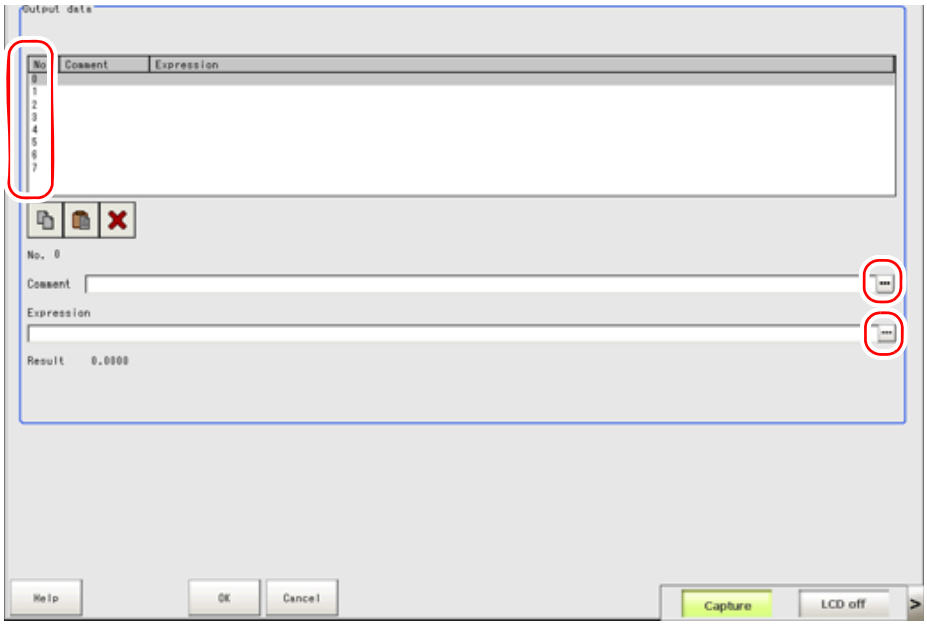
6 Verify measurement results.
"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"
When NG is displayed, please verify measurement results and make Adjust if necessary.

6.2.2 [Output Data Setting (Parallel Data Output)]

Set up the output contents with the expression.
Up to 8 expressions including 0 to 7 can be set up in each unit.

1 In the "Item tab" area, tap [Setting].

2 In the list, tap the output No. for which the expression is to be set.



The selected output No. is displayed under the list.

3 Tap [...] for "Comment" and input an explanation of the expression.

"1.5 Inputting a Text" (→pg.19), of "User's Manual"

4 Tap [...] for "Expression".

The Setting Expression window is displayed.

5 Specify an expression.

"4.1.4 Structure and Creation of Expression" (→pg.5)

6 In Step 2 to 3, specify the output content for each output No.

For the following operations, see "6.2.1 Setting up [Parallel Data Output]" (→pg.1).

6.2.3 When Using Measurement Results Externally (Parallel Data Output)

Value Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.

For how to set up expression, see"4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (Parallel Data)

Measurement items	Character string	Description
Judge	JG	Judgement result
Data 0 to 7	DO0 to DO7	Results of expression that is set up in Output Data 0 to 7

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in the "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

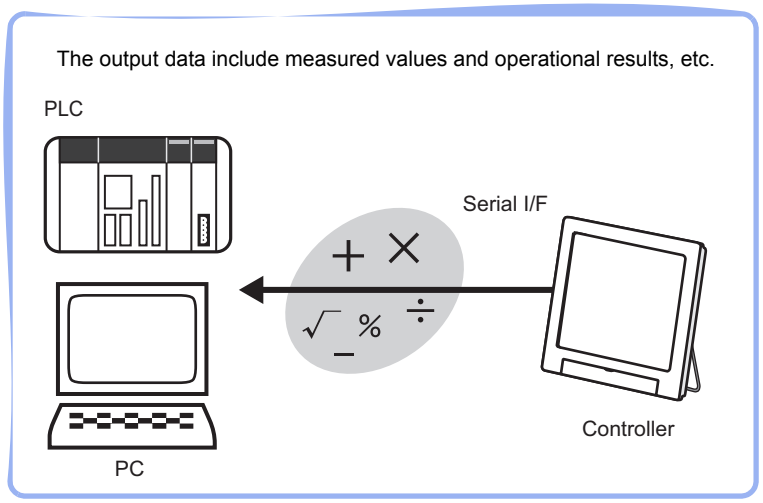
Table: External Reference List (Parallel Data)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5 to 12	Data 0 to 7	Get only	BCD: -999 to 999 Binary: -32768 to 32768
128	Data format	Set/Get	0: Binary 1: BCD

6.3 Data Output

Used for the following case

- Output data to the external devices such as PLC and PC with the no-order mode via the serial interface.



Important

- When performing measurements in the Adjustment window, the values are only output when output is enabled by the following method during the measurement.
  - In the "Control" area, check "Output" in [Test measurement setting].

  When the measurement is executed in the RUN window, output is executed regardless of the external output setting.
- Even if this Processing item is not set for a scene, overall judgement for the set Processing item is output by an OR signal of the serial interface.

6.3.1 Setting up [Data Output]

POINT

Operations of the ProcItem Setting window

- For the basic operations of the ProcItem Setting window, see "1.7 Operations of ProcItem Setting Window" (→pg.23), of "User's Manual".

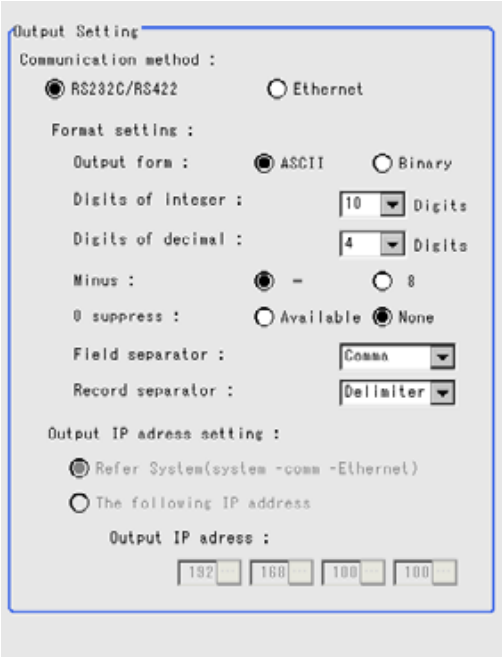
1 In the Edit Flow window, tap [Data Output].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "Item tab" area, tap [Setting] and set up the output contents.
For details, see "6.3.2 [Setting (Data Output)]" (→pg.2).

3 In the "Item tab" area, tap [Output format] and specify the format.



Select the format for serial output.
For Details, see "6.3.3 [Output format (Data Output)]" (→pg.3).

4 Tap [OK].
After confirmation, the ProcItem Setting window will be closed.

5 In the "Control" area, check "Output" in [Test Measurement setting] to enable the external output, and execute measurement.
"6.1 The Flow before Starting the Operation" (→pg.2), of "User's Manual"

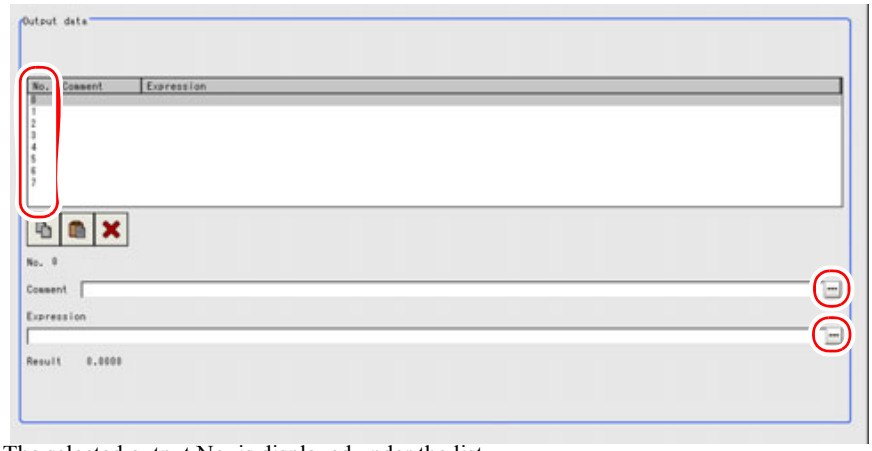
6 Verify measurement results.
"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"
When NG is displayed, please verify measurement results and make Adjust if necessary.

6.3.2 [Setting (Data Output)]

Set up the output contents with the expression.
Up to 8 expressions including 0 to 7 can be set up in each unit.

1 In the "Item tab" area, tap [Setting].

2 In the list, tap the output No. for which the expression is to be set.



The selected output No. is displayed under the list.

3 Tap [...] for "Comment" and input an explanation of the expression.

How to input text:"1.5 Inputting a Text" (→pg.19), of "User's Manual"

4 Tap [...] for "Expression".

The Setting Expression window is displayed.

5 Specify an expression.

"4.1.4 Structure and Creation of Expression" (→pg.5)

6 Repeat the Steps 2 to 5 to set up the output contents for each output No.

For the following operations, see "6.3.1 Setting up [Data Output]" (→pg.1).

6.3.3 [Output format (Data Output)]

1 In the "Item tab" area, tap [Output format].

2 In the "Output setting" area, select the communication method.

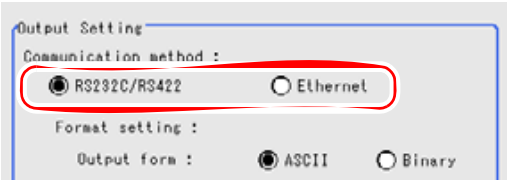


Table: Output Format (Data Output) - Output Setting - Communication Method

Set Value [Factory Default]	Description
[RS-232C/RS-422]	Communication is performed via a RS-232C/RS-422 connection.

Table: Output Format (Data Output) - Output Setting - Communication Method

Set Value [Factory Default]	Description
Ethernet	Communication is performed via the Ethernet.

3 In "Format setting", select the output format.

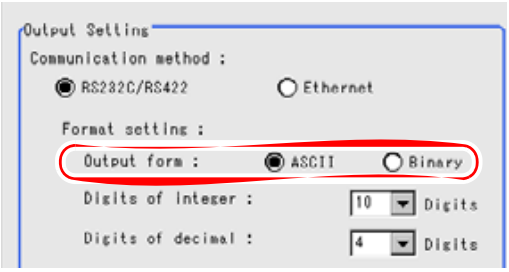


Table: Output Format (Data Output) - Output Setting - Format Setting

Set Value [Factory defaults]	Description
[ASCII]	Outputs in the ASCII format. The ASCII is represented in 7 digits, and composed of 128 Roman numbers, numeric numbers, operators, and control codes.
Binary	Outputs in the binary format. Outputs the Value multiply 1,000 with each digits being represented by 4 bytes.

When the ASCII output format is selected

When "ASCII" is specified as the output format, set up the following options among the format settings.

Whereas "Binary" is selected, no setup is needed.

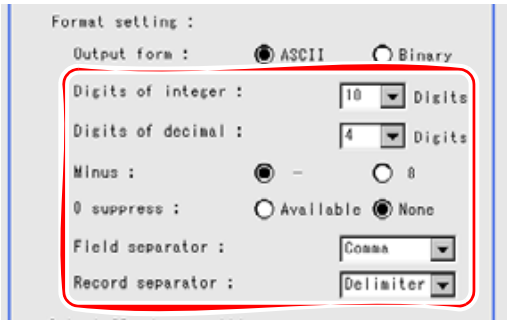


Table: Output Format (Data Output) - Output Setting - Format Setting when [ASCII] is specified

Setting Options	Set Value [Factory defaults]	Description
Digits of integer	1 to [10]	Specify the width of the integer part including the sign. For positive numbers, the plus sign is not output. Example Setting: 4 places, data: -5,619 output -999.
Digits of decimal	0 to [4]	Specify the places of the output Digits of decimal. When 0 is selected, the Digits of decimal will be rounded up.
Minus	・[-] ・8	When a Minus is selected, what is displayed in the sign place.

Table: Output Format (Data Output) - Output Setting - Format Setting when [ASCII] is specified

Setting Options	Set Value [Factory defaults]	Description
0 suppress	・ON ・[OFF]	Select to deal with the blank place to the left side of the output data or not. ON: Insert 0 into the blank place. OFF: Insert the space sign into the blank place. Example) Digits of integer: 5 places, Digits of decimal: 3 places. When the data is 100.000 ON: 00100.000 OFF: _100.000 (denoting the space)
Field separator	・OFF ・[Comma] ・Tab ・Space ・Delimiter	Select the separator for output data. * The delimiter is obtained from the system.
Record separator	・OFF ・Comma ・Tab ・Space ・[Delimiter]	Select the separator each time data is outputted. * The delimiter is obtained from the system.

4 If you have selected "Ethernet" for "Communication method", configure for Ethernet.

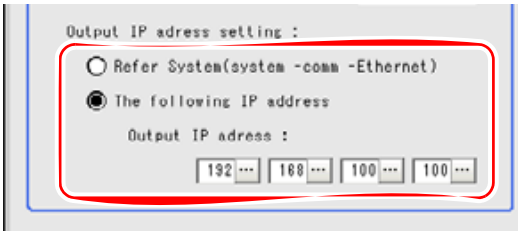


Table: Output format (Data output) - Output setting - Ethernet

Set Value [Factory Default]		Description
[Refer System(system -comm -Ethernet)]		The settings of the Ethernet window is applied. "10.2.2 Setting Communication Specifications (Ethernet Connection)" (→pg.3), of "User's Manual"
The following IP address		
	Output IP address	Enter the destination IP address.

For the following operations, see "6.3.1 Setting up [Data Output]" (→pg.1).

6.3.4 When Using Measurement Results Externally (Data Output)

Value Available in Expression

When this processing unit is selected in the "Unit" area of the Setting Expression window, the measurement items available in expressions are displayed in the sub-menu.
The measurement items displayed in the sub-menu are explained below.
For how to set up expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

Table: Values Available in Expression (Data Output)

Measurement items	Character string	Description
Judge	JG	Judgement result
Data 0 to 7	DO0 to DO7	Results of expression that is set up in Output Data 0 to 7

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in the "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Data Output)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5 to 12	Data 0 to 7	Get only	・ASCII: -99999999.9999 to 999999999.9999 (Maximum of the area) ・Binary: -2147483.648 to 2147483.647
136	Communication method	Set/Get	0: Ethernet 1: RS-232C/ RS-422
137	Output format	Set/Get	0: ASCII 1: Binary
138	Digits of integer	Set/Get	0 to 10
139	Digits of decimal	Set/Get	0: 0 to 4: 4
140	Negative numbers	Set/Get	0: -, 1: 8
141	Field separator	Set/Get	0: OFF, 1: Comma, 2: Tab, 3: Space, 4: Delimiter
142	Record separator	Set/Get	0: OFF, 1: Comma, 2: Tab, 3: Space, 4: Delimiter
143	0 suppress	Set/Get	0: OFF, 1: ON

Table: External Reference List (Data Output)

No.	Data Name	Set/Get	Data Range
144 to 147	Output IP address (1 to 4) (only when Ethernet is selected for "Communication method")	Set/Get	Destination IP address
149	Output IP address setting (only when Ethernet is selected for "Communication method")	Set/Get	0: Reference to system, 1: Individual specification

7

Chapter 7 - Result Display

This chapter describes how to display strings and figures in the window that displays the measurement results.

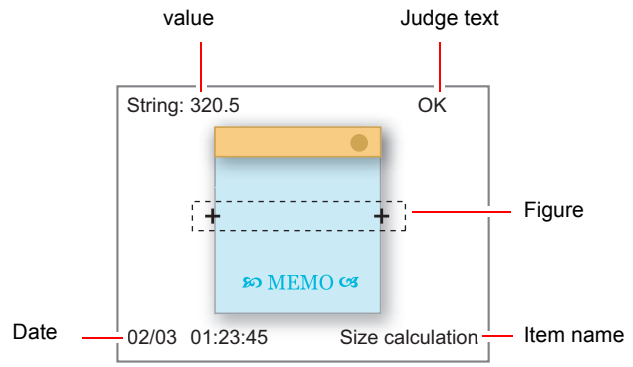
7.1 Result Display 1
7.2 3D Result Display 13

7.1 Result Display

Used for the following case

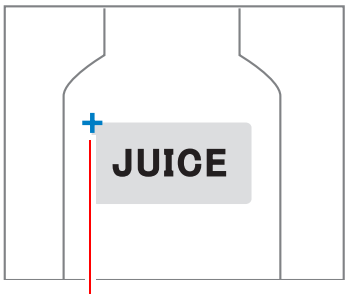
For your convenience to verify measurement results, text and figure will be displayed in the "Image display" area.
The contents to be displayed are as follows:

Example) Displaying options, such as Display string, Display value, Display judge, Display item name, Display date, on screen.



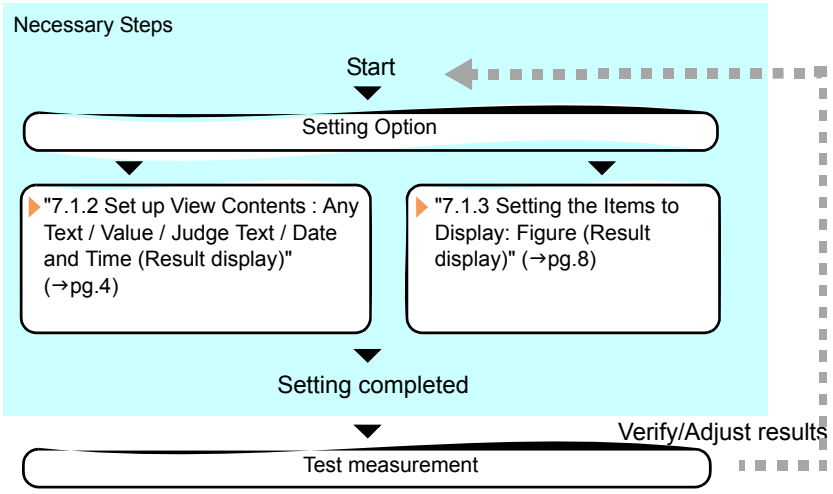
- Display string
  Displays any text about the measurement.
- Display value
  Displays any measured data.
  Since the expression is used, then both the value and the operation result of the expression can be displayed.
- Display judge
  Any text can be displayed according to the judgement (OK/NG).
  OK or NG can be displayed based on the expression that is set up as the judging basis.
- Display item name
  Displays the name of the processing item that is set up in a scene.
  When the unit name is set up in the processing item, it can also be displayed.
- Display date
  Displays the measurement date and time.

Example) Display the cross-shaped cursor at the measured position of the label.



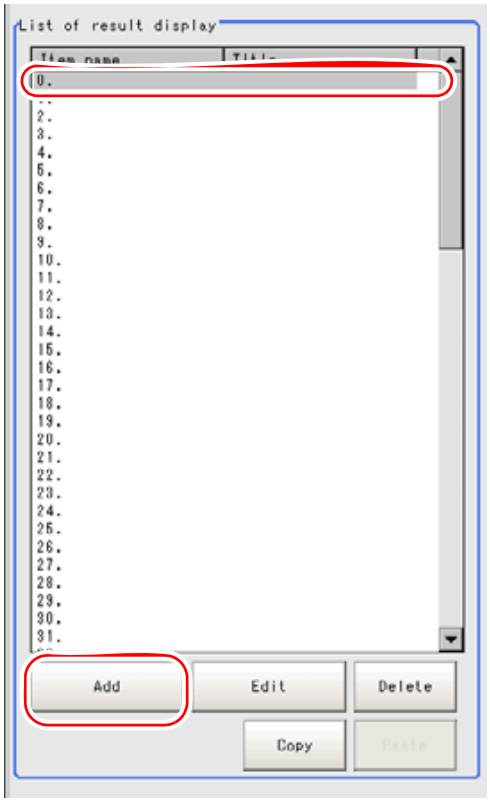
- Display figure
  Figures (rectangles, straight lines, ellipses, circumferences, arcs, and cursors) can be displayed at specific positions.

7.1.1 Setting up [Result Display]



1 In the Edit Flow window, tap [Result display].
The ProcItem Setting window is displayed.
"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "List of result display" area, select the number with which to set the object, and tap [Add].

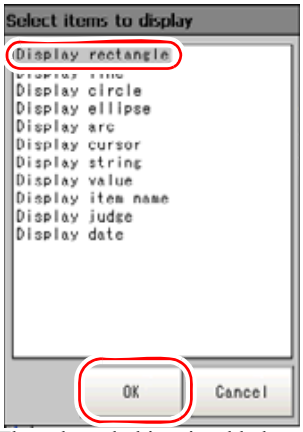


POINT

When editing existing contents

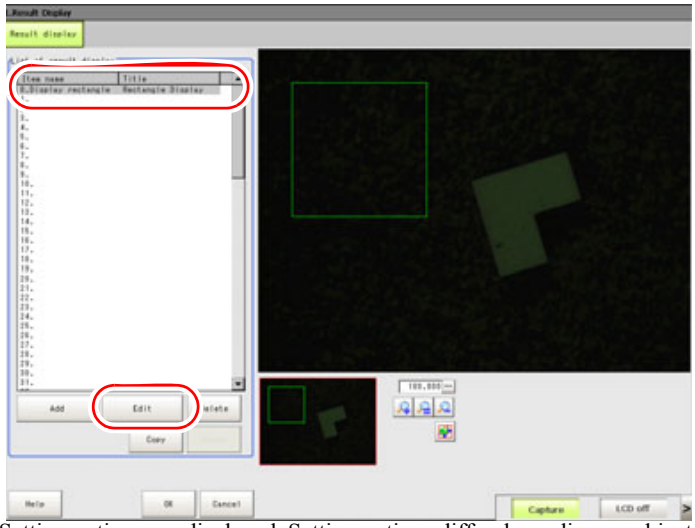
- Select the object to be edited and tap [Edit].

3 In the Select Item to Display window, select the object to be added and tap [OK].



The selected object is added to the "List of result display" area and the "Image display" area.

4 In the "List of result display" area, select the object and tap [Edit].



Setting options are displayed. Setting options differ depending on objects.

- String/Value/Item Name/Judge/Date
  See "7.1.2 Set up View Contents : Any Text / Value / Judge Text / Date and Time (Result display)" (→pg.4).
- Figure
  See "7.1.3 Setting the Items to Display: Figure (Result display)" (→pg.8).

5 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

6 Perform a measurement test.

"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

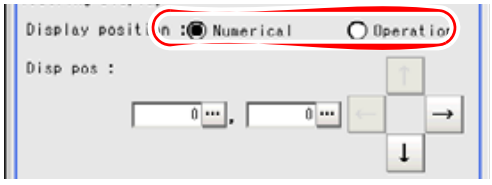
7 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"

When NG is displayed, please verify measurement results and make Adjust if necessary.

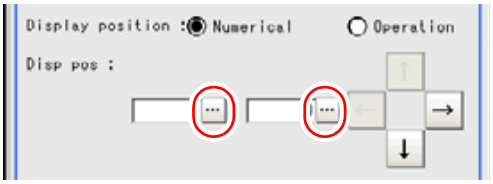
7.1.2 Set up View Contents : Any Text / Value / Judge Text / Date and Time (Result display)

1 Select "Numerical"or "Operation" for "Display position", and specify the display coordinates.



When "Numerical" is selected:

1. Tap [...] for "Disp pos" and specify X and Y coordinates of the upper left corner of the text box.

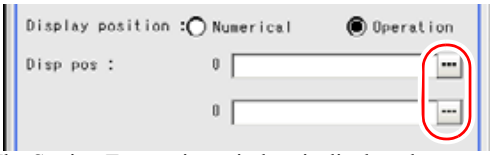


How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"

In the "Image display" area, you can tap your desired display position.

When "Operation" is selected:

1. Tap [...] for "Disp pos".



The Setting Expression window is displayed.

2. Specify an expression.

For how to specify an expression, see "4.1.4 Structure and Creation of Expression" (→pg.5)

2 Specify the display contents.

The display items differ depending on the object selected in the "List of result display" area.

Display string

Tap [...] for "Set letter" and set up the characters to be displayed in the measurement results.

Characters entering methods:"1.5 Inputting a Text" (→pg.19), of "User's Manual"

POINT

- Up to 64 characters can be entered.

Display value

Use the expression to set up the measured data to be displayed.

1. Tap the button to the right of "Measurement".

The Setting Expression window is displayed.

2. Specify an expression.

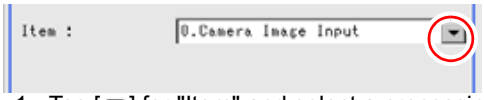
For how to specify an expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).

3. Tap [▼] for "Integer" and "Decimal" and specify the number of digits for each.

Table: Digits Specification (Result Display)

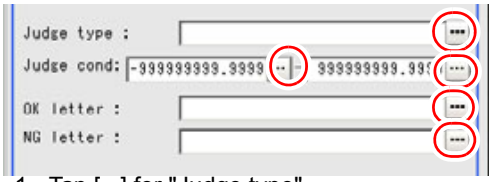
Setting Item	Set Value [Factory Default]	Description
Integer	1 to [10]	Specify the width of the integer part including the sign. For positive numbers, the plus sign is not output. Example Setting:4 digits, Data:-5619 The data is output as "-999".
Decimal	0 to [4]	Specify the number of output digits in the decimal part. When set to 0, the entire decimal part is rounded for output.

Display item name



1. Tap [▼] for "Item" and select a processing item.
   The selected item will be displayed as one of the Processing Item in the currently displayed scene. When a name has been given to the unit, the name will then be displayed.

Display judge



1. Tap [...] for "Judge type".
   The Setting Expression window is displayed.
2. Specify an expression.
   For how to specify an expression, see "4.1.4 Structure and Creation of Expression" (→pg.5).
   Display the Measurement Results that have been set up for the expression in the "Value".
3. Tap each [...] for the "judge cond" and set up the upper limit and the lower limit for the judge condition (OK range) that corresponds to the expression.
   For how to input value, see "1.4 Inputting a Value" (→pg.18), of "User's Manual".
4. Tap each [...] for "OK letter" and "NG letter" and set up the display that corresponds to the result of expression (OK/NG).
   For how to input characters, see "1.5 Inputting a Text" (→pg.19), of "User's Manual"
   Up to 30 characters can be entered.

POINT

- Up to 64 characters can be entered.

Display date

Select the display format of the date and the time.

Important

- Please adjust the calendar embedded in controller in advance.
  "9.3.1 Setting Date and Time [Date-time setting]" (→pg.7), of "User's Manual"

1. Tap [▼] for "Date kind" and select the display format.

Table: Time display specification (Result display)

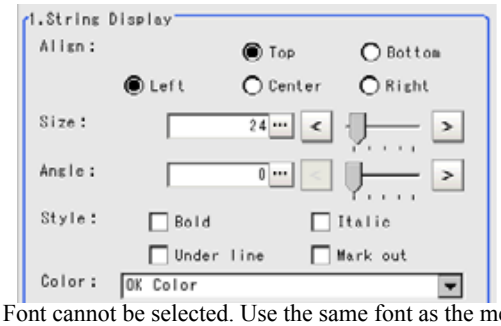
Set Value [Factory defaults]	Examples
Month/Day/Hour/Minute/Second	10/01 01:23:45
Month/Day/Hour/Minute	10/01 01:23
Hour/Minute/Second	01:23:45
Hour/Minute	01:23

3 Perform the detailed settings if required.

1. Tap [Detail].

Detailed setting items are displayed in the "Detail" area.

2. Specify the necessary items.



Font cannot be selected. Use the same font as the menu.

Table: Result display (Result display) - Detailed setting

Setting Options	Set Value [Factory defaults]	Description
Align	・Top ・Bottom ・Left ・Center ・Right	Select the alignment of the text.
Size	10 to 200 [24]	Specify the character size.

Table: Result display (Result display) - Detailed setting

Setting Options	Set Value [Factory defaults]	Description
Angle	[0] to 359	Specify the tilting of the displayed object.
Style	・Bold ・Italic ・Under line ・Mark out	Select the character decoration.
Color	・[OK Color] ・NG Color ・Judgement ・Arbitrary color	Select the display color of the value or date.

4 If necessary, change the title.

1. Tap [Change title].

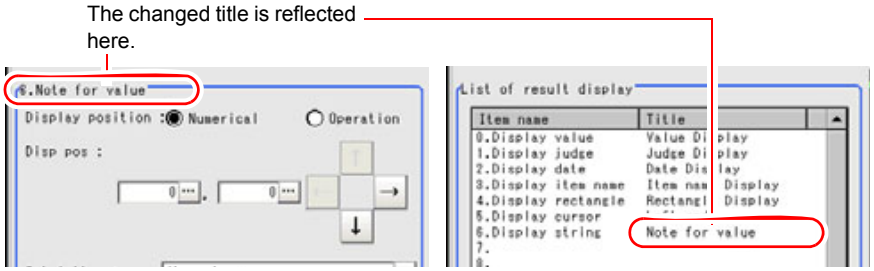
A software keyboard is displayed.

How to input text: "1.5 Inputting a Text" (→pg.19), of "User's Manual"

Up to 15 characters can be entered.

2. Input a title and tap [OK].

The changed title is displayed in the "Detail" area, and in the "Title" column of the "List of result display" area.



5 Tap [OK].

The display settings for the object are registered, and the "List of result display" area is displayed.

For the following operations, see "7.1.1 Setting up [Result Display]" (→pg.2).

7.1.3 Setting the Items to Display: Figure (Result display)

Let's use "Display Rectangle Result" as an example to show how to set up.

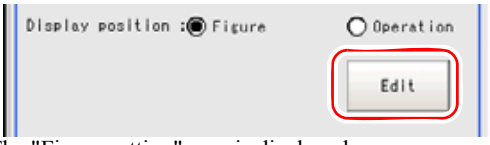
Other options other than "Display Rectangle Result" are similar with this.

For the Figure Setting window for other than rectangle, see "1.9 Setting Figures" (→pg.25), of "User's Manual".

1 Select "Figure" or "Operation" for "Display position".

When "Figure" is selected:

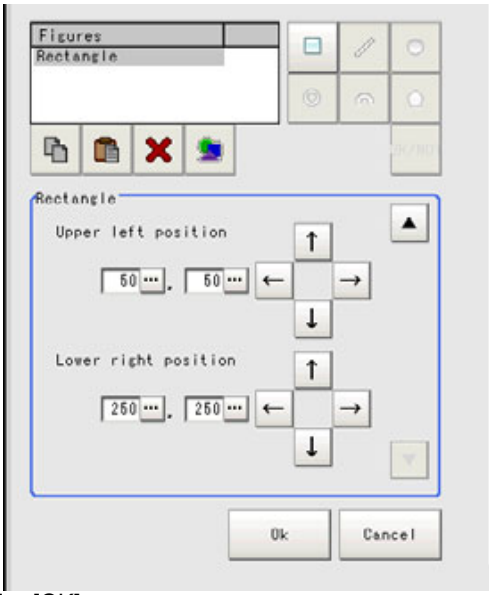
1. Tap [Edit].



The "Figure setting" area is displayed.

2. Specify the coordinates using one of the Drawing Tools.

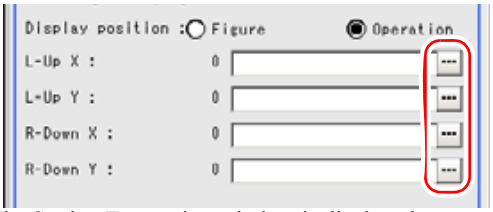
"1.9 Setting Figures" (→pg.25), of "User's Manual"



3. Tap [OK].

When "Operation" is selected:

1. Tap [...] for each item.



The Setting Expression window is displayed.

2. Specify the value and an expression

How to specify an expression: "4.1.4 Structure and Creation of Expression" (→pg.5)

2 Specify the Style, width and color of the line if required.

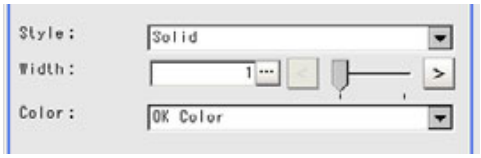


Table: Result display (Result display) - Detailed setting

Setting Item	Set Value [Factory Default]	Description
Style	・[Solid] ・Dash line	Select the line type.
Width	[1] to 10	Specify the line width.
Color	・[OK Color] ・NG Color ・Judgement ・Arbitrary color	Select the color of the figure.

POINT

- For dash line, "Width" is fixed to "1".

3 If necessary, change the title.

1. Tap [Change title].

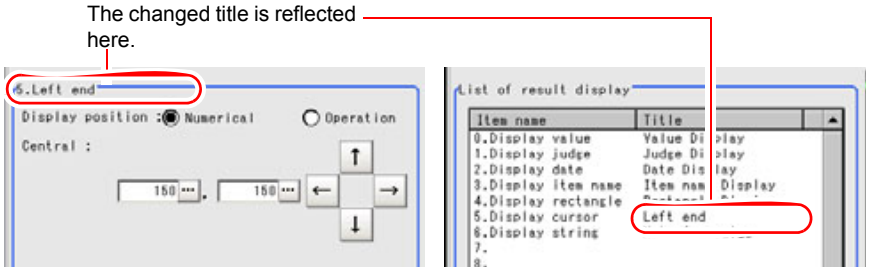
A software keyboard is displayed.

How to input text: "1.5 Inputting a Text" (→pg.19), of "User's Manual"

Up to 15 characters can be entered.

2. Input a title and tap [OK].

The changed title is displayed in the "Detail" area, and in the "Title" column of the "List of result display" area.



4 Tap [OK].

The display settings for the object are registered, and the "List of result display" area is displayed.

For the subsequent operations, see "7.1.1 Setting up [Result Display]" (→pg.2).

7.1.4 When Using Measurement Results Externally (Result Display)

External Reference List

The data types and their numbers that are available to refer from other processing units and external equipment are shown below. For the input method, see "Input Format" in "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference List (Result display)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG

7.2 3D Result Display

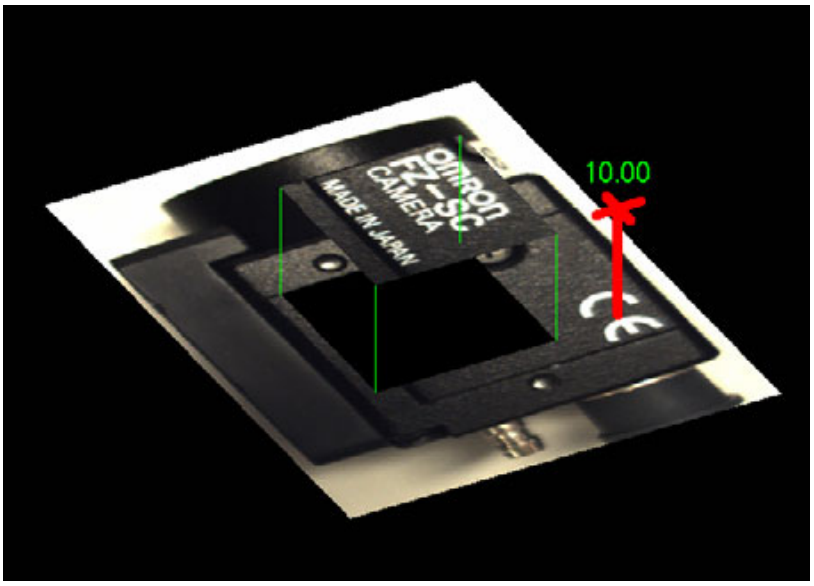
This processing item is for 3D measurement only.

Used for the following cases

The measurements of X, Y, and Z are displayed in 3D in the "Image display" area. You can visually check whether or not the height of the measured part is correctly measured.
Also, you can display texts and figure objects. The following can be displayed:

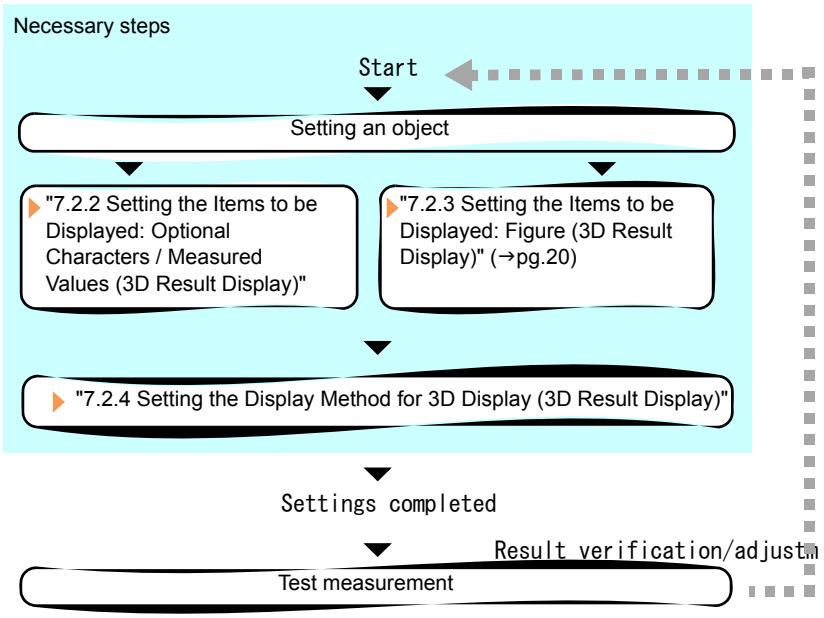
- Display string
  Displays any text about the measurement.
- Display value
  Displays any measured data.
  Since the expression is used, then both the value and the operation result of the expression can be displayed.
- Display figure
  Figures (Rectangle, circle, cross-shaped cursor, straight line, polygon) can be displayed at specific positions.

Example) The information on the measured height is displayed.



By using a touch pen, the image displayed in the "Image display" area can be rotated or its angle can be changed.
"7.2.5 Moving an Image with a Touch Pen (3D Result Display)" (→pg.28)

7.2.1 Setting Up [3D Result Display]

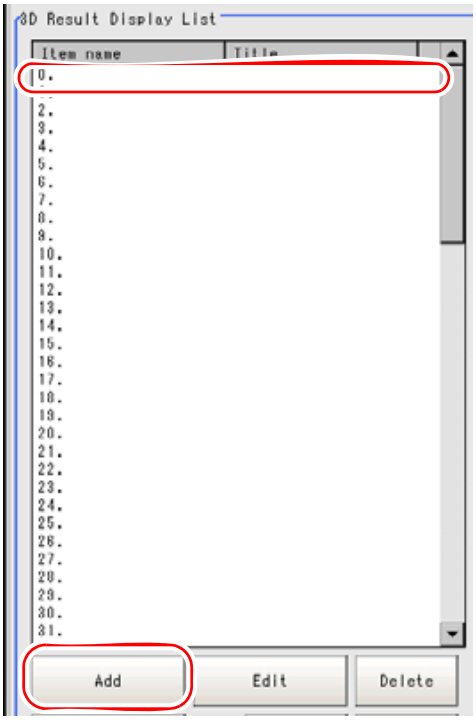


1 In the Edit flow window, tap [3D Result Display].

The ProcItem Setting window is displayed.

"1.2.4 ProcItem Setting Window" (→pg.12), of "User's Manual"

2 In the "3D result display list" area, select the number for the object to be set, and then tap [Add].

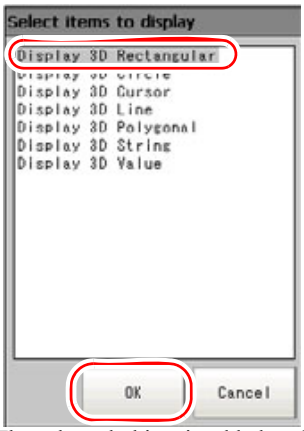


POINT

When editing something that already exists

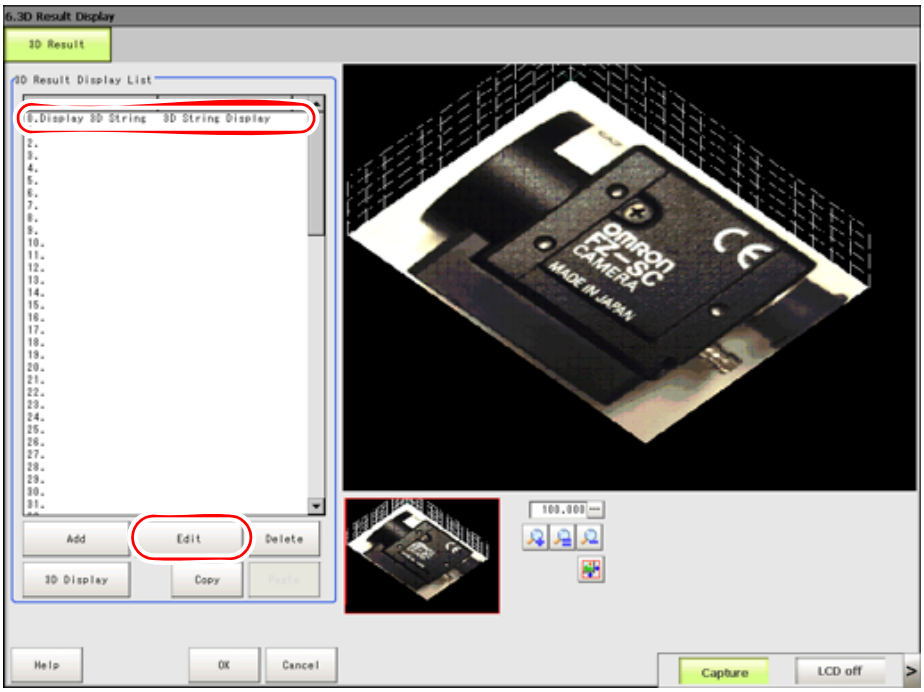
- Select the object to be edited and tap [Edit].

3 In the Select items to display window, select the object to be added and tap [OK].



The selected object is added to the "3D result display list" area.

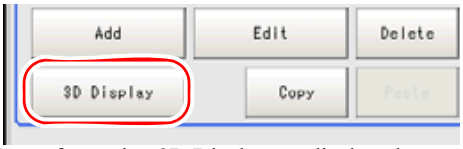
4 Select an object in the "3D result display list" area, and tap [Edit].



Setting options are displayed. Setting options differ depending on objects.

- Optional Characters and/or Measured Values
  See "7.2.2 Setting the Items to be Displayed: Optional Characters / Measured Values (3D Result Display)" (→pg.17).
- Figure
  See "7.2.3 Setting the Items to be Displayed: Figure (3D Result Display)" (→pg.20).

5 Tap [3D Display].



Items for setting 3D Display are displayed.
For how to set them, see "7.2.4 Setting the Display Method for 3D Display (3D Result Display)" (→pg.22).

6 Tap [OK].

After confirmation, the ProcItem Setting window will be closed.

7 Perform a test measurement.

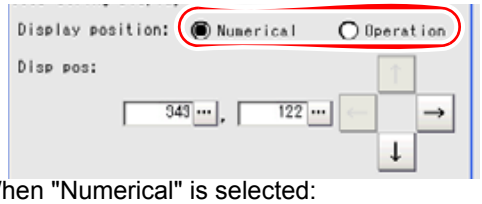
"5.1 Test Measurement before Actual Operation" (→pg.2), of "User's Manual"

8 Verify measurement results.

"6.2 Display of the RUN Window" (→pg.3), of "User's Manual"
When "NG" is displayed, verify measurement results and make adjustments if necessary.

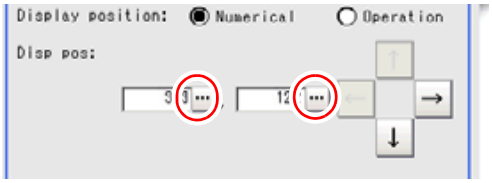
7.2.2 Setting the Items to be Displayed: Optional Characters / Measured Values (3D Result Display)

1 Select "Numerical" or "Operation" for "Display position", and specify the display coordinates.



When "Numerical" is selected:

1. Tap [...] for "Disp pos" and specify X and Y coordinates of the upper left corner of the text box.

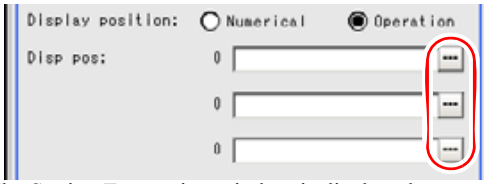


How to input a value: "1.4 Inputting a Value" (→pg.18), of "User's Manual"

In the "Image display" area, you can tap your desired display position.

When "Operation" is selected:

1. Tap [...] for "Disp pos".



The Setting Expression window is displayed.

2. Specify an expression.

How to specify expressions: "4.1.4 Structure and Creation of Expression" (→pg.5)

2 Set up the display contents.

The items displayed differ depending on the object selected in the "3D result display list" area.

Display string

1. Tap [...] of "Set letters", and set the characters to display in the 3D Result Display.

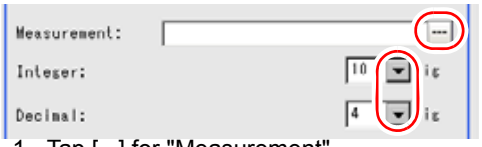
How to input text: "1.5 Inputting a Text" (→pg.19), of "User's Manual"

POINT

- Up to 64 characters can be entered.

Display value

Set an expression to display measured data.



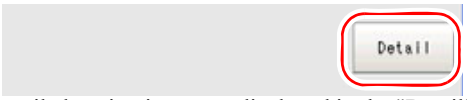
1. Tap [...] for "Measurement".
   The Setting Expression window is displayed.
2. Specify an expression.
   How to specify expressions: "4.1.4 Structure and Creation of Expression" (→pg.5)
3. Tap [▼] for "Integer" and "Decimal" and specify the number of digits for each.

Table: Specifying Number of Digits (3D Result Display)

Setting Item	Set Value [Factory default]	Description
Integer	1 to [10]	Specify number of digits the integer part including the sign. For positive numbers, the plus sign is not output. Example For the data -5619, if 4 is set as the number of digits The data is output as "-999".
Decimal	0 to [4]	Specify the number of output digits in the decimal part. When set to 0, the entire decimal part is rounded for output.

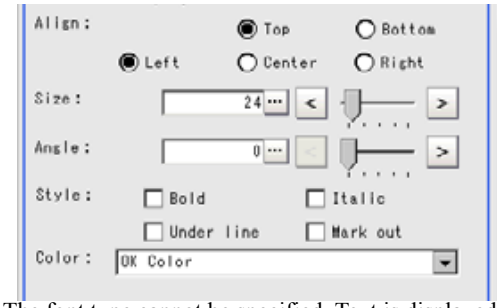
3 Perform the detailed setting if required.

1. Tap [Detail].



Detailed setting items are displayed in the "Detail" area.

2. Set up the necessary items.



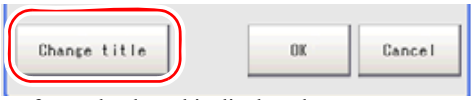
The font type cannot be specified. Text is displayed in the same font as the menus.

Table: 3D Result Display (3D Result Display) - Details

Setting Item	Set Value [Factory default]	Description
Align	・[Top] ・Bottom ・[Left] ・Center ・Right	Select the alignment of the text.
Size	10 to 200 [24]	Specify the font size.
Angle	[0] to 359	Specify the tilting of the displayed object.
Style	・Bold ・Italic ・Under line ・Mark out	Select the character decoration.
Color	・[OK color] ・NG color ・Judgement ・Arbitrary color	Select the color for displaying the measured values.

4 If necessary, change the title.

1. Tap [Change title].

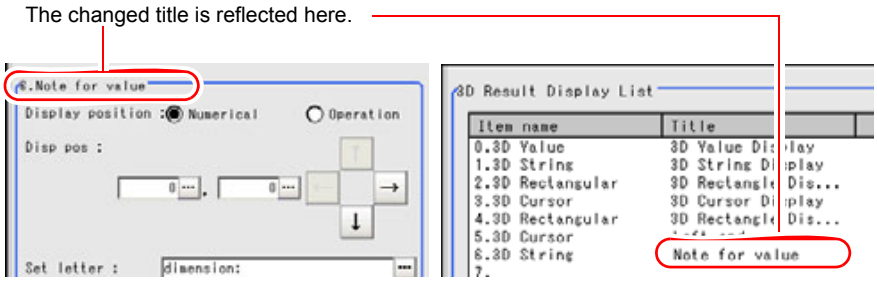


A software keyboard is displayed.

How to input text:"1.5 Inputting a Text" (→pg.19), of "User's Manual"

Up to 15 characters can be entered.

2. Input a title and tap [OK].
   The modified title is displayed as the title for the "Detail" area and in the column of the title in the "3D result display list" area.



5 Tap [OK].
   The items to be displayed for the object are registered, and the "3D result display list" area is displayed.

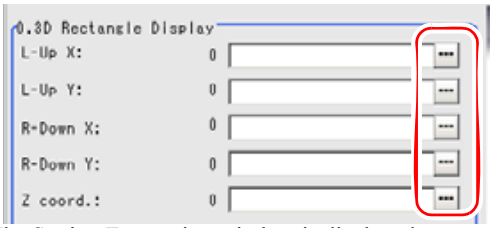
For the subsequent operations, see "7.2.1 Setting Up [3D Result Display]" (→pg.14).

7.2.3 Setting the Items to be Displayed: Figure (3D Result Display)

The operation method is explained here by using [Display 3D Rectangular] as an example.
For setting the items other than [Display 3D Rectangular], replace words as necessary when you read the explanation.
For the "Detail" window of a non-rectangular figure, see "1.9 Setting Figures" (→pg.25), of "User's Manual".

1 Specify the position to display the figure.

1. Tap [...] for each item.



   The Setting Expression window is displayed.
2. Set values and expressions.
   How to specify expressions: "4.1.4 Structure and Creation of Expression" (→pg.5)

2 Set line width and line color as necessary.

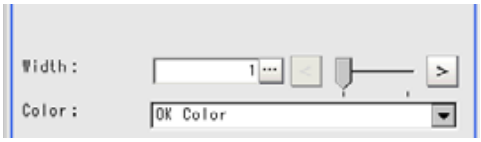


Table: 3D Result Display (3D Result Display) - Details

Setting Item	Set Value [Factory default]	Description
Width	[1] to 10	Specify the line width.
Color	・[OK color] ・NG color ・Judgement ・Arbitrary color	Select the color of the figure.

POINT

- In the 3D Result Display, when Z-coordinate is a minus value, the figure is drawn with a dash line. For dash line, "Width" is fixed to "1".

3 If necessary, change the title.

1. Tap [Change title].

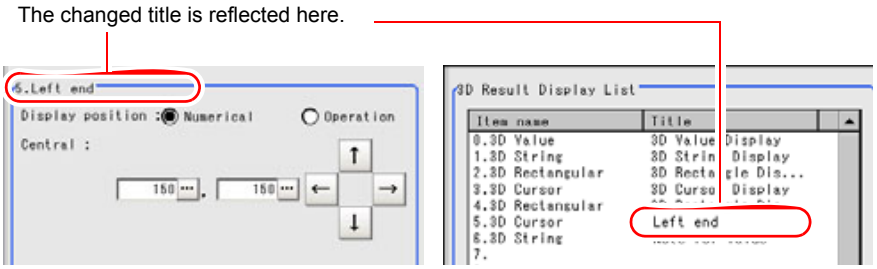
A software keyboard is displayed.

How to input text:"1.5 Inputting a Text" (→pg.19), of "User's Manual"

Up to 15 characters can be entered.

2. Input a title and tap [OK].

The modified title is displayed as the title for the "Detail" area and in the column of the title in the "3D result display list" area.



4 Tap [OK].

The details of the object are registered, and the "3D result display list" area is displayed.

For the subsequent operations, see "7.2.1 Setting Up [3D Result Display]" (→pg.14).

7.2.4 Setting the Display Method for 3D Display (3D Result Display)

Set the method to display images in 3D display. You can set the azimuthal and elevation display angles.

1 Specify the image display angle.

Table: 3D Display (3D Result Display)

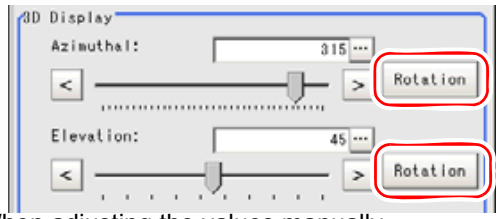
Setting Item	Set Value [Factory default]	Description
Azimuthal	0 to 359 [315]	Specify the azimuthal angle (θ).
Elevation	0 to 90 [45]	Specify the elevation angle (ϕ).

Rough setting

Tap [Rotation] to the right of each item.

With azimuthal angle, the image turns 360 degrees from the current setting.

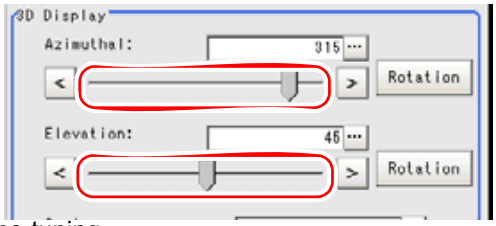
With elevation angle, the image moves in steps of 90 degrees from the current setting.



When adjusting the values manually

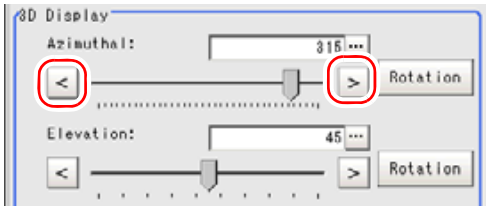
Drag the slider while verifying the image in the "Image display" area.

After the automatic setting, individual fine-tuning can still be performed.



Fine-tuning

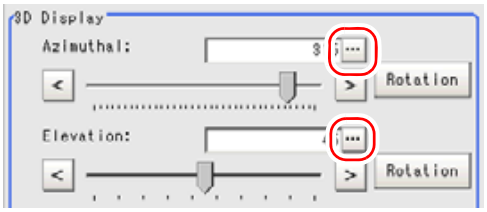
Tap the buttons at both ends of the slider.



Specifying values manually:

Tap [...] of each item and set values.

How to input a value:"1.4 Inputting a Value" (→pg.18), of "User's Manual"



2 Set magnification to display images.

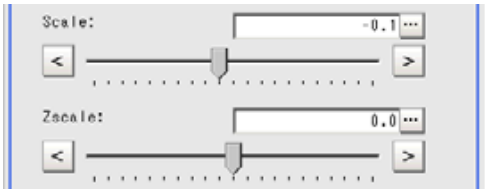


Table: 3D Display (3D Result Display)

Setting Item	Set Value [Factory default]	Description
Scale	-1.0 to 1.0 [-0.1]	Specify magnification to display 2D images. The value is the power of ten. Example: When setting 0.0, the size will be the same. When setting 0.5, the size will be 5 times as large.
Zscale	-1.0 to 1.0 [0.0]	Specify the magnification scale of the Z-axis (height). The value is the power of ten. Example: When setting 0.0, the size will be the same. When setting 0.5, the size will be 3.16227766 times as large.

3 Set the image display position.

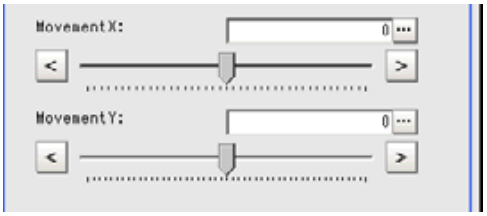


Table: 3D Display (3D Result Display)

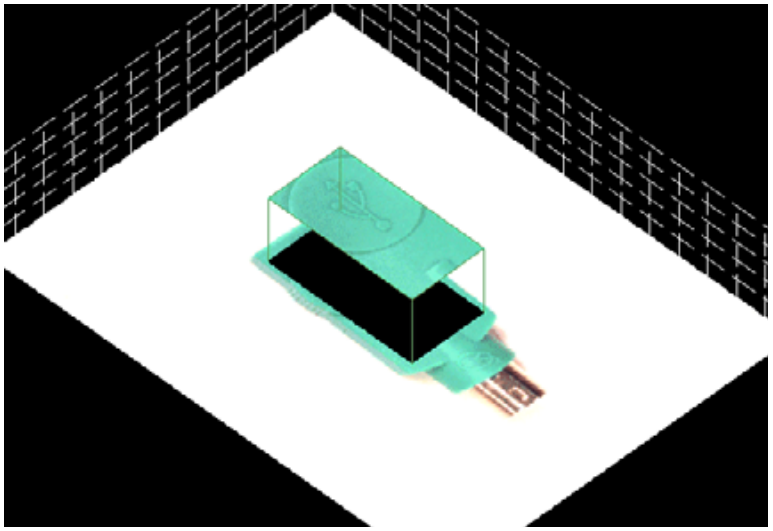
Setting Item	Set Value [Factory default]	Description
Movement X	・For a camera with more than 640 x 480 pixels: -800 to 800 ・For a camera with 640 x 480 pixels or less: -320 to 320	Specify movement in the X-axis direction. The movement is from the basic point 320 pix.
Movement Y	・For a camera with more than 640 x 480 pixels: -600 to 600 ・For a camera with 640 x 480 pixels or less: -240 to 240	Specify movement in the Y-axis direction. The movement is from the basic point 240 pix.

4 Select whether or not to display a mesh in the "Image display" area.

Table: 3D Display (3D Result Display) - Mesh Setting

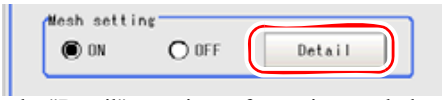
Setting Item	Set Value [Factory default]	Description
Mesh setting	[ON]	A mesh is displayed in the "Image display" area. You can set the details for the mesh by tapping [Detail].
	OFF	The mesh is not displayed in the "Image display" area.

Example of mesh display



When "Mesh setting" is set to "ON", you can set the mesh size, line type and color, etc.

1. Tap [Detail].



In the "Detail" area, items for setting mesh details are displayed.

2. Set up the necessary items.

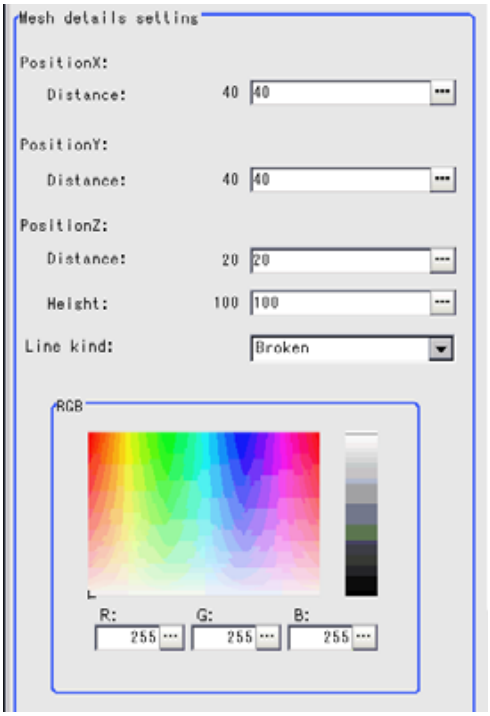


Table: 3D Display (3D Result Display) - Mesh Detail Setting

Setting Item	Set Value [Factory default]	Description
Position X		Specify the details for the X coordinate for the mesh.
Distance	Expression string (256 characters or less) [40]	Specify the width of the X coordinate for the mesh (in pixels). When the value of the expression is a negative number, the image is not displayed in the image region.
Position Y		Specify the details for the Y coordinate for the mesh.
Distance	Expression string (256 characters or less) [40]	Specify the width of the Y coordinate for the mesh (in pixels). When the value of the expression is a negative number, the image is not displayed in the image region.
Position Z		Specify the details for the Z coordinate for the mesh.

Table: 3D Display (3D Result Display) - Mesh Detail Setting

Setting Item	Set Value [Factory default]	Description
Distance	Expression string (256 characters or less) [20]	Specify the width of the Z coordinate for the mesh (in pixels). When the value of the expression is a negative number, the image is not displayed in the image region.
Height	Expression string (256 characters or less) [100]	Specify the height of the Z coordinate for the mesh (in pixels).
Line kind	・Solid ・[Dash line]	Select the type of the line for the mesh.
RGB	・R: 0 to [255] ・G: 0 to [255] ・B: 0 to [255]	Specify the color of the mesh.

5 Select whether or not to set the background color of the "Image display" area.

Table: 3D Display (3D Result Display) - Back Color Setting

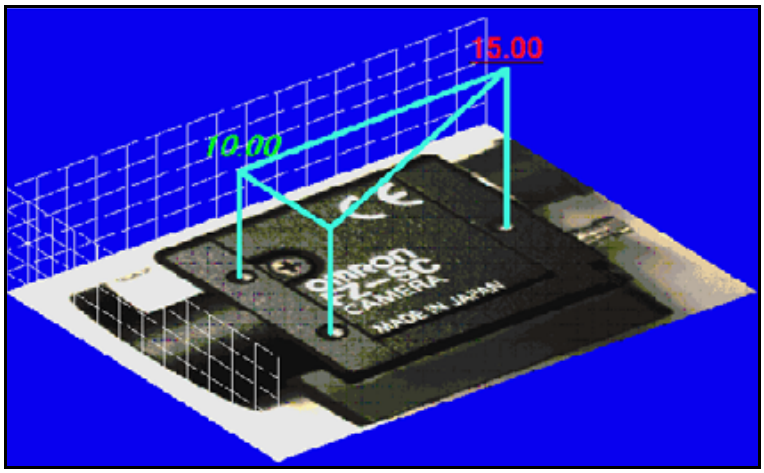
Setting Item	Set Value [Factory default]	Description
Back color setting	ON	You can set the background color by tapping [Detail]. If a background color has been specified, the specified background color is displayed.
	[OFF]	The background is displayed in black.

POINT

- For the following cases, background color is fixed to gray.
  - When using a monochrome camera

- When the color images are converted to monochrome images with [Color Gray Filter].

Display example of background color



When "Back color setting" is set to "ON", you can set a background color.

1. Tap [Detail].

In the "Detail" area, items for setting details for the background color are displayed.

2. Specify a background color.

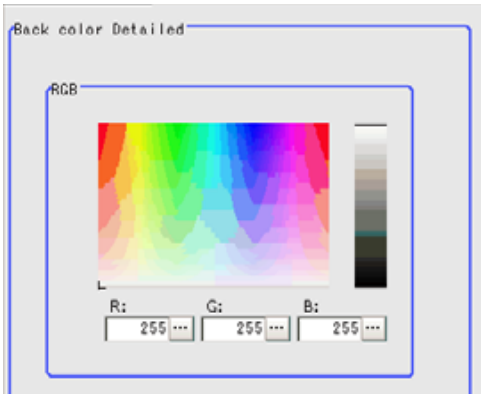


Table: 3D Display (3D Result Display) - Back Color Detailed

Setting Item	Set Value [Factory default]	Description
RGB	・R: 0 to [255] ・G: 0 to [255] ・B: 0 to [255]	Specify a background color.

6 Tap [OK].

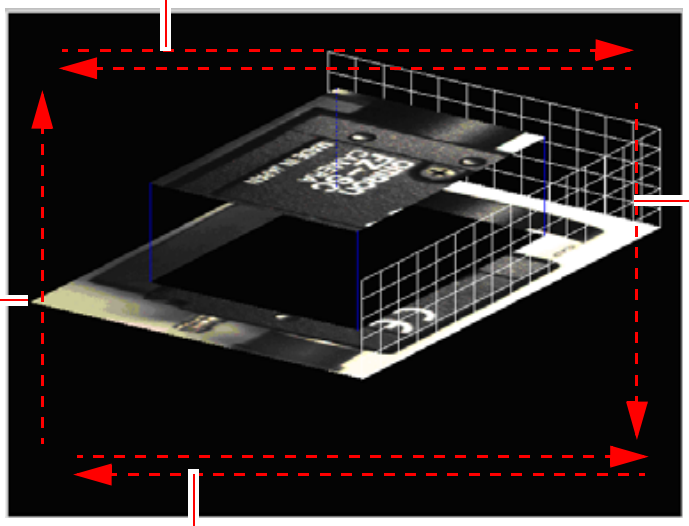
The details for 3D display are registered, and the "3D result display list" area is displayed.

For the subsequent operations, see "7.2.1 Setting Up [3D Result Display]" (→pg.14).

7.2.5 Moving an Image with a Touch Pen (3D Result Display)

By tracing over an image with a touch pen, you can turn or change the angle of the image displayed in the "Image display" area.

Above the center point:
If you trace the image to the right with the touch pen, the image turns clockwise.
If you trace the image to the left with the touch pen, the image turns counterclockwise.



Below the center point:
If you trace the image to the right with the touch pen, the image turns counterclockwise. If you trace the image to the left with the touch pen, the image turns clockwise.

If you trace the image from the bottom to the top with the touch pen, the image moves towards the elevation angle 0 degrees.

If you trace the image from the top to the bottom with the touch pen, the image moves towards the elevation angle 90 degrees.

7.2.6 When Using Measurement Results Externally (3D Result Display)

External Reference List

The data types and their numbers that are available to refer from other processing units and external devices are shown below. For the input method, see "Input Format" in "Chapter 10 - How To Connect & Communicate With External Devices" (→pg.1), of "User's Manual".

Table: External Reference Data List (3D Result Display)

No.	Data Name	Set/Get	Data Range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG

Table: External Reference Data List (3D Result Display)

No.	Data Name	Set/Get	Data Range
140	Azimuthal θ	Set/Get	0 to 359
141	Elevation ϕ	Set/Get	0 to 90
142	Magnification	Set/Get	-1.0 to 1.0
143	Z scale	Set/Get	-1.0 to 1.0
144	Movement X	Set/Get	For a camera with over 640 x 480 pixels: -800 to 800 For a camera with 640 x 480 pixels or less: -320 to 320
145	Movement Y	Set/Get	For a camera with over 640 x 480 pixels: -600 to 600 For a camera with 640 x 480 pixels or less: -240 to 240
146	Mesh	Set/Get	ON: 1, OFF: 0
147	Mesh color R	Set/Get	0 to 255
148	Mesh color G	Set/Get	0 to 255
149	Mesh color B	Set/Get	0 to 255
150	Mesh line type	Set/Get	0: Solid, 1: Broken
151	Mesh width X	Set/Get	Expression string (256 characters or less) When the value of the expression is a negative number, the image is not displayed in the image region.
152	Mesh width Y	Set/Get	Expression string (256 characters or less) When the value of the expression is a negative number, the image is not displayed in the image region.
153	Mesh width Z	Set/Get	Expression string (256 characters or less) When the value of the expression is a negative number, the image is not displayed in the image region.
154	Mesh height Z	Set/Get	Expression string (256 characters or less)
155	BG color	Set/Get	ON: 1, OFF: 0
156	Background color R	Set/Get	0 to 255
157	Background color G	Set/Get	0 to 255
158	Background color B	Set/Get	0 to 255