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SECTION 2
Processing items Setting Procedure

List of Processing Items

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- Inputting Camera Images
- Switch camera
- Changing Filtering
- Filtering Again

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- Scroll
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- End

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- Memory card data
- DO data output
- DO judgement output
- Host link data
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7. Results Display Items

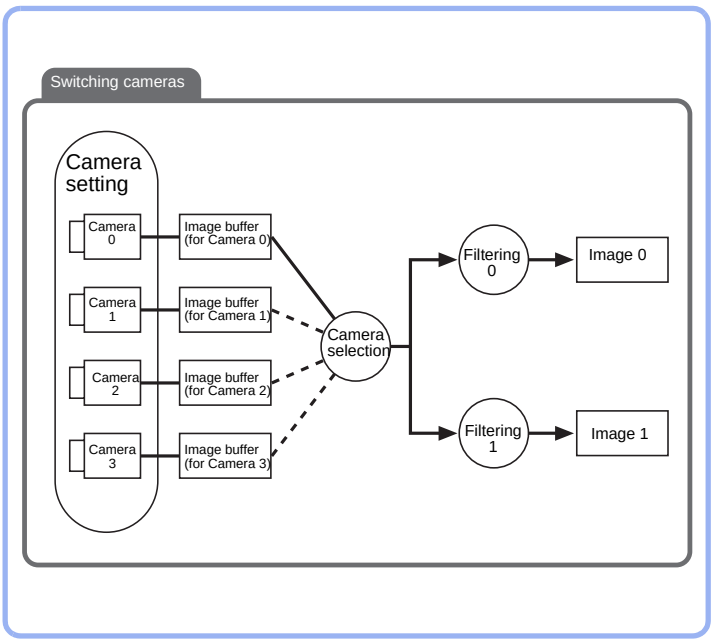
- Display string
- Display Measure
- Display judge
- Display Item
- Display Time
- Display Figure
- Display Line, Display Box, Display Circle, and Display Cursor
- Display Last NG Image

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Inputting Camera Images

This section describes how to make the condition of settings required when storing conditions for reading Camera images and storing measurement object images to [Image 0] or [Image 1].

A Camera image must be read to perform measurements, and Camera image is thus set for unit 0 by default.Do not delete Camera image from unit 0 or change it to another processing item.



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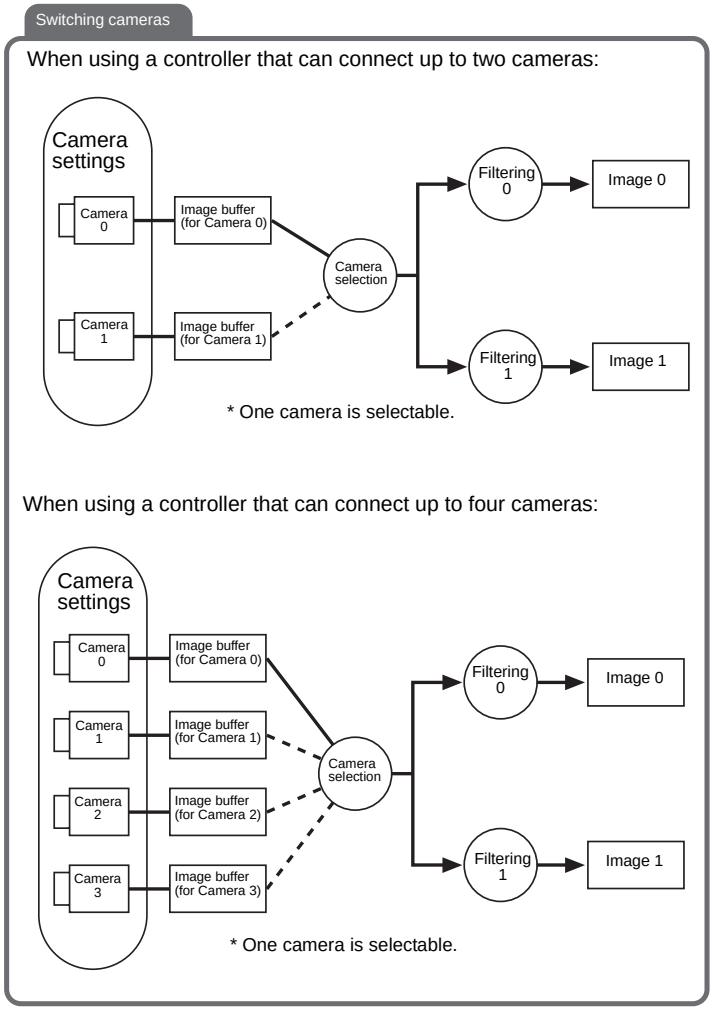
- External Reference Table 29

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Inputting Camera Images

The items that can be set under [Camera Image] can be broadly classified into three groups:

- The shutter speed and other conditions relating to when the image is captured (camera settings).
- Selection of which camera image will be measured (camera selection).
- Settings to make the image easier to measure (filtering).



Two images, [Image 0] and [Image 1], are stored for the camera image selected under Select Camera.Both images are for the same Camera but different filtering can be applied to each of the images.

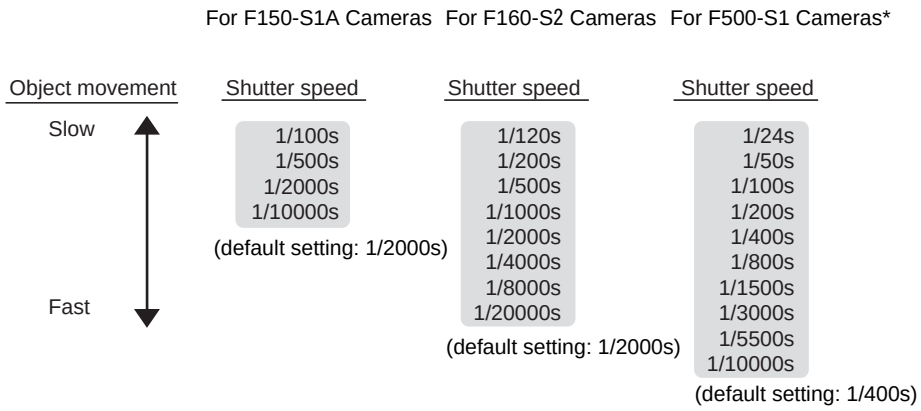
Some processing items require selection of either [Image 0] or [Image 1] for object measurement and other processing items measure only [Image 0]. For details, refer to the explanation given for each processing item.

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Camera Settings

Shutter speed

Change the shutter speed when the object is moving quickly, causing the image to be blurred.



* Some shutter speeds cannot be set depending on [Number of input lines].

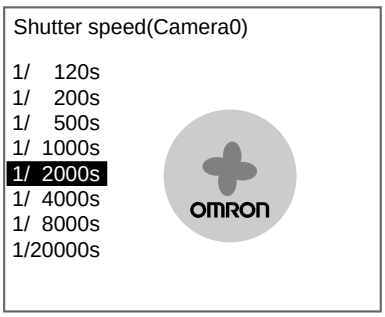
Setup Manual

If a camera other that those given above is connected, the shutter speed cannot be changed from the menu.

▶ [Camera image/Camera settings/Shutter speed (Cam No.)]

1. Select the shutter speed while monitoring the image.

2. Press the ENT Key.



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Lighting Control

When using Cameras with Intelligent Lighting, the light level can be adjusted from the Controller.

Before using Intelligent Lighting, be sure to change the settings in [SYS/Camera settings].

SECTION 5 System Settings p.2

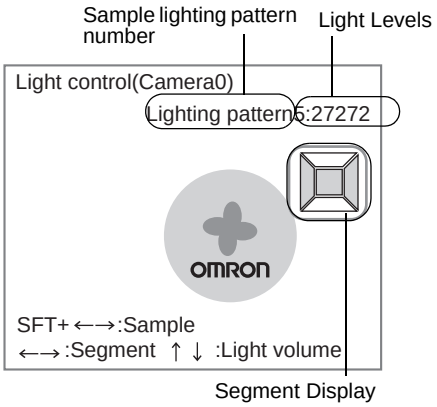
▶ [Camera image/Camera settings/Light control (Cam No.)]

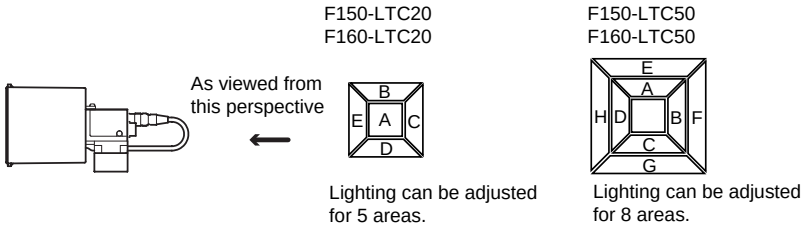
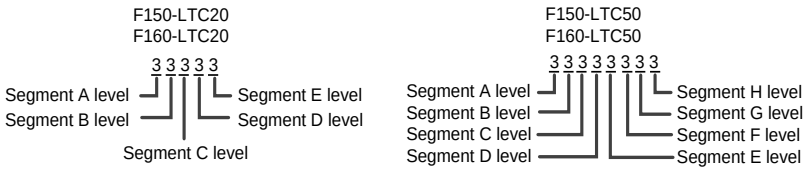
1. Switch the sample pattern lighting level using the SHIFT+Left/Right Keys.

For fine adjustment of light levels, move to the desired segment using the Right and Left Keys and adjust the light level using the Up and Down Keys.

Adjustment Method p.6

2. Press the ENT Key.



Display item	Details
Segment Display	ON/OFF status of the intelligent lighting is displayed by an illustration. The illustration will be black if the lighting is OFF, and the larger the light quantity the whiter the illustration becomes. 
Light Levels	The light level for each segment is displayed in a 5- or 8-digit value, with each digit representing the light level of one of the segments.The light levels are displayed from 0 to 7, with 0 indicating that the light is OFF. The higher the setting, the higher the light level.  CHECK! If all light adjustments are set to 5 or higher, there may be insufficient light emitted if the distance between measurements is approximately 15 ms or less.If this happens, set the light level to 4 or less.
Sample lighting pattern number	There are 15 sample lighting patterns registered in advance.

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- Adjustment Method 1: Sample Lighting Patterns

  There are 15 lighting patterns registered in advance. The lighting can be set simply by going through the different patterns in order and selecting the one that gives the clearest image.Use the SHIFT+Left and Right Keys to switch between sample patterns.

F150-LTC20, F160-LTC20 ■···Not lit □···Lit (maximum light level)

Pattern No.	Light level	Pattern No.	Light level	Pattern No.	Light level	Pattern No.	Light level	Pattern No.	Light level
1	50000	4	07070	7	22727	10	00070	13	52222
2	03333	5	27272	8	07000	11	00007	14	17777
3	07777	6	00707	9	00700	12	51111	15	27777

F150-LTC50, F160-LTC50

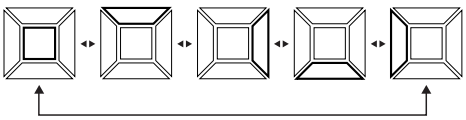
Pattern No.	Light level	Pattern No.	Light level	Pattern No.	Light level	Pattern No.	Light level	Pattern No.	Light level
1	77777777	4	00004444	7	07070707	10	00700000	13	00000700
2	44440000	5	00007777	8	70000000	11	00070000	14	00000070
3	77770000	6	70707070	9	07000000	12	00007000	15	00000007

- Adjustment Method 2: Adjusting Light Levels by Segment

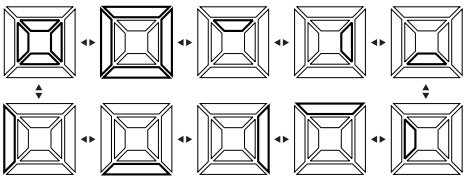
  The light level for each segment can be set separately to a value between 0 and 7. The setting “0” represents the unlit state, and the higher the setting value the higher the light level. Light levels can also be set by adjusting the light levels for the segments separately after selecting a sample lighting pattern. Use the Left and Right Keys to select the segment to be adjusted and use the Up and Down Keys to adjust the light level.

  The segments are shifted in the following order.

F150-LTC20, F160-LTC20



F150-LTC50, F160-LTC50



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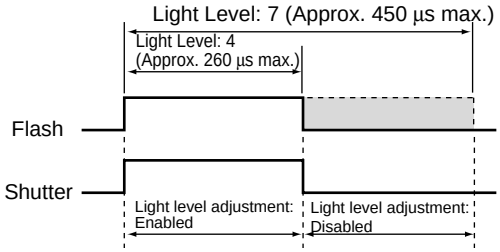
CHECK!

If the number of lines to be read has been set to a value other than 484 in the case of F160-S2 camera, it is not possible to use intelligent lighting.

CHECK!

When the shutter speed is faster than 1/2000s, the brightness of the lighting may not change even if the light level is changed.
Intelligent lighting uses pulse lighting synchronized with the shutter trigger and the light level can be adjusted by changing the pulse width. If the light level is at the maximum setting of 7, the pulse width is approximately 450 µs and the time the shutter is open is about the same as when the shutter speed is set to 1/2000s. This means that settings will become invalid (the brightness will not change) if the shutter speed is faster than 1/2000s and the light level setting is high.

Example: When Shutter Speed is 1/4000s, Light Level Adjusted to 4



Camera Gain F500

Adjust the camera gain if it is not possible to make the image brighter by changing the shutter speed, lens focus or lighting. Normally, the default camera gain will be satisfactory.
This function can be used with F500 only.

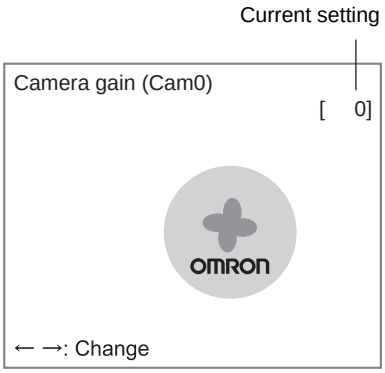
Camera Gain	Quality	Image
100	Bad (much noise)	Bright
0		
-100	Good (little noise)	Dark

(default setting: 0)

▶ [Camera image/Camera settings/Camera gain (Cam No.)]

1. Change the current value using the Left and Right Keys while observing the image.

2. Press the ENT Key.



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Calibration

Calibration can be set to output the measurement results in physical units.

Selection	Details	Reference
Sampling	This function is used set calibration based on the measurement results.	p.8
Specifying Points	This function is used to specify and set any point in pixel units.	p.13
Specifying Coordinate Axis	This method is used to specify the coordinate axis while monitoring the messages displayed on the screen.	p.15
Inputting Parameters	This function is used set calibration by entering values directly.	p.17
Reference Parameters	This function is used to check the calibration settings.	p.18

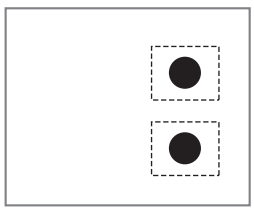
Calibration
SECTION 7 Appendix, “Terminology”

CHECK!
To output measurement results in physical units, set [Coordinate mode/Calibration] to [ON] for each processing item. If [Calibration] remains set to [OFF], the default settings will remain, and measurements using the Camera coordinates will be output.

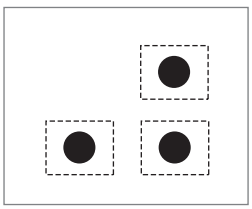
■ Sampling

The sampling function is used to set calibration based on measurement results.
Register a model, and perform a sample measurement to obtain the position. (The position will be obtained in sub-pixel units.) Enter the physical coordinates of the position of the model. The calibration will be calculated automatically. Sample measurements can be made in up to 3 places.

- When the magnifications are the same for the X and the Y directions: Sample measurements are performed in two places.



- When the magnifications in the X and Y directions are different: Sample measurements are performed in three places.

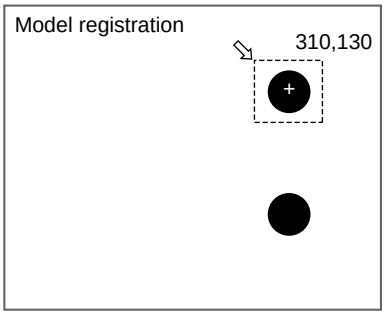


CHECK!
- The point measured by the Controller becomes the specified point for calibration, giving a higher degree of accuracy than when using [Point specification].
- If sample measurements are performed at two points, the left-hand coordinate system will be set. If you want to perform calibration including the coordinate system, sample measurements must be performed at three points.

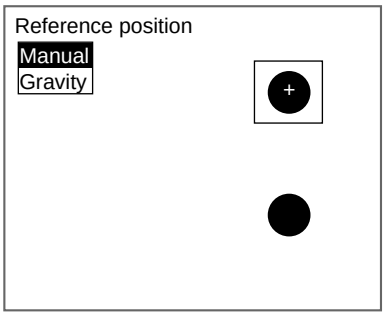
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▶ [Camera image/Camera settings/Calibration (Cam No.)/Sampling/Model registration]

1. Circumscribe one figure with a box and register the model image to be used for sampling.



The screen for selecting the reference position settings for the model will be displayed.



2. Select [Manual] or [Gravity].

[Manual]: Any reference position can be set.

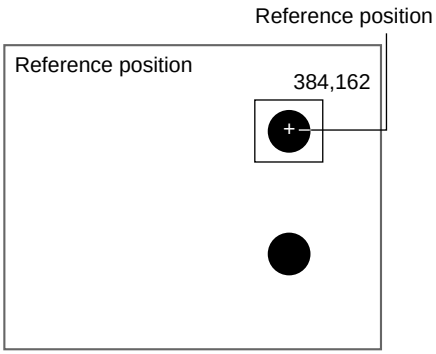
[Gravity]: The image is converted to binary and the center of gravity is set as the reference position.

When [Manual] is Selected: The Reference Position Settings Screen will be displayed.
A display cursor will appear at the center of the model, as the default position.

When [Gravity] is selected: The Gravity Settings Screen will be displayed.

3. Set the reference position.

[Manual]
Use the Up, Down, Right and Left Keys to move the cursor to the reference position and press the ENT Key.

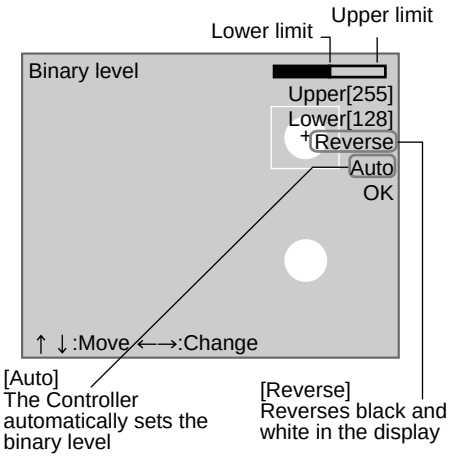


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[Gravity]
Specify the binary level so that the reference figure will be white and select [OK].

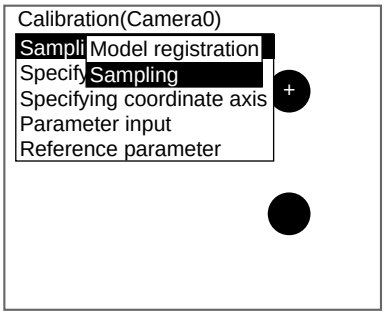
Move the cursor to the upper limit or lower limit and use the Left and Right Keys to change the value.

Right Key: Increases the lowest digit by one.
SHIFT+Right Keys: Increases the value 10 times faster.
Left Key: Decreases the lowest digit by one.
SHIFT+Left Keys: Decreases the value 0 times faster.
Up and Down Keys: Switches between setting items.



The model will be registered and the calibration initial screen will reappear.

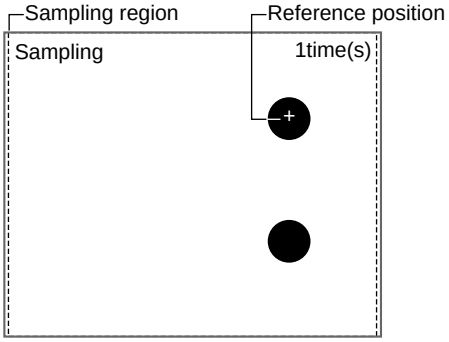
4. Select [Sampling].



The first Sampling Screen will be displayed.

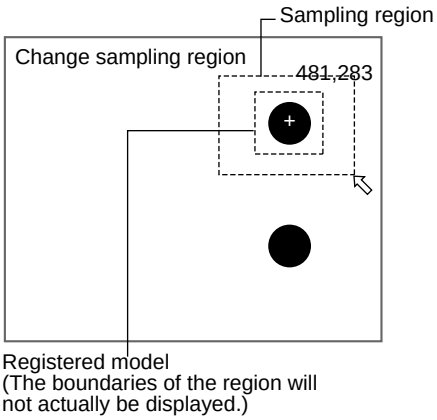
5. Decide whether or not to change the sampling region.

When there are two or more similar-shaped objects on the screen:
Press the SHIFT+ENT Keys. Go to step **6.**
When there are no similar-shaped objects on the screen, go to step **7.**



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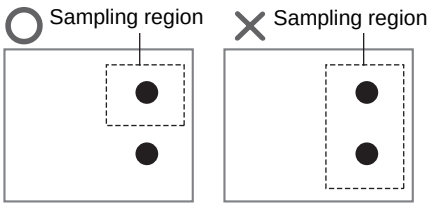
The Change Sampling Region Settings Screen will be displayed.



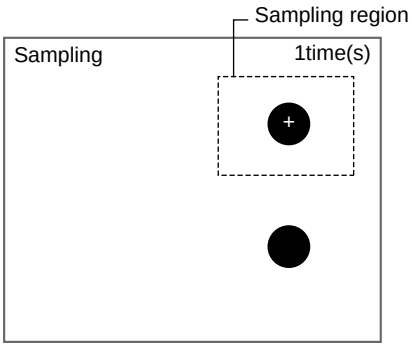
6. Change the region.

CHECK!

Draw the region so that there will not be 2 or more similar figures within the sampling region.

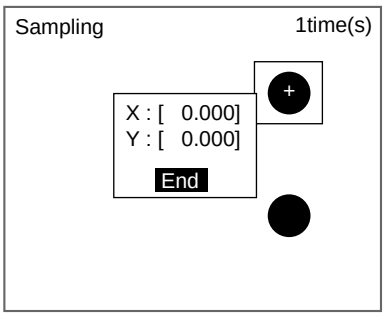


The region will be set and the Sampling Screen will return.



7. Press the TRIG Key to execute the first sampling.

A frame and display cursor will appear where the model was found and the screen for inputting physical coordinates will be displayed.



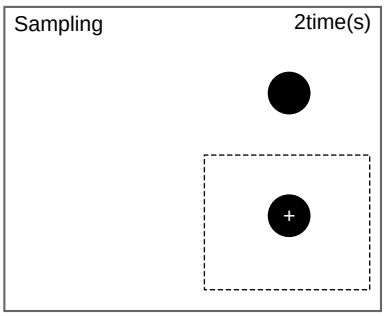
8. Input the coordinates for the model position (display cursor), select [End].

CHECK!

Correcting Mistakes
Press the SHIFT + ENT Keys.
The previous sampling can be corrected and re-executed.

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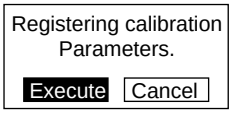
The first sampling will be confirmed, and the second screen will be displayed.



9. Repeat steps **6.** to **9.** and perform sampling for at least two locations.

Adjust the sampling region so that only the target figure is enclosed.

Once sampling has been completed, a confirmation message will be displayed.



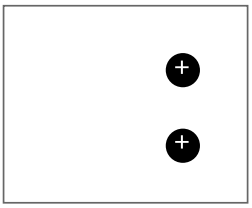
10. Select [Execute].

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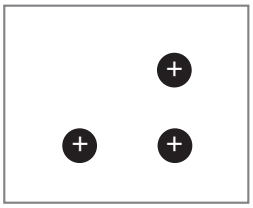
■ Specifying Points

This function is used to specify and set any point in pixel units.
If the coordinates of the specified position are input, the calibration data is automatically calculated. Up to 3 points can be specified.

- When the magnifications are the same for the X and the Y directions:
  Specify two places only.



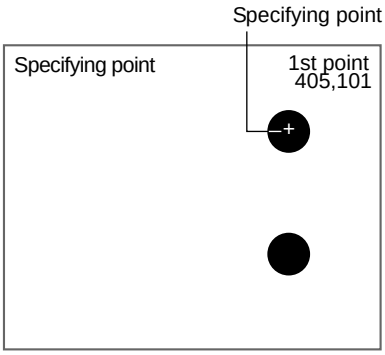
- When the magnifications in the X and Y directions are different:
  Specify three places only.



CHECK! If two points are specified, the left-hand coordinate system will be set. If you want to perform calibration including the coordinate system, specify three points.

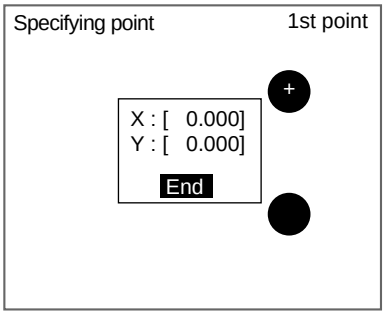
▶ [Camera image/Camera settings/Calibration (Cam No.)/Specifying point]

1. Use the Up/Down and Right/Left Keys to move the cursor to the desired point and press the ENT Key.



The screen for inputting coordinates will be displayed.

2. Input the coordinates for the point to be specified and select [End].

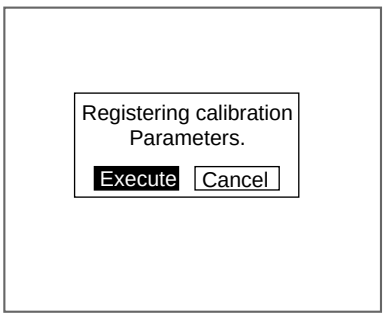


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The coordinates for the 1st point will be set and the Specifying Point Screen for the 2nd point will be displayed.

3. Repeat steps **1.** and **2.** and specify 2 or more points.

Once point specification has been completed, a confirmation message will be displayed.



4. Select [Execute].

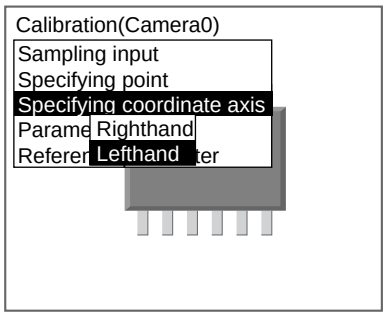
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■ Specifying Coordinate Axis

This method is used to specify the coordinate axis while monitoring the messages displayed on the screen.

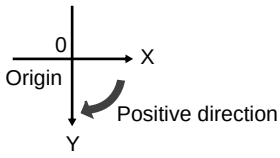
The coordinate system, the origin, the rotation angle, and the magnification, are set in that order. The magnification for X and Y directions is the same setting when specifying the coordinate axis.

▶ [Camera image/Camera settings/Calibration (Cam No.)/Specifying coordinate axis]

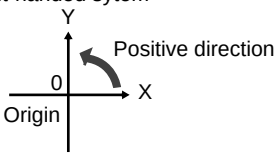


1. Select [Righthand] or [Lefthand].

Left-handed sytem

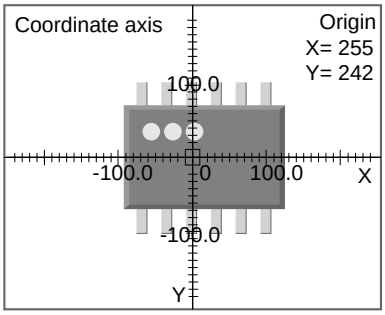


Right-handed sytem



The screen for specifying the origin will be displayed.

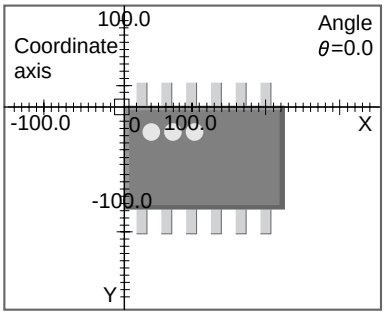
2. Use the Up/Down and Right/Left Keys to move the cursor to the origin and press the ENT Key.



Up, Down, Right and Left Keys: Moves the position one pixel at a time.
SHIFT+Up/Down and Right/Left Keys: Moves the position 10 pixels at a time.

The origin will be set and the screen for setting the rotation angle will be displayed.

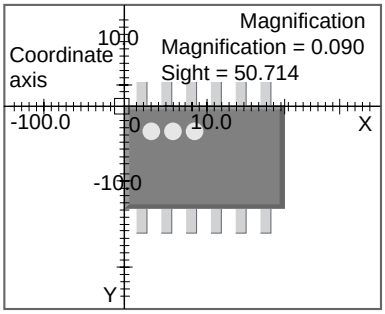
3. Specify the angle for the axis and press the ENT Key.



Left and Up Keys: Rotates the angle by 0.5 in the counterclockwise direction.
SHIFT+Right and Down Keys: Rotates the angle by 5°
Left and Up Keys: Rotates the angle by 0.5 in the counterclockwise direction.
SHIFT+Right and Down Keys: Rotates the angle by 5° in the counterclockwise direction.

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The angle will be set and the screen for specifying magnification will be displayed.

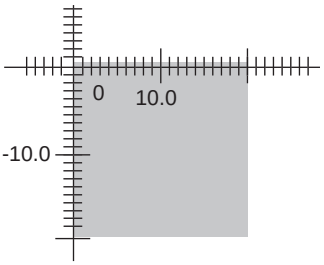


4. Specify the magnification.

Use the following procedure to specify the actual dimensions that correspond to one pixel.
Right/Down Keys: Enlarges the image 10 gradations at a time.
SHIFT+Right and Down Keys: Enlarges the image 100 gradations at a time.
Left and Up Keys: Reduces the image 10 gradations at a time.
SHIFT+Right and Down Keys: Enlarges the image 100 gradations at a time.

CHECK!

Example: For a measurement object with actual length of 20 mm
Align the origin with the upper-left corner of the measurement object and align the 20.0 gradation line with the upper-right corner of the measurement object.



5. Press the ENT Key.

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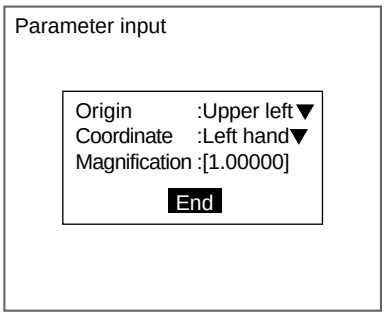
■ Inputting parameters

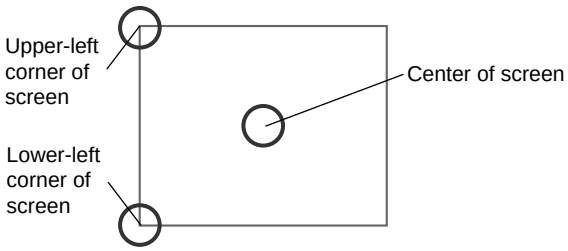
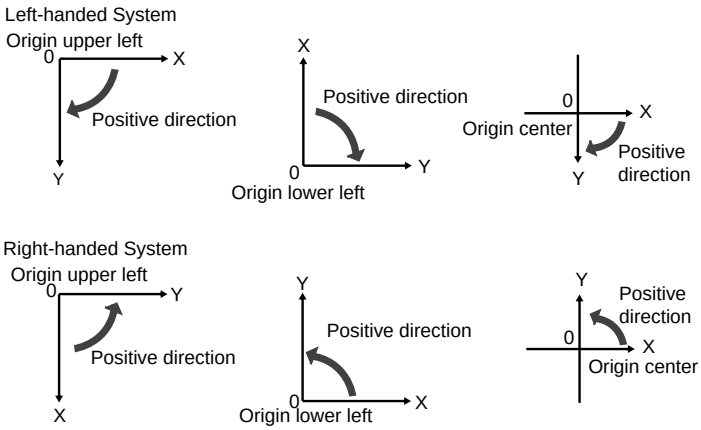
Use the following procedure to directly input parameters to be used for calibration.

▶ [Camera image/Camera settings/Calibration (Cam No.)/Inputting parameters]

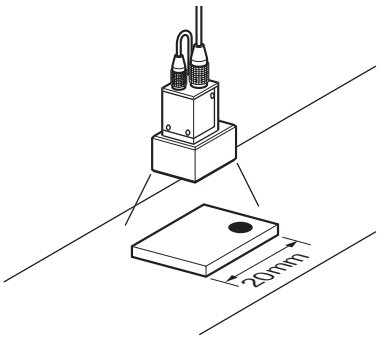
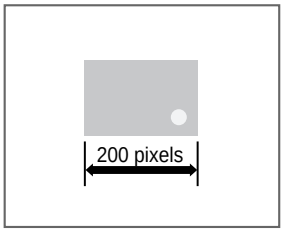
1. Set each item.

2. Select [End].



Setting data	Selection	Details
Origin	Upper-left corner of screen Lower-left corner of screen Center of screen	Specify the physical coordinates for the position of the origin as desired. 
Coordinate System	Left-handed System Right-handed System	Select the coordinate system for the physical coordinates. 

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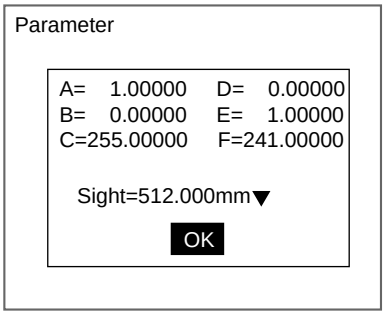
Setting data	Selection	Details
Magnification and Units	0.00100 to 9.99999	Set the physical unit that will correspond to one pixel.  Screen  The magnification is 20(mm) / 200(pixels) = 0.1(mm/pix). In other words, 1 pixel in camera coordinates will correspond to 0.1 mm in physical units. In the menu, pixel is denoted as "pix."

■ Reference Parameters

This screen is used to check data settings.

▶ [Camera image/Camera settings/Calibration (Cam No.)/Parameter]

1. Select [OK] to exit this screen.



Display item	Details
A to F	Represent the calibration conversion values. The camera coordinates are converted to physical coordinates based on these calibration conversion values. The formulae for conversion to physical coordinates are as follows: (X,Y): measurement position (camera coordinates), unit: pixels (X',Y'): conversion position (physical coordinates), units: mm X' = A x X + B x Y + C Y' = D x X + E x Y + F
Sight	The physical unit for X direction on the screen can be selected from μm, mm, cm, and m.

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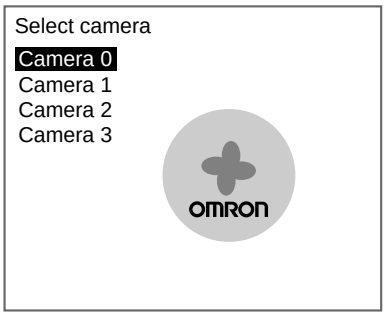
Selecting the Camera

Select Camera is used to select which Camera image will be used for measurement.
The Controller has two image memories that store two images called [Image 0] and [Image 1] for the Camera selected under Select Camera. Both images are from the same Camera number but different filtering can be applied to each.
Whether [Image 0] or [Image 1] is used for measurement depends on the processing item, so refer to the explanation for each processing item for details.

▶ [Camera image/Select camera]

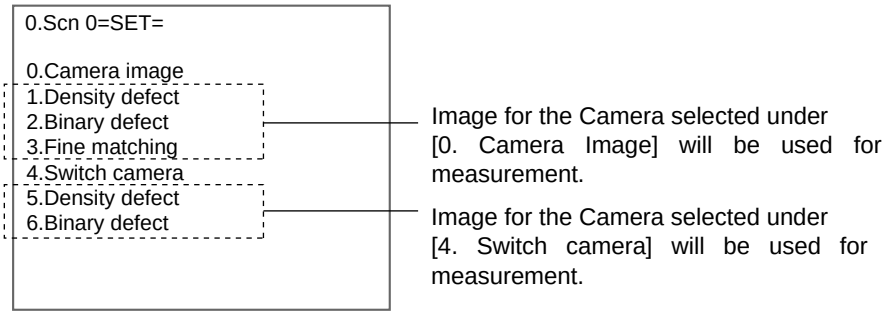
1. Select the number of the Camera to be used.

2. Press the ENT Key.



CHECK!

The Camera image selected here will be used for all subsequent unit measurements.
To switch to a different Camera part way through processing, use the [Switch Camera] processing item.
Other Camera images stored in the image buffers can be imported to [Image 0] and [Image 1].



* When [Switch camera] is selected, the images stored in the image buffers will be read to [Image 0] and [Image 1]. New images are not read to the image buffers.

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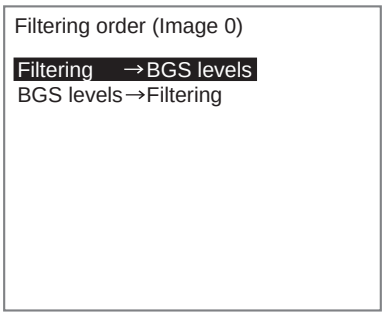
Filtering Order

The processing order for filtering and BGS levels can be selected.
The cursor can be moved on the image to see the effects of filtering. Select the order while confirming the results on the image.

▶ [Camera image/Filtering order (Image No.)]

1. Select the desired filtering order while monitoring the image.

2. Press the ENT Key.



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Filtering

The image read by the Camera can be manipulated to create an image that is easier to measure by using the 9 filtering methods.
The settings can be made separately for [Image 0] and [Image 1].

- List of Filtering
  The cursor can be moved on the image to see the effects of filtering.

Filtering	Target	Filtering	Example:
OFF	–	–	–
Weak smoothing Strong smoothing	Measurement objects with slight surface irregularity	Reduces the irregularity through smoothing.	Stable searches
Dilation	White measurement objects with black noise	Increases white to eliminate black noise.	Removal of noise from measurement objects
Erosion	Black measurement objects with white noise	Reduces white to eliminate the white noise.	Removal of noise from measurement objects
Median	Measurement objects with slight surface irregularity	Reduces surface irregularities while maintaining the contour.	Edge positioning (with no reduction in accuracy)
Edge enhancement	Blurred measurement objects (e.g., due to lighting changes)	Enhances edges between bright and dark regions.	Edge positioning
Vertical edge extraction	Measurement objects difficult to extract due to bad image contrast	Extracts the vertical edges (light and dark) of an image.	Defect (Digitization used)
Horizontal edge extraction	Measurement objects difficult to extract due to bad image contrast	Extracts the horizontal edges (light and dark) of an image.	Defect (Digitization used)
Edge extraction	Measurement objects difficult to extract due to bad image contrast	Extracts the vertical edges (light and dark) of an image.	Defect (Digitization used)

- Filter size
  The strength of the filtering can be selected if Frame/Field is set to Frame.
  The image changes each time SHIFT + ENT keys are pressed.

  3 × 3 ⟷ 5 × 5
  Weak Strong

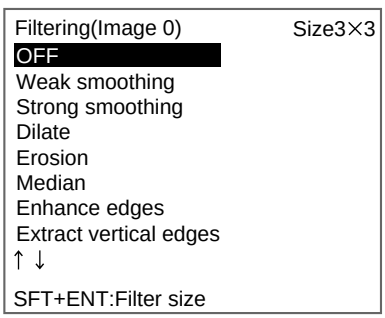
  The image changes each time SHIFT + ENT keys are pressed.

▶ [Camera image/Filtering order (Image No.)]

1. Select the desired filtering while monitoring the image.

If Frame/Field is set to Frame, the filter size will be displayed in the top right-hand corner of the screen.
Press the SHIFT+ ENT Keys to change the filter size.

2. Press the ENT Key.



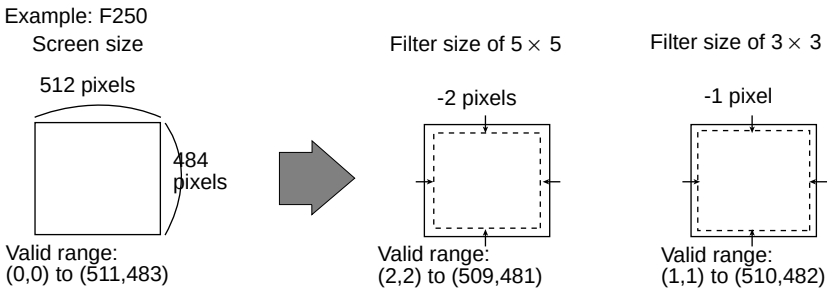
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- Restrictions When Setting the Measurement Region

  When images are filtered, the pixels at the edges of the screen cannot be processed accurately. Do not include the outer edges of the screen when setting the measurement region.

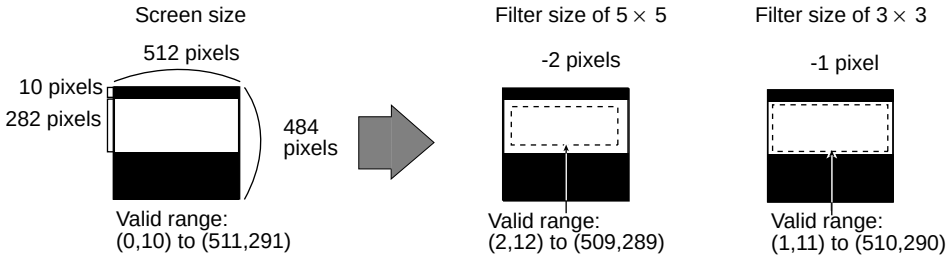
  • Filter size of 5 × 5: -2 pixel
  • Filter size of 3 × 3: -1 pixel

  In particular, when performing position displacement compensation, adjust so that the scrolled image or the measurement range will not overlap with this region.



* The screen size varies depending on the controller model.
F500: 1024 x 1024
For the other controllers: 512×484

When a camera with virtual scan function is used and the number of lines to be input is specified:
Example: The number of lines to be input is set to 282 lines in F160-S2:



If the [Filtering Again] processing item is set to filter the image again, the range of inaccurate pixels will be increased further.

For example, if filtering is performed twice, the valid range will be reduced as follows:

Filter size of 5 x 5: -2 pixel x 2 = -4 pixels

Filter size of 3 x 3: -1 pixel x 2 = -2 pixels

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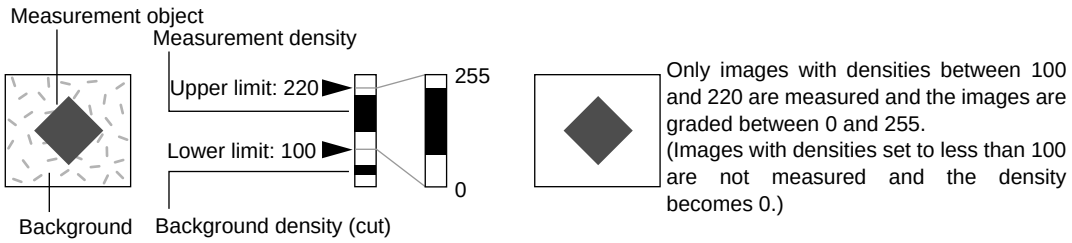
Background Suppression

Background suppression (BGS) excludes the background of the measurement object from the measurement process for easier measurement. The settings can be made separately for [Image 0] and [Image 1].

Set the upper and lower limits of the BGS density while monitoring the image.

BGS changes image areas with densities below the lower limit to 0, and image areas with densities above the upper limit to 255. Image areas with densities between the lower and upper limits are graded from 0 to 255 so that only images with densities between the lower and upper limits are measured.

Example: Lower limit set to 100 and upper limit set to 220

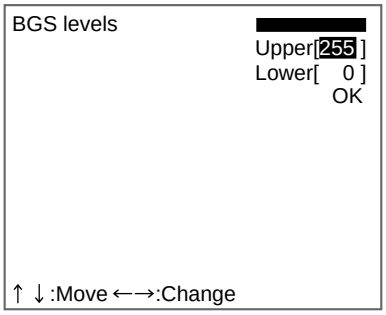


▶ [Camera image/BGS levels]

1. Move the cursor to the upper value and use the Left and Right Keys to adjust the value.

2. Use the same method to change the lower value.

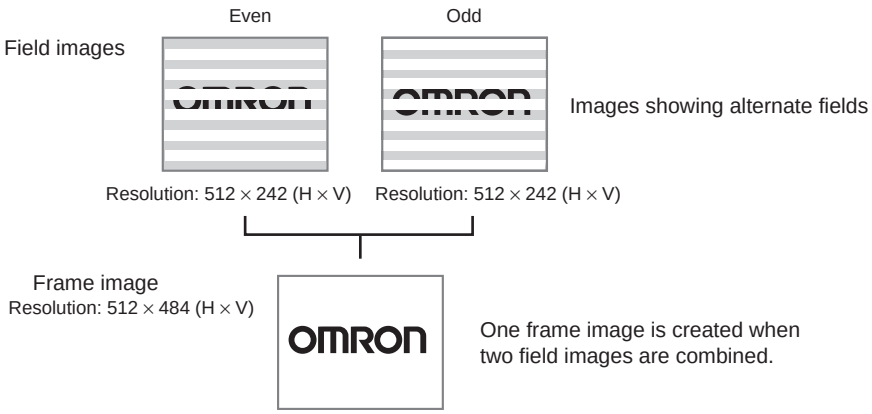
3. Select [OK].



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Frame/Field F210 F250 F270

Frame/Field is used to select the unit for one image.



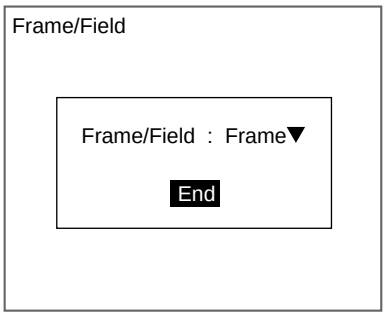
This setting can only be made once for each scene. If [Camera image] is set more than once for the scene, this menu will be displayed under [Camera image] for the unit with the smallest unit number.

CHECK! If this setting is changed, the image must be re-adjusted.

▶ [Camera image/Frame/Field]

1. Set each item.

2. Select [End].



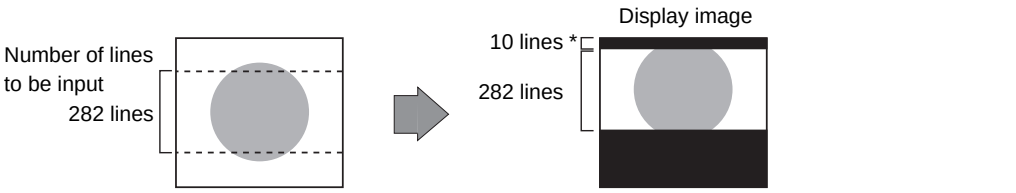
Selection	Details
Frame (default setting.)	Measures using frame images.
Field	Measures images in fields. The processing time can be reduced but the accuracy of the measurement will be reduced because the measurement is performed on an image with low resolution in the vertical direction.

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Number of Lines to be Read

The image read time can be reduced by limiting the vertical image reading range. This function can be set only when a camera with virtual scan function (e.g. F160-S2, F500-S1) is connected.
The range must be set with positional shift of the object taken into account.
An image consisting of the specified number of lines is displayed in the top of the monitor.

Example: When the number of lines is set to 282 in F160-S2:



* When the number of lines is set to 48 in F500-S1

This setting can only be made once for each scene. If [Camera image] is set more than once for the scene, this menu will be displayed under [Camera image] for the unit with the smallest unit number.

CHECK!

Coordinate values: For the coordinate values (measurement results), the value for the position where the image is displayed on the monitor will be displayed. The image capture position changes if the number of lines to be read has been changed. Therefore, the number of lines needs to be set again if calibration has been performed.
Image read time: Only the image read time can be reduced. Processing time for each processing item will not be reduced.

▶ [Camera image/Number of input lines]

1. Select the desired number of lines.

Up/Down Keys: Changes the number of lines.
If the number of lines is changed, the read range will be enclosed by dotted lines.
Right and Left Keys: When using two or more cameras, they can be switched from one to another

CHECK!

The number of lines that can be read depends on the setting made for [Frame/Field].
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Example: For F160-S2

Number of input lines
484 lines
432 lines
402 lines
372 lines
342 lines
312 lines
282 lines
252 lines
↑ ↓
←→:Switch camera

2. Press the ENT Key.

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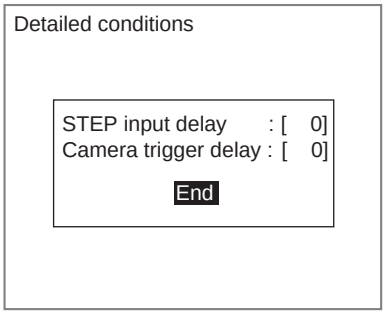
Detailed Settings F500

Parameters related to camera shutter trigger can be set.

The setting contents are given for each item in the controller's Setup Manual.

SECTION 4 Connecting External Devices in the Setup Manual

▶ [Camera image/Detailed settings]



1. Set each item.

2. Select [End].

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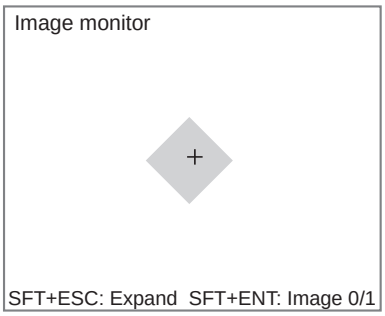
Checking the Input Image

This section explains how to enlarge a part of the camera image and check it.
Since the image can be enlarged at any point, it is possible to check whether the area to be measured is focused.

▶ [Camera image/Image monitor/Camera No.]

1. Move the cursor to the area you want to enlarge, and press the SHIFT+ESC Keys.

CHECK! Make sure that the cursor is located on the image.

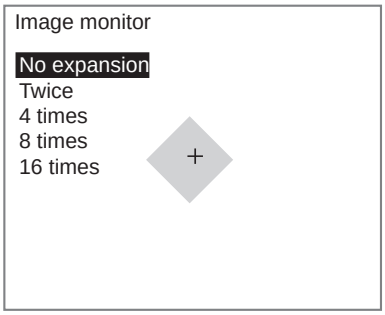


Magnification ratios will appear.

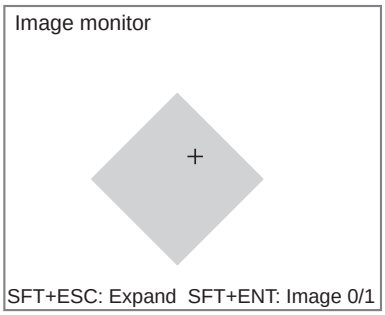
2. Select the desired magnification ratio.

The image will change according to the magnification ratio set for the cursor position.

3. Press the ENT Key.



The image will be enlarged according to the selected magnification ratio.
To display the image in the original size, press the ESC key.

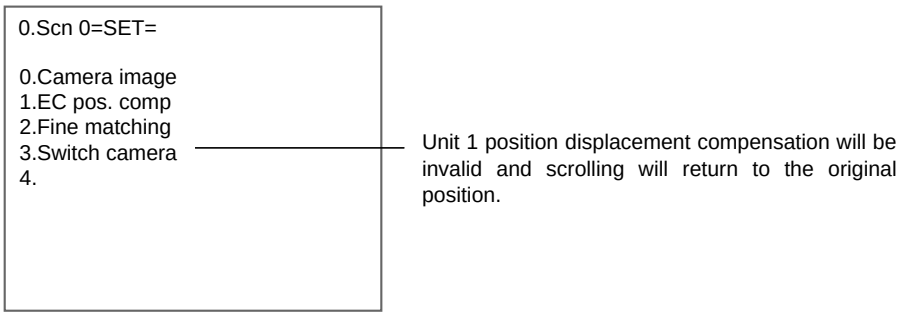


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Additional Information

If [Camera image] after Position Displacement Compensation is set, scrolling for position displacement compensation will return to the original position.

Example:



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When you want to obtain measurement results externally

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Saved image number (0 to 35)

■ Setting Data

Data type	Details
16	Input Camera number (0 to 3)
17	Filtering [Image 0] (0: OFF 1: Weak smoothing 2: Strong smoothing 3: Dilate 4: Erosion 5: Median 6: Enhance edges 7: Vertical edges 8: Horizontal edges 9: Extract edges)
18	Filtering [Image 1] 0 to 9: Same as filtering ([Image 1])
19	Filter size [Image 0] (0: 3 × 3, 1.5 × 5)
20	Filter size [Image 1] (0: 3 × 3, 1.5 × 5)
21	BGS levels lower limit [Image 0] (0 to 255)
22	BGS levels upper limit ([Image 0]) (0 to 255)
23	BGS levels lower limit [Image 1] (0 to 255)
24	BGS levels upper limit ([Image 1]) (0 to 255)
25	Filtering order [Image 0] (0: Filtering first and then background cut, 1: Background cut first and then filtering)
26	Filtering order [Image 1] (0: Filtering first and then background cut, 1: Background cut first and then filtering)
32	Camera 0 shutter speed (See *1.)
33	Camera 1 shutter speed (See *1.)
34	Camera 2 shutter speed (See *1.)
35	Camera 3 shutter speed (See *1.)
36	Light level data for camera 0 light level adjustment section A (0 to 7)
37	Light level data for camera 0 light level adjustment section B (0 to 7)
38	Light level data for camera 0 light level adjustment section C (0 to 7)
39	Light level data for camera 0 light level adjustment section D (0 to 7)
40	Light level data for camera 0 light level adjustment section E (0 to 7)
41	Light level data for camera 0 light level adjustment section F (0 to 7)
42	Light level data for camera 0 light level adjustment section G (0 to 7)
43	Light level data for camera 0 light level adjustment section H (0 to 7)

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Data type	Details
52	Light level data for camera 1 light level adjustment section A (0 to 7)
53	Light level data for camera 1 light level adjustment section B (0 to 7)
54	Light level data for camera 1 light level adjustment section C (0 to 7)
55	Light level data for camera 1 light level adjustment section D (0 to 7)
56	Light level data for camera 1 light level adjustment section E (0 to 7)
57	Light level data for camera 1 light level adjustment section F (0 to 7)
58	Light level data for camera 1 light level adjustment section G (0 to 7)
59	Light level data for camera 1 light level adjustment section H (0 to 7)
68	Light level data for camera 2 light level adjustment section A (0 to 7)
69	Light level data for camera 2 light level adjustment section B (0 to 7)
70	Light level data for camera 2 light level adjustment section C (0 to 7)
71	Light level data for camera 2 light level adjustment section D (0 to 7)
72	Light level data for camera 2 light level adjustment section E (0 to 7)
73	Light level data for camera 2 light level adjustment section F (0 to 7)
74	Light level data for camera 2 light level adjustment section G (0 to 7)
75	Light level data for camera 2 light level adjustment section H (0 to 7)
84	Light level data for camera 3 light level adjustment section A (0 to 7)
85	Light level data for camera 3 light level adjustment section B (0 to 7)
86	Light level data for camera 3 light level adjustment section C (0 to 7)
87	Light level data for camera 3 light level adjustment section D (0 to 7)
88	Light level data for camera 3 light level adjustment section E (0 to 7)
89	Light level data for camera 3 light level adjustment section F (0 to 7)
90	Light level data for camera 3 light level adjustment section G (0 to 7)
91	Light level data for camera 3 light level adjustment section H (0 to 7)
100	Frame/Field (0: Frame 1: Field)
101	Camera 0 calibration parameter A
102	Camera 0 calibration parameter B
103	Camera 0 calibration parameter C
104	Camera 0 calibration parameter D
105	Camera 0 calibration parameter E
106	Camera 0 calibration parameter F
117	Camera 1 calibration parameter A
118	Camera 1 calibration parameter B
119	Camera 1 calibration parameter C
120	Camera 1 calibration parameter D
121	Camera 1 calibration parameter E
122	Camera 1 calibration parameter F
133	Camera 2 calibration parameter A
134	Camera 2 calibration parameter B
135	Camera 2 calibration parameter C
136	Camera 2 calibration parameter D
137	Camera 2 calibration parameter E
138	Camera 2 calibration parameter F

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Data type	Details
149	Camera 3 calibration parameter A
150	Camera 3 calibration parameter B
151	Camera 3 calibration parameter C
152	Camera 3 calibration parameter D
153	Camera 3 calibration parameter E
154	Camera 3 calibration parameter F
165	Camera 0 gain (-100 to 100)
166	Camera 1 gain (-100 to 100)
167	Camera 2 gain (-100 to 100)
168	Camera 3 gain (-100 to 100)
170	Number of lines to be read (0 to 15) (See *2.)
175	STEP input delay (0 to 512)
176	Inter-camera trigger delay (0 to 63)

(*1) The shutter speed setting varies depending on the model of the connected camera.

Parameter	Cameras (except for F500-S1) (s)	For F500-S1 Cameras
0	1/120	1/24
1	1/200	1/50
2	1/500	1/100
3	1/1000	1/200
4	1/2000	1/400
5	1/4000	1/800
6	1/6000	1/1500
7	1/8000	1/3000
8	1/12000	1/5500
9	1/16000	1/10000
10	1/20000	-
11	1/30000	-
12	1/60000	-
13	1/100000	-
14	1/160000	-
15	1/200000	-

(*2) In the case of F210, F250 and F270, the number of lines that can be read depends on the setting made for [Frame/Field].

- Frame

Parameter	Number of lines (lines)	Read time (ms) *
0	484	16.7
1	432	14.8
2	402	13.8
3	372	12.9
4	342	11.9
5	312	11.0
6	282	10.0
7	252	9.1

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Parameter	Number of lines (lines)	Read time (ms) *
8	222	8.1
9	192	7.1
10	162	6.2
11	132	5.2
12	102	4.3
13	72	3.3
14	42	2.4
15	12	1.4

- Field

Parameter	Number of lines (lines)	Read time (ms) *
0	484	8.3
1	60	2.0
2	60	2.0
3	60	2.0
4	60	2.0
5	60	2.0
6	60	2.0
7	60	2.0
8	60	2.0
9	384	7.1
10	324	6.2
11	264	5.2
12	204	4.3
13	144	3.3
14	84	2.4
15	24	1.4

- For F500

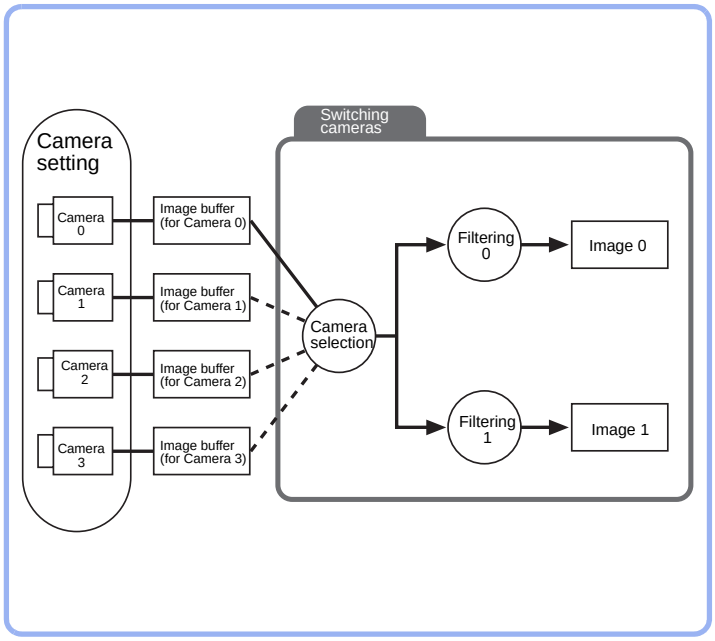
Parameter	Number of lines (lines)	Read time (ms) *
0	1024	48.3
1	512	27.6
2	256	16.3
3	128	10.7

* The shutter time is not included in the read time.

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Switch camera

The Switch Camera processing item is used to switch the Camera (image buffer) from which images will be stored to [Image 0] and [Image 1]. New images are not read from the Camera.
The filtering settings will be changed at the same time.



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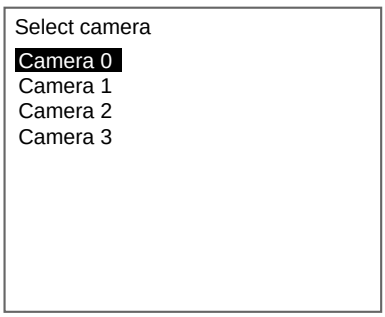
Selecting the Camera

When Camera Image is executed, the images stored in the image buffers will be read to [Image 0] and [Image 1]. New images are not read to the image buffers.

▶ [Switch camera/Select camera]

1. Select the number of the Camera to be used.

2. Press the ENT Key.



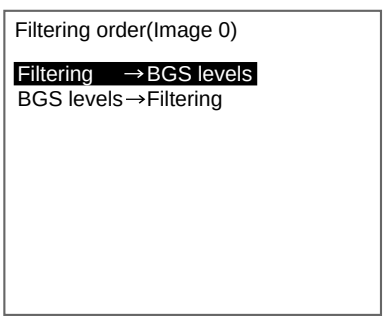
Filtering Order

The processing order for filtering and BGS levels can be selected.
The cursor can be moved on the image to see the effects of filtering. Select the order while confirming the results on the image.

▶ [Switch camera/Filtering order (Image 0)]

1. Select the desired filtering order while monitoring the image.

2. Press the ENT Key.

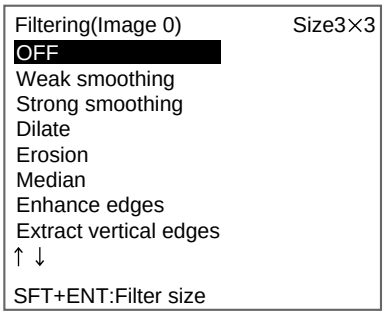


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Filtering

The image read by the Camera can be manipulated to create an image that is easier to measure using the 9 filtering methods:
The settings can be made separately for [Image 0] and [Image 1]. Weak smoothing, strong smoothing, dilation, erosion, median, edge enhancement, vertical edge extraction, horizontal edge extraction, and edge extraction.
The cursor can be moved on the image to see the effects of filtering. Select filtering while confirming the results on the image.

▶ [Switch camera/Filtering (Image 0)]



1. Select the desired filtering while monitoring the image.

If Frame/Field is set to Frame, the filter size will be displayed in the top right-hand corner of the screen.
Press the SHIFT+ENT Keys to change the filter size.

For the detail of settings:

SECTION 2, 1.1 Inputting Camera Images, “Filtering”

2. Press the ENT Key.

CHECK!

When images are filtered, the pixels at the edges of the screen cannot be processed accurately. Do not include the outer edges of the screen when setting the measurement region.

SECTION 2, 1.1 Inputting Camera Images, “Filtering”

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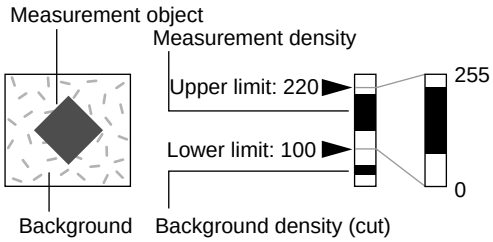
Background Suppression

Background suppression (BGS) excludes the background of the measurement object from the measurement process for easier measurement. The settings can be made separately for [Image 0] and [Image 1].

Set the upper and lower limits of the BGS density while monitoring the image.

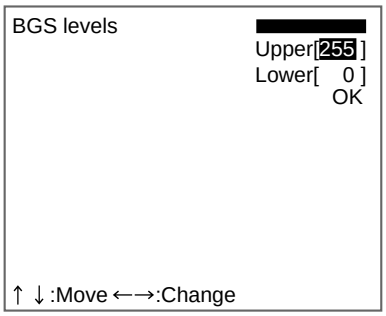
BGS changes image areas with densities below the lower limit to 0, and image areas with densities above the upper limit to 255. Image areas with densities between the lower and upper limits are graded from 0 to 255 so that only images with densities between the lower and upper limits are measured.

Example: Lower limit set to 100 and upper limit set to 220



Only images with densities between 100 and 220 are measured and the images are graded between 0 and 255.
(Images with densities set to less than 100 are not measured and the density becomes 0.)

▶ [Switch camera/BGS levels (Image No.)]



1. Move the cursor to the upper value and use the Left and Right Keys to adjust the value.

2. Use the same method to change the lower value.

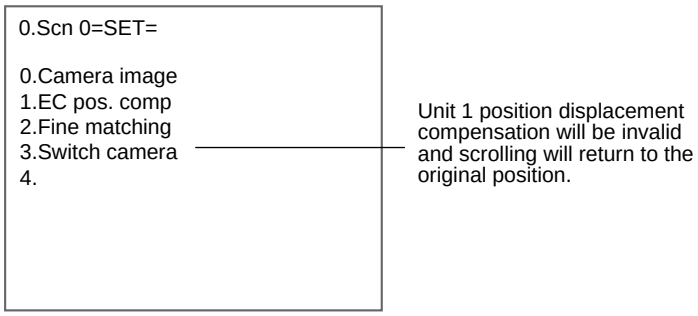
3. Select [OK].

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Additional Information

If [Switch Camera] after Position Displacement Compensation is set, scrolling for position displacement compensation will return to the original position.

Example:



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When you want to obtain measurement results externally

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Saved image number (0 to 35)

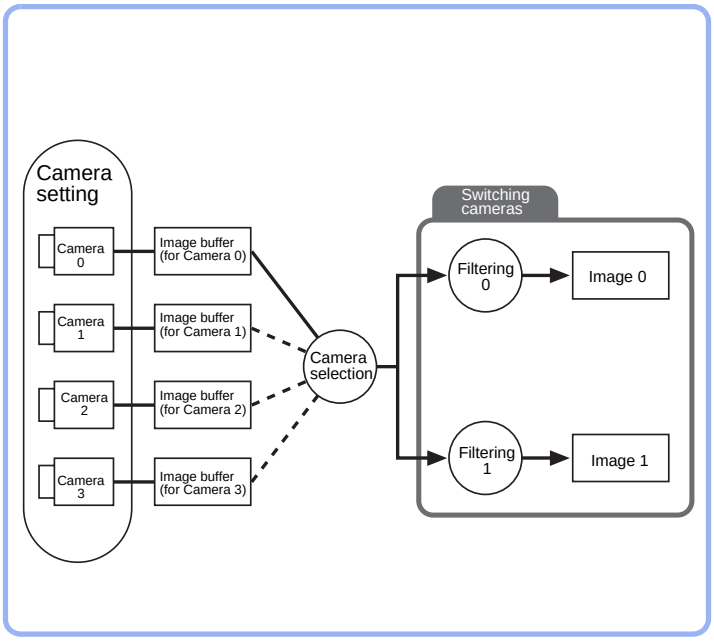
■ Setting Data

Data type	Details
16	Input Camera number (0 to 3)
17	Filtering [Image 0] (0: OFF 1: Weak smoothing 2: Strong smoothing 3: Dilate 4: Erosion 5: Median 6: Enhance edges 7: Vertical edges 8: Horizontal edges 9: Extract edges)
18	Filtering [Image 1] 0 to 9: Same as filtering ([Image 1])
19	Filter size [Image 0] (0: 3 × 3, 1.5 × 5)
20	Filter size [Image 1] (0: 3 × 3, 1.5 × 5)
21	BGS levels lower limit [Image 0] (0 to 255)
22	BGS levels upper limit ([Image 0]) (0 to 255)
23	BGS levels lower limit [Image 1] (0 to 255)
24	BGS levels upper limit ([Image 1]) (0 to 255)
25	Filtering order [Image 0] (0: Filtering first and then background cut, 1: Background cut first and then filtering)
26	Filtering order [Image 1] (0: Filtering first and then background cut, 1: Background cut first and then filtering)

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Changing Filtering

The Change Filtering processing item is used to change only the filtering settings for [Image 0] and [Image 1]. New images are not read from the Camera.



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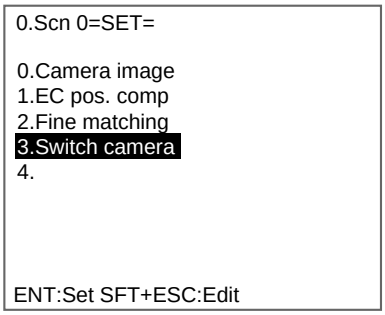
Filtering Order

The processing order for filtering and BGS levels can be selected.
The cursor can be moved on the image to see the effects of filtering. Select the order while confirming the results on the image.

▶ [Changing filtering/Filtering order (Image 0)]

1. Select the desired filtering order while monitoring the image.

2. Press the ENT Key.



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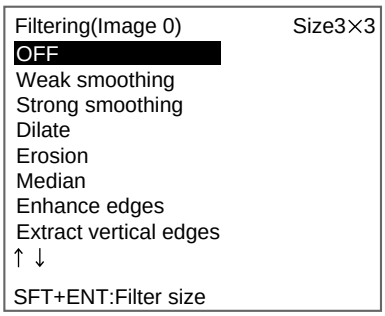
Filtering

The image read by the Camera can be manipulated to create an image that is easier to measure using the 9 filtering methods:
The settings can be made separately for [Image 0] and [Image 1]. Weak smoothing, strong smoothing, dilation, erosion, median, edge enhancement, vertical edge extraction, horizontal edge extraction, and edge extraction.
The cursor can be moved on the image to see the effects of filtering. Select filtering while confirming the results on the image.

▶ [Changing filtering/Filtering (Image 0)]

1. Select the desired filtering while monitoring the image.

If Frame/Field is set to Frame, the filter size will be displayed in the top right-hand corner of the screen.
Press the SHIFT+ENT Keys to change the filter size.



For the detail of settings:

SECTION 2, 1.1 Inputting Camera Images, “Filtering”

2. Press the ENT Key.

CHECK!

When images are filtered, the pixels at the edges of the screen cannot be processed accurately. Do not include the outer edges of the screen when setting the measurement region.

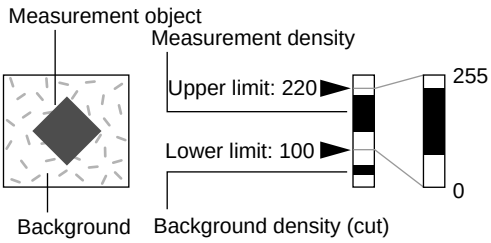
SECTION 2, 1.1 Inputting Camera Images, “Filtering”

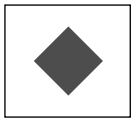
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Background Suppression

Background suppression (BGS) excludes the background of the measurement object from the measurement process for easier measurement. The settings can be made separately for [Image 0] and [Image 1].
Set the upper and lower limits of the BGS density while monitoring the image.
BGS changes image areas with densities below the lower limit to 0, and image areas with densities above the upper limit to 255. Image areas with densities between the lower and upper limits are graded from 0 to 255 so that only images with densities between the lower and upper limits are measured.

Example: Lower limit set to 100 and upper limit set to 220





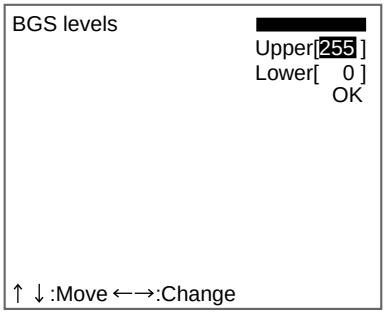
Only images with densities between 100 and 220 are measured and the images are graded between 0 and 255.
(Images with densities set to less than 100 are not measured and the density becomes 0.)

▶ [Changing filtering/BGS levels (Image 0)]

1. Move the cursor to the upper value and use the Left and Right Keys to adjust the value.

2. Use the same method to change the lower value.

3. Select [OK].



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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)

■ Setting Data

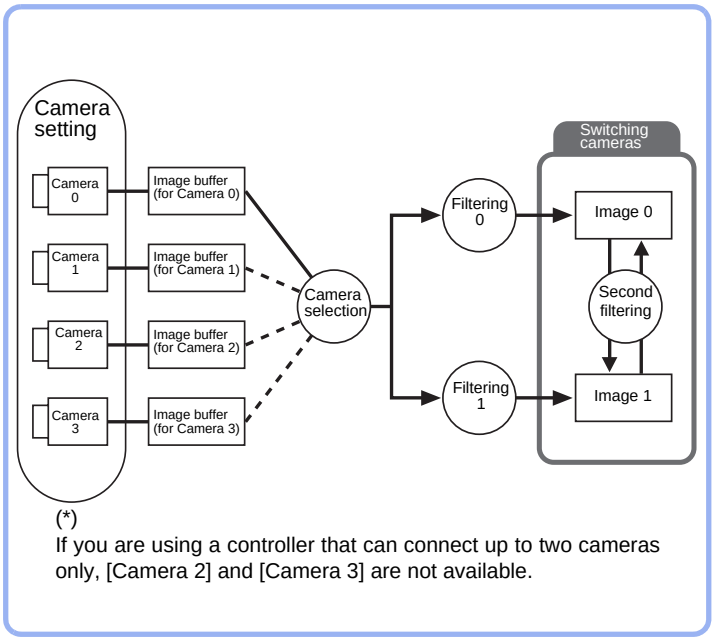
Data type	Details
16	Input Camera number (0 to 3)
17	Filtering [Image 0] (0: OFF 1: Weak smoothing 2: Strong smoothing 3: Dilate 4: Erosion 5: Median 6: Enhance edges 7: Vertical edges 8: Horizontal edges 9: Extract edges)
18	Filtering [Image 1] 0 to 9: Same as filtering ([Image 1])
19	Filter size [Image 0] (0: 3 × 3, 1.5 × 5)
20	Filter size [Image 1] (0: 3 × 3, 1.5 × 5)
21	BGS levels lower limit [Image 0] (0 to 255)
22	BGS levels upper limit ([Image 0]) (0 to 255)
23	BGS levels lower limit [Image 1] (0 to 255)
24	BGS levels upper limit ([Image 1]) (0 to 255)
25	Filtering order [Image 0] (0: Filtering first and then background cut, 1: Background cut first and then filtering)
26	Filtering order [Image 1] (0: Filtering first and then background cut, 1: Background cut first and then filtering)

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Filtering Again

The Filtering Again processing item is used to add filtering to an image. Images can be sent from [Image 0] to [Image 1] or from [Image 1] to [Image 0] to add filtering to the image when it is transferred.

This processing item is useful if stronger smoothing is required to eliminate noise or increase edge enhancement.



(*)
If you are using a controller that can connect up to two cameras only, [Camera 2] and [Camera 3] are not available.

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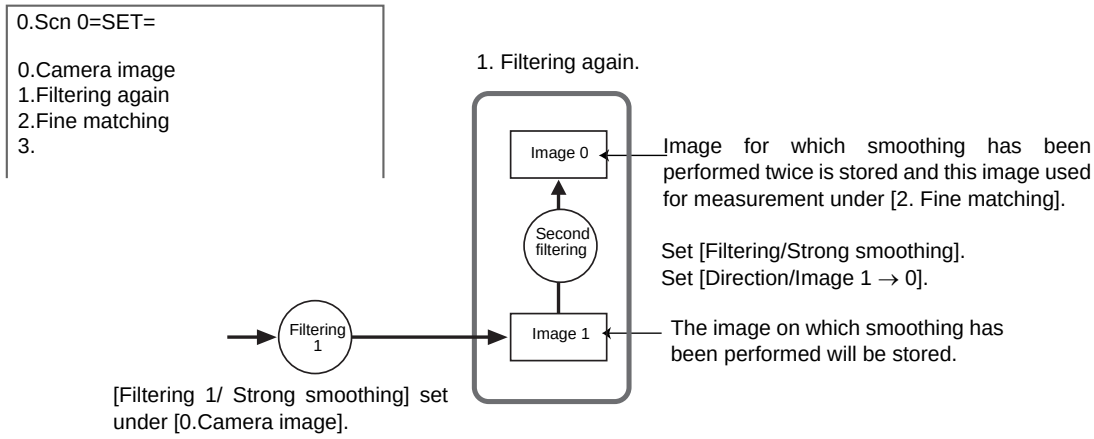
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Direction

Images can be sent from Image 0 to Image 1 or from Image 1 to Image 0 to add filtering to the image when it is transferred.

Example: To execute smoothing twice before measurement.



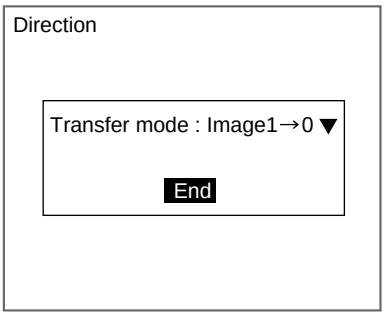
CHECK! For some processing items, the image No. of the image to be measured is already specified. To ascertain whether there are restrictions on the transfer direction, refer to explanation files of the corresponding processing items.

SECTION 2, 3. Measurement

▶ [Filtering again/Direction]

1. Select the desired direction.

2. Select [End].



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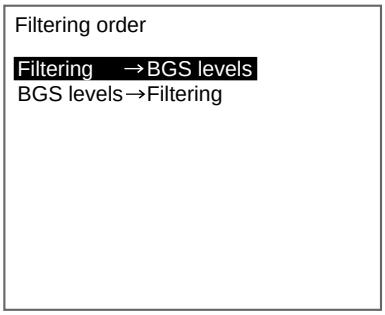
Filtering Order

The processing order for filtering and BGS levels can be selected.
The cursor can be moved on the image to see the effects of filtering. Select the order while confirming the results on the image.

▶ [Filtering again/Filtering order]

1. Select the desired filtering order while monitoring the image.

2. Press the ENT Key.

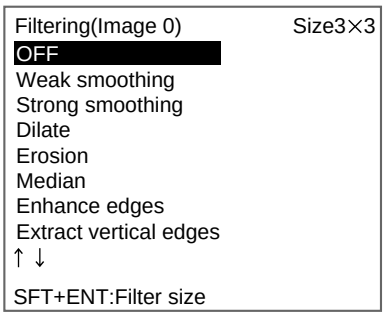


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Filtering

The image read by the Camera can be manipulated to create an image that is easier to measure using the 9 filtering methods:
The settings can be made separately for Image 0 and Image 1. Weak smoothing, strong smoothing, dilation, erosion, median, edge enhancement, vertical edge extraction, horizontal edge extraction, and edge extraction.
The cursor can be moved on the image to see the effects of filtering. Select filtering while confirming the results on the image.

▶ [Filtering again/Filtering]



3. Select the desired filtering while monitoring the image.

If [Frame/Field] is set to [Frame], the filter size will be displayed in the top right-hand corner of the screen.
Press the SHIFT+ENT Keys to change the filter size.

For the detail of settings:
SECTION 2, 1.1 Inputting Camera Images, “Filtering”

4. Press the ENT Key.

CHECK!
When images are filtered, the pixels at the edges of the screen cannot be processed accurately. Do not include the outer edges of the screen when setting the measurement region.
If the Filtering Again processing item is set to filter the image again, the range of inaccurate pixels will be increased further.

SECTION 2, 1.1 Inputting Camera Images, “Filtering”

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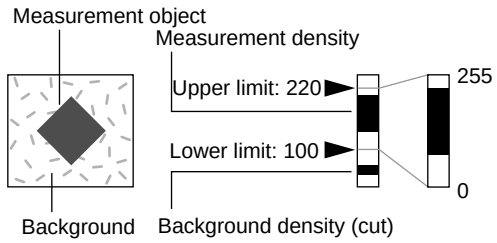
Background Suppression

Background suppression (BGS) excludes the background of the measurement object from the measurement process for easier measurement. The settings can be made separately for [Image 0] and [Image 1].

Set the upper and lower limits of the BGS density while monitoring the image.

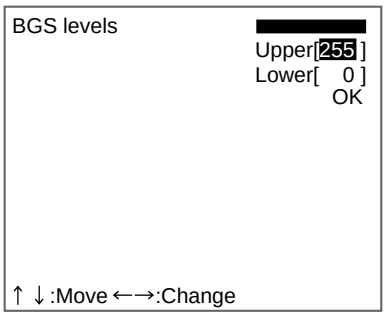
BGS changes image areas with densities below the lower limit to 0, and image areas with densities above the upper limit to 255. Image areas with densities between the lower and upper limits are graded from 0 to 255 so that only images with densities between the lower and upper limits are measured.

Example: Lower limit set to 100 and upper limit set to 220



Only images with densities between 100 and 220 are measured and the images are graded between 0 and 255.
(Images with densities set to less than 100 are not measured and the density becomes 0.)

▶ [Filtering again/BGS levels]



1. Move the cursor to the upper value and use the Left and Right Keys to adjust the value.

2. Use the same method to change the lower value.

3. Select [OK].

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When you want to obtain measurement results externally

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)

■ Setting Data

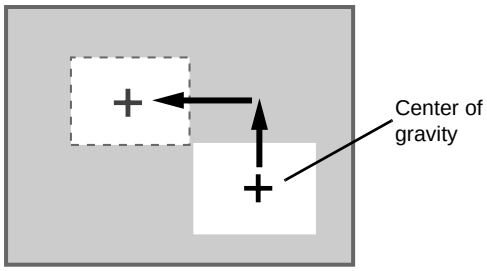
Data type	Details
16	Direction (0: Image 1 ← 0 1: Image0 → 1)
17	Filtering (0: OFF, 1: Weak smoothing, 2: Strong smoothing, 3: Dilate, 4: Erosion, 5: Median, 6: Enhance edges, 7: Vertical edges, 8: Horizontal edges, 9: Extract edges)
19	Filter size (0: 3 × 3, 1.5 × 5)
21	BGS levels lower limit (0 to 255)
22	BGS levels upper limit (0 to 255)
25	Filtering order (0: Filtering first and then background cut, 1: Background cut first and then filtering)

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Binary Position Compensation

The Binary Position Compensation processing item is used to convert an image to binary, find the center of gravity of the measurement object, and detect the position compensation amount.
Position compensation can be performed even if the measurement object is at an angle.

The image read by the Camera is a 256-gradation image. This is converted to a binary image made up of black and white pixels. The center of gravity of the white area is used to perform position compensation.



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Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [Binary pos. comp/Measurement image]

1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.



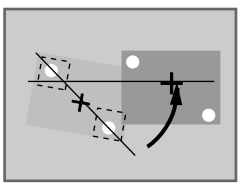
Setting Position Displacement Compensation Regions

There are two methods for binary position. Select one of the methods suitable for the contents to be corrected.

Method	Details	Page
Gravity and Area	Finds the center of gravity for the white pixel area and corrects the position displacement of the measurement object.	4
Gravity and Axis	Finds the center of gravity and axis angle for the white pixel area and corrects the position displacement of the measurement object.	9

CHECK!

In addition, two regions can be set and position compensation performed using the center coordinates and angle connecting two points.



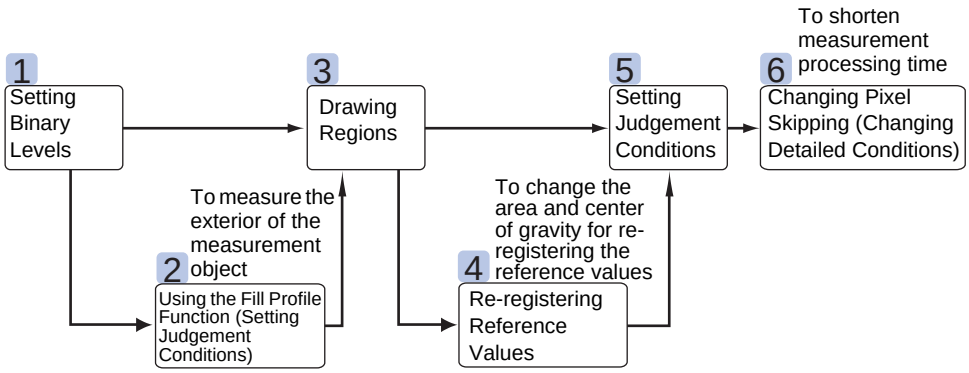
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Position Compensation with Gravity and Area

Density images taken by the Camera are converted into binary images made up of black and white pixels and then measured.
The size (area) and position (center of gravity) of the area occupied by the white pixels are measured.

For Position Compensation with Gravity and Area, SECTION 7 Appendix, “Position Compensation Items”

■ Operational Flow



1 Setting Binary Levels

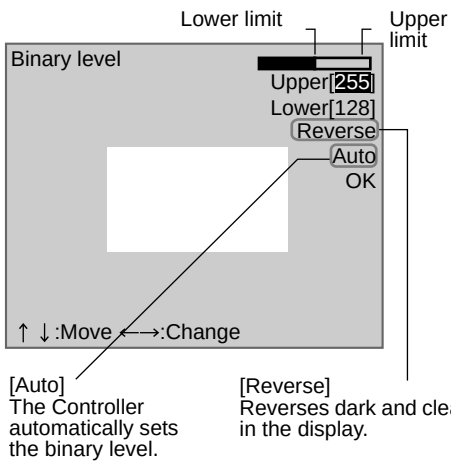
Set the level for converting 256-gradation images read by the Camera into binary images. Measurements are performed for the white pixels. Therefore, make the settings so that the measurement object is white. The binary level set here is used for all of the measurement regions.

▶ [Binary pos. comp/Position compensation (No)/Gravity and area/Binary]

1. Move the cursor to the upper value and use the Left and Right Keys to adjust the value.

2. Use the same method to change the lower value.

3. Select [OK].



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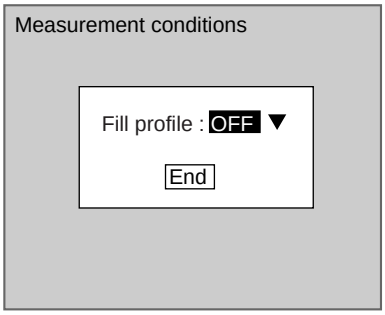
2 Using the Fill Profile Function (Setting Judgement Conditions)

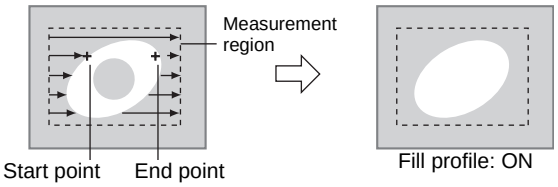
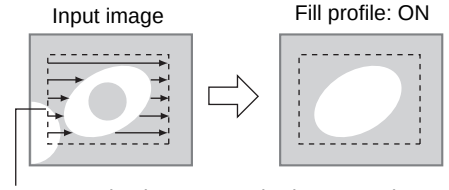
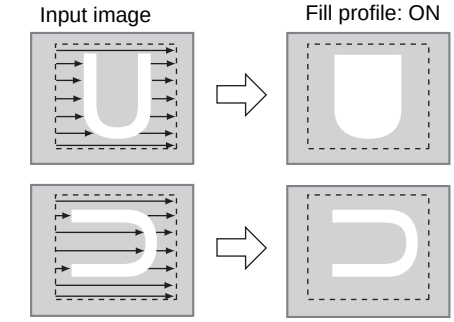
The fill profile function is set when the exterior of the measurement object is being measured.

▶ [Binary pos. comp/Position compensation (No)/Gravity and area/Measurement conditions]

1. Select [ON] or [OFF].

2. Select [End].



Setting data	Selection	Details
Fill Profile Function	ON OFF (default setting)	Set the fill profile function to [ON] when the exterior of the measurement object is being measured. Turn [ON] the [Fill profile] function to measure the whole area between the start point (black pixels to white) and the end point (white pixels to black) in the measurement region as white pixels.  • When a White-pixel Section Encroaches on the Measurement Region  Not recognized as start point because change from white to black. • Measuring Open-form Measurement Objects The measurement result changes depending on the orientation of the measurement object. 

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3 Drawing Regions

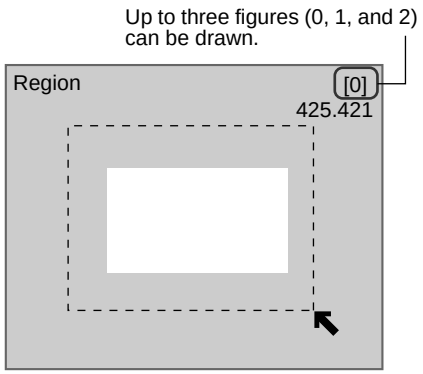
When a measurement region is drawn, measurement is performed for the displayed image and the results are registered as the reference values (area and center of gravity). This position becomes the reference position, so be sure to place the measurement object in the correct position before drawing the measurement region.

CHECK! In the case of F500-C10, the reference position will be restricted depending on the scroll amount.
SECTION 7 Appendix, “Q & A, Position Compensation Items”

▶ [Binary pos. comp/Position compensation (No.)/Gravity and area/Region/New/figure/drawing mode]

1. Draw a figure in the region to be measured.

SECTION 1 Basic Operating Procedures, “Drawing a Region”



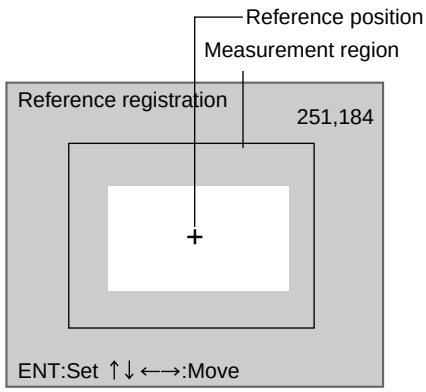
4 Re-registering Reference Values

This operation is performed when only the reference value is to be re-registered.
When a measurement region is drawn, the measurement is performed for the displayed image and the result is registered as the reference value. If the re-registering function explained here is used, only the reference value for the image currently displayed will be registered.
The area and center of gravity are registered for the reference values.

▶ [Binary pos. comp/Position compensation (No.)/Gravity and area/Reference registration]

1. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.



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5 Setting Judgement Conditions

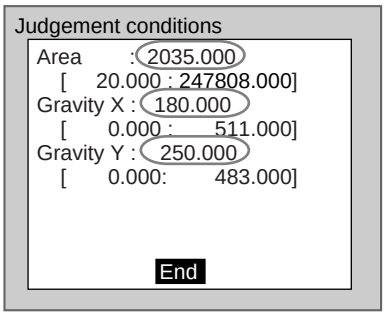
Make settings for the area and center of gravity.

CHECK!
Position Compensation judgement Results and Scrolling
OK: Image is scrolled.
NG: Scroll will not be performed. The overall judgement will be NG, regardless of the measurement result.

▶ [Binary pos. comp/Position compensation (No.)/Gravity and area/Judgement conditions]

1. Set each item.

2. Select [End].



: Measurement results for the displayed image
Use these values as a reference for setting upper and lower limits.

Setting data	Selection	Details
Area	0 to 9,999,999.999	Set the area range for an OK judgement.
Gravity X	-9,999.999 to 9,999.999	Set the range of movement of the measurement object in the X direction for an OK judgement.
Gravity Y	-9,999.999 to 9,999.999	Set the range of movement of the measurement object in the Y direction for an OK judgement.

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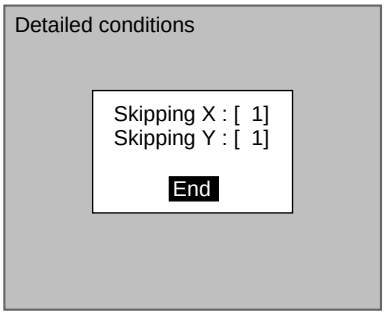
6 Changing Pixel Skipping (Changing Detailed Conditions)

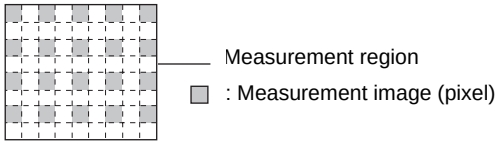
To shorten measurement processing time, change the number of pixels to be skipped. The greater the skipping setting, the shorter the processing time. However, the accuracy of the measurement will decrease.
After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

▶ [Binary pos. comp/Position compensation (No.)/Gravity and area/Detailed conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Skipping X Skipping Y	1 to 15 (default setting: 1)	Set how many pixels to skip in the measurement region during measurement. Set how many pixels to skip in the measurement region during measurement. The default setting is 1, which means that all of the measurement region will be measured. Example: Skipping X and Skipping Y are set to 2: 

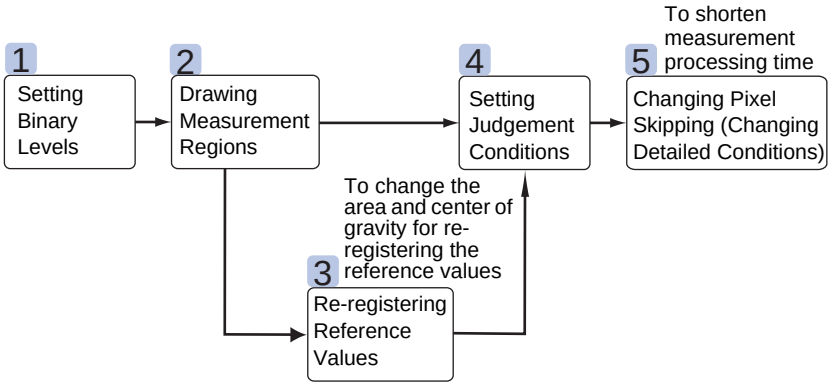
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Position Compensation with Gravity and Axis

Density images taken by the Camera are converted into binary images made up of black and white pixels and then measured. The size (area), position (center of gravity), and axis angle of the white-pixel area is calculated.

For Position Compensation with Gravity and Angle, SECTION 7 Appendix, “Position Compensation Items”

■ Operational Flow



1 Setting Binary Levels

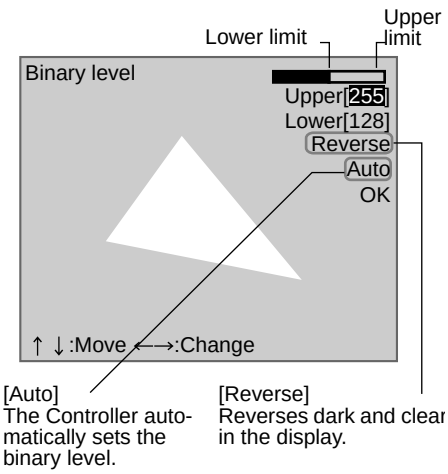
Set the level for converting 256-gradation images read by the Camera into binary images. Measurements are performed for the white pixels. Therefore, make the settings so that the measurement object is white. The binary level set here is used for all of the measurement regions.

▶ [Binary pos. comp/Position compensation (No.)/Gravity and axis/Binary]

1. Move the cursor to the upper value and use the Left and Right Keys to adjust the value.

2. Use the same method to change the lower value.

3. Select [OK].



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2 Drawing Measurement Regions

When a measurement region is drawn, measurement is performed for the displayed image and the results are registered as the reference values (area, center of gravity, and axis). This position becomes the reference position, so be sure to place the measurement object in the correct position before drawing the measurement region.

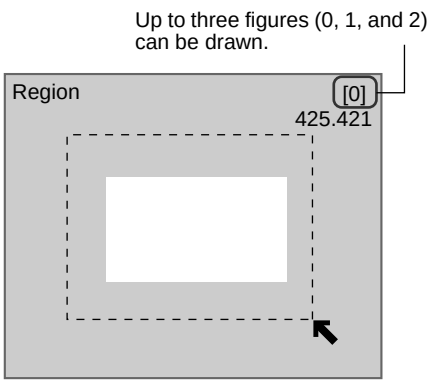
CHECK! In the case of F500-C10, the reference position will be restricted depending on the scroll amount.

SECTION 7 Appendix, “Q & A, Position Compensation Items”

▶ [Binary pos. comp/Position compensation (No.)/Gravity and axis/Region/New/figure/drawing mode]

1. Draw a figure in the region to be measured.

SECTION 1 Basic Operating Procedures, “Drawing a Region”



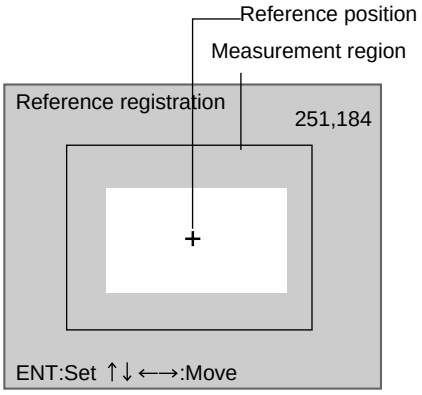
3 Re-registering Reference Values

This operation is performed when only the reference value is to be re-registered.
When a measurement region is drawn, the measurement is performed for the displayed image and the result is registered as the reference value. If the re-registering function explained here is used, only the reference value for the image currently displayed will be registered.
The area, center of gravity, and axis are registered for the reference values.

▶ [Binary pos. comp/Position compensation (No.)/Gravity and axis/Reference registration]

1. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.



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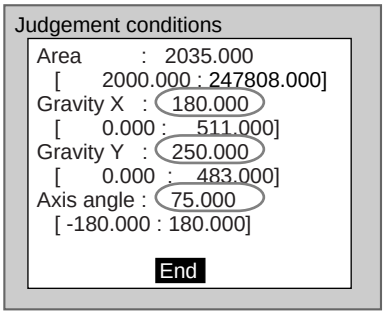
4 Setting Judgement Conditions

Make settings for the area, center of gravity, and axis angle.
Range for an OK judgement

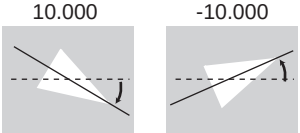
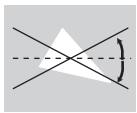
▶ [Binary pos. comp/Position compensation (No.)/Gravity and axis/Judgement conditions]

1. Set each item.

2. Select [End].



: Measurement results for the displayed image
Use these values as a reference for setting upper and lower limits.

Setting data	Selection	Details
Area	0 to 9,999,999.999	Set the area range for an OK judgement.
Gravity X	-9,999.999 to 9,999.999	Set the range of movement of the measurement object in the X direction for an OK judgement.
Gravity Y	-9,999.999 to 9,999.999	Set the range of movement of the measurement object in the Y direction for an OK judgement.
Axis angle	-180.000 to 180.000	Set the axis angle for an OK judgement. Output in the measurement value of -90,000 to 90,000 Example: Measurement value for axis angle 10.000 -10.000   If this range is to be judged OK, set to [-10.000: 10.000].

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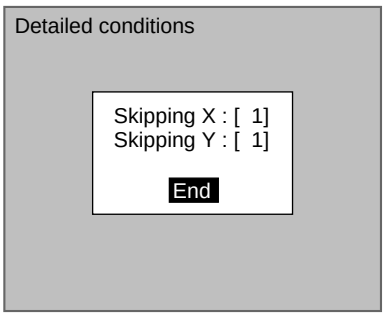
5 Changing Pixel Skipping (Changing Detailed Conditions)

To shorten measurement processing time, change the number of pixels to be skipped.
The greater the skipping setting, the shorter the processing time. However, the accuracy of the measurement will decrease.
After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

▶ [Binary pos. comp/Position compensation (No.)/Gravity and axis/Detailed conditions]

1. Set each item.
The number of pixels to skip p.8

2. Select [End].



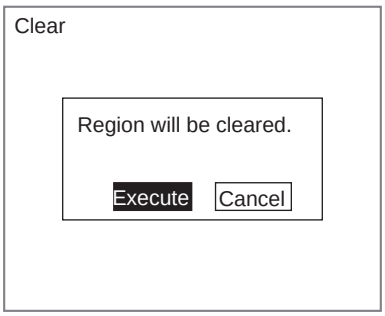
Clearing the Set Regions

The clear operation is performed separately for each region.
The region must also be cleared if you want to change the compensation method.

Example: Clearing [Gravity and area] set in the displacement compensation region 1

▶ [Binary pos. comp/Position compensation 0/Gravity and area/Clear]

1. Select [Execute].

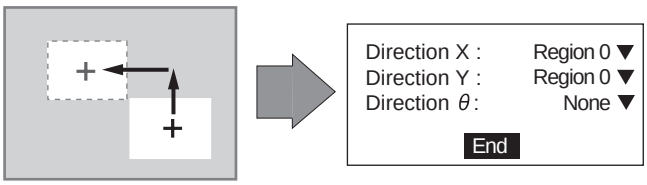


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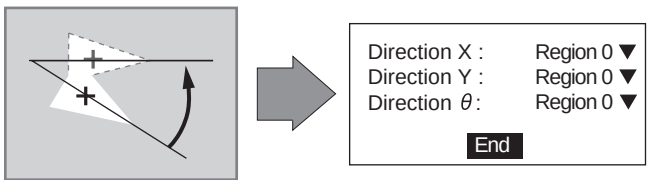
Setting the Displacement Direction

The direction function is used to select which region's measurement results will be used as the basis for position displacement compensation in the X, Y, and θ (rotation) directions.

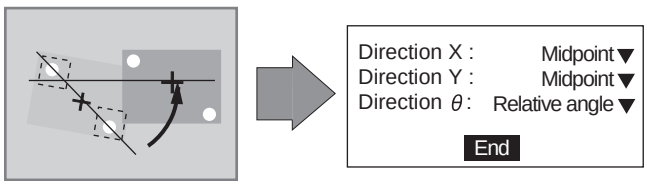
- Measurement Objects Not at An Angle (Example: Gravity and Area Set to Region 0)



- Measurement Objects at an Angle (Example: Gravity and Axis Set to Region 0)



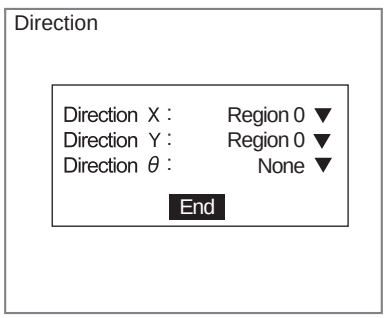
- For Precision Position Compensation Using Measurement Object Angles (Example: When Region 0 and Region 1 Are Set)



▶ [Binary pos. comp/Direction]

1. Set each item.

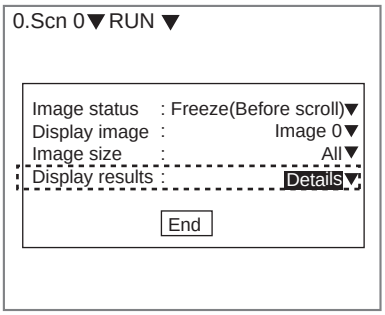
2. Select [End].



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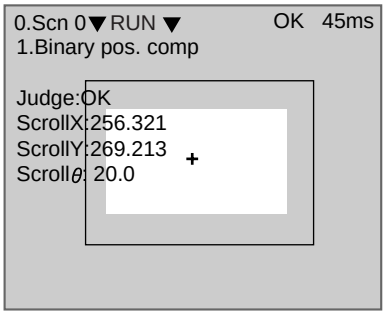
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.
Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed. Use the SHIFT+Right or Left Keys to switch in order between the two screens.

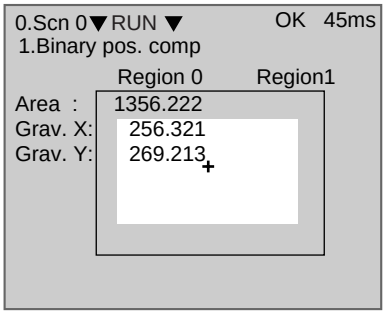
(1) Scroll Amount



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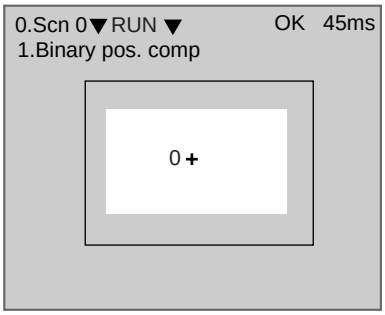
(2) Detailed Display

The measurement values for each region will be displayed.



(3) Position Display

Only the region will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.

This section describes each item displayed in the submenu.

For details on equation setting method, refer to SECTION 2, 4.1 Calculation

Measurement item	String	Details
The following measurement data is for unit		
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Scroll X	DX	Scroll X
Scroll Y	DY	Scroll Y
Scroll θ	DT	Scroll θ
Measurement X	X	X coordinate of measurement value
Measurement Y	Y	Y coordinate of measurement value
Measurement angle	TH	Measurement angle
The following measurement data is for Region 0.		
Judgement	R00JG	Judgement result (-2: Not measured -1: NG 0: OK)
Center of gravity	R00X	X coordinate of center of gravity for measurement result
Center of gravity	R00Y	Y coordinate of center of gravity for measurement result
Axis angle	R00TH	Axis angle for measurement result.
Area	R00AR	Area for measurement result
Reversed area	R00RA	Difference between area measurement value and area for measurement result
Reference position	R00SX	X coordinate of reference position
Reference position	R00SY	Y coordinate of reference position
Reference axis	R00ST	Axis angle when measurement region drawn
Reference area	R00SA	Area when measurement region drawn
The following measurement data is for Region 1.		
Judgement	R01JG	Judgement result (-2: Not measured -1: NG 0: OK)
Center of gravity	R01X	X coordinate of center of gravity for measurement result
Center of gravity	R01Y	Y coordinate of center of gravity for measurement result
Axis angle	R01TH	Axis angle for measurement result
Area	R01AR	Area for measurement result
Reversed area	R01RA	Difference between area measurement value and area for measurement result
Reference position	R01SX	X coordinate of reference position
Reference position	R01SY	Y coordinate of reference position
Reference axis	R01ST	Axis angle when measurement region drawn
Reference area	R01SA	Area when measurement region drawn

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
The following measurement data is for unit	
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Scroll X
2	Scroll Y
3	Scroll θ
4	X coordinate of measurement value
5	Y coordinate of measurement value
6	Measurement angle
The following measurement data is for Region 0.	
7	Judgement result (-2: Not measured -1: NG 0: OK)
8	X coordinate of center of gravity for measurement result
9	Y coordinate of center of gravity for measurement result
10	Axis angle for measurement result.
11	Area for measurement result
12	Difference between area measurement value and area for measurement result
13	X coordinate of reference position
14	Y coordinate of reference position
15	Axis angle when measurement region drawn
16	Area when measurement region drawn
The following measurement data is for Region 1.	
17	Judgement result (-2: Not measured -1: NG 0: OK)
18	X coordinate of center of gravity for measurement result
19	Y coordinate of center of gravity for measurement result
20	Axis angle for measurement result
21	Area for measurement result
22	Difference between area measurement value and area for measurement result
23	X coordinate of reference position
24	Y coordinate of reference position
25	Axis angle when measurement region drawn
26	Area when measurement region drawn

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■ Setting Data

Data type	Details
30	Measurement image (0: Image 1: Image 1)
31	Displacement direction (0 to 18) (See *1.)
The following settings data is for Region 0.	
The following settings data is for [Gravity and area] and [Gravity and axis] measurement.	
32	Binary level upper limit (0 to 255)
33	Binary level lower limit (0 to 255)
34	Reverse binary level (0: Not reversed 1: Reversed)
35	X upper limit (-9,999.999 to 9,999.999)
36	X lower limit (-9,999.999 to 9,999.999)
37	Y upper limit (-9,999.999 to 9,999.999)
38	Y lower limit (-9,999.999 to 9,999.999)
39	Area upper limit (-9999999.999 to 9,999,999.999)
40	Area lower limit (-9999999.999 to 9,999,999.999)
41	Skipping X (1 to 15)
42	Skipping Y (1 to 15)
The following settings data is for [Gravity and area].	
43	Fill profile (0: OFF 1: ON)
The following settings data is for [Gravity and axis].	
44	Axis angle upper limit (-180.000 to 180.000)
45	Axis angle lower limit (-180.000 to 180.000)
The following settings data is for processing item region and reference position measurement.	
46	Region 0 Region upper left X (0 to X_MAX) (See *2., *3)
47	Region 0 Region upper left Y (0 to Y_MAX) (See *2., *3)
48	Region 0 Region lower right X (0 to X_MAX) (See *2., *3)
49	Region 0 Region lower right Y (0 to Y_MAX) (See *2., *3)
50	Reference position X (0 to X_MAX) (See *3)
51	Reference position Y (0 to Y_MAX) (See *3)
The following settings data is for Region 1.	
The following settings data is for [Gravity and area] and [Gravity and axis] measurement.	
52	Binary level upper limit (0 to 255)
53	Binary level lower limit (0 to 255)
54	Reverse binary level (0: Not reversed 1: Reversed)
55	X upper limit (-9,999.999 to 9,999.999)
56	X lower limit (-9,999.999 to 9,999.999)
57	Y upper limit (-9,999.999 to 9,999.999)
58	Y lower limit (-9,999.999 to 9,999.999)
59	Area upper limit (-9999999.999 to 9,999,999.999)
60	Area lower limit (-9999999.999 to 9,999,999.999)
61	Skipping X (1 to 15)
62	Skipping Y (1 to 15)

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Data type	Details
The following settings data is for [Gravity and area].	
63	Fill profile (0: OFF 1: ON)
The following settings data is for [Gravity and axis].	
64	Axis angle upper limit (-180.000 to 180.000)
65	Axis angle lower limit (-180.000 to 180.000)
The following settings data is for processing item region and reference position measurement.	
66	Region 0 Region upper left X (0 to X_MAX) (See *2., *3)
67	Region 0 Region upper left Y (0 to Y_MAX) (See *2., *3)
68	Region 0 Region lower right X (0 to X_MAX) (See *2., *3)
69	Region 0 Region lower right Y (0 to Y_MAX) (See *2., *3)
70	Reference position X (0 to X_MAX) (See *3)
71	Reference position Y (0 to Y_MAX) (See *3)

*1 The displacement direction settings are shown in the following table.

Data type	Skipping X	Skipping Y	Displacement θ
0	None	None	None
1	Displacement compensation region 0	None	None
2	Displacement compensation region 0	Displacement compensation region 0	None
3	Displacement compensation region 0	Displacement compensation region 1	None
4	None	Displacement compensation region 0	None
5	Displacement compensation region 1	None	None
6	Displacement compensation region 1	Displacement compensation region 0	None
7	Displacement compensation region 1	Displacement compensation region 1	None
8	None	Displacement compensation region 1	None
9	Midpoint	None	None
10	None	Midpoint	None
11	Midpoint	Midpoint	None
12	Displacement compensation region 0	Midpoint	None
13	Midpoint	Displacement compensation region 0	None
14	Displacement compensation region 1	Midpoint	None
15	Midpoint	Displacement compensation region 1	None
16	Displacement compensation region 0	Displacement compensation region 0	Displacement compensation region 0
17	Displacement compensation region 1	Displacement compensation region 1	Displacement compensation region 1
18	Midpoint	Midpoint	Relative angle

*2 If these settings are changed, one rectangular region will be set and the previously drawn figures will be deleted.

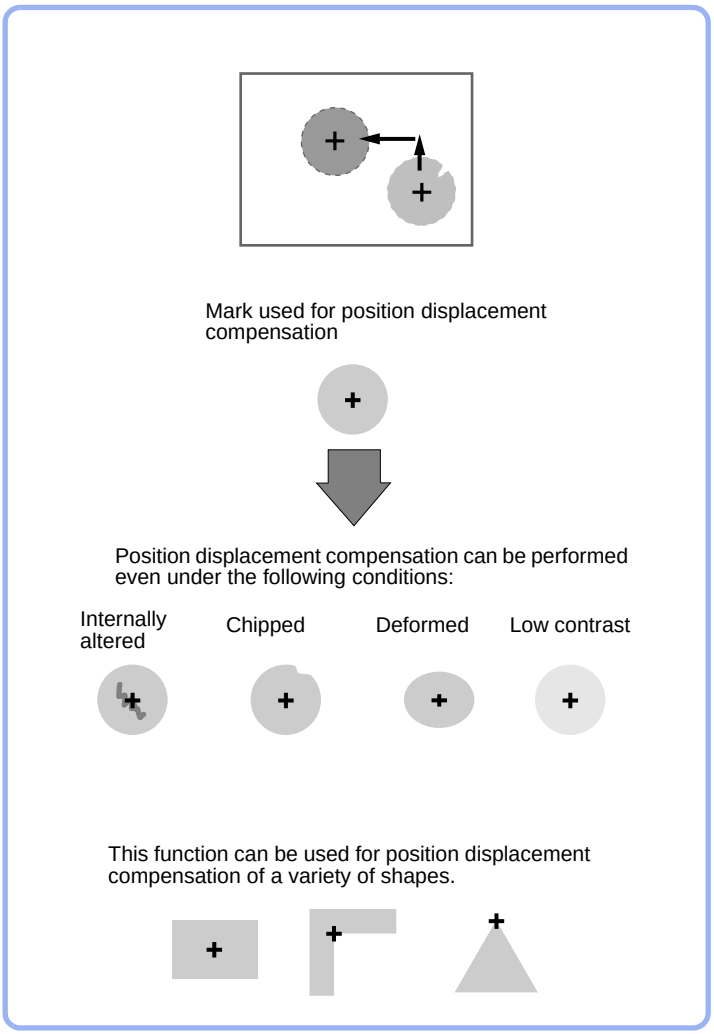
*3 The setting range varies depending on the controller model.

Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

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EC Position Compensation

The EC Position Compensation processing item finds marks for position displacement compensation using shape information such as “round”, “angular”, etc.
This allows position displacement compensation to be performed even if the section used for position compensation is deformed or chipped.



Edge Code (EC)
SECTION 7 Appendix, “Terminology”

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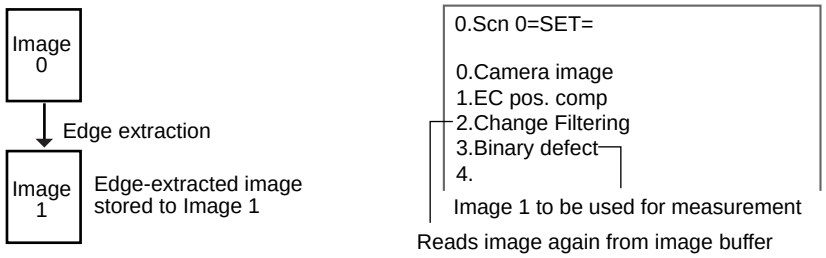
Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

CHECK!

The edges are extracted for the image number selected here and this image is then stored at the other image number. Set [Change Filtering] as the next processing item to use this image for measurement for units after the unit for which this processing item was set. Then store the image stored in the image buffer to [Image 0] or [Image 1].

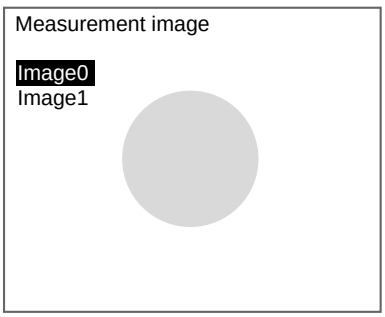
Example: When Image 0 Is Selected as Measurement Image



▶ [EC pos. comp/Measurement image]

1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.



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Extracting Edges

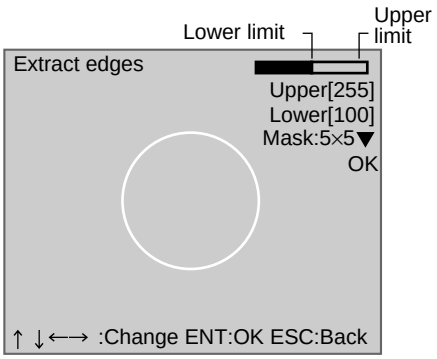
This processing Item is performed for images for which the edges have been extracted.
Adjust the upper and lower levels for edge extraction if there is low contrast between the measurement object and the background and to remove noise.

▶ [EC pos. comp/Extract edges]

1. Set the upper and lower limits.

2. Select the desired mask size.

3. Select [OK].



Setting data	Selection	Details
Upper and Lower Limits	10 to 255 (default setting 100:255).	Set the level to which the background will be cut. Adjust the upper and lower levels for edge extraction if there is low contrast between the measurement object and the background and to remove noise.
Mask Size	5 × 5 (default setting) 3 × 3	The mask size function is used when searching for edges to judge edges using peripheral information. The greater the mask size, the more the variations in surrounding pixels can be absorbed. CHECK! This setting will be enabled only if [Camera image] is set to [Frame].

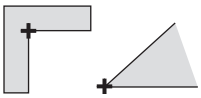
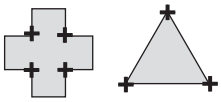
Settings Data

SECTION 7 Appendix, “EC (Edge Code) Image Measurement”

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Setting Position Displacement Compensation Regions

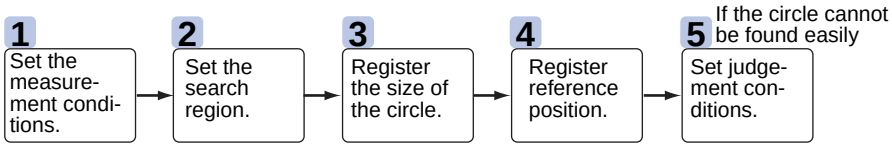
The following four figures can be chosen for measurement regions, depending on the shape of the positioning mark.

Positioning mark		Figure	Details	Page
Circular 		Circular	Searches for a circle of a specified size and can output the position coordinates (center of the circle).	p.6
Box 		Box	Searches for a rectangle of a specified size and can output the position coordinates. The center or one of the four corners can be selected for the position coordinates.	p.17
Other figures	One angle used as a mark 	Cross point	Outputs the position coordinates for the intersection of two lines. If there are multiple lines, the following conditions can be set: ·Output the cross point only for intersections at a certain angle. ·Output the cross point only for intersections of lines of a certain length.	p.12
	Several angles are used to one set of coordinates 	Multiple cross points	Up to 20 cross point coordinates can be found. The detection conditions can be changed to suit any purpose.	p.22

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Circles

■ Operational Flow



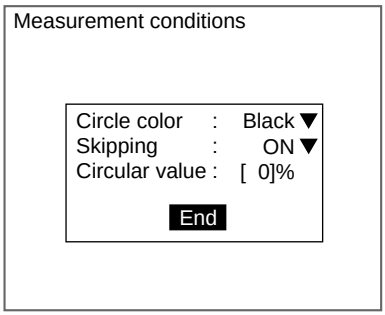
1 Setting Measurement Conditions

Set the conditions for searching for the positioning mark.

▶ [EC pos. comp/Position compensation (No.)/Circle/Measurement conditions]

1. Set each item.

2. Select [End].

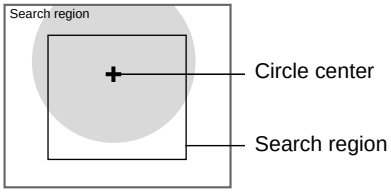


Setting data	Selection	Details
Circle color	Black (default setting) White white/black	Select whether the circle color for the positioning mark will be white or black compared to the background.Select “white/black” if the circle color is not fixed to either black or white.
Skipping	ON (default setting) None	Select whether pixel skipping (1 pixel) will be used when searching for the circle. Processing is faster if pixel skipping is turned ON, so normally “ON” is appropriate. However, if the measurement values are inconsistent, set to “OFF.”
Circular value	0 to 100 (default setting: 0)	Select the lower limit of the circle to be extracted. The value drops if the circle is deformed or chipped. The object is not extracted as a circle if the value is lower than the set value.

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2 Setting the Search Region

Set the region to search for the positioning mark.
Adjust the search region if there are areas not to be included in circle searches.
The search can be performed even if the whole circle is not within the search region, as long as the center of the circle is within the region.



CHECK!

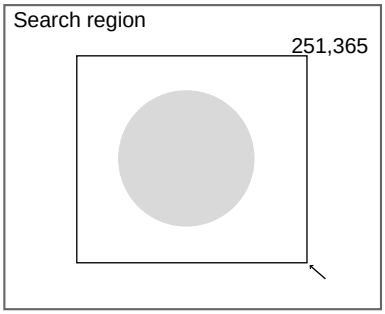
When edges are extracted, the pixels at the edges of the screen cannot be processed accurately. Do not include the outer edges of the screen when setting the search region.

SECTION 2, 1.1 Inputting Camera Images, “Filtering”.

▶ [EC pos. comp/Position compensation (No.)/Circle/Search region]

1. Draw a rectangular search region.

Specify the upper left and lower right coordinates.



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3 Registering the Size of the Circle

There are two methods for registering the size of the circle.

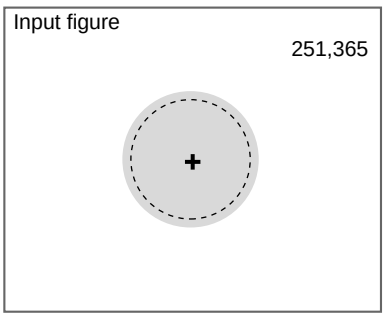
Registration method	Details
Inputting Figures	The measurement object is displayed on the screen, a circle is drawn on the exterior edge of the object and the size of the circle is registered.
Inputting Parameters	The radius of the circle and the permissible range are entered as parameters (in pixel units).

■ Inputting Figures

▶ [EC pos. comp/Position compensation (No.)/Circle/Radius/Input figure]

1. Specify the center position of the circle.

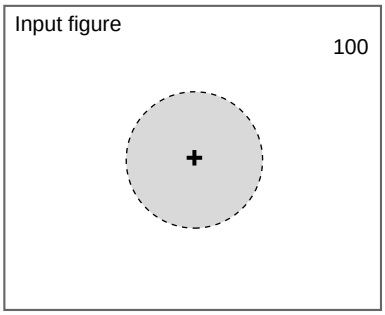
Up/Down/Left/Right Keys: Move the cursor.
ENT Key: Confirms the setting.



The screen for setting the radius will be displayed.

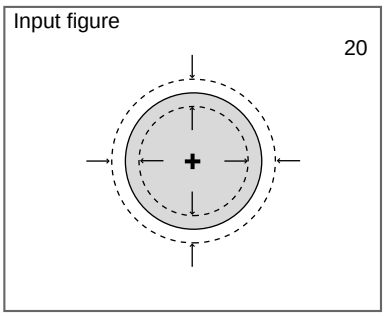
2. Specify the radius.

Up/Right Keys: Larger
Down/Left Keys: Smaller
ENT Key: Confirms the setting.



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The screen for setting the latitude of the radius will be displayed.



3. Specify the latitude of the radius (1 to 64 pixels).

Up/Right Keys: Larger
Down/Left Keys: Smaller
ENT Key: Confirms the setting.

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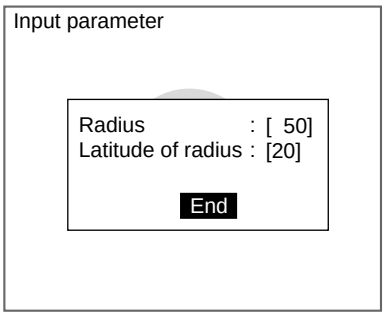
■ Inputting Parameters

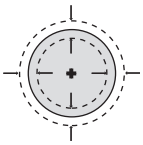
Input the parameters in pixel units for the radius and latitude of the search circle.

▶ [EC pos. comp/Position compensation (No.)/Circle/Radius/Input parameter]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Radius of search circle	3 to RMAX	Set the radius and the permissible radius range for the circle to be searched. The settable maximum value (RMAX) varies depending on the controller model. p.31 
Latitude of radius	1 to 64	Set the permissible width for [Latitude of radius]. 

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4 Registering Reference Positions

Register the reference position for position displacement compensation. Place the measurement object in the correct position before executing reference position registration.

CHECK!

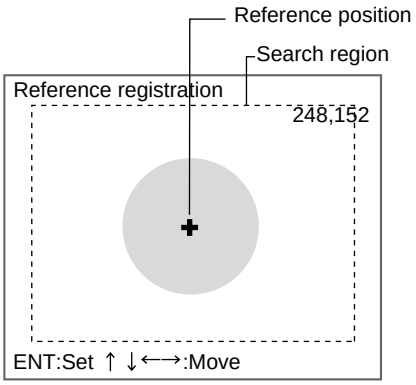
In the case of F500-C10, the reference position will be restricted depending on the scroll amount.

SECTION 7 Appendix, “Q & A, Position Compensation Items”

▶ [EC pos. comp/Position compensation (No.)/Circle/Judgement conditions]

1. The Controller will search for the circle in the displayed image that matches the conditions and a display cursor will appear at that position.
To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.



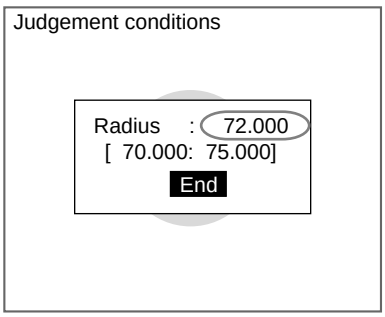
5 Setting Judgement Conditions

Set the conditions for judging whether or not a circle of the registered size has been found. This has to be set if a circle of a different size is found as a circle.

▶ [EC pos. comp/Position compensation (No.)/Circle/Reference registration]

1. Set the radius range for an OK circle.

2. Select [End].



: Measurement results for the displayed image

Setting data	Selection	Details
Radius	1.000 to 9999.999	Set in pixel units the radius of circles to receive an OK judgement.

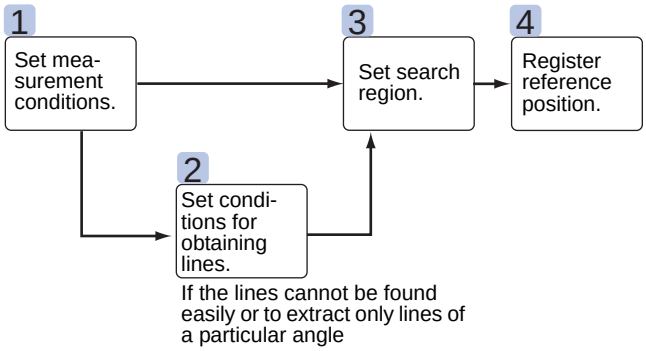
CHECK!

Position Compensation judgement Results and Scrolling
OK: Image is scrolled.
NG: Scroll will not be performed. The overall judgement will be NG, regardless of the measurement result.

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Cross Points

■ Operational Flow



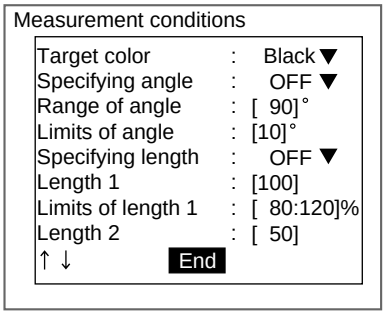
1 Setting Measurement Conditions

Set the conditions for searching for the positioning mark.

▶ [EC pos. comp/Position compensation (No.)/Cross point/Measurement conditions]

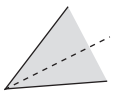
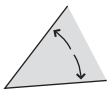
1. Set each item.

2. Select [End].



Setting data		Selection	Details
Target color		Black (default setting) White	Select whether the positioning mark color will be white or black compared to the background.
Angles	Specifying angle	ON OFF (default setting)	Use the following settings to set the angle of intersection and thus find the coordinates of only the desired intersection even though many lines exist on the screen. Select [ON] if you want to find the cross point by specifying the angle.To find the coordinates of the cross point of lines regardless of their angle, set [Specifying angle] to OFF. (The settings for the angle will be ignored.)
	Range of angle	0 to 359	Angle of the section in the target color. If [Target color] changes, change the [Range of angle] setting too.
	Limits of angle	0 to 99 (default setting: 10)	Set the permissible range for [Range of angle].

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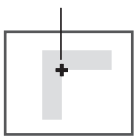
Setting data		Selection	Details
Length	Specifying length	ON OFF (default setting)	Use the following settings to set the length and thus find the coordinates of only the desired intersection even though many lines exist on the screen. Select [ON] if you want to find the cross point by specifying the lengths of the lines.To find the coordinates of the cross point of the lines regardless of their lengths, set [Specifying angle] to OFF. The settings of the line lengths and the limits of the lengths will be ignored.
	Length	1 to 1450	Set the line length in pixels.
	Limits of length	1 to 200 (default setting 80 : 120)	Set the permissible range for the length.
Select which position θ will be obtained.		Midline of Corner (default setting) Side 1 Side 2	Only one angle (q) will be output as the measurement results for the lines that are found. Select the position for which the angle will be obtained.  Obtained midline between two sides [Side 1] and [Side 2] With the target color between the two sides, the side in the clockwise direction is side 1 and the side in the counterclockwise direction is side 2. Side 2  Side 1

CHECK!

Specifying Angle

Example: To find this cross point

Cross point



[Target color]: Black
[Specifying angle]: ON
[Range of angle]: 90°
[Limits of angle]: 270°

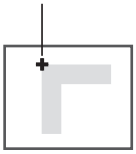


CHECK!

Specifying Length

Example: To find this cross point

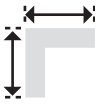
Cross point



Set the [Length 1] and [Length 2] to the lengths

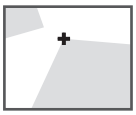
[Length 1]

[Length 2]



CHECK!

If both [Specifying angle] and [Specifying length] are set to [OFF] and there are multiple lines displayed on the screen, the cross point of the longest line and the line that crosses it will be found.



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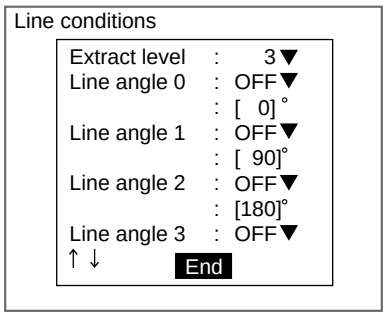
2 Setting Conditions for Obtaining Lines

Adjust the line conditions if the lines cannot be found easily or to extract only lines of a particular angle.

▶ [EC pos. comp/Position compensation (No.)/Cross point/Line conditions]

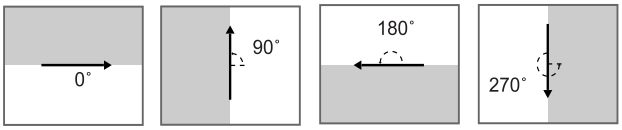
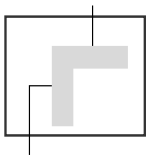
1. Set each item.

2. Select [End].



Setting data	Selection	Details
The level for extracting lines can be changed.	1 to 5 (default setting: 3)	The level for extracting lines can be changed. To make a broken line into a single line, change the extraction level to a larger value.  To extract as separate lines, change the extraction level to a smaller value  To ignore noise, change the extraction level to a smaller value.  When the measurement object is small and cannot be detected easily, change the extraction level to a larger value. 

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Setting data	Selection	Details
Line angle 0	ON OFF (default setting)	By setting [Line angle□] to [ON] and specifying the desired angle, only the lines of the specified angle can be extracted. The way in which black and white meet determines the direction of an edge code, and the angle is calculated as shown below.  0 to 360° can be set. Example: Use 180° to extract this line  Use 270° to extract this line
	0 to 359 (default setting: 0)	
Line angle 1	ON OFF (default setting)	
	0 to 359 (9o: default setting)	
Line angle 2	ON OFF (default setting)	
	0 to 359 (default setting: 180)	
Line angle 3	ON OFF (default setting)	
	0 to 359 (default setting: 270)	

3 Setting the Search Region

Set the region to search for the positioning mark.

Adjust the search region if there are areas not to be included in cross point searches.

CHECK!

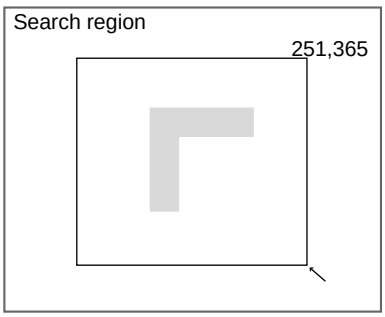
When edges are extracted, the pixels at the edges of the screen cannot be processed accurately. Do not include the outer edges of the screen when setting the search region.

SECTION 2, 1.1 Inputting Camera Images, “Filtering”

▶ [EC pos. comp/Position compensation (No.)/Cross point/Search region]

1. Draw a rectangular search region.

Specify the upper left and lower right coordinates.



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4 Registering Reference Positions

Register the reference position for position displacement compensation. Place the measurement object in the correct position before executing reference position registration.

CHECK!

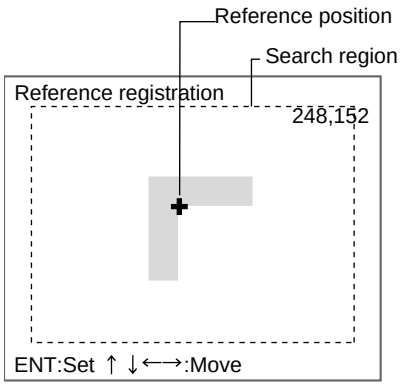
In the case of F500-C10, the reference position will be restricted depending on the scroll amount.

SECTION 7 Appendix, “Q & A, Position Compensation Items”

▶ [EC pos. comp/Position compensation (No.)/Cross point/Reference registration]

1. The Controller will search for the cross point in the displayed image that matches the conditions and a display cursor will appear at that position.
To change the position, use the Up/Down and Right/Left Keys to move the cursor.

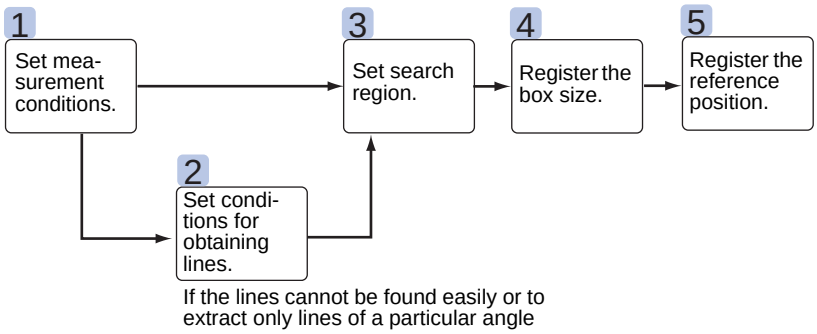
2. Press the ENT Key.



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Boxes

■ Operational Flow



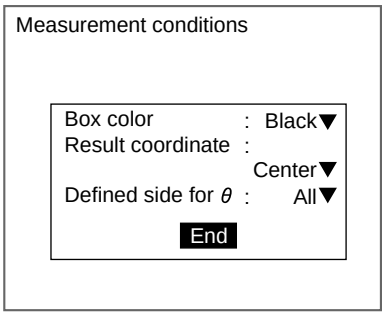
1 Setting Measurement Conditions

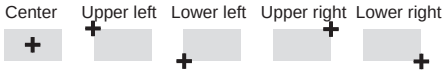
Set the conditions for searching for the positioning mark.

▶ [EC pos. comp/Position compensation (No.)/Box/Measurement conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Box color	Black (default setting) White	Select whether the positioning mark color will be white or black compared to the background.
Result coordinate	Center (default setting) Upper left Lower left Upper right Lower right	Select which position coordinates will be obtained. 
Select which position θ will be obtained.	All (default setting) Upper Lower Left Right	The angle of one side of the box can be output as a measurement result. Select the side for which the angle will be obtained. Output in the range of -90,000 to 90,000. 

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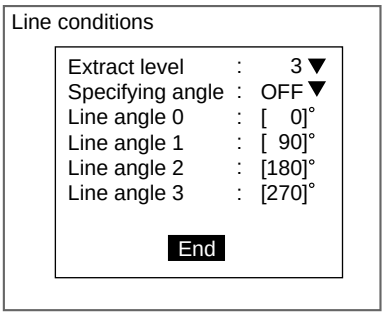
2 Setting Conditions for Obtaining Lines

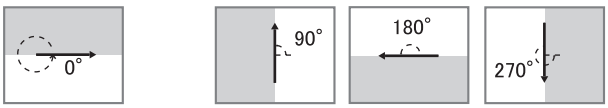
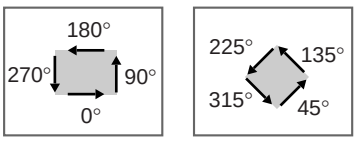
The Controller detects 4 lines and searches for a box.Adjust the conditions for detecting the lines so that desired lines are detected.

▶ [EC pos. comp/Position compensation (No.)/Box/Line conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Extracting level	1 to 5 (default setting: 3)	The level for extracting lines can be changed. p.14
Specifying angle	ON OFF (default setting)	Specify values if a lot of noise or foreign matter results in boxes not being detected with stability. Specifying angle: Set to ON. Line angle _: Set the angles of the lines to detect. The way in which black and white meet determines the direction of an edge code, and the angle is calculated as shown below.  Set the angles as a combination of the four sides of the box to be found (angles 0 to 3). Example: The following examples are for black boxes.  However, this function cannot be used if the positioning mark is likely to rotate.
Line angle 0	0 to 359 (default setting: 0)	
Line angle 1	0 to 359 (9o: default setting)	
Line angle 2	0 to 359 (default setting: 180)	
Line angle 3	0 to 359 (default setting: 270)	

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3 Setting the Search Region

Set the region to search for the positioning mark.

Adjust the search region if there are areas not to be included in box searches.

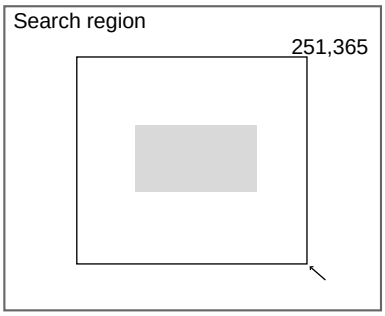
CHECK! When edges are extracted, the pixels at the edges of the screen cannot be processed accurately. Do not include the outer edges of the screen when setting the search region.

SECTION 2, 1.1 Inputting Camera Images, “Filtering”

▶ [EC pos. comp/Position compensation (No.)/Box/Search region]

1. Draw a rectangular search region.

Specify the upper left and lower right coordinates.



4 Registering the Size of the Box

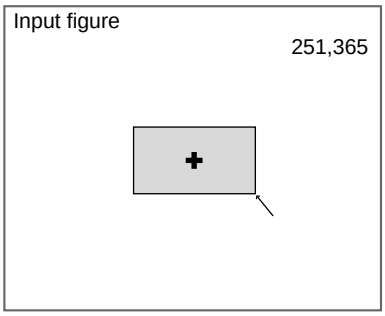
There are two methods for registering the size of the circle.

Registration method	Details
Inputting Figures	The measurement object is displayed on the screen, a box is drawn on the exterior edge of the object and the size of the box is registered. Adjust the permissible range by inputting parameters.
Inputting Parameters	The lengths of sides of the box and the permissible range are entered as parameters (in pixel units).

■ Inputting Figures

▶ [EC pos. comp/Position compensation (No.)/Box/Box size/Input figure]

1. Specify the top left and bottom right coordinates of the box.



CHECK! Figures can be input to make settings only for the Long size and Short size of the box. Use the parameter input screen to make permissible size range and other detailed settings.

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■ Inputting Parameters

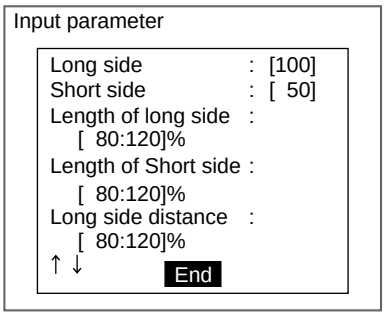
Set the size of the box and the permissible range using parameter input.

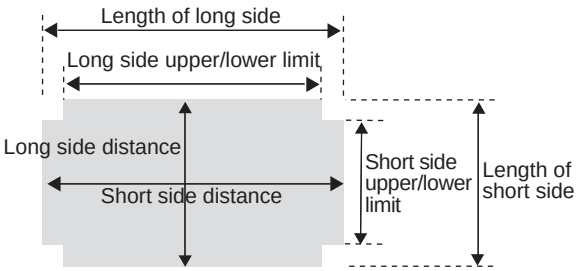
If the size of the box is entered using figure input, those parameters will be reflected under [Long size] and [Short size] on the Input Parameter Screen.

▶ [EC pos. comp/Position compensation (No.)/Box/Box size/Input parameter]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Length of long side	1 to X_SIZE	Set the box size and permissible range for OK judgement.  X SIZE and Y SIZE values vary depending on the controller model. p.32
Length of short side	1 to Y_SIZE	
Long side upper/lower limit	1 to 200 (default setting 80 : 120)	
Short side upper/lower limit	1 to 200 (default setting 80 : 120)	
Long side distance	1 to 200 (default setting 80 : 120)	
Short side distance	1 to 200 (default setting 80 : 120)	
Line parallelism	1 to 99 (default setting: 20)	Set the long side and short side parallelism for OK judgement.

CHECK!

If the size of the box changes:
Increase [Length of long side] and [Length of short side].
Increase [Long side distance] and [Short side distance].



When a Box Is Chipped:
Reduce the lower limit of Length of long side and Length of short side.

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5 Registering Reference Positions

Register the reference position for position displacement compensation. Place the measurement object in the correct position before executing reference position registration.

CHECK!

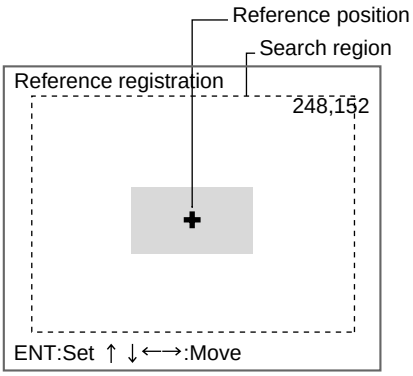
In the case of F500-C10, the reference position will be restricted depending on the scroll amount.

SECTION 7 Appendix, “Q & A, Position Compensation Items”

▶ [EC pos. comp/Position compensation (No.)/Box/Reference registration]

1. The Controller will search for the box in the displayed image and a display cursor will appear at that position. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

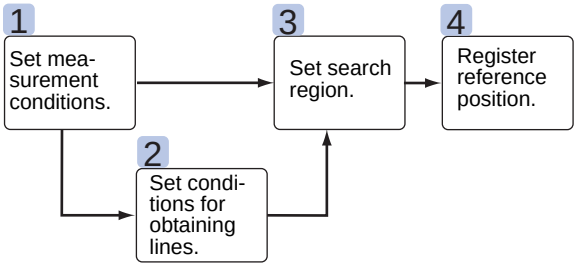
2. Press the ENT Key.



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Multi-points

■ Operational Flow



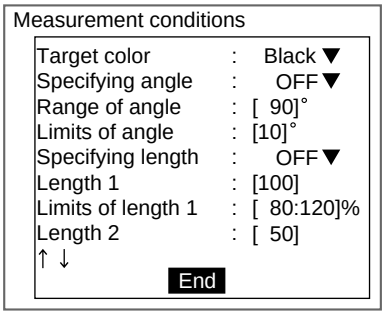
1 Setting Measurement Conditions

Set the conditions for searching for the positioning mark.

▶ [EC pos. comp/Position compensation (No.)/Multi-points/Measurement conditions]

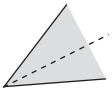
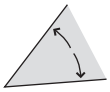
1. Set each item.

2. Select [End].



Setting data		Selection	Details
Target color		Black (default setting) White	Select whether the positioning mark color will be white or black compared to the background.
Angles	Specifying angle	ON OFF (default setting)	Use the following settings to set the angle of intersection and thus find the coordinates of only the desired intersection even though many lines exist on the screen. Select [ON] if you want to find the cross point by specifying the angle.To find the coordinates of the cross point of lines regardless of their angle, set [Specifying angle] to OFF. (The settings for the angle will be ignored.)
	Range of angle	0 to 359	Angle of the section in the target color. If [Target color] changes, change the [Range of angle] setting too.
	Limits of angle	0 to 99 (default setting: 10)	Set the permissible range for [Range of angle].

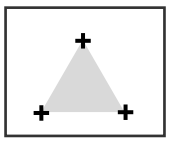
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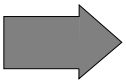
Setting data		Selection	Details
Length	Specifying length	ON OFF (default setting)	Use the following settings to set the length and thus find the coordinates of only the desired intersection even though many lines exist on the screen. Select [ON] if you want to find the cross point by specifying the lengths of the lines. To find the coordinates of the cross point of the lines regardless of their lengths, set [Specifying angle] to OFF. The settings of the [Length☐] and the [Limits of the length☐] will be ignored.
	Length☐	1 to 1450	Set the line length in pixels.
	Limits of length☐	1 to 200 (default length 80:120)	Set the permissible range for the [Length].
Cross point extracting conditions		X ascending order (default setting) X descending order Y ascending order Y descending order	Select the sorting conditions for determining which cross point coordinates will be output. Up to 20 points can be obtained. The coordinates for the first point matching the selected conditions will be output.
Select which position θ will be obtained.		Midline of Corner (default setting) Side 1 Side 2	Only one angle (q) will be output as the measurement results for the lines that are found. Select the position for which the angle will be obtained. (The lines that are considered are the two lines meeting at the intersection point.)  Obtained midline between two sides [Side 1] and [Side 2] Side 2  With the target color between the two sides, the side in the clockwise direction is side 1 and the side in the counterclockwise direction is side 2. Side 1

CHECK!

Specifying Angle

Example: To extract the following 3 cross points:





[Target color]: Black
[Specifying angle]: ON
[Range of angle]: 60°

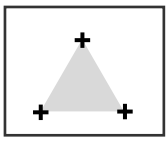


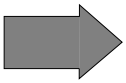
CHECK!

Specifying Length

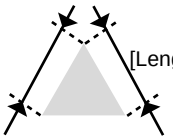
Example: To extract the following 3 cross points:

[Target color]: Black
Set the [Length 1] and [Length 2] to the lengths





[Length 1]



[Length 2]

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2 Setting Conditions for Obtaining Lines

Adjust the line conditions if the lines cannot be found easily or to extract only lines of a particular angle.

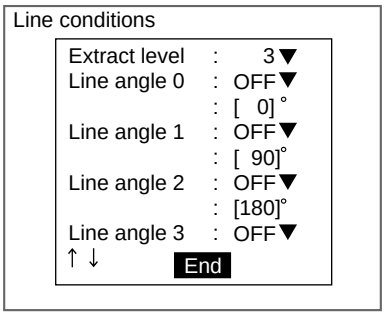
Refer to the page of [Cross Point] for an outline.

p.14

▶ [EC pos. comp/Position compensation (No.)/Multi-points/Line conditions]

1. Set each item.

2. Select [End].



3 Setting the Search Region

Set the region to search for the positioning mark.

Adjust the search region if there are areas not to be included in multi-point searches.

CHECK!

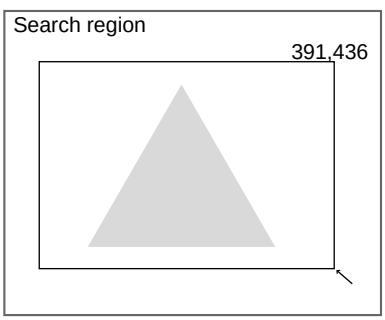
When edges are extracted, the pixels at the edges of the screen cannot be processed accurately. Do not include the outer edges of the screen when setting the search region.

SECTION 2, 1. 1 Inputting Camera Images, “Filtering”

▶ [EC pos. comp/Position compensation (No.)/Multi-point/Search region]

1. Draw a rectangular search region.

Specify the upper left and lower right coordinates.



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4 Registering Reference Positions

Register the reference position for position displacement compensation. Place the measurement object in the correct position before executing reference position registration.

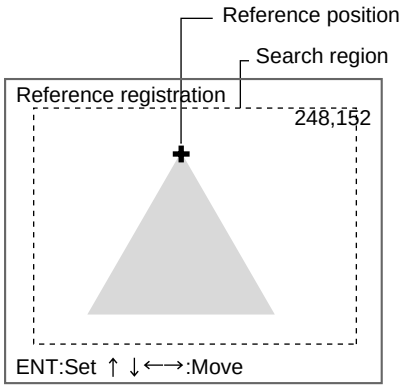
CHECK!

In the case of F500-C10, the reference position will be restricted depending on the scroll amount.
SECTION 7 Appendix, “Q & A, Position Compensation Items”

▶ [EC pos. comp/Position compensation (No.)/Multi-point/Judgement conditions]

1. The Controller will search for the cross point in the displayed image that matches the conditions and a display cursor will appear at that position. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.

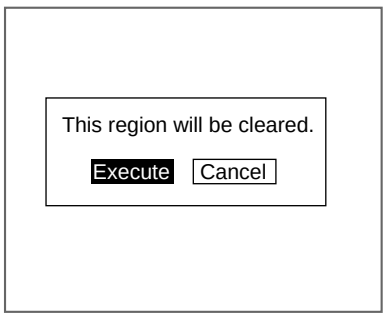


Clearing the Set Regions

The clear operation is executed for each region.

▶ [EC pos. comp/Position compensation (region No.)/Clear]

1. Select [Execute].

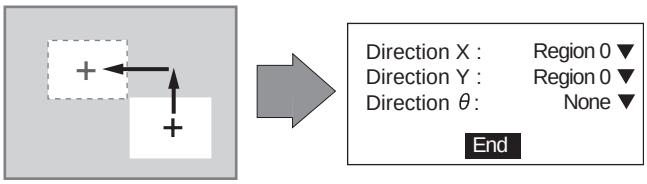


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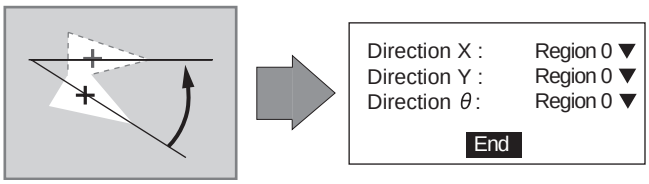
Setting the Displacement Direction

The direction function is used to select which region's measurement results will be used as the basis for position displacement compensation in the X, Y, and θ (rotation) directions.

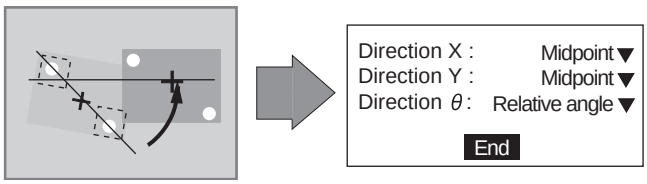
- Measurement Objects Not On An Angle (Example: Region 0 Set to Box)



- Measurement Objects On An Angle (Example: Region 0 Set to Cross Point)



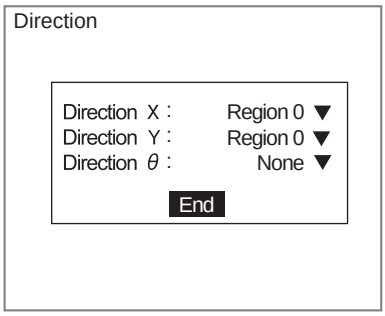
- For Precision Position Compensation Using Measurement Object Angles (Example: When Region 0 and Region 1 Are Set)



▶ [EC pos. comp/Direction]

1. Set each item.

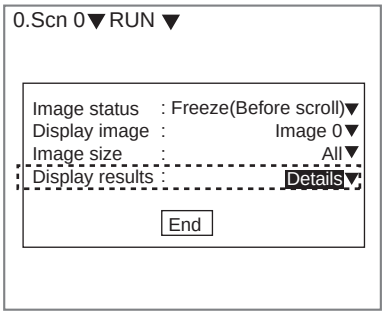
2. Select [End].



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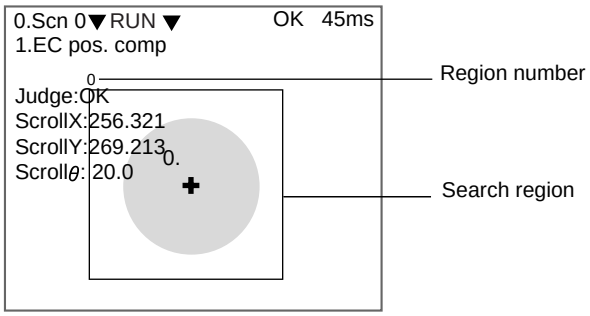
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.
Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



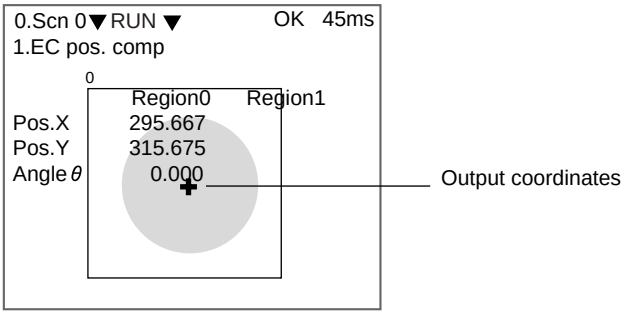
Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed. Use the SHIFT+Right or Left Keys to switch in order between the two screens.

(1) Scroll Amount



(2) Detailed Display

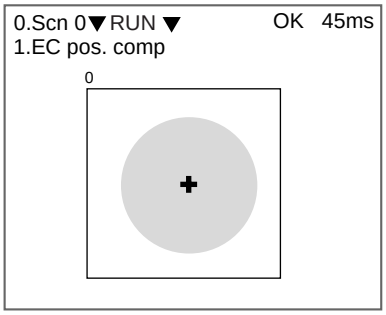
The measurement values for each region will be displayed.



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(3) Position Display

Only the search region will be displayed.

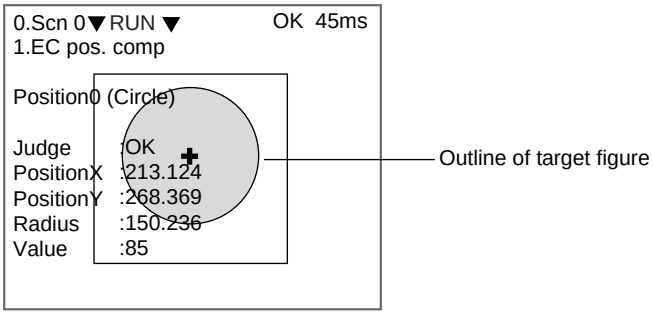


(4) Individual Region Display

More detailed measurement results are displayed for each region.

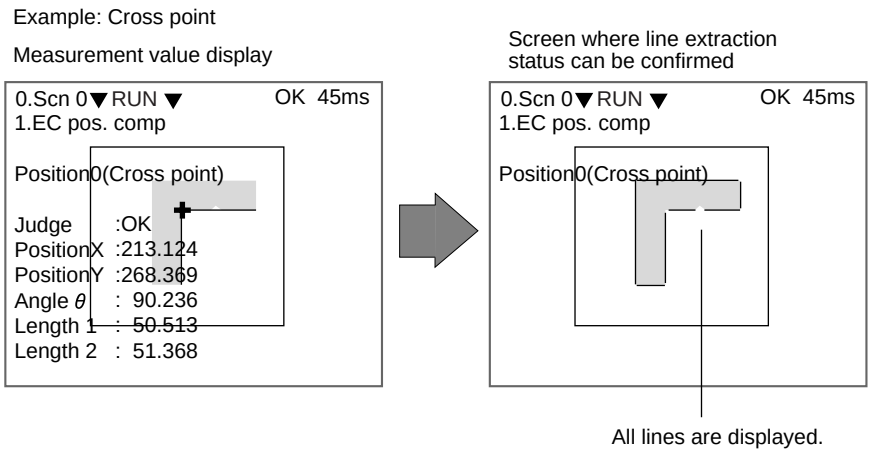
Press the SHIFT+Right or Left Keys to display the set regions in order.

• Circular



• Cross points, boxes, and multiple cross points

Once the measurement values for the region have been displayed, the screen for confirming the line extraction status will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
The following measurement data is for unit		
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Scroll X	DX	Scroll X
Scroll Y	DY	Scroll Y
Scroll θ	DT	Scroll θ
Measurement X	X	X coordinate of measurement value
Measurement Y	Y	Y coordinate of measurement value
Measurement angle	TH	Measurement angle
The following measurement data is for Region 0.		
Judgement	R00JG	Judgement result (-2: Not measured -1: NG 0: OK)
Measured X	R00X	X coordinate of position where tag found
Measured Y	R00Y	Y coordinate of position where tag found
Measurement angle	R00TH	Axis angle of found tag
Reference X	R00SX	X coordinate of reference position
Reference Y	R00SY	Y coordinate of reference position
Reference angle	R00ST	Reference angle (cross point, box, multiple cross points)
Radius	R00R	Radius of measured circle (for circles)
Circular value	R00CV	Evaluation results for measured circle (for circles)
Line length 1	R00L1	Length of measured edge 1 (for cross points and multiple cross points)
Line length 2	R00L2	Length of measured edge 2 (for cross points and multiple cross points)
Upper left apex X	R00PX1	X coordinate of measured upper left corner (for boxes)
Upper left apex Y	R00PY1	Y coordinate of measured upper left corner (for boxes)
Lower left apex X	R00PX2	X coordinate of measured lower left corner (for boxes)
Lower left apex Y	R00PY2	Y coordinate of measured lower left corner (for boxes)
Upper right apex X	R00PX3	X coordinate of measured upper right corner (for boxes)
Upper right apex Y	R00PY3	Y coordinate of measured upper right corner (for boxes)
Lower right apex X	R00PX4	X coordinate of measured lower right corner (for boxes)
Lower right apex Y	R00PY4	Y coordinate of measured lower right corner (for boxes)
The following measurement data is for Region 1.		
Judgement	R01JG	Judgement result (-2: Not measured -1: NG 0: OK)

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Measurement item	String	Details
Measured X	R010X	X coordinate of position where tag found
Measured Y	R01Y	Y coordinate of position where tag found
Measurement angle	R01TH	Axis angle of found tag
Reference X	R01SX	X coordinate of reference position
Reference Y	R01SY	Y coordinate of reference position
Reference angle	R01ST	Reference angle (cross point, box, multiple cross points)
Radius	R01R	Radius of measured circle (for circles)
Circular value	R01CV	Evaluation results for measured circle (for circles)
Line length 1	R01L1	Length of measured edge 1 (for cross points and multiple cross points)
Line length 2	R01L2	Length of measured edge 2 (for cross points and multiple cross points)
Upper left apex X	R01PX1	X coordinate of measured upper left corner (for boxes)
Upper left apex Y	R01PY1	Y coordinate of measured upper left corner (for boxes)
Lower left apex X	R01PX2	X coordinate of measured lower left corner (for boxes)
Lower left apex Y	R01PY2	Y coordinate of measured lower left corner (for boxes)
Upper right apex X	R01PX3	X coordinate of measured upper right corner (for boxes)
Upper right apex Y	R01PY3	Y coordinate of measured upper right corner (for boxes)
Lower right apex X	R01PX4	X coordinate of measured lower right corner (for boxes)
Lower right apex Y	R01PY4	Y coordinate of measured lower right corner (for boxes)

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
The following measurement data is for unit	
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Scroll X
2	Scroll Y
3	Scroll θ
4	X coordinate of measurement value
5	Y coordinate of measurement value
6	Measurement angle
The following measurement data is for Region 0.	
7	Judgement result (-2: Not measured -1: NG 0: OK)
8	X coordinate of position where tag found
9	Y coordinate of position where tag found
10	Axis angle of found tag
11	X coordinate of reference position
12	Y coordinate of reference position
13	Reference angle (cross point, box, multiple cross points)
14	Radius of measured circle (for circles)
15	Evaluation results for measured circle (for circles)
16	Length of measured edge 1 (for cross points and multiple cross points)
17	Length of measured edge 2 (for cross points and multiple cross points)
18	X coordinate of measured upper left corner (for boxes)
19	Y coordinate of measured upper left corner (for boxes)
20	X coordinate of measured lower left corner (for boxes)
21	Y coordinate of measured lower left corner (for boxes)
22	X coordinate of measured upper right corner (for boxes)
23	Y coordinate of measured upper right corner (for boxes)
24	X coordinate of measured lower right corner (for boxes)
25	Y coordinate of measured lower right corner (for boxes)
The following measurement data is for Region 1.	
26	Judgement result (-2: Not measured -1: NG 0: OK)
27	X coordinate of position where tag found
28	Y coordinate of position where tag found
29	Axis angle of found tag
30	X coordinate of reference position

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Data type	Details
31	Y coordinate of reference position
32	Reference angle (cross point, box, multiple cross points)
33	Radius of measured circle (for circles)
34	Evaluation results for measured circle (for circles)
35	Length of measured edge 1 (for cross points and multiple cross points)
36	Length of measured edge 2 (for cross points and multiple cross points)
37	X coordinate of measured upper left corner (for boxes)
38	Y coordinate of measured upper left corner (for boxes)
39	X coordinate of measured lower left corner (for boxes)
40	Y coordinate of measured lower left corner (for boxes)
41	X coordinate of measured upper right corner (for boxes)
42	Y coordinate of measured upper right corner (for boxes)
43	X coordinate of measured lower right corner (for boxes)
44	Y coordinate of measured lower right corner (for boxes)

■ Setting Data

Data type	Details
50	Measurement image (0: Image 0 1: Image 1)
51	Edge extraction mask size (0: 3 ~ 3 1: 5 ~ 5)
52	Edge extraction lower limit (10 to 255)
53	Edge extraction upper limit (10 to 255)
54	Displacement direction (0 to 18) (See *1.)
The following settings data is for Region 0.	
The following settings data is for all measurements.	
55	Search region upper left X (0 to X_MAX) (See *2.)
56	Search region upper left Y (0 to Y_MAX) (See *2.)
57	Search region lower right X (0 to X_MAX) (See *2.)
58	Search region lower right Y (0 to Y_MAX) (See *2.)
The following settings data is for [Circle] measurement.	
59	Circle color (0: Black 1: White 2: Both)
60	Skipping (0: OFF 1: ON)
61	Circular value (0 to 100)
62	Circle center X coordinate (0 to X_MAX) (See *2.)
63	Circle center Y coordinate (0 to Y_MAX) (See *2.)
64	Circumference radius (3 to R_MAX) (See *2.)
65	Circumference width (1 to 64)
66	Radius judgement lower limit (1 to 9,999.999)
67	Radius judgement upper limit (1 to 9,999.999)
The following settings are for [Line conditions] (common to [Cross point], [Box] and [Multi-points]).	

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Data type	Details
68	Extracting level (0: Level 1 1: Level 2 2: Level 3 3: Level 4 4: Level 5)
69	Line angle specification (0: OFF 1: ON)
70	Line angle 0 specification (0: OFF 1: ON)
71	Line angle 0 (0 to 359)
72	Line angle 1 specification (0: OFF 1: ON)
73	Line angle 1 (0 to 359)
74	Line angle 2 specification (0: OFF 1: ON)
75	Line angle 2 (0 to 359)
76	Line angle 3 specification (0: OFF 1: ON)
77	Line angle 3 (0 to 359)
The following settings data is for [Cross point] and [Multi-points] measurements.	
78	Target color (0: Black 1: White)
79	Angle specification (0: OFF 1: ON)
80	Range of angle (0 to 359)
81	Limits of angle (0 to 99)
82	Length specification (0: OFF 1: ON)
83	Length 1 (1 to 1450)
84	Length 1 lower limit (0 to 200)
85	Length 1 upper limit (0 to 200)
86	Length 2 (1 to 1450)
87	Length 2 lower limit (0 to 200)
88	Length 2 upper limit (0 to 200)
89	Defined side of θ (0: Midline of corner 1: Side 1 2: Side 2)
The following settings data is for [Box] measurement.	
90	Box color (0: Black 1: White)
91	Result coordinate (0: Center 1: Upper left 2: Lower left 3: Upper right 4: Lower right)
92	Defined side of θ (0: All 1: Upper 2: Lower 3: Left 4: Right)
93	Long side (I to X_SIZE) (See *2.)
94	Short side (I to Y_SIZE) (See *2.)
95	Long side lower limit (1 to 200)
96	Long side upper limit (1 to 200)
97	Short side lower limit (1 to 200)
98	Short side upper limit (1 to 200)
99	Long side distance lower limit (1 to 200)
100	Long side distance upper limit (1 to 200)
101	Short side distance lower limit (1 to 200)
102	Short side distance upper limit (1 to 200)
103	Line parallelism (1 to 99)
The following settings data is for [Multi-points] measurement.	
104	Sorting method (0: X ascending order 1: X descending order 2: Y ascending order 3: Y descending order)
The following settings data is for Region 1.	

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Data type	Details
The following settings data is for all measurements.	
105	Search region upper left X (0 to X_MAX) (See *2.)
106	Search region upper left Y (0 to Y_MAX) (See *2.)
107	Search region lower right X (0 to X_MAX) (See *2.)
108	Search region lower right Y (0 to Y_MAX) (See *2.)
The following settings data is for [Circle] measurement.	
109	Circle color (0: Black 1: White 2: Both)
110	Skipping (0: OFF 1: ON)
111	Circular value (0 to 100)
112	Circle center X coordinate (0 to X_MAX) (See *2.)
113	Circle center Y coordinate (0 to Y_MAX) (See *2.)
114	Circumference radius (3 to R_MAX) (See *2.)
115	Circumference width (1 to 64)
116	Radius judgement lower limit (1 to 9,999.999)
117	Radius judgement upper limit (1 to 9,999.999)
The following settings are for [Line conditions] (common to [Cross point], [Box] and [Multi-points]).	
118	Extracting level (0: Level 1 1: Level 2 2: Level 3 3: Level 4 4: Level 5)
119	Line angle specification (0: OFF 1: ON)
120	Line angle 0 specification (0: OFF 1: ON)
121	Line angle 0 (0 to 359)
122	Line angle 1 specification (0: OFF 1: ON)
123	Line angle 1 (0 to 359)
124	Line angle 2 specification (0: OFF 1: ON)
125	Line angle 2 (0 to 359)
126	Line angle 3 specification (0: OFF 1: ON)
127	Line angle 3 (0 to 359)
The following settings data is for [Cross point] and [Multi-points] measurements.	
128	Target color (0: Black 1: White)
129	Angle specification (0: OFF 1: ON)
130	Range of angle (0 to 359)
131	Limits of angle (0 to 99)
132	Length specification (0: OFF 1: ON)
133	Length 1 (1 to 1450)
134	Length 1 lower limit (0 to 200)
135	Length 1 upper limit (0 to 200)
136	Length 2 (1 to 1450)
137	Length 2 lower limit (0 to 200)
138	Length 2 upper limit (0 to 200)
139	Defined side of θ (0: Midline of corner 1: Side 1 2: Side 2)
The following settings data is for [Box] measurement.	
140	Box color (0: Black 1: White)
141	Result coordinate (0: Center 1: Upper left 2: Lower left 3: Upper right 4: Lower right)

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Data type	Details
142	Defined side of θ (0: All 1: Upper 2: Lower 3: Left 4: Right)
143	Long side (I to X_SIZE) (See *2.)
144	Short side (I to Y_SIZE) (See *2.)
145	Long side lower limit (1 to 200)
146	Long side upper limit (1 to 200)
147	Short side lower limit (1 to 200)
148	Short side upper limit (1 to 200)
149	Long side distance lower limit (1 to 200)
150	Long side distance upper limit (1 to 200)
151	Short side distance lower limit (1 to 200)
152	Short side distance upper limit (1 to 200)
153	Line parallelism (1 to 99)
The following settings data is for [Multi-points] measurement.	
154	Sorting method (0: X ascending order 1: X descending order 2: Y ascending order 3: Y descending order)

*1: The displacement direction settings are shown in the following table.

Data type	Skipping X	Skipping Y	Displacement θ
0	None	None	None
1	Displacement compensation region 0	None	None
2	Displacement compensation region 0	Displacement compensation region 0	None
3	Displacement compensation region 0	Displacement compensation region 1	None
4	None	Displacement compensation region 0	None
5	Displacement compensation region 1	None	None
6	Displacement compensation region 1	Displacement compensation region 0	None
7	Displacement compensation region 1	Displacement compensation region 1	None
8	None	Displacement compensation region 1	None
9	Midpoint	None	None
10	None	Midpoint	None
11	Midpoint	Midpoint	None
12	Displacement compensation region 0	Midpoint	None
13	Midpoint	Displacement compensation region 0	None
14	Displacement compensation region 1	Midpoint	None
15	Midpoint	Displacement compensation region 1	None

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Data type	Skipping X	Skipping Y	Displacement θ
16	Displacement compensation region 0	Displacement compensation region 0	Displacement compensation region 0
17	Displacement compensation region 1	Displacement compensation region 1	Displacement compensation region 1
18	Midpoint	Midpoint	Relative angle

*2: The range varies depending on the controller model.

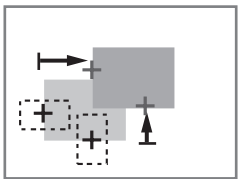
Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483
1 to X_SIZE	1 to 1024	1 to 512
1 to Y_SIZE	0 to 1024	1 to 484
3 to R_MAX	3 to 1024	3 to 512

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Edge Position Compensation

The Edge Position Compensation processing item is used to detect the amount of measurement object displacement by using the edge of the measurement region, where the density changes.
Position compensation is not possible if the measurement object is inclined.

The edge of the measurement region, where the density changes, is detected and the position corrected.



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Operational Flow

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Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [Edge pos. comp/Measure image]



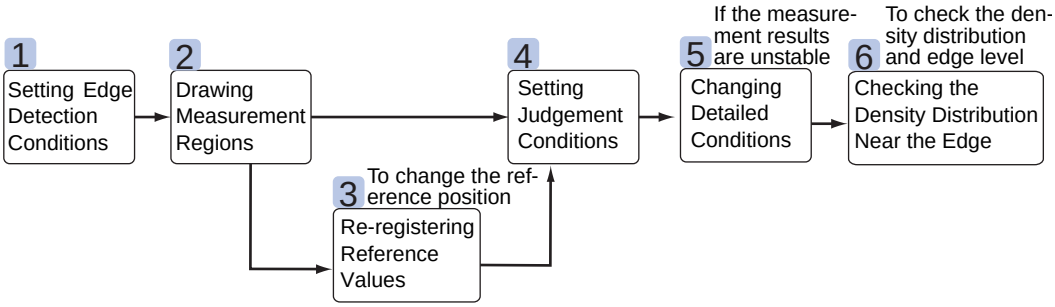
1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.

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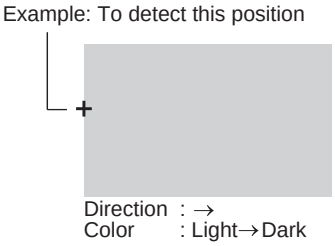
Setting Position Displacement Compensation Regions

■ Operational Flow



1 Setting Edge Detection Conditions

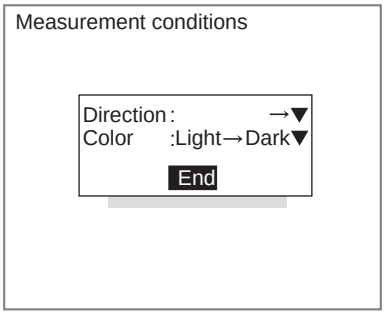
Set the direction for edge detection and the density changes.



▶ [Edge pos. comp/Position compensation (No.)/Measurement conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Direction	← → ↑ ↓	Select the edge detection direction.
Color	Light to Dark Dark to Light	Select the density change.

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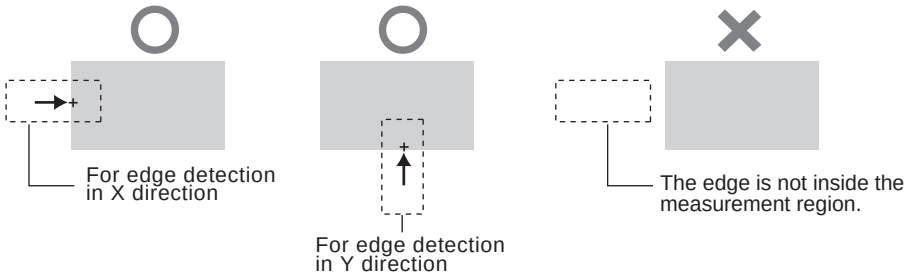
2 Drawing Measurement Regions

Draw a measurement region to include all the edges for detection.

When a measurement region is drawn, measurement is performed for the displayed image and the result is registered as the reference value (edge position). This position becomes the reference position, so be sure to place the measurement object in the correct position before drawing the measurement region.

CHECK!

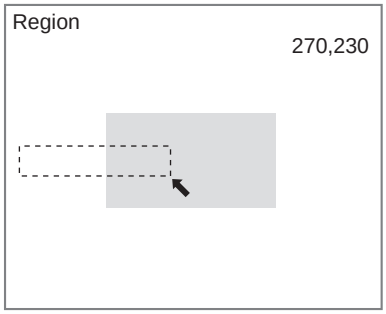
If the edge is not in the measurement region, measurement will not be possible. Make a region of a size and position that allows for movement of the range of the measurement object.



▶ [Edge pos. comp/Position compensation (No.)/Region]

1. Draw a box-shaped region.

Specify the upper left and lower right coordinates.



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3 Re-registering Reference Values

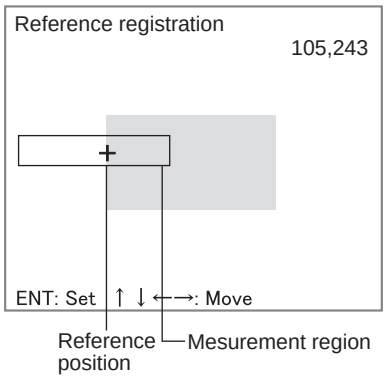
This operation is performed when only the reference value is to be re-registered.
When a measurement region is drawn, the measurement is performed for the displayed image and the result is registered as the reference value. If the re-registering function explained here is used, only the reference value for the image currently displayed will be registered.
Edge position is registered for the reference value.

CHECK! The reference value is also re-registered if the measurement region is changed.

▶ [Edge pos. comp/Position compensation (No.)/Reference registration]

1. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.



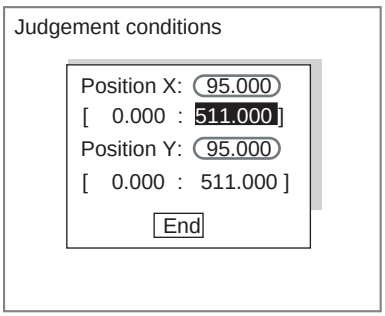
4 Setting Judgement Conditions

Set the position ranges for an OK judgement.

▶ [Edge pos. comp/Position compensation (No.)/Judgement conditions]

1. Set each item.

2. Select [End].



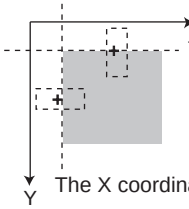
: Measurement result for the displayed image.
Use as a reference for setting conditions.

Setting data	Selection	Details
Position X	-9999.999 to 9999.999	Set the range of movement in the X direction for an OK judgement.
Position Y	-9999.999 to 9999.999	Set the range of movement in the Y direction for an OK judgement.

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CHECK!

Position X and Position Y will change depending on the settings under [Measurement/Direction].



The Y coordinate is set when [↑] and [↓] are selected.

The X coordinate is set when [←] and [→] are selected.

* The origin and coordinate system vary with the calibration setting.

CHECK!

Position Compensation judgement Results and Scrolling

OK: Image is scrolled.

NG: Scroll will not be performed. The overall judgement will be NG, regardless of the measurement result.

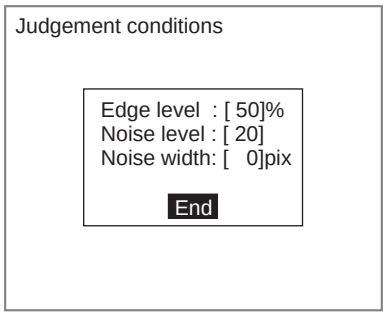
5 Changing Detailed Conditions

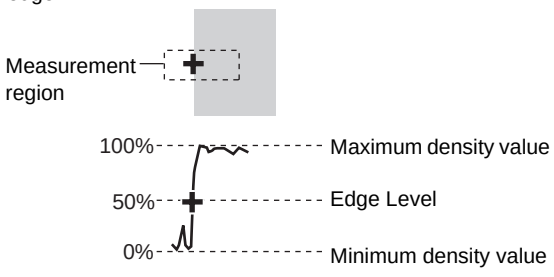
Change the detailed conditions when the measurement results are unstable. Normally, the method can be left on the default setting. After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

▶ [Edge pos. comp/Position compensation (No.)/Detailed conditions]

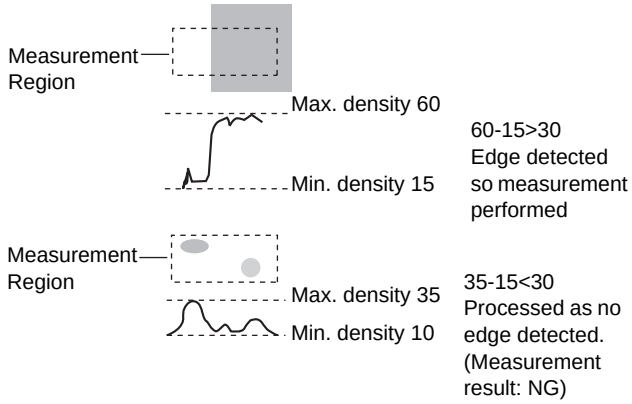
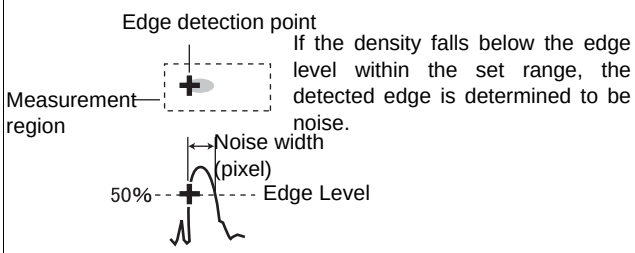
1. Set each item.

2. Select [End].



Setting data	Selection	Details
Edge Level	0 to 100 (default setting: 50)	Set a density change level between 0 and 100 that will indicate the edge. 

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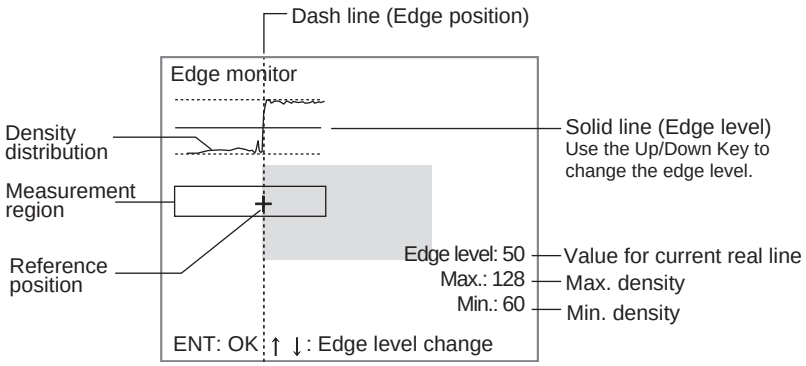
Setting data	Selection	Details
Noise Level	0 to 255 (default setting: 20)	Noise level used to make judgement if edges are present or not. The maximum density and minimum density within the edge detection area is calculated and if the difference between the two values is less than the noise level, then the Controller determines that there is no edge. If noise is causing incorrect detection, make this value higher. (Within the edge detection region) Max. density - min. density < noise level → no edge → NG measurement result Max. density - min. density ≥ noise level → Edge → Used for measurement Example: When [Noise level] is set to 30 
Noise Width	0 to 255 (default setting: 0)	Set the width of objects that are to be judged as noise. If the density distribution from the position where the edge was first detected falls to below the edge level within the noise width range, the detected point is judged as noise.If noise is causing incorrect detection, make this value higher. 

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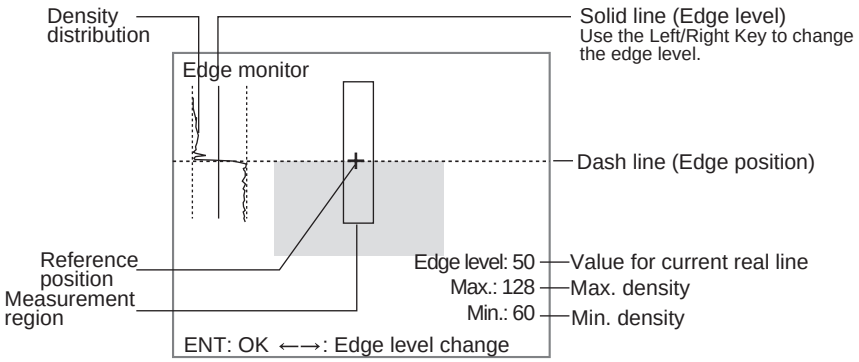
6 Checking the Density Distribution Near the Edge

The density distribution and edge level within the measurement region can be checked on the screen.
The edge level can also be set while monitoring density distribution.
After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

- When edge detection directions is Left or Right:

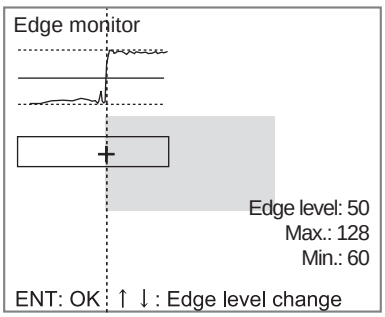


- When edge detection directions is Up or Down:



▶ [Edge pos. comp/Position compensation (No.)/Edge monitor]

- To check density distribution and edge level
  Check the density distribution near the edge and press the ESC key to exit.
- To change the edge level
  Use the Up/Down/Left/Right Keys to move the cursor and press the ENT Key.



CHECK! The edge level can also be set in [Detailed conditions]. (The setting that has been specified the last will become effective.)
p.7

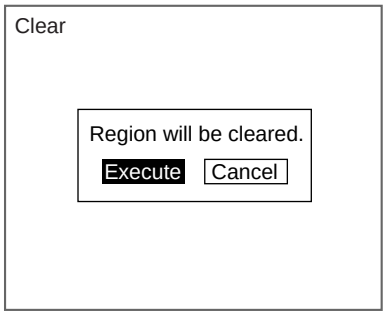
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Clearing the Set Regions

The clear operation is performed separately for each region.

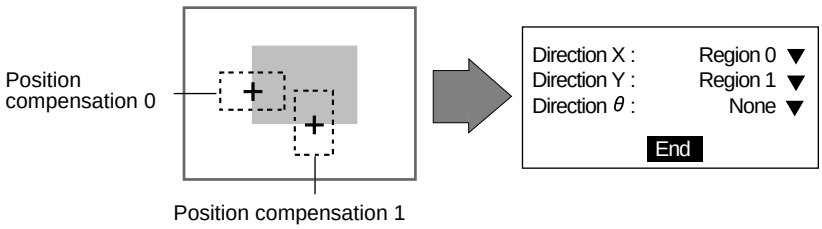
▶ [Edge pos. comp/Position compensation (No.)/Clear]

1. Select [Execute].



Setting the Displacement Direction

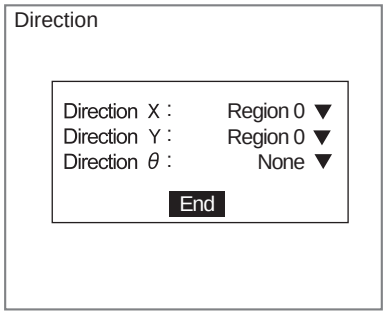
The direction function is used to select which region's measurement results will be used as the basis for position displacement compensation in the X, Y, and θ (rotation) directions.



▶ [Edge pos. comp/Direction]

1. Set each item.

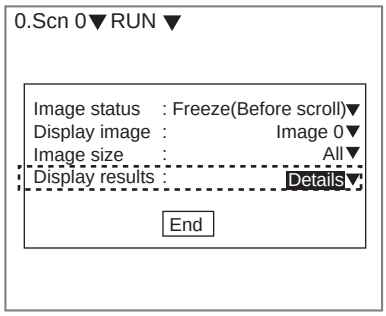
2. Select [End].



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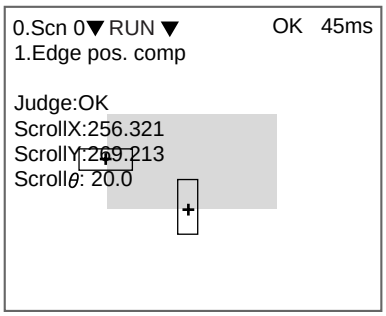
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.
Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



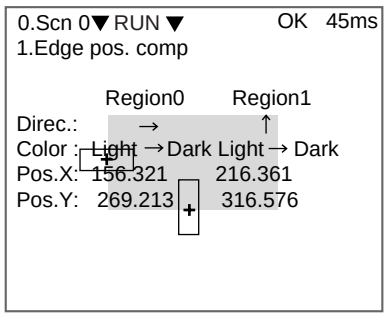
Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed. Use the SHIFT+Right or Left Keys to switch in order between the two screens.

(1) Scroll Amount



(2) Detailed Display

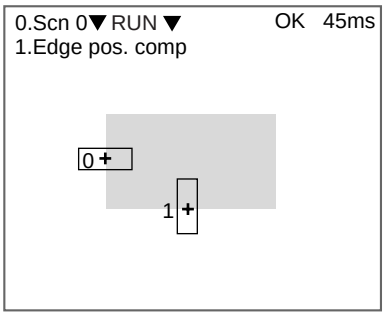
The measurement values for each region will be displayed.



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(3) Position Display

Only the region will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
The following measurement data is for unit		
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Scroll X	DX	Scroll X
Scroll Y	DY	Scroll Y
Scroll θ	DT	Scroll θ
Measurement X	X	X coordinate of measurement value
Measurement Y	Y	Y coordinate of measurement value
Measurement angle	TH	Measurement angle
The following measurement data is for Region 0.		
Judgement	R00JG	Judgement result (-2: Not measured -1: NG 0: OK)
Edge position	R00X	X coordinate of edge position
Edge position	R00Y	Y coordinate of edge position
Reference position	R00SX	X coordinate of reference position
Reference position	R00SY	Y coordinate of reference position
The following measurement data is for Region 1.		
Judgement	R01JG	Judgement result (-2: Not measured -1: NG 0: OK)
Edge position	R01X	X coordinate of edge position
Edge position	R01Y	Y coordinate of edge position
Reference position	R01SX	X coordinate of reference position
Reference position	R01SY	Y coordinate of reference position

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
The following measurement data is for unit	
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Scroll X
2	Scroll Y
3	Scroll θ
4	X coordinate of measurement value
5	Y coordinate of measurement value
6	Measurement angle
The following measurement data is for Region 0.	
7	Judgement result (-2: Not measured -1: NG 0: OK)
8	X coordinate of edge position
9	Y coordinate of edge position
10	X coordinate of reference position
11	Y coordinate of reference position
The following measurement data is for Region 1.	
12	Judgement result (-2: Not measured -1: NG 0: OK)
13	X coordinate of edge position
14	Y coordinate of edge position
15	X coordinate of reference position
16	Y coordinate of reference position

■ Setting Data

Data type	Details
20	Measurement image (0: Image 0 1: Image 1)
21	Displacement direction (0 to 16) (See *1.)
The following settings data is for Region 0.	
22	Edge detection direction (0: ↑ 1: ↓ 2: → 3: ←)
23	Edge color (0: Light → Dark 1: Dark → Light)
24	X upper limit (-9,999.999 to 9,999.999)
25	X lower limit (-9,999.999 to 9,999.999)
26	Y upper limit (-9,999.999 to 9,999.999)
27	Y lower limit (-9,999.999 to 9,999.999)
28	Edge level (0 to 100)
39	Noise level (0 to 255)
30	Noise width (0 to 255)

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Data type	Details
31	Region upper left X (0 to X_MAX) (See *2.)
32	Region upper left Y (0 to Y_MAX) (See *2.)
33	Region lower right X (0 to X_MAX) (See *2.)
34	Region lower right Y (0 to Y_MAX) (See *2.)
35	Reference position X (0 to X_MAX) (See *2)
36	Reference position Y (0 to Y_MAX) (See *2)
The following settings data is for Region 1.	
37	Edge search direction (0: ↑ 1: ↓ 2: → 3: ←)
38	Edge color (Light → Dark, Dark → Light)
39	X upper limit (-9,999.999 to 9,999.999)
40	X lower limit (-9,999.999 to 9,999.999)
41	Y upper limit (-9,999.999 to 9,999.999)
42	Y lower limit (-9,999.999 to 9,999.999)
43	Edge level (0 to 100)
44	Noise level (0 to 255)
45	Noise width (0 to 255)
46	Region upper left X (0 to X_MAX) (See *2.)
47	Region upper left Y (0 to Y_MAX) (See *2.)
48	Region lower right X (0 to X_MAX) (See *2.)
49	Region lower right Y (0 to Y_MAX) (See *2.)
50	Reference position X (0 to X_MAX) (See *2)
51	Reference position Y (0 to Y_MAX) (See *2)

*1: The displacement direction settings are shown in the following table.

Data type	Skipping X	Skipping Y	Displacement θ
0	None	None	None
1	Displacement compensation region 0	None	None
2	Displacement compensation region 0	Displacement compensation region 0	None
3	Displacement compensation region 0	Displacement compensation region 1	None
4	None	Displacement compensation region 0	None
5	Displacement compensation region 1	None	None
6	Displacement compensation region 1	Displacement compensation region 0	None
7	Displacement compensation region 1	Displacement compensation region 1	None
8	None	Displacement compensation region 1	None
9	Midpoint	None	None
10	None	Midpoint	None
11	Midpoint	Midpoint	None

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Data type	Skipping X	Skipping Y	Displacement θ
12	Displacement compensation region 0	Midpoint	None
13	Midpoint	Displacement compensation region 0	None
14	Displacement compensation region 1	Midpoint	None
15	Midpoint	Displacement compensation region 1	None
16	Midpoint	Midpoint	Relative angle

*2: The range varies depending on the controller model.

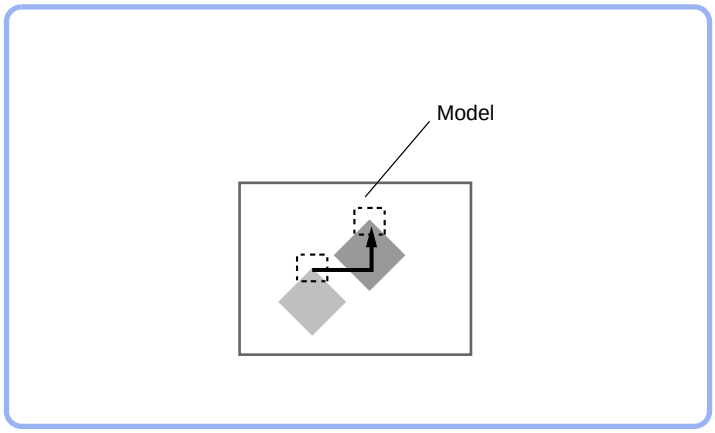
Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

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Model Positions Compensation

The Model Position Compensation processing item is used to detect features (called a model) of the measurement object on the screen and perform position compensation. This processing item is suitable for position compensation of measurement objects with marks, protruding portions, or other characteristic features.

Position compensation can be performed even if the measurement object is at an angle.



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Operational Flow

Changing Measurement Conditions 3

Setting Position Displacement Compensation Regions 4

Setting the Displacement Direction 8

Changing Detailed Conditions 9

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- Submenus for Expressions 12
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Model position compensation uses the image stored at [Image 0] as the measurement image; there is no menu for selecting the measurement image. The results of the position displacement compensation (scrolling) are executed for both [Image 0] and [Image 1].

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Changing Measurement Conditions

Change the measurement conditions if position displacement compensation is required in the rotation direction.

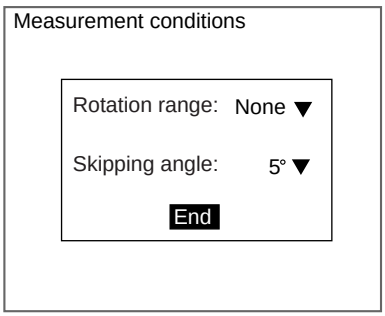
A search is performed using a model that rotates in skipping angle increments within the rotation range.

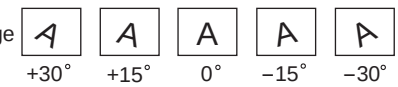
Search processing p.9

▶ [Model pos. comp/Measurement conditions]

1. Set each item.

2. Select [End].

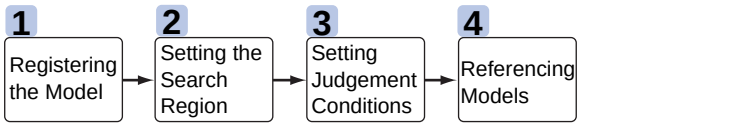


Setting item	Selection	Details	
Rotation range	None (default setting) ±5° ±15° ±30° ±45° 0±15° 180±15° 0±30° 180±30° All angles	Select the range for model rotation.	A search is performed using a model that rotates in skipping angle increments within the rotation range. Example: Rotation range: Creates a model that rotates 15° at a time between -30° and 30°. (Coordinate system: Left-hand) Image  +30° +15° 0° −15° −30°
Skipping angle	1° 10° 2° 15° 3° 20° 5° 30° 6° (default setting: 5°)	Set the skipping angle for the model. The smaller the angle, the more precise the search. Processing time, however, will be longer.	

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Setting Position Displacement Compensation Regions

■ Operational Flow



1 Registering the Model

Register a characteristic portion as the model for position displacement compensation. When a model is registered, the center position of the model is registered as the search coordinates. This position becomes the reference position, so make sure the measurement object is in the correct position before registering the model.

CHECK!

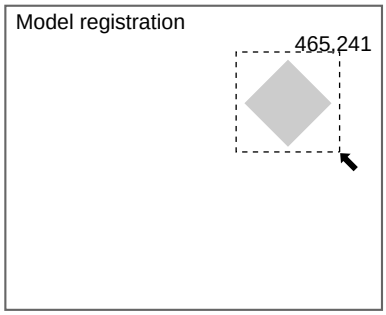
The size of the model that can be registered depends on [Verification] setting under Detailed conditions.
No search verification (default):15 × 9 to 70 × 66 pixels
With search verification: No limit
To register large models, change the detailed conditions before registering the model.
p.9

CHECK!

The model can also be registered using the DI signal (parallel interface).
SECTION 6 Communicating with External Devices, “Parallel Interface”

▶ [Model pos. comp/Positions compensation (No.)/Model registration]

1. Draw a box to show the region in which the model can be registered.
Specify the upper left and lower right coordinates.



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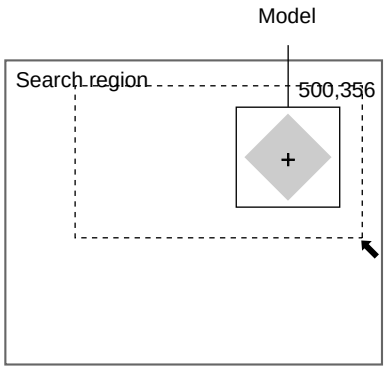
2 Setting the Search Region

Set the region in which the model is to be searched for.

▶ [Model pos. comp /Positions compensation (No.)/Search region]

1. Draw a rectangular search region.

Specify the upper left and lower right coordinates.



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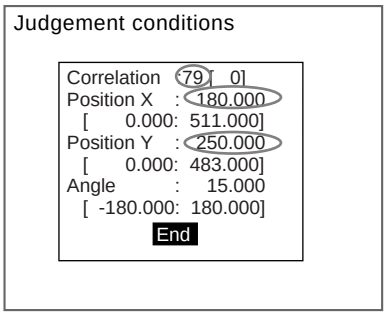
3 Setting Judgement Conditions

Set the judgement conditions for the correlation with the model and for the position (X, Y) where the object was detected.
Set a deviation for an OK judgement.

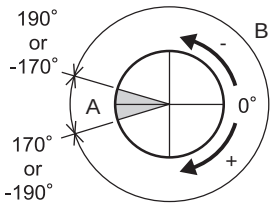
▶ [Model pos. comp /Positions compensation (No.)/Judgement conditions]

1. Set each item.

2. Select [End].



○ : The measurement results for the displayed image
Use these values as references in setting the upper and lower limits.

Setting data	Selection	Details
Correlation	0 to 100	Set the correlation lower limit. The judgement will be OK if the measured value is upper than this.
Position X	-9,999.999 to 9,999.999	Set the range of movement in the X direction for an OK judgement.
Position Y	-9,999.999 to 9,999.999	Set the range of movement in the Y direction for an OK judgement.
Angle	-360.000 to 360.000	Angle range for measurement object. Output in the range of –180.000 to 180.000. Two values between -360° and 360° can be set. The value on the right, however, must be higher than the value on the left. Example: When setting the following range A (coordinate system: left-hand)  Angle: [190 : 170] ○ OK [-190 : -170] ○ OK (Give the same result.) [170 : -170] × The value on the right is smaller. [-170 : -170] × Setting within the B range. The measurement value is output between -180° and 180°, so a measurement value of 190° becomes -170°.

Search
SECTION 7 Appendix, “Terminology”

CHECK!
Position Compensation judgement Results and Scrolling
OK: Image is scrolled.
NG: Scroll will not be performed. The overall judgement will be NG, regardless of the measurement result.

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4 Referencing Models

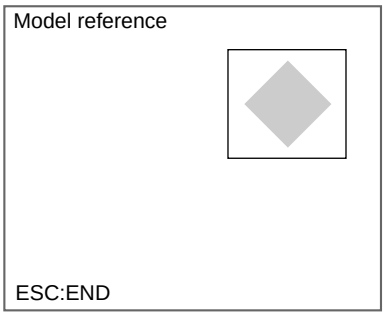
Models can be displayed on screen to check what kind of images are registered as models.

▶ [Model pos. comp/Positions compensation (No.)/Model reference]

1. Check the model.

The model will be displayed at the position where registered.

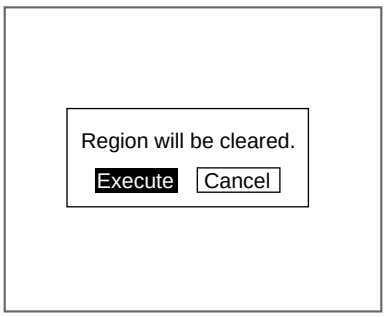
2. Press the ESC Key to exit.



Clearing the Settings

▶ [Model pos. comp/Positions compensation (No.)/Clear]

1. Select [End].

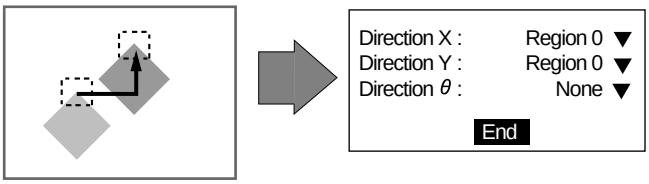


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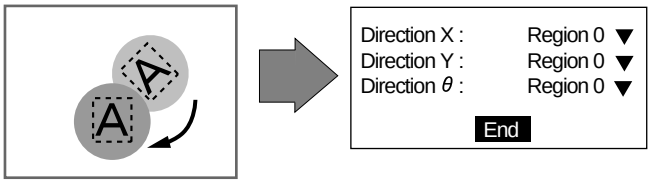
Setting the Displacement Direction

The direction function is used to select which region's measurement results will be used as the basis for position displacement compensation in the X, Y, and θ (rotation) directions.

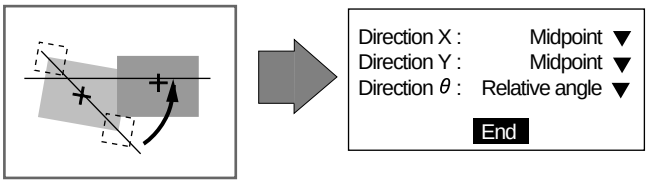
- Measurement Objects Not On An Angle (Example: When Only Region 0 Is Set)



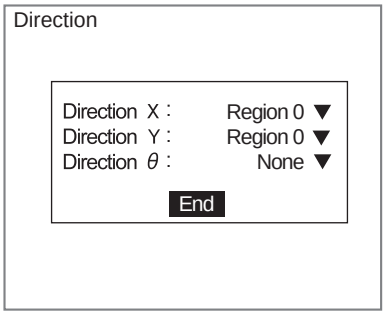
- Measurement Objects On An Angle (Example: When Only Region 0 Is Set)



- For Precision Position Compensation Using Measurement Object Angles (Example: When Region 0 and Region 1 Are Set)



▶ [Model pos. comp/Direction]



1. Set each item.

2. Select [End].

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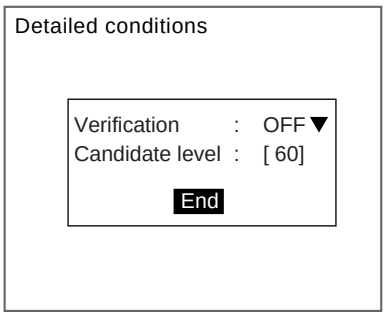
Changing Detailed Conditions

Change the detailed conditions if the detection of the registered model is unstable.
After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

▶ [Model pos. comp/Detailed conditions]

1. Set each item.

2. Select [End].



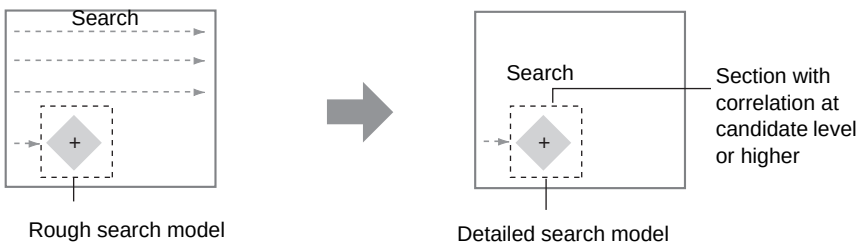
Setting data	Selection	Details
Search verification	OFF (default setting) ON	Set whether or not to perform further detailed verification near the position where the model was found. If [Verification] is set to [ON], the following two levels of search processing will be executed.
Candidate level	0 to 99 (default setting: 60)	This setting item is enabled only when [Verification] is set to [ON]. Set the correlation value for detailed search target images. Reduce the correlation level if the model searches are unstable. A detailed search will be performed on all images above this level in the rough.

CHECK!

Two levels of search processing

1. Rough search
   The rough search model is used to search every item in the measurement region.

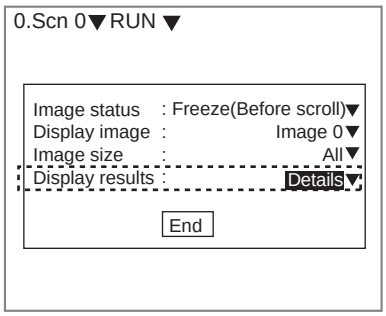
2. Detailed search
   Measures again using the detailed search model to compare to the images surrounding the section at the candidate level or higher.



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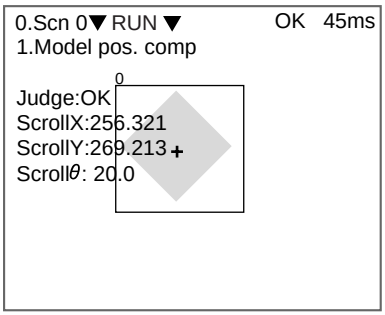
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.
Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed. Use the SHIFT+Right or Left Keys to switch in order between the two screens.

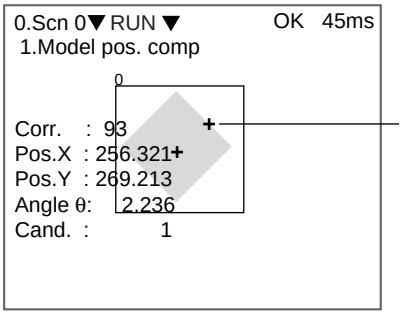
(1) Scroll Amount



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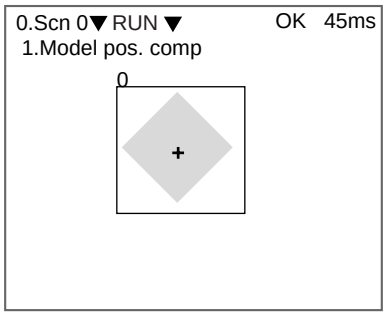
(2) Detailed Display

The measurement values for each region will be displayed.



(3) Position Display

Only the region will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
The following measurement data is for unit		
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Scroll X	DX	Scroll X
Scroll Y	DY	Scroll Y
Scroll θ	DT	Scroll θ
Measurement X	X	X coordinate of measurement value
Measurement Y	Y	Y coordinate of measurement value
Measurement angle	TH	Measurement angle
The following measurement data is for Region 0.		
Judgement	R00JG	Judgement result (-2: Not measured -1: NG 0: OK)
Correlation value	R00CR	Model correlation value
Search position	R00X	X coordinate of position where model found
Search position	R00Y	Y coordinate of position where model found
Measurement angle	R00TH	Angle of found model
The following measurement data is for Region 1.		
Judgement	R01JG	Judgement result (-2: Not measured -1: NG 0: OK)
Correlation value	R01CR	Model correlation value
Search position	R01X	X coordinate of position where model found
Search position	R01Y	Y coordinate of position where model found
Measurement angle	R01TH	Angle of found model

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
The following measurement data is for unit	
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Scroll X
2	Scroll Y
3	Scroll θ
4	X coordinate of measurement value
5	Y coordinate of measurement value
6	Measurement angle
The following measurement data is for Region 0.	
7	Judgement result (-2: Not measured -1: NG 0: OK)
8	Model correlation value
9	X coordinate of position where model found
10	Y coordinate of position where model found
11	Angle of found model
The following measurement data is for Region 1.	
12	Judgement result (-2: Not measured -1: NG 0: OK)
13	Model correlation value
14	X coordinate of position where model found
15	Y coordinate of position where model found
16	Angle of found model

■ Setting Data

Data type	Details
32	Displacement direction (0 to 18) (See *1.)
33	Rotation range (0: None 1: ±5° 2: ±15° 3: ±30° 4: ± 45° 5: 0±15° 180±15° 6: 0±30° 180±30° 7: All)
34	Skipping angle (0: 1° 1: 2° 2: 3° 3: 5° 4: 6° 5: 10° 6: 15° 7: 20° 8: 30°
35	Verification (0: ON 1: OFF)
36	Candidate level (0 to 99)
The following settings data is for Region 0.	
37	Model position upper left X (0 to 511)
38	Model position upper left Y (0 to 483)
39	Model position upper right X (0 to 511)

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Data type	Details
40	Model position upper right Y (0 to 483)
41	Search region upper left X (0 to 511)
42	Search region upper left Y (0 to 483)
43	Search region lower right X (0 to 511)
44	Search region lower right Y (0 to 483)
45	Correlation judgement (0 to 100)
46	X upper limit (-9999.9999 to 9,999.999)
47	X lower limit (-9999.9999 to 9,999.999)
48	Y upper limit (-9999.9999 to 9,999.999)
49	Y lower limit (-9999.9999 to 9,999.999)
50	Angle judgement upper limit (-360.00 to 360.00)
51	Angle judgement lower limit (-360.00 to 360.00)
The following settings data is for Region 1.	
52	Model position upper left X (0 to 511)
53	Model position upper left Y (0 to 483)
54	Model position upper right X (0 to 511)
55	Model position upper right Y (0 to 483)
56	Search region upper left X (0 to 511)
57	Search region upper left Y (0 to 483)
58	Search region lower right X (0 to 511)
59	Search region lower right Y (0 to 483)
60	Correlation judgement (0 to 100)
61	X upper limit (-9999.9999 to 9,999.999)
62	X lower limit (-9999.9999 to 9,999.999)
63	Y upper limit (-9999.9999 to 9,999.999)
64	Y lower limit (-9999.9999 to 9,999.999)
65	Angle judgement upper limit (-360.00 to 360.00)
66	Angle judgement lower limit (-360.00 to 360.00)

*1 The displacement direction settings are shown in the following table.

Data type	Skipping X	Skipping Y	Displacement θ
0	None	None	None
1	Displacement compensation region 0	None	None
2	Displacement compensation region 0	Displacement compensation region 0	None
3	Displacement compensation region 0	Displacement compensation region 1	None
4	None	Displacement compensation region 0	None
5	Displacement compensation region 1	None	None
6	Displacement compensation region 1	Displacement compensation region 0	None

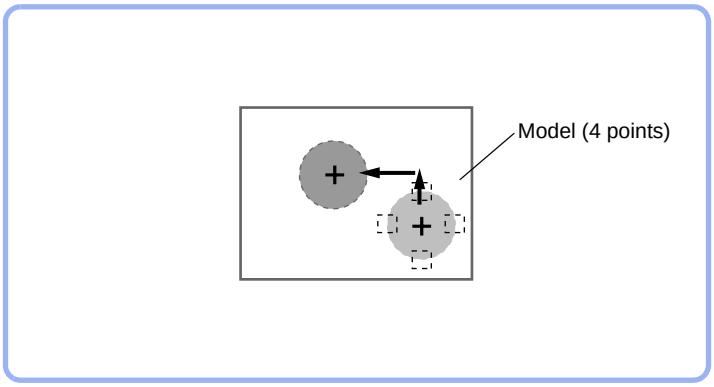
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Data type	Skipping X	Skipping Y	Displacement θ
7	Displacement compensation region 1	Displacement compensation region 1	None
8	None	Displacement compensation region 1	None
9	Midpoint	None	None
10	None	Midpoint	None
11	Midpoint	Midpoint	None
12	Displacement compensation region 0	Midpoint	None
13	Midpoint	Displacement compensation region 0	None
14	Displacement compensation region 1	Midpoint	None
15	Midpoint	Displacement compensation region 1	None
16	Displacement compensation region 0	Displacement compensation region 0	Displacement compensation region 0
17	Displacement compensation region 1	Displacement compensation region 1	Displacement compensation region 1
18	Midpoint	Midpoint	Relative angle

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Circle Position Compensation

The Circle Position Compensation processing item is useful for circular measurement objects (workpieces).
Registers four points on the circumference as the model, performs a search using this model, and detects and compensates the position displacement of the measurement object.
Position compensation can be performed even if the measurement object is at an angle.



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Operational Flow

Setting Position Displacement Compensation Regions 3

Not Rotate 4
1 Model 8
Defect (Circle) and Defect (Arc) 12
Circle angle 16

Changing Detailed Conditions 21

Referencing Models 22

Checking the Measurement Image 22

When you want to obtain measurement results externally 24

Submenus for Expressions 24
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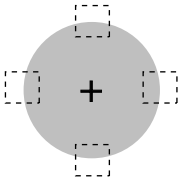
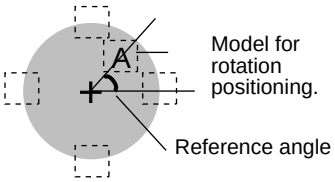
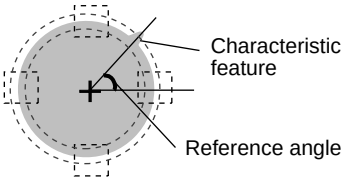
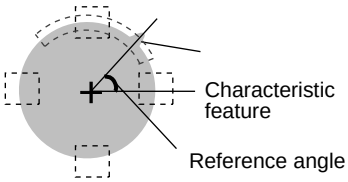
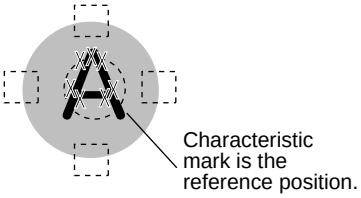
CHECK!

Circle position compensation uses the image stored at [Image 0] as the measurement image; there is no menu for selecting the measurement image. The results of the position displacement compensation (scrolling) are executed for both [Image 0] and [Image 1].

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Setting Position Displacement Compensation Regions

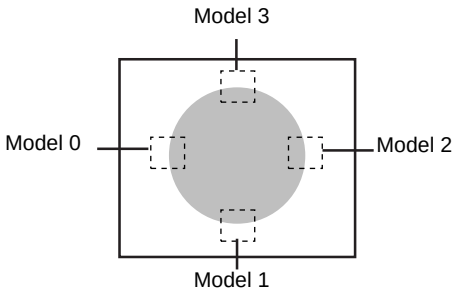
There are five methods available for circle position compensation.

Method	Details	Page
Not rotate	Registers four points on the circumference as the model, performs a search using this model, and detects and compensates the position displacement of the measurement object. 	p.4
1 model	Position displacement compensation can be performed in the rotation direction by registering a characteristic feature as the rotation positioning model. 	p.8
Defect (circle)	Position compensation can also be performed in the rotation direction by searching for characteristic features on the circumference using defect algorithms.The circumference (360°) will be the search region for defects. 	p.12
Defect (Arc)	Position compensation can also be performed in the rotation direction by searching for characteristic features on the circumference using defect algorythms.The angle range to search for defects can be specified. 	
Circle Angle	Another circle is drawn, in addition to the circle for external positioning. A characteristic feature on the circumference of the new circle can be used for position compensation in the rotation direction. 	p.16

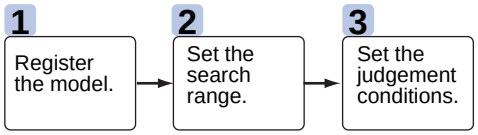
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Not Rotate

A model is registered using four points on the circumference. Using this model, the position displacement is detected and compensation performed.



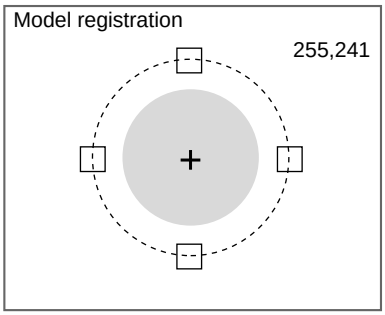
■ Operational Flow



1 Registering the Model

Register four points on the circumference as the model.

▶ [Circle pos. comp/Position compensation/Not rotate/Model registration]



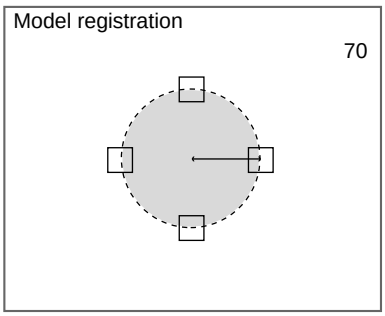
1. Specify the coordinates for the center of the circle.

Up/Down/Left/Right Keys: Move the display cursor.

2. Press the ENT Key.

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The screen for specifying the radius will be displayed.

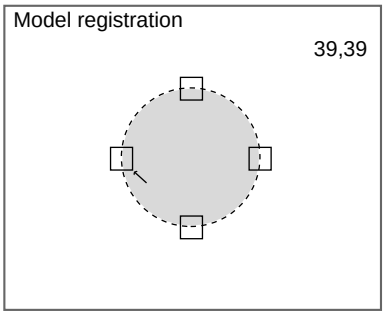


3. Specify the size of the circle.

Left Keys: Smaller
Right Keys: Larger

4. Press the ENT Key.

The screen for registering the size of the model will be displayed.



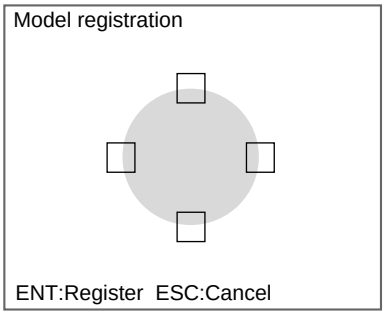
5. Adjust the size of the model.

Right Key: Increases the size horizontally.
Left Key: Decreases the size horizontally.
Down Key: Increases the size vertically.
Up Key: Decreases the size vertically.

When the size of model 0 is adjusted, models 1 to 3 will also change to the same size.

6. Press the ENT Key.

A confirmation message will be displayed.



7. Check that an appropriate position has been registered as the model.

8. Press the ENT Key.

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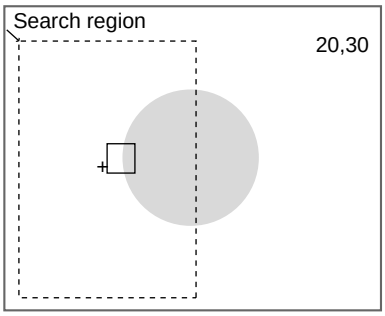
2 Setting the Search Region

Set the search region for each model.

▶ [Circle pos. comp/Position compensation/Not rotate/Search region]

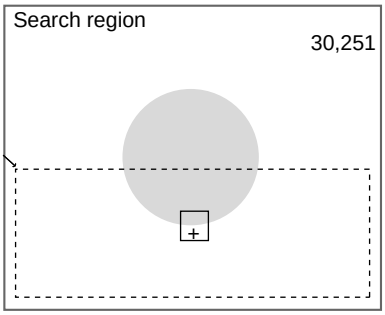
1. Draw a rectangular search region for model 0.

Specify the upper left and lower right coordinates.



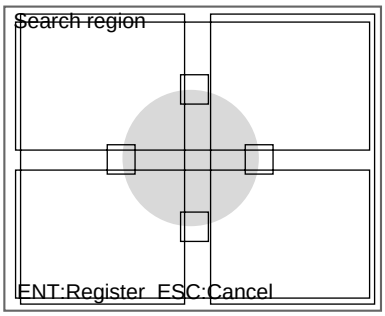
The Search Region Settings Screen for model 1 will be displayed.

2. Use the same method as for model 0 and set the search regions for each model.



Once the search regions have been set for all models, a registration confirmation screen will be displayed.

3. Press the ENT Key.



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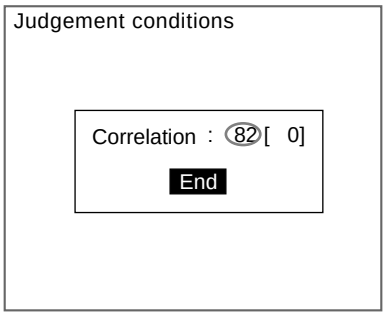
3 Setting Judgement Conditions

Set the conditions for judging the correlation of the measurement object to the model.
The judgement conditions will be shared by all 4 models.

▶ [Circle pos. comp/Position compensation/Not rotate/Judgement conditions]

1. Set the correlation value.

2. Select [End].



: Measurement results for the displayed image.
Use these values as a reference for setting upper and lower limits.

Setting data	Selection	Details
Correlation	0 to 100	Set the correlation lower limit. The judgement will be OK if the measured value is upper than this.

Search
SECTION 7 Appendix, “Terminology”

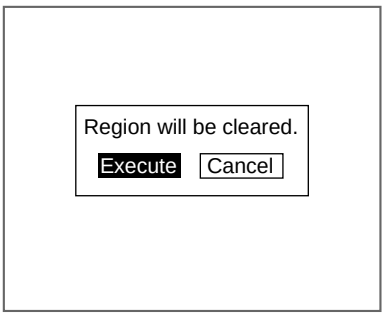
CHECK!
Position Compensation judgement Results and Scrolling
OK: Image is scrolled.
NG: Scroll will not be performed. The overall judgement will be NG, regardless of the measurement result.

Changing to Other Modes (Clearing Settings)

The settings must be cleared before changing to another mode.

▶ [Circle pos. comp/Position compensation/Not rotate/Clear]

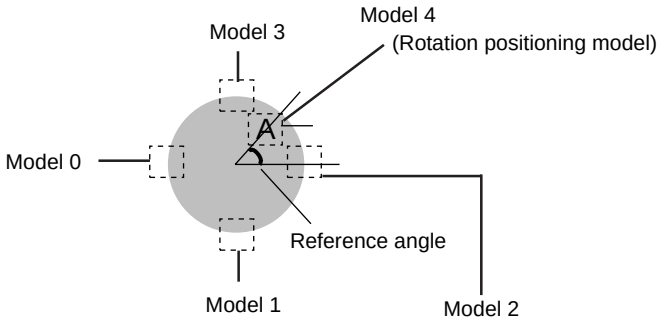
1. Select [End].



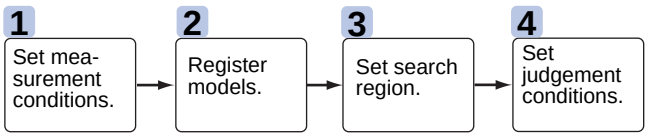
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1 Model

Position displacement compensation can be performed in the rotation direction by registering the characteristic features of a rotation positioning model other than models 0 to 3 on the circumference.



■ Operational Flow



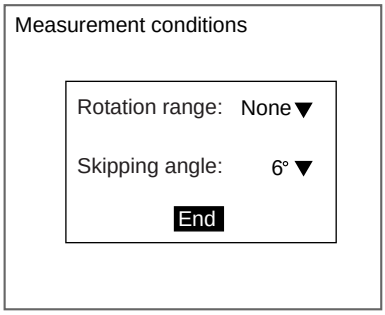
1 Setting Measurement Conditions

Set the conditions for searching for the rotation positioning model.

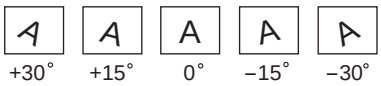
▶ [Circle pos. comp/Position compensation/1 model/Measurement conditions]

1. Set each item.

2. Select [End].



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Setting item	Selection	Details	
Rotation range	None (default setting) ±5° ±15° ±30° ±45° 0±15° 180±15° 0±30° 180±30° All angles	Select the range for model rotation.	A search is performed using a model that rotates in skipping angle increments within the rotation range. Example: Rotation range: Rotation range: ±30°, Skipping angle: 15° Create a model. Image  +30° +15° 0° −15° −30°
Skipping angle	1° 10° 2° 15° 3° 20° 5° 30° 6° (default setting)	Set the skipping angle for the model.The smaller the angle, the more precise the search. Processing time, however, will be longer.	

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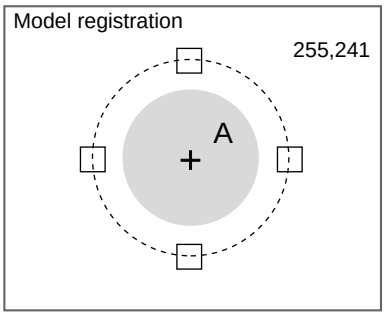
2 Registering the Model

Register four points on the circumference and the rotation positioning model.

▶ [Circle pos. comp/Position compensation/1 model/Model registration]

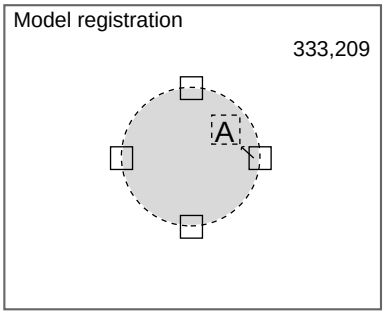
1. Designate the models at the four points on the circumference in the same way as steps **1.** to **6.** given in [Not Rotate].
p.4

2. Press the ENT Key.



The registration frame for model 4 will be displayed.

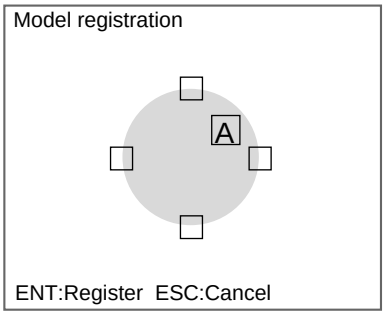
3. Enclose the rotation positioning mark.



A confirmation message will be displayed.

4. Check that an appropriate position has been registered as the model.

5. Press the ENT Key.



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3 Setting the Search Region

Set the search region for each model.

The settings method is the same as for Not Rotate.

p.6

4 Setting Judgement Conditions

Set the conditions for judging the correlation of the measurement object to the model.

The judgement conditions will be shared by all 5 models.

Set the range between 0 and 100, with 100 for objects that perfectly match the model.

If the correlation is equal to or above the judgement condition set here, the judgement result will be OK.

The settings method is the same as for Not Rotate.

p.7

CHECK!

Position Compensation judgement Results and Scrolling

OK: Image is scrolled.

NG: Scroll will not be performed.The overall judgement will be NG, regardless of the measurement result.

Changing to Other Modes (Clearing Settings)

The settings must be cleared before changing to another mode.

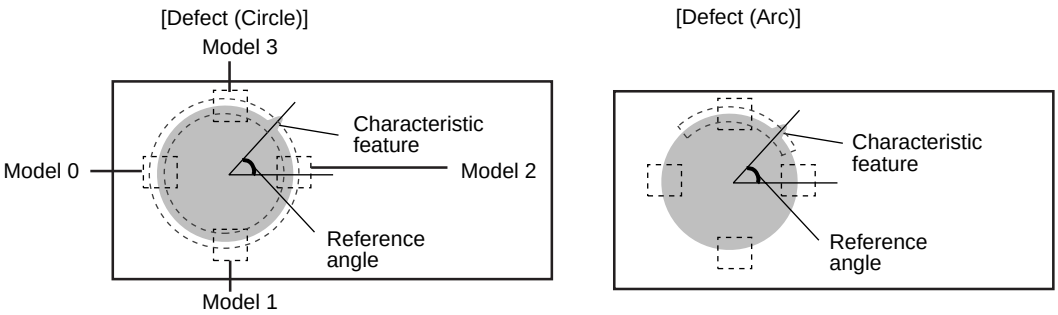
The settings method is the same as for Not Rotate.

p.7

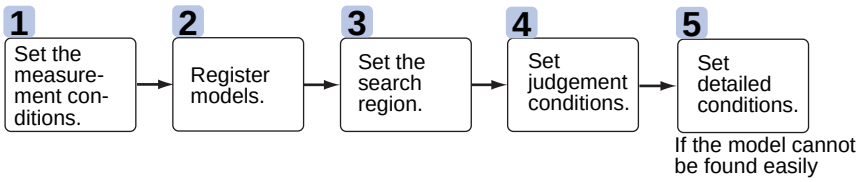
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Defect (Circle) and Defect (Arc)

Position compensation can also be performed in the rotation direction by searching for characteristic features on the circumference using defect algorithms.
The difference between defect (circle) and defect (arc) is the search region. For circles, the circumference (360°) is searched and for arcs, an angle range is specified.



■ Operational Flow



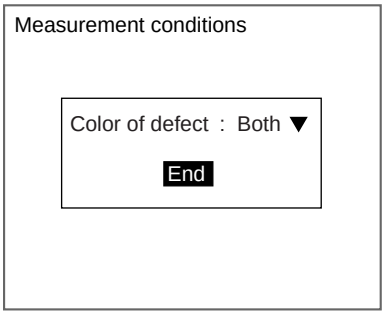
1 Setting Measurement Conditions

Select the color of the rotation positioning tag (the section to be detected as a defect).

▶ [Circle pos. comp/Position compensation/Defect(Circle) or Defect(Arc)/Measurement conditions]

1. Select the defect color.

2. Select [End].



Setting data	Selection	Details
Defect color	Black	For defects that appear black compared to the background.
	White	For defects that appear white compared to the background.
	Both (default setting)	For defects not necessarily white or black.

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2 Registering the Model

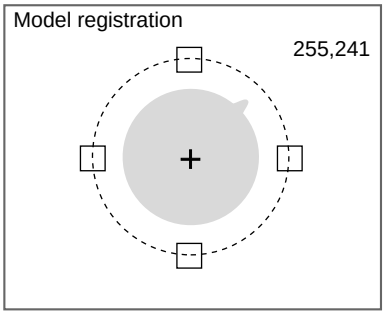
Register 4 points on the circumference and the region in which to search for the rotation positioning tag.

▶ [Circle pos. comp/Position compensation/Defect(Circle) or Defect(Arc)/Model registration]

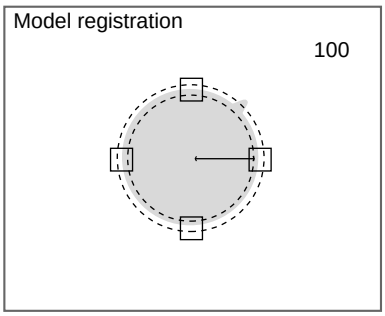
1. Designate the models at the four points on the circumference in the same way as steps **1.** to **6.** given in [Not Rotate].

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2. Press the ENT Key.



A settings screen for the rotation positioning range will be displayed.

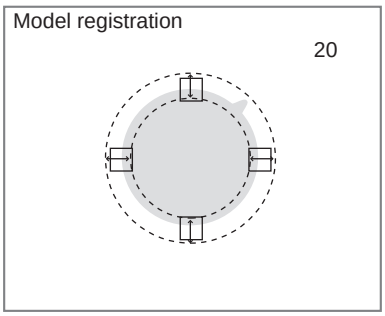


3. Specify the size of the circle.

Left Keys: Smaller
Right Keys: Larger

4. Press the ENT Key.

The screen for registering the width will be displayed.



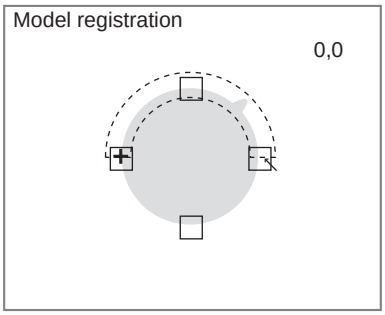
5. Specify the width.

Right/Up Keys: Increase the width.
Left/Down Keys: Decrease the width.

6. Press the ENT Key.

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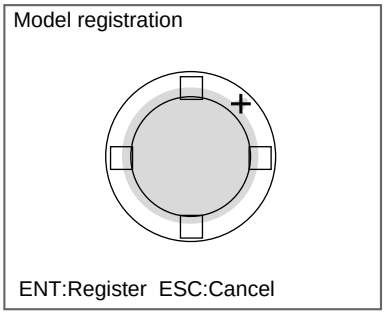
If Defect (Arc) has been selected, a screen for specifying the start and end points of the arc will be displayed.
If Defect (Circle) has been selected, move to **8.**



7. Specify the start and end points of the arc, keeping in mind the rotation angle.

A confirmation message will be displayed.

CHECK! A display cursor will appear at the position where the defect has been detected.



8. Check that an appropriate position has been registered as the model.

9. Press the ENT Key.

3 Setting the Search Region

Set the search region for each model.
The settings method is the same as for Not Rotate.
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4 Setting Judgement Conditions

Set the conditions for judging the correlation of the measurement object to the model.
The judgement conditions will be shared by all 4 models.
Set the range between 0 and 100, with 100 for objects that perfectly match the model.
If the correlation is equal to or above the judgement condition set here, the judgement result will be OK.
The settings method is the same as for Not Rotate.
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CHECK! Position Compensation judgement Results and Scrolling
OK: Image is scrolled.
NG: Scroll will not be performed. The overall judgement will be NG, regardless of the measurement result.

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5 Setting Detailed Conditions

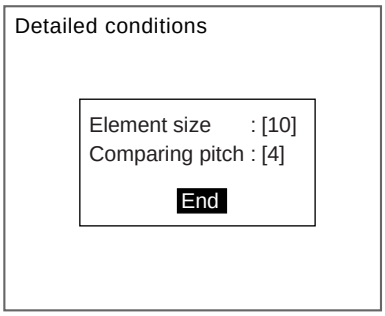
Adjust the detailed conditions if detection of the rotation positioning tag is unstable.

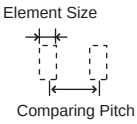
CHECK! Re-register the model if the detailed conditions have been changed.

▶ [Circle pos. comp/Position compensation/Defect(Circle) or Defect(Arc)/Detailed conditions]

1. Set each item.

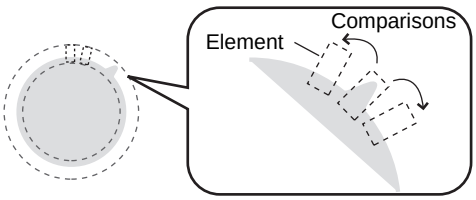
2. Select [End].



Setting data	Selection	Details
Element Size	4 to 80 (default setting: 10)	Set the pitch at which element sizes are to be compared. 
Comparing Pitch	1 to 6 (default setting: 4)	

CHECK! Element Sizes and Comparing Pitch

When a region is drawn on the circumference, a box (element) is automatically drawn inside the region. The density of each element is calculated and the position of defects is detected by comparing the element with surrounding elements and looking at differences in densities.



The densities of neighboring elements are compared and the difference in density becomes the element defect value for the element with the greater density.
The element with the largest defect value is recognized as the characteristic portion for rotation positioning.

Changing to Other Modes (Clearing Settings)

The settings must be cleared before changing to another mode.

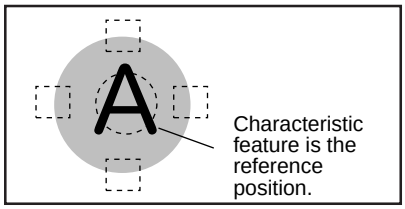
The settings method is the same as for Not Rotate.

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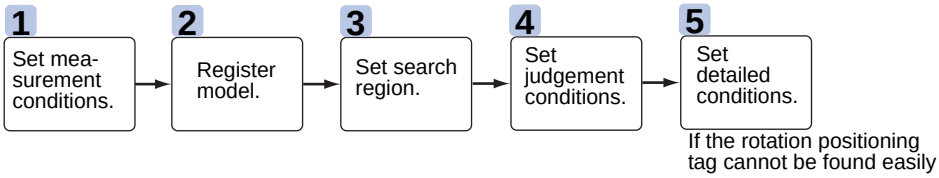
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Circle angle

Draw another circle in addition to models 0 to 3 on circumference. A characteristic feature on the circumference of the new circle can be used for position compensation in the rotation direction.



■ Operational Flow



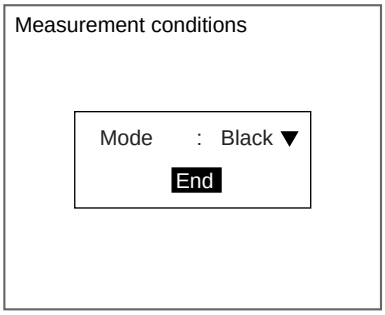
1 Setting Measurement Conditions

Set the conditions for detecting the feature on the circumference.

▶ [Circle pos. comp/Position compensation/Circular angle/Measurement conditions]

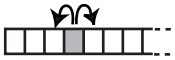
1. Select the mode.

2. Select [End].



Setting data	Selection	Details
Mode	Black (default setting)	Uses the low density (black) points.
	White	Uses the high density (white) points.

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Setting data	Selection	Details
Mode	Black	Compares the density with surrounding pixels and uses the point with the largest difference (where the density decreases suddenly). 
	White	Compares the density with surrounding pixels and uses the point with the largest difference (where the density increases suddenly). 
	Edge	Compares the density with surrounding pixels and uses the point with the largest difference (where the density decreases/increases suddenly).

2 Registering the Model

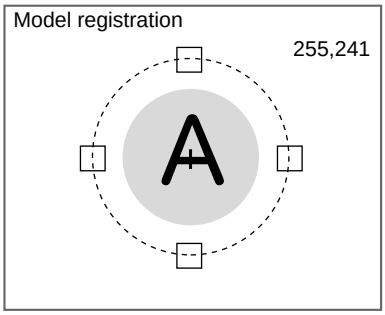
Register 4 points on the circumference and a circle for detecting the characteristic feature.

▶ [Circle pos. comp/Position compensation/Circular angle/Model registration]

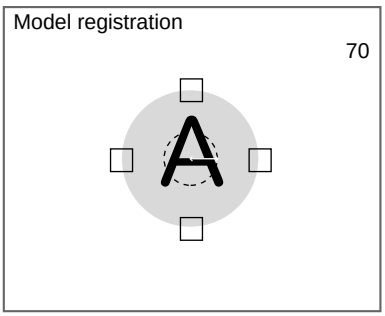
1. Designate the models at the four points on the circumference in the same way as steps **1.** to **6.** given in [Not Rotate].

p.4

2. Press the ENT Key.



A screen for setting the circle for rotation positioning will be displayed.



3. Specify the size of the circle.

Left Keys: Smaller
Right Keys: Larger

4. Press the ENT Key.

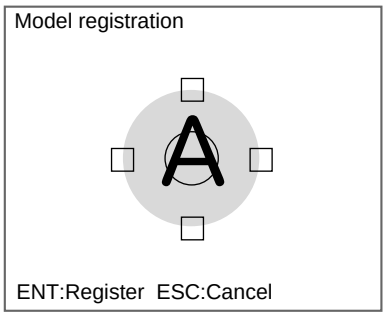
CHECK! If the number of circles is set to 2 under Detailed conditions, the screen for drawing another circle will be displayed.

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A confirmation message will be displayed.

5. Check that an appropriate position has been registered as the model.

6. Press the ENT Key.



3 Setting the Search Region

Set the search region for each model.
The settings method is the same as for Not Rotate.

p.6

4 Setting Judgement Conditions

Set the conditions for judging the correlation of the measurement object to the model.
The judgement conditions will be shared by all 4 models.
Set the range between 0 and 100, with 100 for objects that perfectly match the model.
If the correlation is equal to or above the judgement condition set here, the judgement result will be OK.
The settings method is the same as for Not Rotate.

p.7

CHECK!

Position Compensation judgement Results and Scrolling
OK: Image is scrolled.
NG: Scroll will not be performed.The overall judgement will be NG, regardless of the measurement result.

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5 Setting Detailed Conditions

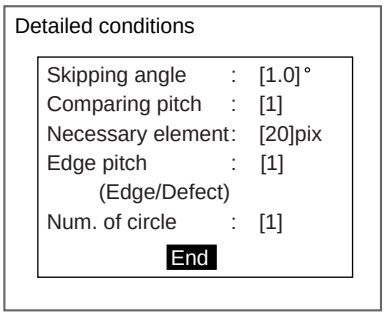
Adjust the detailed conditions if detection of the rotation positioning tag is unstable.

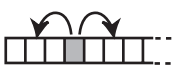
CHECK! Re-register the model if the detailed conditions have been changed.

▶ [Circle pos. comp/Position compensation/Circular angle/Detailed conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details	
Skipping angle	0.4 to 2.0	Set the angle to skip between point extractions. The density of all points on the circumference corresponding to the skipping angle will be measured. The most suitable value for the radius of the circle that was drawn will be set automatically. The larger the setting, the fewer points will be extracted. This will increase processing speed, but decrease detection and rotation accuracy.	
Comparing Pitch	1 to 9 (default setting: 1)	Select the number of registered detection points on the input image that are to be compared to the reference image. The larger the setting, the larger the detection interval. This will increase processing speed, but decrease detection accuracy.	
Compared Pixels	1 to 99 (default setting: 20)	Set how many points (pixels) out of the characteristic feature detected using the mode set under Measurement conditions will be registered for comparison. The smaller the setting, the fewer points will be compared. This will increase processing speed, but decrease detection accuracy. If two or more points of the same conditions exist, all of them will be registered even if the set number of points has been reached.	
		Black	Set points in order from the lowest density until the set number of points is reached.
		White	Set points in order from the highest density until the set number of points is reached.
		Black	Registers points in order, starting from the one with the highest density difference against the surrounding pixels (i.e. the one where the density decreases suddenly), until the set number of points is reached.
		White	Registers points in order, starting from the one with the highest density difference against the surrounding pixels (i.e. the one where the density increases suddenly), until the set number of points is reached.
		Edge	Registers points in order, starting from the one with the highest density difference against the surrounding pixels (i.e. the one where the density increases/decreases suddenly), until the set number of points is reached.
Edge Pitch	1 to 9 (default setting: 1)	Set the pitch to obtain the density difference. The edge pitch setting is enabled only when [Black defect], [White defect], or [Edge] are selected as the mode under [Measurement conditions]. Example: Mode: Black defect Edge Pitch: 2  Compares the density with a point two pixels away.	

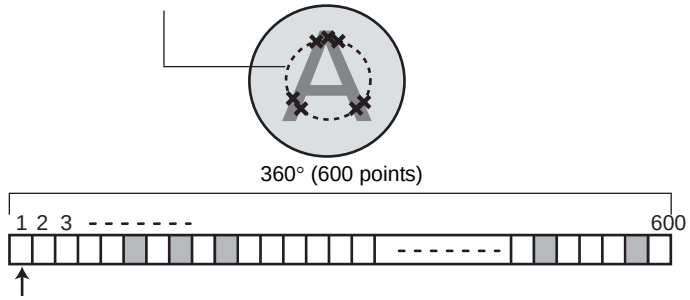
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Setting data	Selection	Details
Number of Circles	1 to 2 (default setting: 1)	Set the number of circles for detecting the rotation positioning tag.(1 or 2 (1*)) The number of circles that can be drawn on the Model Registration Screen will be limited to the number set here. If the number is set to 2, the detection accuracy will increase but processing will take longer.

CHECK! If the skipping angle has been changed, it cannot return to the automatically set values even if the model is re-registered.
To automatically set the most suitable value for the radius after the skipping angle has been changed, clear the settings first and then re-register the model.

- Skipping angle

A total of 600 points are detected on this line.

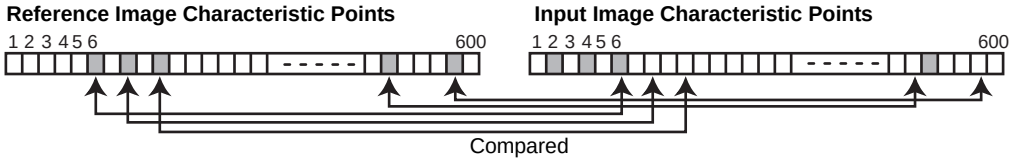


- Comparing pitch.

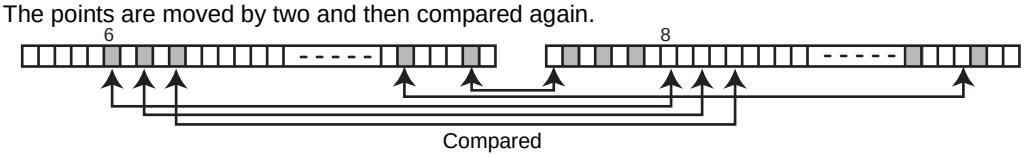
The characteristic points (here, black points) on the reference image are compared to those on the input image shifting two points at a time



Comparison is started from the reference image characteristic features with the lowest number.



The points are moved by two and then compared again.



Changing to Other Modes (Clearing Settings)

The settings must be cleared before changing to another mode.

The settings method is the same as for Not Rotate.

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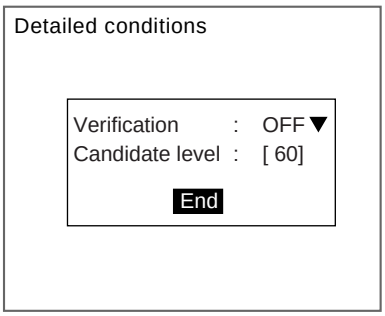
Changing Detailed Conditions

Change the detailed conditions if the detection of the registered model is unstable.
After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

▶ [Circle pos. comp/Detailed conditions]

1. Set each item.

2. Select [End].



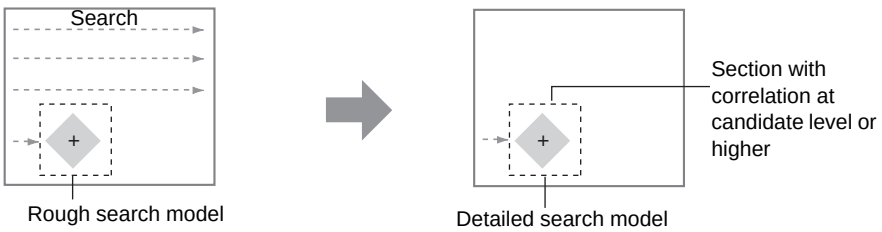
Setting data	Selection	Details
Search verification	OFF (default setting) ON	Set whether or not to perform further detailed verification near the position where the model was found. If [Verification] is set to [ON], the following two levels of search processing will be executed.
Candidate level	0 to 99 (default setting: 60)	This setting item is enabled only when [Verification] is set to [ON]. Set the correlation value for detailed search target images. Reduce the correlation level if the model searches are unstable. A detailed search will be performed on all images above this level in the rough.

CHECK!

Two levels of search processing

1. Rough search
   The rough search model is used to search every item in the measurement region.

2. Detailed search
   Measures again using the detailed search model to compare to the images surrounding the section at the candidate level or higher.

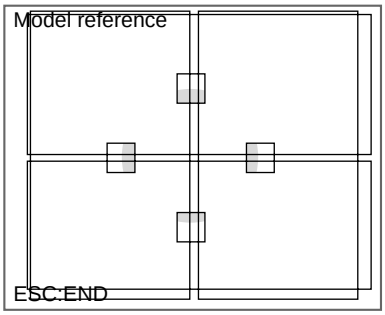


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Referencing Models

Models can be displayed on screen to check what kind of images are registered as models.

▶ [Circle pos. comp/Model reference]

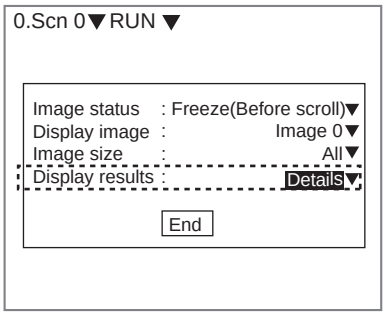


1. Check the model.

2. Press the ESC Key to exit.

Checking the Measurement Image

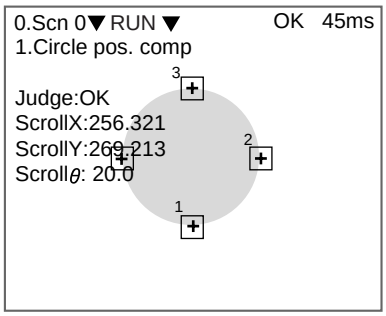
Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.
Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed. Use the SHIFT+Right or Left Keys to switch in order between the two screens.

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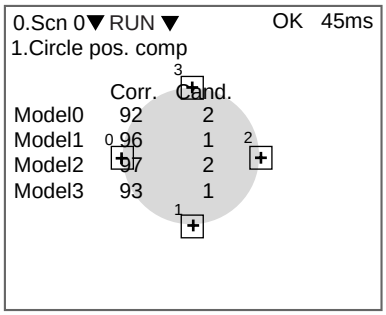
(1) Scroll Amount



(2) Detailed Display

The correlation values for each model will be displayed.

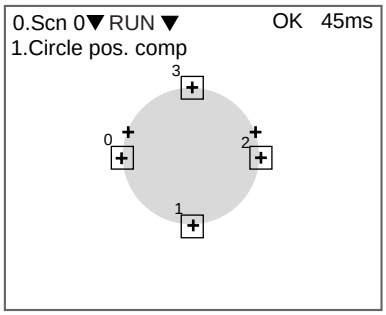
If search verification is set to ON, the number of points detected as candidates will be displayed.



(3) Position Display

Only the model frame will be displayed.

If search verification is set to ON, a display cursor will indicate the candidates.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
The following measurement data is for unit		
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Scroll X	DX	Scroll X
Scroll Y	DY	Scroll Y
Scroll θ	DT	Scroll θ
Measurement X	X	X coordinate of measurement value
Measurement Y	Y	Y coordinate of measurement value
Measurement angle	TH	Measurement angle
The following measurement data is for Model N (0 to 4).		
Judgement	R**JG	Judgement result (-2: Not measured -1: NG 0: OK)
Correlation value	R**CR	Model correlation value
Search position X	R**X	X coordinate of position where model found
Search position Y	R**Y	Y coordinate of position where model found

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
The following measurement data is for unit	
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Scroll X
2	Scroll Y
3	Scroll θ
4	X coordinate of measurement value
5	Y coordinate of measurement value
6	Measurement angle
The following measurement data is for Model N (0 to 4).	
4N+7	Judgement result (-2: Not measured -1: NG 0: OK)
4N+8	Model correlation value
4N+9	X coordinate of position where model found
4N+10	Y coordinate of position where model found

■ Setting Data

Data type	Details
33	Verification (0: ON 1: OFF)
34	Candidate level (0 to 99)
35	Model correlation judgement value (0 to 100)
36	Circle center X coordinate (0 to 511)
37	Circle center Y coordinate (0 to 483)
38	Radius (0 to 232)
39	Model width WX (15 to 67)
40	Model width WY (15 to 466)
The following measurement data is for Model N (0 to 3).	
4N+41	Search region upper left X (0 to 511)
4N+42	Search region upper left Y (0 to 483)
4N+43	Search region lower right X (0 to 511)
4N+44	Search region lower right Y (0 to 483)
The following settings data is for [1 Model] measurement.	
57	Rotation range (0: None 1: ±5° 2: ±15° 3: ±30° 4: ± 45° 5: 0±15° 180±15° 6: 0±30° 180±30° 7: All)

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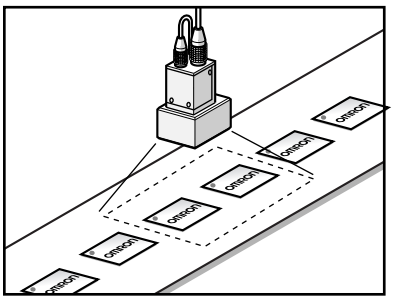
Data type	Details
58	Skipping angle (0: 1° 1: 2° 2: 3° 3: 5° 4: 6° 5: 10° 6: 15° 7: 20° 8: 30°)
59	Model 4 position upper left X (14 to 497)
60	Model 4 position upper left Y (16 to 467)
61	Model 4 position lower right X (14 to 497)
62	Model 4 position lower right Y (16 to 467)
63	Model 4 search position upper left X (0 to 511)
64	Model 4 search position upper left Y (0 to 483)
65	Model 4 search position lower right X (0 to 511)
66	Model 4 search position lower right Y (0 to 483)
The following settings data is for [Defect (Circle)] and [Defect (Arc)] measurement.	
67	Defect color (0: White 1: Black 2: White and black)
68	Element size (4 to 80)
69	Comparing pitch (1 to 6)
70	Defect circle radius (20 to 242)
71	Defect circle width (3 to 39)
The following settings data is for [Defect (arc)] measurement.	
72	Start angle (arc) (-180.000 to 180.000)
73	End angle (arc) (-180.000 to 180.000)
The following settings data is for [Circle angle] measurement.	
74	Mode (0: Black 1: White 2: Black defect 3: White defect 4: Edge)
75	Circle 0 radius (circumference) (20 to 242)
76	Circle 1 radius (circumference) (20 to 242)
77	Skipping angle (0.4 to 2.0)
78	Comparing pitch (1 to 9)
79	Necessary number of elements (1 to 99)
80	Edge pitch (1 to 9)
81	Number of circles (1 or 2)

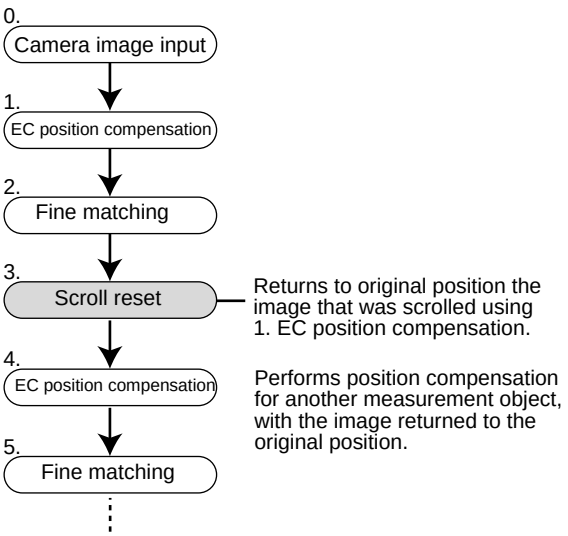
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Reset Scroll

The Reset Scroll processing item is used to return images that were scrolled using position displacement compensation to their original position (the position when read to the image buffer).
No other conditions need to be set when this processing item is added to the flowchart.

Example: To perform position displacement compensation separately on two measurement objects within the same field of vision.





CHECK!

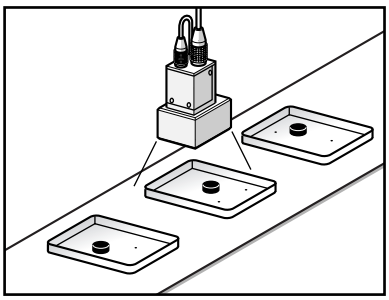
The scroll is reset for all Camera image input processing items, including [Camera Image] and [Switch Camera].

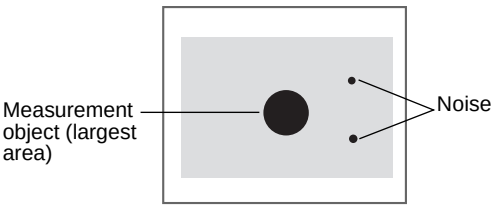
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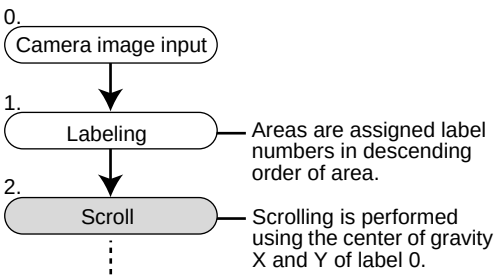
Scroll

The Scroll processing item scrolls an image based on the measured values from other units.
It can be used in combination with other general measurement processing items when the required results cannot be achieved with position compensation processing items.

Example: Position Compensation without Being Affected by Noise.







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Setting the Reference

Set expressions to specify the units and measured values to be used as the reference for scrolling.

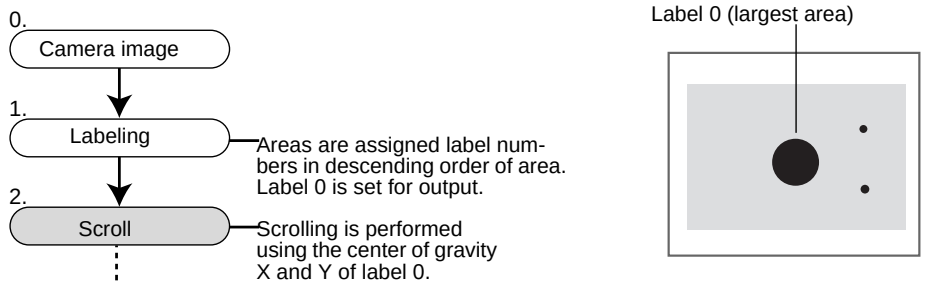
CHECK!

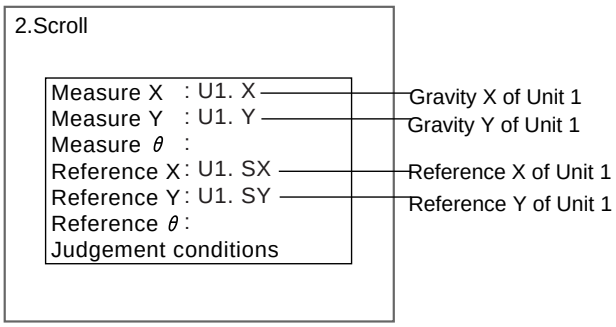
In the case of F500-C10, the reference position will be restricted depending on the scroll amount.

SECTION 7 Appendix, “Q & A, Position Compensation Items”

Setting data	Details
Measurement X	Scroll image in X direction for difference between reference X and value of this expression.
Measurement Y	Scroll image in Y direction for difference between reference Y and value of this expression.
Measure θ	Scroll image rotationally for difference between reference θ and value of this expression.
Reference X	Value of this expression is reference position for scrolling in X direction.
Reference Y	Value of this expression is reference position for scrolling in Y direction.
Reference θ	Value of this expression is reference position for scrolling rotationally.

Example: Scrolling Using [Labeling] in Unit 1 as the Reference



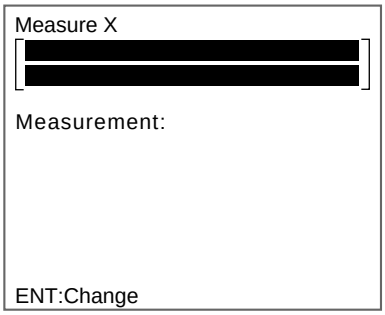


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The following example shows the procedure for using [measure X] for scrolling. This procedure can be adapted for setting expressions for other items.

▶ [Scroll/Measure X]

1. Place the cursor inside the square bracket and press the ENT Key.

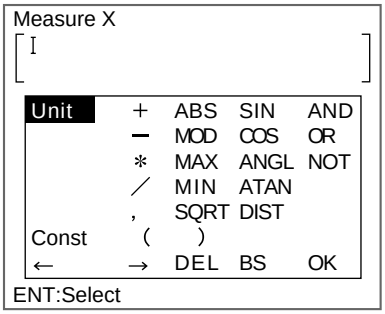


The setting items will be displayed.

2. Select the items to be set and set the expression.

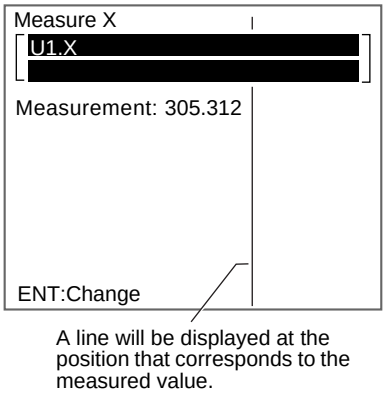
SECTION 2, 4.1 Calculation “Setting Expressions”

3. Once the expression has been set, select [OK].



The settings will be saved and the screen in **1.** will return.

4. Press the ESC Key.



A line will be displayed at the position that corresponds to the measured value.

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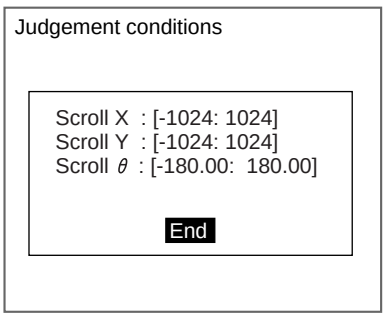
Setting judgement Conditions

judgement conditions are set for the scroll amount.
Set a deviation for an OK judgement.

▶ [Scroll/Judgement conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Scroll X	-1024 to 1024	X-direction scroll amount
Scroll Y	-1024 to 1024	Y-direction scroll amount
Scroll θ	-180.00 to 180.00	Rotational scroll amount

CHECK!

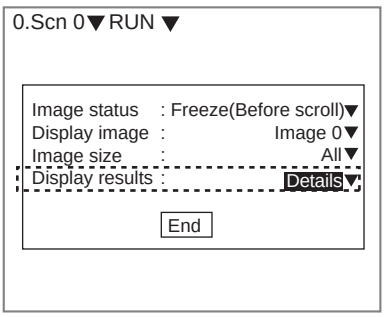
Scroll judgement Results and Scrolling
OK: Image is scrolled.
NG: Scroll will not be performed. The overall judgement will be NG, regardless of the measurement result.

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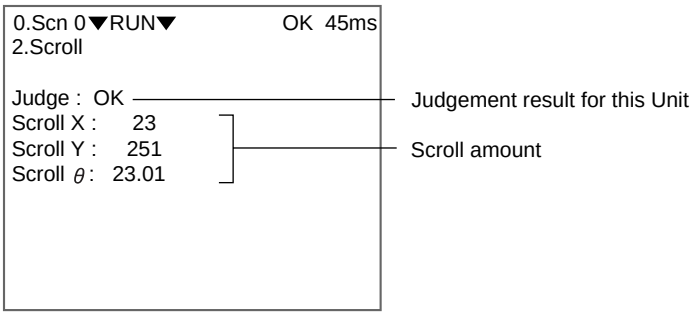
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Scroll X	DX	Scroll X
Scroll Y	DY	Scroll Y
Scroll θ	DT	Scroll θ
Measurement X	X	X coordinate of measurement value
Measurement Y	Y	Y coordinate of measurement value
Measurement angle	TH	Measurement angle
Reference X	SX	X coordinate of reference
Reference Y	SY	Y coordinate of reference
Reference angle	ST	Reference angle

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Scroll X
2	Scroll Y
3	Scroll θ
4	X coordinate of measurement value
5	Y coordinate of measurement value
6	Measurement angle
7	X coordinate of reference
8	Y coordinate of reference
9	Reference angle

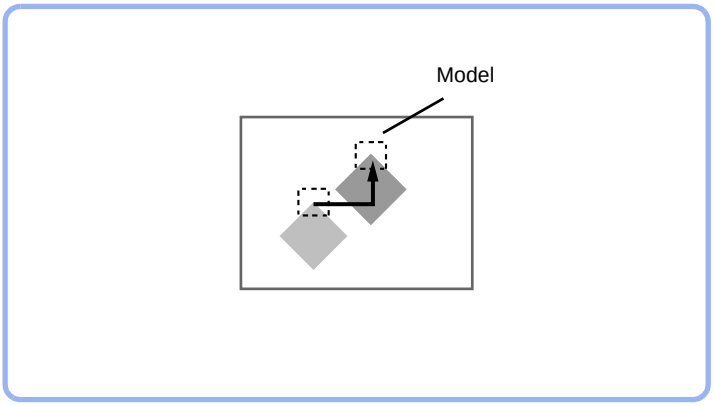
■ Setting Data

Data type	Details
32	Judgement upper limit for Scroll X (-1024 to 1024)
33	Judgement lower limit for Scroll X (-1024 to 1024)
34	Judgement upper limit for Scroll Y (-1024 to 1024)
35	Judgement lower limit for Scroll Y (-1024 to 1024)
36	Judgement upper limit for Scroll θ (-180.00 to 180.00)
37	Judgement lower limit for Scroll θ (-180.00 to 180.00)

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Model Positions Compensation

The Model Position Compensation processing item is used to detect features (called a model) of the measurement object on the screen and perform position compensation. This processing item is suitable for position compensation of measurement objects with marks, protruding portions, or other characteristic features.
Position compensation can be performed even if the measurement object is at an angle.



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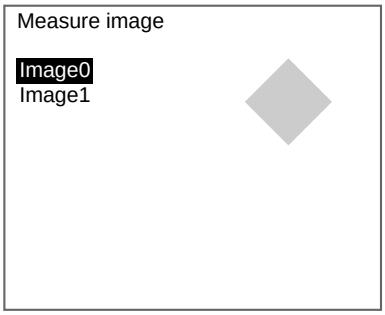
Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [Model pos. comp #/Measure image]

1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.



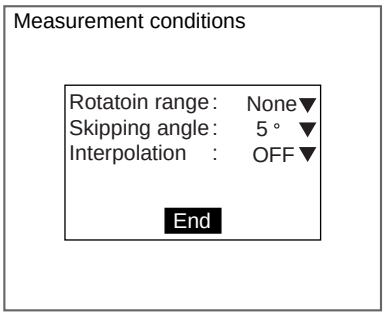
Changing Measurement Conditions

Change the measurement conditions if position displacement compensation is required in the rotation direction.
A search is performed using a model that rotates in skipping angle increments within the rotation range.

▶ [Model pos. comp #/Measurement conditions]

1. Set each item.

2. Select [End].



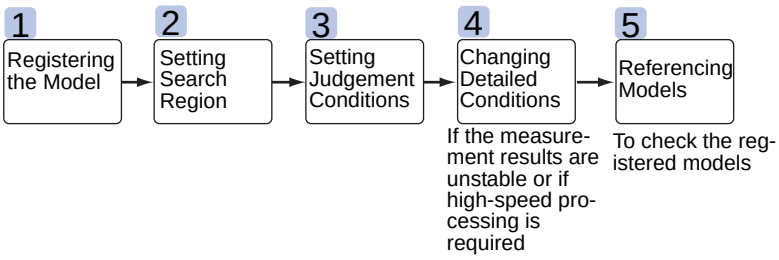
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Setting item	Selection	Details	
Rotation range	None (default setting) ±5° ±15° ±30° ±45° 0±15° 180±15° 0±30° 180±30° All angles	Select the range for model rotation.	A search is performed using a model that rotates in skipping angle increments within the rotation range. Example: Rotation range: Rotation range: ±30°, Skipping angle: 15° Create a model. (Coordinate system: Left-hand) Image  +30° +15° 0° −15° −30°
Skipping angle	1° 10° 2° 15° 3° 20° 5° 30° 6° (default setting)	Set the skipping angle for the model. The smaller the angle, the more precise the search. Processing time, however, will be longer.	
Angle interpolation	OFF (default setting) ON	Set the unit of the angle to be found. OFF: Finds the angle in units of skipping angle. ON: Finds the angle (value of up to the third decimal digit) based on the correlation value obtained in units of skipping angle. Processing time, however, will be longer.	

Setting Position Displacement Compensation Regions

Register an image pattern (called a model) in advance.
The part of an input image that is most similar to the model is found, the position is calculated in pixel units, and the degree of similarity is expressed with a correlation value. Perform processing directly on the density image taken by the Camera.

■ Operational Flow



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1 Registering the Model

Register a characteristic portion as the model for position displacement compensation. When a model is registered, the center position of the model is registered as the search coordinates. This position becomes the reference position, so make sure the measurement object is in the correct position before registering the model.

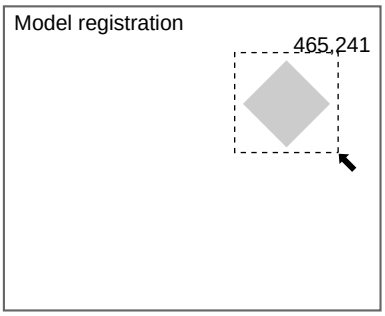
CHECK! In the case of F500-C10, the reference position will be restricted depending on the scroll amount.

SECTION 7 Appendix, “Q & A, Position Compensation Items”

▶ [Model pos. comp #/Positions compensation (No.)/Model registration]

1. Draw a box to show the region in which the model can be registered.

Specify the upper left and lower right coordinates.



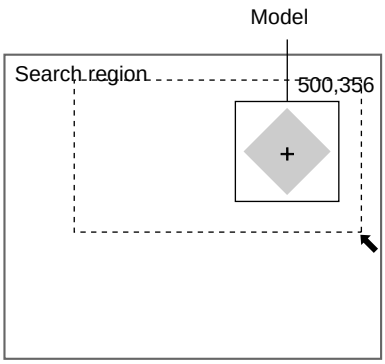
2 Setting the Search Region

Set the region in which the model is to be searched for.

▶ [Model pos. comp #/Positions compensation (No.)/Search region]

1. Draw a rectangular search region.

Specify the upper left and lower right coordinates.



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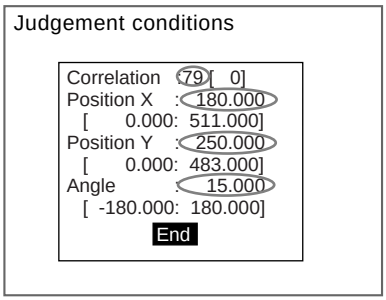
3 Setting Judgement Conditions

Set the judgement conditions for the correlation with the model and for the position (X, Y) where the object was detected.

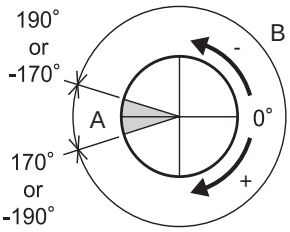
▶ [Model pos. comp #/Positions compensation (No.)/Judgement conditions]

1. Set each item.

2. Select [End].



: The measurement results for the displayed image.
Use these values as references in setting the upper and lower limits.

Setting data	Selection	Details
Correlation	0 to 100	Set the correlation lower limit. The judgement will be OK if the measured value is upper than this.
Position X	-9,999.999 to 9,999.999	Set the range of movement in the X direction for an OK judgement.
Position Y	-9,999.999 to 9,999.999	Set the range of movement in the Y direction for an OK judgement.
Angle	-360.000 to 360.000	Angle range for measurement object. Output in the range of –180.000 to 180.000. Two values between -360° and 360° can be set. The value on the right, however, must be higher than the value on the left. Example: When setting the following range A (coordinate system: left-hand)  Angle: [190 : 170] O OK [-190 : -170] O OK (Give the same result.) [170 : -170] X The value on the right is smaller. [-170 : -170] X Setting within the B range. The measurement value is output between -180° and 180°, so a measurement value of 190° becomes -170°.

Search
SECTION 7 Appendix, “Terminology”

CHECK!
Position Compensation judgement Results and Scrolling
OK: Image is scrolled.
NG: Scroll will not be performed. The overall judgement will be NG, regardless of the measurement result.

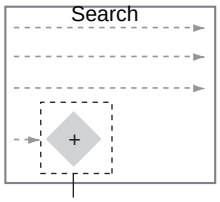
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4 Changing Detailed Conditions

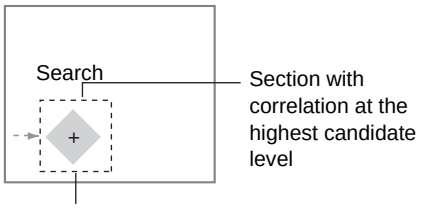
The search settings can be changed here. Change the conditions if the measurement results are unstable or if high-speed processing is required. Normally, the method can be left on the default setting. After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

The Controller performs the following 2-stage processing internally.

1. Rough search
   The rough search model is used to search every item in the measurement region.



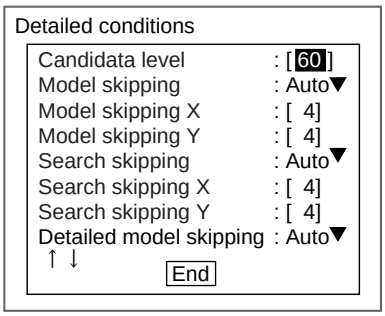
2. Detailed search
   Measures again using the detailed search model to compare to the images surrounding the section at the highest candidate level.



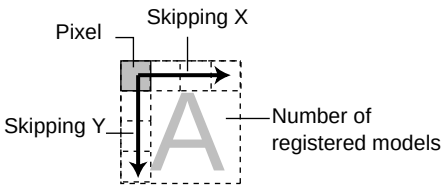
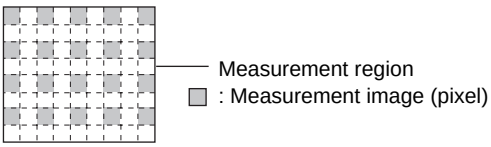
▶ [Model pos. comp #/Positions compensation (No.)/Detailed conditions]

1. Set each item.

2. Select [End].



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Setting data	Selection	Contents
Candidate level	0 to 100 (default setting: 60)	Set the reference level to be used for detailed search. A detailed search will be performed on all images that are above this level.
Model skipping Detailed model skipping	Change the number of pixels to be skipped for the search model (i.e. the number of pixels to be skipped from the registered models). [Model skipping] is used to set pixel skipping conditions for rough search models, and [Detailed model skipping] is used to set for detailed search models. The setting range is the same.  	
	Auto (default setting)	The controller sets the appropriate numbers (X, Y) of pixels to be skipped. The specified values will be displayed for model skipping X, Y (or detailed model skipping X, Y).
	Fixed	Specify the desired number of pixels to be skipped. The specified values will be reflected for model skipping X, Y (or detailed model skipping X, Y).
Model skipping X Detailed model skipping X	1 to 15	Set the number of pixels to be skipped in X direction. The changes made to the number of pixels to be skipped will be effective for the models that will be registered next time. They will not be effective for the models that have already been registered.
Model skipping Y Detailed model skipping Y	1 to 15	Set the number of pixels to be skipped in Y direction. The changes made to the number of pixels to be skipped will be effective for the models that will be registered next time. They will not be effective for the models that have already been registered.
Search skipping	Set the number of pixels to be skipped for rough search. The number of pixels to be skipped in the measurement region must be set. Example: When Skipping X: 2 and Skipping Y: 2  	
	Auto (default setting)	The controller sets the appropriate numbers (X, Y) of pixels to be skipped. The specified values will be displayed for search skipping X, Y.
	Fixed	Specify the desired number of pixels to be skipped. The specified values will be reflected for search skipping X, Y.
Search skipping X	1 to 15	Set the number of pixels to be skipped in X direction.
Search skipping Y	1 to 15	Set the number of pixels to be skipped in Y direction.

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5 Referencing Models

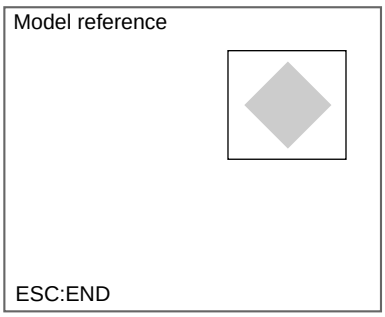
Models can be displayed on screen to check what kind of images are registered as models.

▶ [Model pos. comp #/Positions compensation (No.)/Model reference]

1. Referencing Models

The model will be displayed at the position where registered.

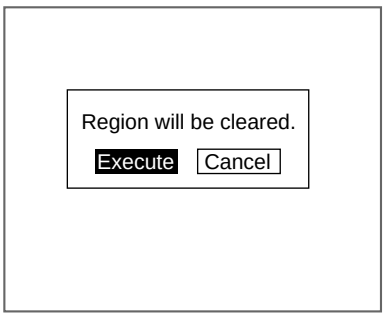
2. Press the ESC Key to exit.



Clearing the Settings

▶ [Model pos. comp #/Positions compensation (No.)/Clear]

1. Select [End].

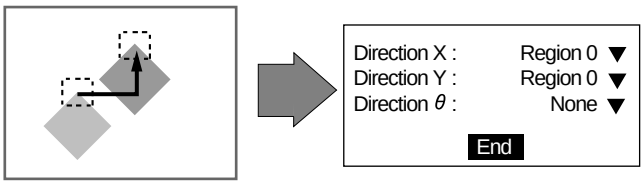


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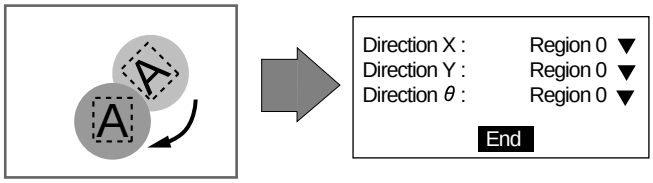
Setting the Displacement Direction

The direction function is used to select which region's measurement results will be used as the basis for position displacement compensation in the X, Y, and θ (rotation) directions.

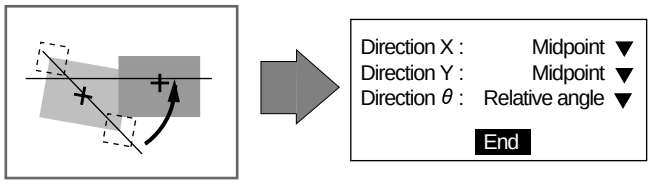
- Measurement Objects Not On An Angle (Example: When Only Region 0 Is Set)



- Measurement Objects On An Angle (Example: When Only Region 0 Is Set)



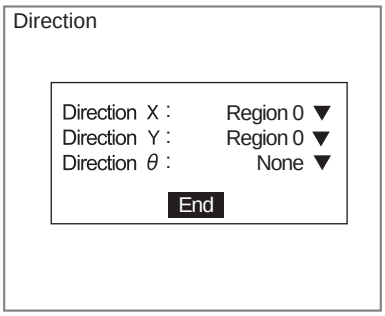
- For Precision Position Compensation Using Measurement Object Angles (Example: When Region 0 and Region 1 Are Set)



▶ [Model pos. comp #/Positions compensation (No.)/Direction]

1. Set each item.

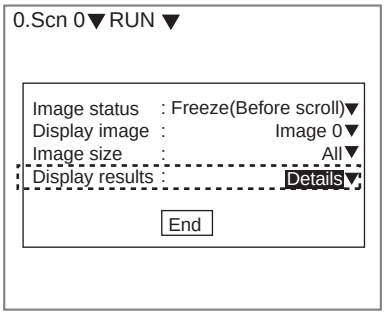
2. Select [End].



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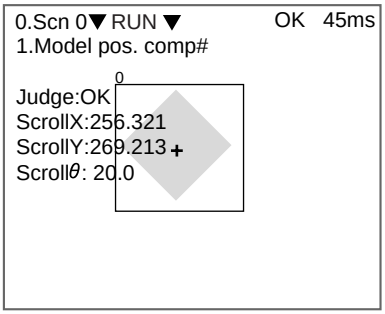
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.
Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed. Use the SHIFT+Right or Left Keys to switch in order between the two screens.

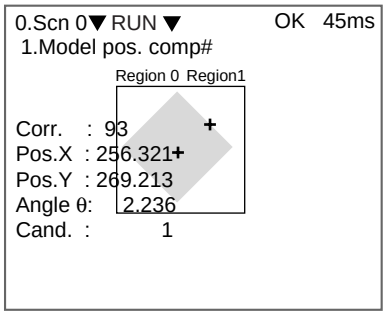
(1) Scroll Amount



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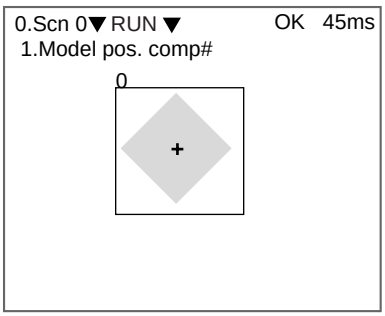
(2) Detailed Display

The measurement values for each region will be displayed.



(3) Position Display

Only the region will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
The following measurement data is for unit		
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Scroll X	DX	Scroll X
Scroll Y	DY	Scroll Y
Scroll θ	DT	Scroll θ
Measurement X	X	X coordinate of measurement value
Measurement Y	Y	Y coordinate of measurement value
Measurement angle	TH	Measurement angle
The following measurement data is for Region 0.		
Judgement	R00JG	Judgement result (-2: Not measured -1: NG 0: OK)
Corr.	R00CR	Model correlation value
Position X	R00X	X coordinate of position where model found
Position Y	R00Y	Y coordinate of position where model found
Angle	R00TH	Angle of found model
The following measurement data is for Region 1.		
Judgement	R01JG	Judgement result (-2: Not measured -1: NG 0: OK)
Corr.	R01CR	Model correlation value
Position X	R01X	X coordinate of position where model found
Position Y	R01Y	Y coordinate of position where model found
Angle	R01TH	Angle of found model

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement Data

Data type	Details
The following measurement data is for unit	
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Scroll X
2	Scroll Y
3	Scroll θ
4	X coordinate of measurement value
5	Y coordinate of measurement value
6	Measurement angle
The following measurement data is for Region 0.	
7	Judgement result (-2: Not measured -1: NG 0: OK)
8	Model correlation value
9	X coordinate of position where model found
10	Y coordinate of position where model found
11	Angle of found model
The following measurement data is for Region 1.	
12	Judgement result (-2: Not measured -1: NG 0: OK)
13	Model correlation value
14	X coordinate of position where model found
15	Y coordinate of position where model found
16	Angle of found model

■ Setting Data

Data type	Details
32	Measurement image (0: Image 0 1: Image 1)
33	Displacement direction (0 to 18) (See *1.)
34	Rotation range (0: None 1: ±5° 2: ±15° 3: ±30° 4: ± 45° 5: 0±15°, 180±15° 6: 0±30°, 180±30° 7: All)
35	Skipping angle (0: 1° 1: 2° 2: 3° 3: 5° 4: 6° 5: 10° 6: 15° 7: 20° 8: 30°)
36	Angle compensation (0: OFF 1: ON)
The following settings data is for Region 0.	
37	Correlation judgement (0 to 100)
38	Position X upper limit (-9999.9999 to 9999.999)
39	Position X lower limit (-9999.9999 to 9999.999)
40	Position Y upper limit (-9999.9999 to 9999.999)
41	Position Y lower limit (-9999.9999 to 9999.999)

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Data type	Details
42	Angle judgement upper limit (-360.00 to 360.00)
43	Angle judgement lower limit (-360.00 to 360.00)
44	Candidate level (0 to 100)
45	Model skipping setting (0: Auto 1: Fixed)
46	Model skipping X (1 to 15)
47	Model skipping Y (1 to 15)
48	Search skipping setting (0: Auto 1: Fixed)
49	Search skipping X (1 to 15)
50	Search skipping Y (1 to 15)
51	Detailed model skipping setting (0: Auto 1: Fixed)
52	Detailed model skipping X (1 to 15)
53	Detailed model skipping Y (1 to 15)
54	Search region upper left X (0 to X_MAX) (See *2.)
55	Search region upper left Y (0 to Y_MAX) (See *2.)
56	Search region lower right X (0 to X_MAX) (See *2.)
57	Search region lower right Y (0 to Y_MAX) (See *2.)
58	Model position upper left X (0 to X_MAX) (See *2.)
59	Model position upper left X (0 to Y_MAX) (See *2.)
60	Model position lower right X (0 to X_MAX) (See *2.)
61	Model position lower right X (0 to Y_MAX) (See *2.)
62	Model reference position lower right X (0 to X_MAX) (See *2.)
63	Model reference position Y (0 to Y_MAX) (See *2.)
Region 1	
64	Correlation judgement (0 to 100)
65	Position X upper limit (-9999.9999 to 9999.999)
66	Position X lower limit (-9999.9999 to 9999.999)
67	Position Y upper limit (-9999.9999 to 9999.999)
68	Position Y lower limit (-9999.9999 to 9999.999)
69	Angle judgement upper limit (-360.00 to 360.00)
70	Angle judgement lower limit (-360.00 to 360.00)
71	Candidate level (0 to 100)
72	Model skipping setting (0: Auto 1: Fixed)
73	Model skipping X (1 to 15)
74	Model skipping Y (1 to 15)
75	Search skipping setting (0: Auto 1: Fixed)
76	Search skipping X (1 to 15)
77	Search skipping Y (1 to 15)
78	Detailed model skipping setting (0: Auto 1: Fixed)
79	Detailed model skipping X (1 to 15)
80	Detailed model skipping Y (1 to 15)
81	Search region upper left X (0 to X_MAX) (See *2.)
82	Search region upper left Y (0 to Y_MAX) (See *2.)
83	Search region lower right X (0 to X_MAX) (See *2.)
84	Search region lower right Y (0 to Y_MAX) (See *2.)
85	Model position upper left X (0 to X_MAX) (See *2.)
86	Model position upper left X (0 to Y_MAX) (See *2.)

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Data type	Details
87	Model position lower right X (0 to X_MAX) (See *2.)
88	Model position lower right X (0 to Y_MAX) (See *2.)
89	Model reference position lower right X (0 to X_MAX) (See *2.)
90	Model reference position Y (0 to Y_MAX) (See *2.)

*1: The displacement direction settings are shown in the following table.

Data type	Skipping X	Skipping Y	Displacement θ
0	None	None	None
1	Displacement compensation region 0	None	None
2	Displacement compensation region 0	Displacement compensation region 0	None
3	Displacement compensation region 0	Displacement compensation region 1	None
4	None	Displacement compensation region 0	None
5	Displacement compensation region 1	None	None
6	Displacement compensation region 1	Displacement compensation region 0	None
7	Displacement compensation region 1	Displacement compensation region 1	None
8	None	Displacement compensation region 1	None
9	Midpoint	None	None
10	None	Midpoint	None
11	Midpoint	Midpoint	None
12	Displacement compensation region 0	Midpoint	None
13	Midpoint	Displacement compensation region 0	None
14	Displacement compensation region 1	Midpoint	None
15	Midpoint	Displacement compensation region 1	None
16	Displacement compensation region 0	Displacement compensation region 0	Displacement compensation region 0
17	Displacement compensation region 1	Displacement compensation region 1	Displacement compensation region 1
18	Midpoint	Midpoint	Relative angle

*2: The setting range varies depending on the controller model.

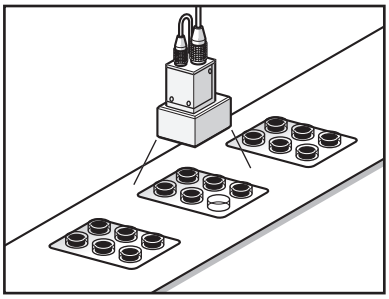
Setting range	For F500	For the other controllers
0 to X_MAX	0 × 1023	0 × 511
0 to Y_MAX	0 × 1023	0 × 483

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Binary Defect

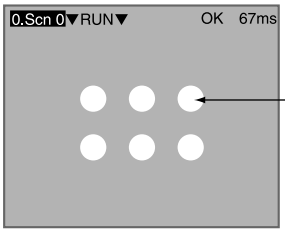
The 256-gradation images read by the Camera are converted into binary black-and-white images and measurement is performed on the white pixels.
The size (area), position (center of gravity), and orientation (angle) of the measurement object can be detected.

Example: Detecting the Presence of Tablets



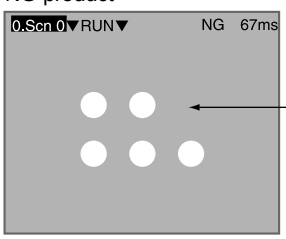
The image is converted into binary.

OK product



The image is converted into binary, showing the tablets in white.

NG product



The area of the white pixels is insufficient, indicating that a tablet is missing.

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Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [Binary defect/Measurement image]

1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.



Setting Binary Levels

Set the level for converting 256-gradation images read by the Camera into binary images. Measurements are performed for the white pixels. Therefore, make the settings so that the measurement object is white. The binary level set here is used for all of the measurement regions.

CHECK!

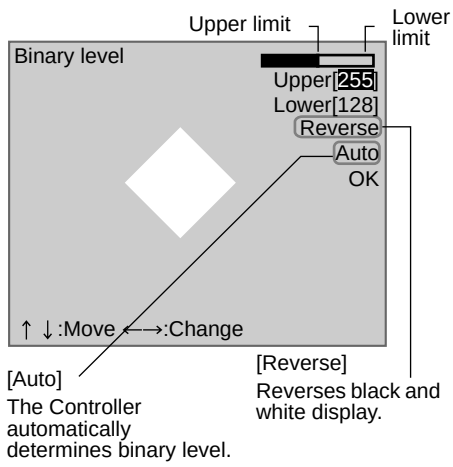
The binary levels can be set for each measurement region.
If Binary defect/Binary (Common) are changed after the binary levels are changed for each region, the settings for each region are disabled and the setting levels under Binary defect/Binary (Common) are enabled.

▶ [Binary defect/Binary(Common)]

1. Move the cursor to the upper value and use the Left and Right Keys to adjust the value.

2. Use the same method to change the lower value.

3. Select [OK].



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Set the measurement region.

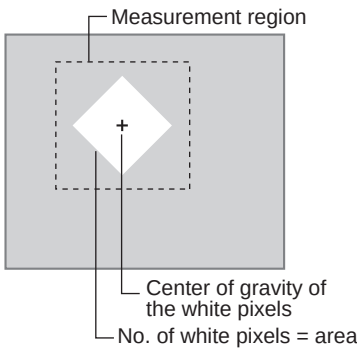
Up to 8 regions can be set.
There are 3 measurement methods for binary defect inspections and different methods can be set for each region. Select the best method for the inspection.

Defect	Details	Page
Gravity and Area	Use a gravity and area measurement to find the size and position (center of gravity) of a measurement object.	4
Gravity and Axis	Use a gravity and axis measurement to find the angle of a measurement object. This measurement method also calculates the axis angle, in addition to the binary center of gravity and area calculations described previously.	10
Area (Var. Box)	Use an area (variable box) measurement to adjust the measurement region (a box) for measurement objects with varying sizes or positions and find their size and center of gravity.	15

Gravity and Area

Density images taken by the Camera are converted into binary images made up of black and white pixels and then measured. The size (area) and position (center of gravity) of the area occupied by the white pixels are measured.

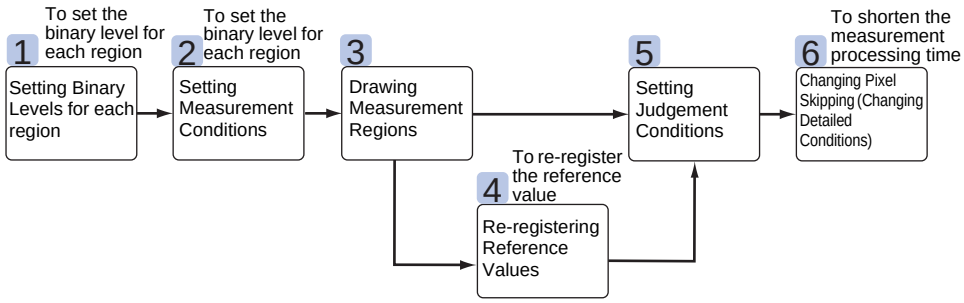
- Area
  The area is the number of white pixels in the measurement region.
- Center of Gravity
  The center of gravity is the center of the area of white pixel. When the white pixel area of the region forms a square, the center of gravity is the intersection of the lines from diagonal corners.



CHECK!

- If the number of white pixels is the same, the measurement result will be OK even if the shape of the measurement object is different. Use pattern detection to distinguish between measurement object shapes.
- Use an area (variable box) measurement for measurement objects with varying measurement region sizes or positions.

■ Operational Flow



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1 Setting Binary Levels for each region

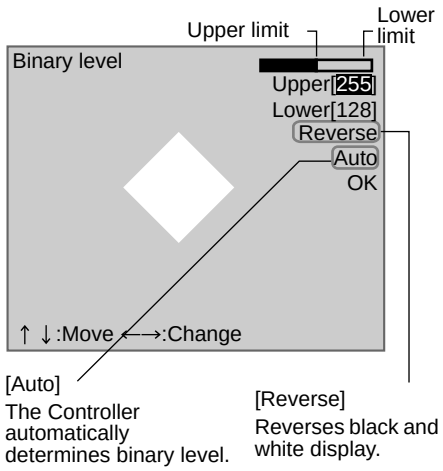
Perform this operation to change the binary level for each region.
Set the level for converting 256-gradation images read by the Camera into binary images. Measurements are performed for the white pixels. Therefore, make the settings so that the measurement object is white.

▶ [Binary defect/Select region/Region No./Gravity and area/Binary]

1. Move the cursor to the upper value and use the Left and Right Keys to adjust the value.

2. Use the same method to change the lower value.

3. Select [OK].



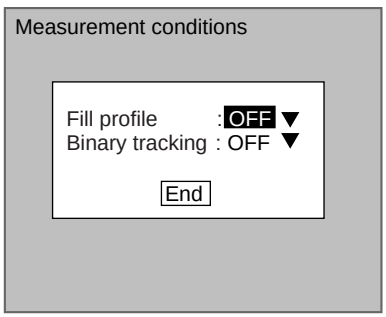
2 Setting Measurement Conditions

Set measurement conditions to measure the exterior of a measurement object or to make the binary levels track the brightness of the measurement image.

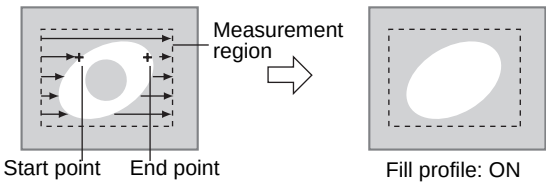
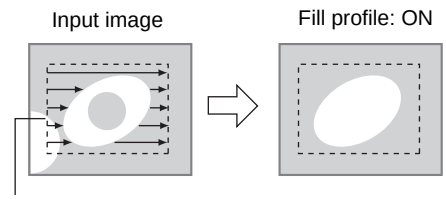
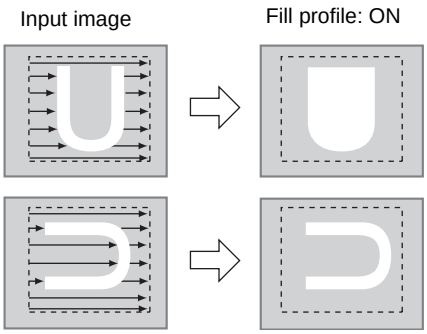
▶ [Binary defect/Select region/Region No./Gravity and area/Measurement conditions]

1. Set each item.

2. Select [End].



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Setting data	Selection	Details
Fill Profile Function	ON OFF (default setting)	Set the fill profile function to [ON] when the exterior of the measurement object is being measured. Turn [ON] the [Fill profile] function to measure the whole area between the start point (black pixels to white) and the end point (white pixels to black) in the measurement region as white pixels.  • When a White-pixel Section Encroaches on the Measurement Region  Not recognized as start point because change from white to black. • Measuring Open-form Measurement Objects The measurement result changes depending on the orientation of the measurement object. 
Binary Tracking Function	ON OFF (default setting)	Set the binary tracking function when the variations in lighting prevent correct measurement with stable binary levels. If the binary tracking function is set to [ON], the Controller will automatically adjust the binary levels in line with the brightness of the input image.

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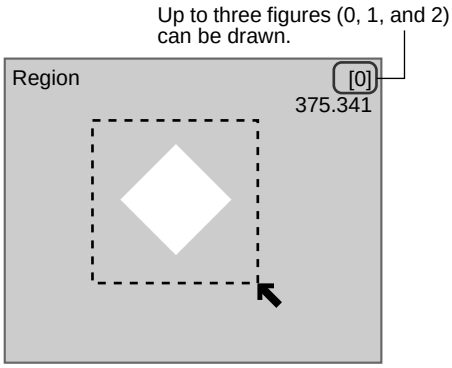
3 Drawing Measurement Regions

When a measurement region is drawn, measurement is performed for the displayed image and the results are registered as the reference values (area and center of gravity).

▶ [Binary defect/Select region/Region(No.)/Gravity and area/Region/New/figure/drawing mode]

1. Draw a figure in the region to be measured.

SECTION 1 Basic Operating Procedures, “Drawing a Region”



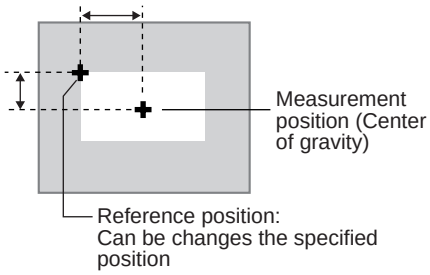
4 Re-registering Reference Values

This operation is performed when only the reference value is to be re-registered.
When a measurement region is drawn, the measurement is performed for the displayed image and the results are registered as the reference values. If the re-registering function explained here is used, only the reference values for the image currently displayed will be registered.
The area and center of gravity are registered for the reference values.

CHECK!

The reference position can be changed to enable the following function.

- Measuring Positions from a Specified Position
  Once the reference values have been obtained for the image currently displayed, the reference position is changed to an suitable point. Position inspection can be performed by calculating the difference between this reference position and the measurement position.

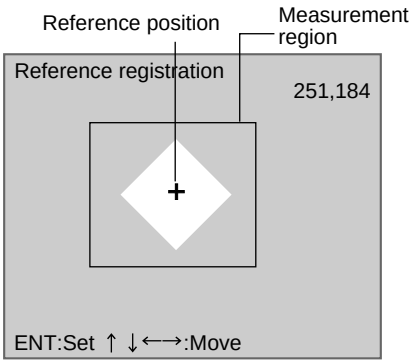


CHECK!

When the measurement region is changed, the reference value returns to the default setting.

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▶ [Binary defect/Select region/Region No./Gravity and area/Reference registration]



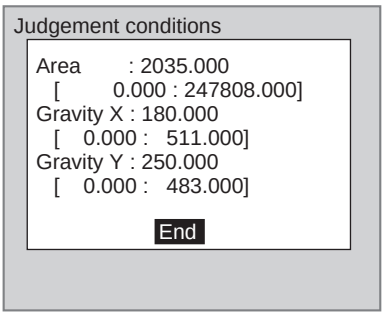
1. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.

5 Setting Judgement Conditions

Make settings for the area and center of gravity.

▶ [Binary defect/Select region/Region No./Gravity and area/Judgement conditions]



1. Set each item.

2. Select [End].

Setting data	Selection	Details
Area	0 to 9,999,999.999	Set the area range for an OK judgement.
Gravity X	-9,999.999 to 9,999.999	Set the range of movement of the measurement object in the X direction for an OK judgement.
Gravity Y	-9,999.999 to 9,999.999	Set the range of movement of the measurement object in the Y direction for an OK judgement.

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6 Changing Pixel Skipping (Changing Detailed Conditions)

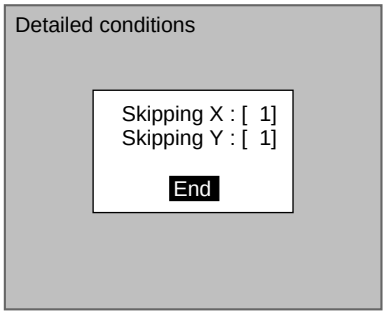
To shorten measurement processing time, change the number of pixels to be skipped. The greater the skipping setting, the shorter the processing time. However, the accuracy of the measurement will decrease.

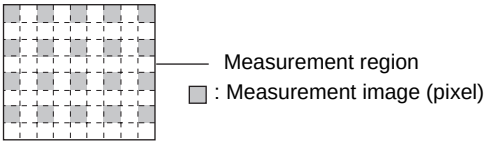
After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

▶ [Binary defect/Select region/Region No./Gravity and area/Detailed conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Skipping X	1 to 15 (default setting: 1)	Set how many pixels to skip in the measurement region during measurement. The default setting is 1, which means that all of the measurement region will be measured. Example: Skipping X and Skipping Y are set to 2: 
Skipping Y		

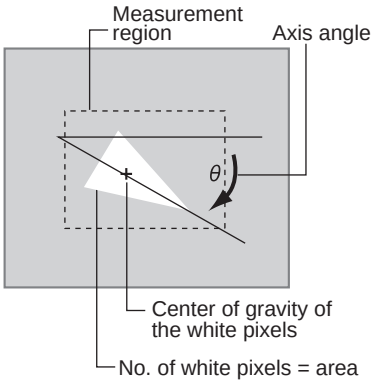
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Gravity and Axis

Density images taken by the Camera are converted into binary images made up of black and white pixels and then measured. The size (area), position (center of gravity), and axis angle of the white-pixel area is calculated.

• Axis Angle

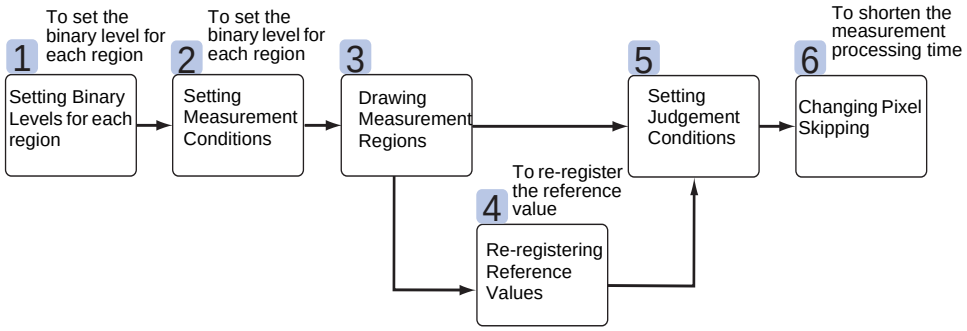
The axis angle is the angle of the major axis of an ellipse that is diagrammatically equivalent to the area occupied by the white pixels.



CHECK!

More processing time is required to calculate the axis angle.
To simply find the area and center of gravity, use a gravity and area measurement.

■ Operational Flow



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1 Setting Binary Levels for each region

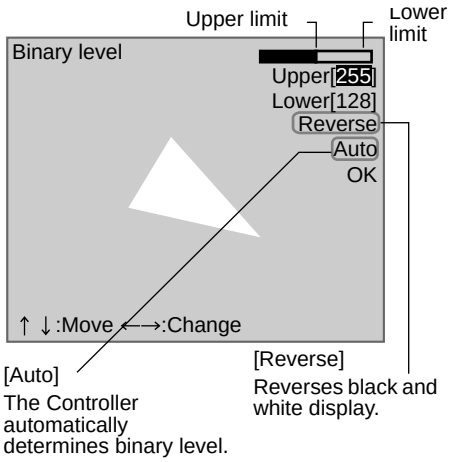
Perform this operation to change the binary level for each region.
Set the level for converting 256-gradation images read by the Camera into binary images. Measurements are performed for the white pixels. Therefore, make the settings so that the measurement object is white.

▶ [Binary defect/Select region/Region No./Gravity and axis/Binary]

1. Move the cursor to the upper value and use the Left and Right Keys to adjust the value.

2. Use the same method to change the lower value.

3. Select [OK].



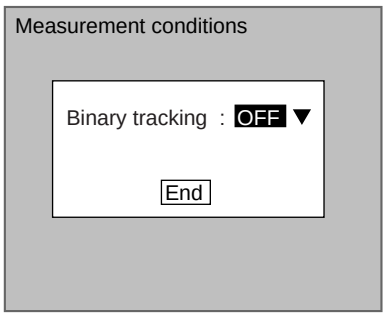
2 Setting Measurement Conditions

Set the binary tracking function when the variations in measurement object color or other factors prevent correct measurement with stable binary levels.

▶ [Binary defect/Select region/Region No./Gravity and axis/Measurement conditions]

1. Select [ON] or [OFF].
Settings Data p.6

2. Select [End].



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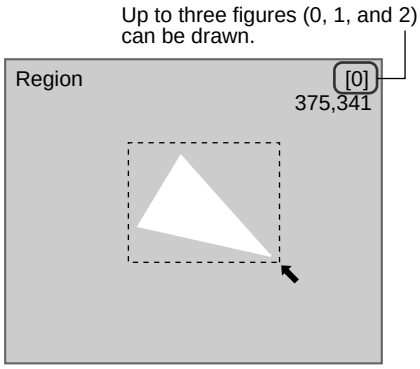
3 Drawing Measurement Regions

When a measurement region is drawn, measurement is performed for the displayed image and the results are registered as the reference values (area, center of gravity, and axis).

▶ [Binary defect/Select region/Region(No.)/Gravity and axis/Region/New/figure/drawing mode]

1. Draw a figure in the region to be measured.

SECTION 1 Basic Operating Procedures, “Drawing a Region”



4 Re-registering Reference Values

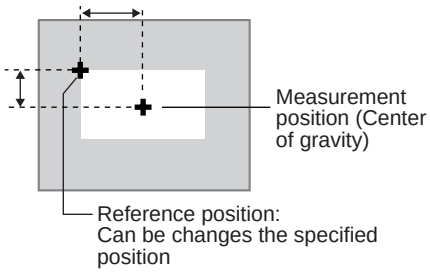
This operation is performed when only the reference value is to be re-registered.
When a measurement region is drawn, the measurement is performed for the displayed image and the results are registered as the reference values. If the re-registering function explained here is used, only the reference values for the image currently displayed will be registered.
The area, center of gravity, and axis are registered for the reference values.

CHECK!

The reference position can be changed to enable the following function.

Measuring Positions from a Specified Position

Once the reference values have been obtained for the image currently displayed, the reference position is changed to an suitable point. Position inspection can be performed by calculating the difference between this reference position and the measurement position.



CHECK!

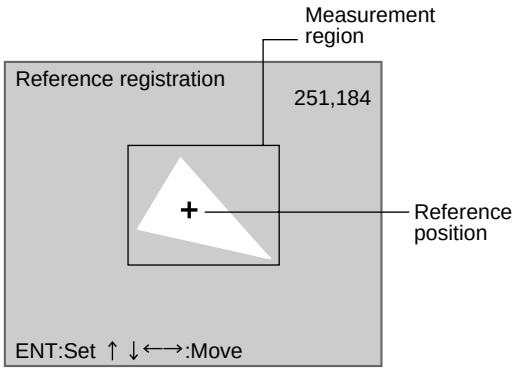
When the measurement region is changed, the reference value returns to the default setting.

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▶ [Binary defect/Select region/Region No./Gravity and axis/Reference registration]

1. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.



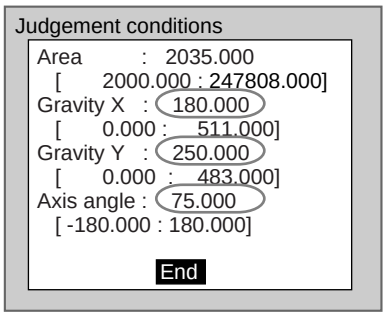
5 Setting Judgement Conditions

Make settings for the area, center of gravity, and axis angle.
Range for an OK judgement.

▶ [Binary defect/Select region/Region No./Gravity and axis/Judgement conditions]

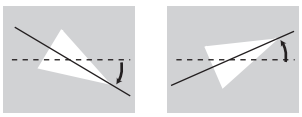
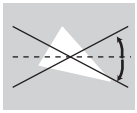
1. Set each item.

2. Select [End].



: Measurement results for the displayed image
Use these values as a reference for setting upper and lower limits.

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Setting data	Selection	Details
Area	0 to 9,999,999.999	Set the area range for an OK judgement.
Gravity X	-9,999.999 to 9,999.999	Set the range of movement of the measurement object in the X direction for an OK judgement.
Gravity Y	-9,999.999 to 9,999.999	Set the range of movement of the measurement object in the Y direction for an OK judgement.
Axis angle	-180.000 to 180.000	Set the axis angle for an OK judgement. Output in the measurement value of -90,000 to 90,000 Example: Measurement value for axis angle 10.000 -10.000   If this range is to be judged OK, set to [-10.000: 10.000].

6 Changing Pixel Skipping (Changing Detailed Conditions)

To shorten measurement processing time, change the number of pixels to be skipped. The greater the skipping setting, the shorter the processing time. However, the accuracy of the measurement will decrease.

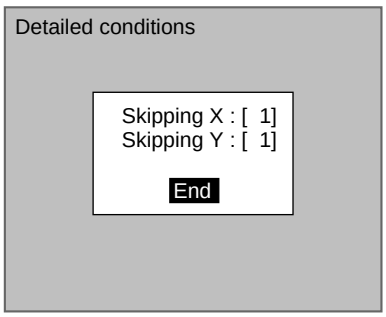
After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

▶ [Binary defect/Select region/Region No./Gravity and axis/Judgement conditions]

1. Set each item.

Settings Data p.8

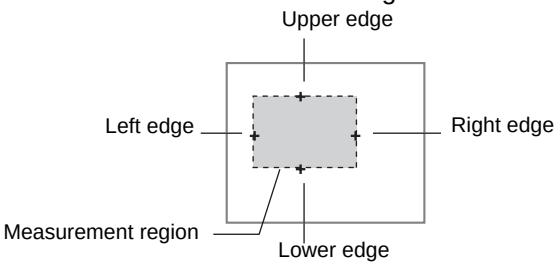
2. Select [End].



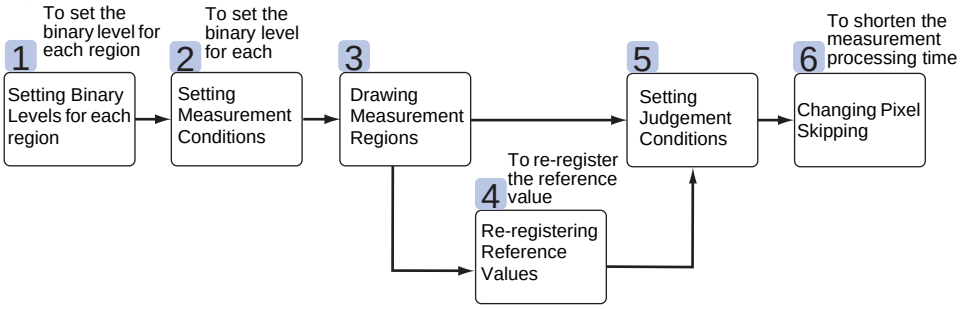
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Area (Var. Box)

Use an area (variable box) measurement to adjust the measurement region (a box) for measurement objects with varying sizes or positions and find their size and center of gravity. The upper, lower, left, and right edges of the measurement object are found. The region inside the edges that are found will be the measurement region.



■ Operational Flow



1 Setting Binary Levels for each region

Perform this operation to change the binary level for each region.

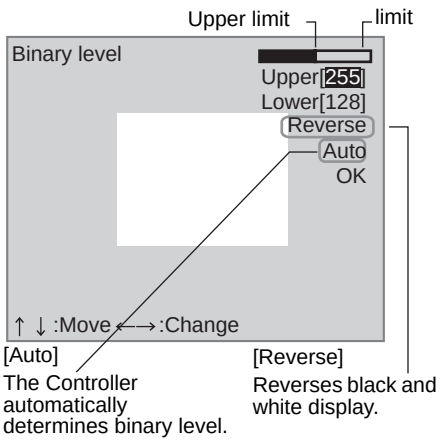
Set the level for converting 256-gradation images read by the Camera into binary images. Measurements are performed for the white pixels. Therefore, make the settings so that the measurement object is white.

▶ [Binary defect/Select region/Region No./Area (var. box)/Binary]

1. Move the cursor to the upper value and use the Left and Right Keys to adjust the value.

2. Use the same method to change the lower value.

3. Select [OK].



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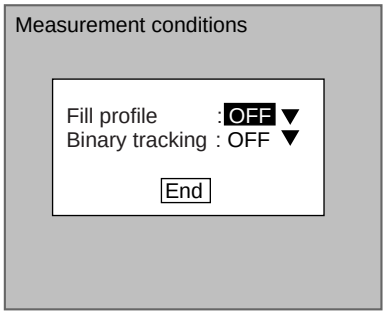
2 Setting Measurement Conditions

Set measurement conditions to measure the exterior of a measurement object or to make the binary levels track the brightness of the measurement image. The default for all settings is [OFF].

▶ [Binary defect/Select region/Region No./Area (var. box)/Measurement conditions]

1. Select [ON] or [OFF].
Settings Data p.6

2. Select [End].



3 Set the measurement region.

The measurement region is drawn by specifying the upper, lower, left, and right edges of the measurement object.
If even one of the edges cannot be located, the judgement result will be NG.
When one of the edges is selected, the settings for the conditions for the selected edge will be displayed. In this example, the settings for [Left edge] will be explained. Make adjustments as necessary when setting conditions for [Upper edge], [Lower edge], and [Right edge].

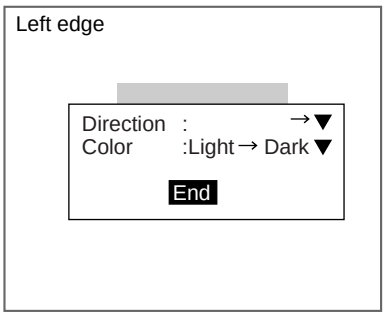
3 1.Set the edge detection conditions.

Set the direction for edge detection and the density changes.

▶ [Binary defect/Select region/Region No./Area (var. box)/Left edge/Measurement conditions]

1. Set each item.

2. Select [End].

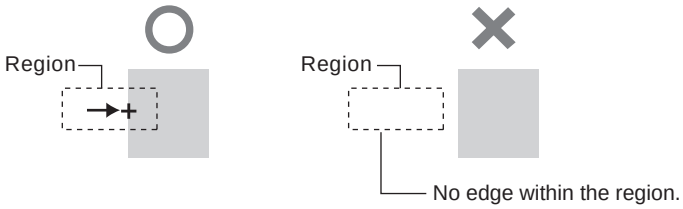


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Setting data	Selection	Details
Direction	→←↑ , ↓	Set the direction to detect the edge. Set a combination of upper, lower, right, and left edge detection directions that surround the area to be measured. Example: 
Color	Light →Dark Dark →Light	Set the density change to be considered as edges.

3 2.Drawing the Edge Detection Region

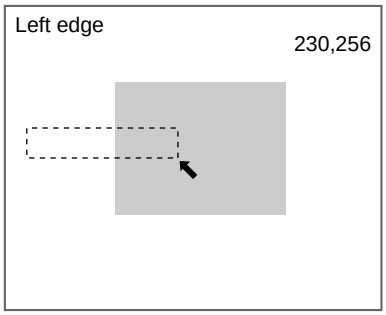
Draw a region to include the edge for detection.



▶ [Binary defect/Select region/Region No./Area (var. box)/Left edge/Region]

1. Draw a box-shaped region.

Specify the upper left and lower right coordinates.

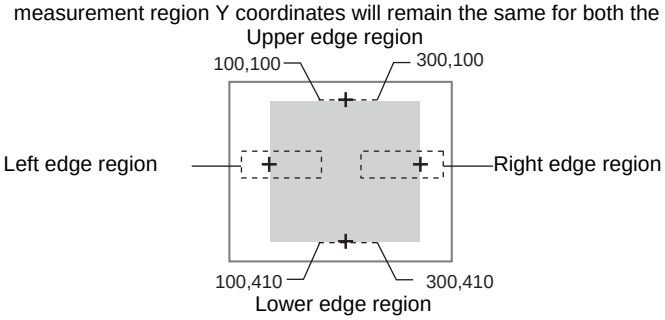


CHECK!

Use the following procedure to fix the measurement region

Measurement Objects with Variable Widths Only

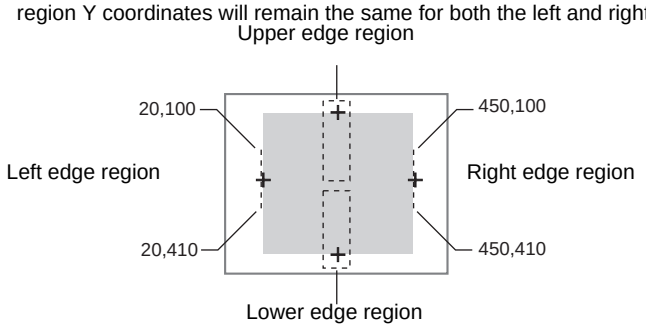
Draw the edge detection region so that the measurement region Y coordinates will remain the same for both the upper and lower edges. Draw the edge detection region so that the measurement region Y coordinates will remain the same for both the upper and lower edges.



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Measurement Objects with Variable Heights Only

Draw the edge detection region so that the measurement region X coordinates will remain the same for both the left and right edges. Draw the edge detection region so that the measurement region Y coordinates will remain the same for both the left and right edges.



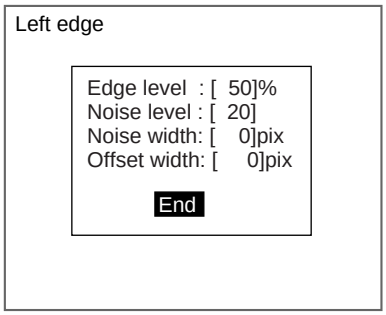
3 3.Changing Detailed Conditions as Required

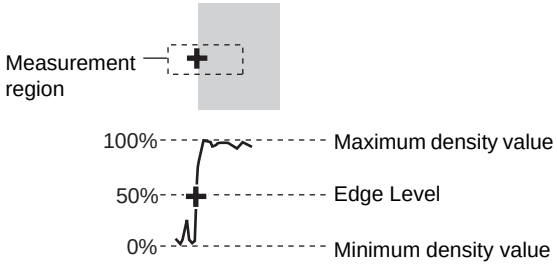
Change the detailed conditions when the measurement results are unstable.
Normally, the method can be left on the default setting.
After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

▶ [Binary defect/Select region/Region No./Area (var. box)/Left edge/Detailed conditions]

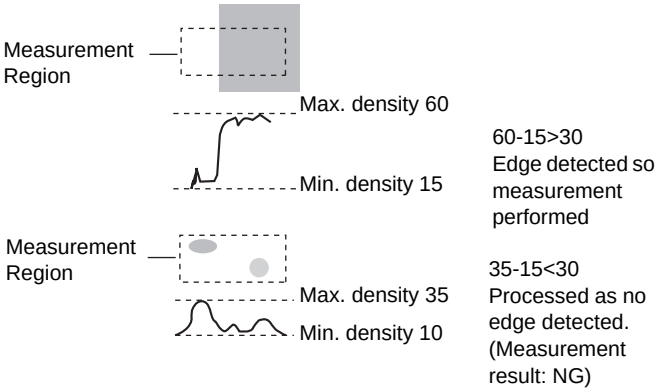
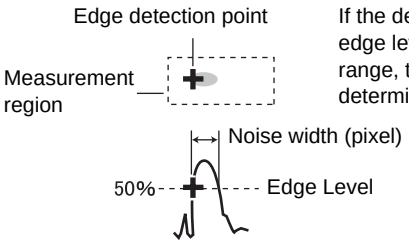
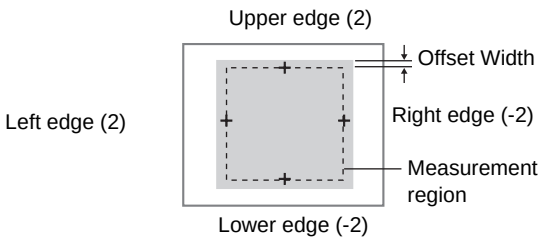
1. Set each item.

2. Select [End].



Setting data	Selection	Details
Edge Level	0 to 100 (default setting: 50)	Set a density change level between 0 and 100 that will indicate the edge. 

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Setting data	Selection	Details
Noise Level	0 to 255 (default setting: 20)	Noise level used to make judgement if edges are present or not. The maximum density and minimum density within the edge detection area is calculated and if the difference between the two values is less than the noise level, then the Controller determines that there is no edge. If noise is causing incorrect detection, make this value higher. (Within the edge detection region) Max. density - min. density < noise level →no edge →NG measurement result Max. density - min. density ≥ noise level →Edge →Used for measurement Example: When [Noise level] is set to 30 
Noise Width	0 to 255 (default setting: 0)	Set the width of objects that are to be judged as noise. If the density distribution from the position where the edge was first detected falls to below the edge level within the noise width range, the detected point is judged as noise. If noise is causing incorrect detection, make this value higher. Example: 
Offset Width	-1,023 to 1,023 (default setting: 0)	Set the adjustment width (in pixel units) for the detected edge position. Example: To Measure from 2 Pixel-widths Inside the Edge Detection Point B 

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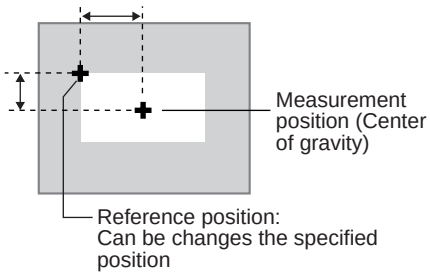
4 Registering Reference Positions

When detecting differences from an acceptable product, reference values must be registered. Place the acceptable product in the correct position and register the reference values.
The area and center of gravity are registered for the reference values.

CHECK!

The reference position can be changed to enable the following function.

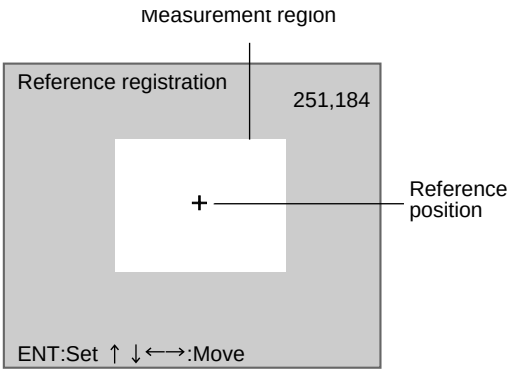
- Inspecting Positions from a Specified Point
  Once the reference values (area and center of gravity) have been obtained for the image currently displayed, the reference position is changed to an suitable point. Position inspection can be performed by calculating the difference between this reference position and the measurement position.



▶ [Binary defect/Select region/Region No./Area (var. box)/Reference registration]

1. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.



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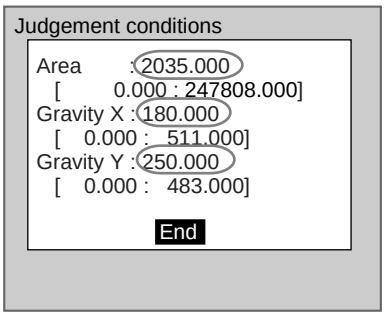
5 Setting Judgement Conditions

Make settings for the area and center of gravity.
Range for an OK judgement.

▶ [Binary defect/Select region/Region No./Area (var. box)/Judgement conditions]

1. Set each item.
Settings Data p.8

2. Select [End].



: Measurement results for the displayed image
Use these values as a reference for setting upper and lower limits.

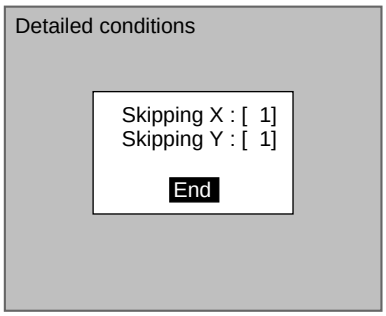
6 Changing Pixel Skipping (Changing Detailed Conditions)

To shorten measurement processing time, change the number of pixels to be skipped. The greater the skipping setting, the shorter the processing time. However, the accuracy of the measurement will decrease.
After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

▶ [Binary defect/Select region/Region No./Area (var. box)/Detailed conditions]

1. Set each item.
Settings Data p.8

2. Select [End].



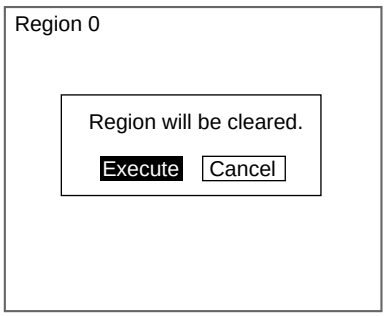
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Clearing the Set Regions

The clear operation is executed for each region.

▶ [Binary defect/Select region/Region No./Clear]

1. Select [Execute].



Setting the Coordinate Mode

Select the type of coordinate values.

CHECK!

If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

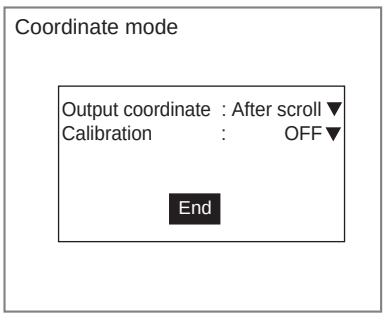
▶ [Binary defect/Coordinate mode]

1. Set each item.

2. Select [End].

Settings Data

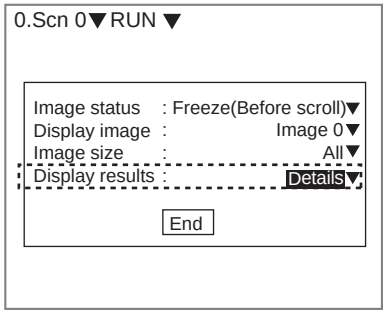
SECTION 7 Appendix, “Coordinate Handling Method”



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Checking the Measurement Image

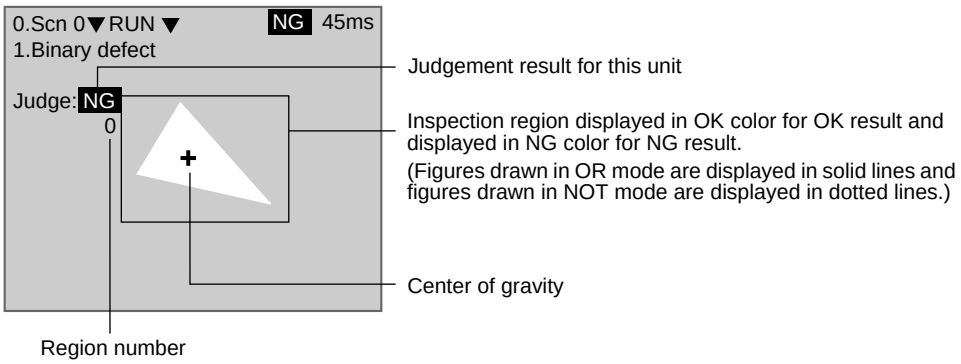
Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.
Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed. Use the SHIFT+Right or Left Keys to switch in order between the two screens.

(1) Judgement Result

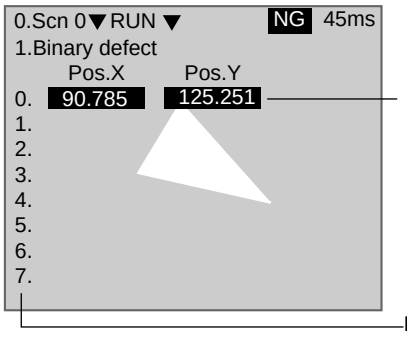
Judgement result for this unit



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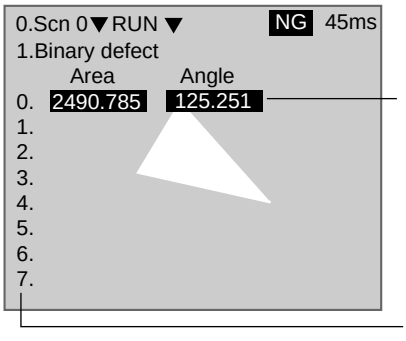
(2) List of Positions

A list of the center of gravity positions for each region is displayed.



Area and Axis

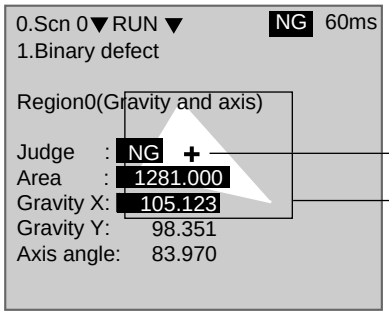
A list of the area and axis for each region is displayed.



(4) Individual Region Display

More detailed measurement results are displayed for each region.

Press the SHIFT+ Right or Left Keys to display the set regions in order.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Unit judgement result (-2: Not measured. -1: NG 0: OK)
The following measurement data is for Region N (0 to 7).		
Judgement	R**JG	Judgement result
Measurement region	R**X1	Upper left X coordinate of measurement region (See *1.)
Measurement region	R**Y1	Upper left Y coordinate of measurement region (See *1.)
Measurement region	R**X2	Lower right X coordinate of measurement region (See *1.)
Measurement region	R**Y2	Lower right Y coordinate of measurement region (See *1.)
Center of gravity	R**X	X coordinate of center of gravity
Center of gravity	R**Y	Y coordinate of center of gravity
Axis angle	R**TH	Axis angle
Area	R**AR	Area
Reversed area	R**RA	Difference between area measurement value and area for measurement result
Reference position	R**SX	X coordinate of reference position
Reference position	R**SY	Y coordinate of reference position
Reference axis	R**ST	Axis angle when measurement region drawn
Reference area	R**SA	Area when measurement region drawn

*1 The upper left and lower right coordinates of the calculated measurement region will be output whenever Area (Variable Box) is set for any of the regions 0 to 7. These coordinates will be output in pixels regardless of the setting for calibration.

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Unit judgement result (-2: Not measured. -1: NG 0: OK)
The following measurement data is for Region N (0 to 7).	
14N+1	Judgement result
14N+2	Upper left X coordinate of measurement region (See *1.)
14N+3	Upper left Y coordinate of measurement region (See *1.)
14N+4	Lower right X coordinate of measurement region (See *1.)
14N+5	Lower right Y coordinate of measurement region (See *1.)
14N+6	X coordinate of center of gravity
14N+7	Y coordinate of center of gravity
14N+8	Axis angle
14N+9	Area
14N+10	Difference between area measurement value and area for measurement result
14N+11	X coordinate of reference position
14N+12	Y coordinate of reference position
14N+13	Axis angle when measurement region drawn
14N+14	Area when measurement region drawn

*1: The upper left and lower right coordinates of the calculated measurement region will be output whenever Area (Variable Box) is set for any of the regions 0 to 7. These coordinates will be output in pixels regardless of the setting for calibration.

■ Setting Data

Data type	Details
120	Measurement image (0: Image 0 1: Image 1)
121	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF, 2: After scroll, calibration ON, 3: Before scroll, calibration ON)
122	Binary level (common) upper limit (0 to 255)
123	Binary level (common) lower limit (0 to 255)
124	Reverse binary level (common) (0: Not reversed 1: Reversed)
The following measurement data is for Region N (0 to 7).	

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Data type	Details
The following settings data is for [Gravity and area], [Gravity and axis] and [Area (var. box)] measurement.	
61N+125	Binary level upper limit (0 to 255)
61N+126	Binary level lower limit (0 to 255)
61N+127	Reverse binary level (0: Not reversed 1: Reversed)
61N+128	Binary tracking (0: OFF 1: ON)
61N+129	X upper limit (-9,999.999 to 9,999.999)
61N+130	X lower limit (-9,999.999 to 9,999.999)
61N+131	Y upper limit (-9,999.999 to 9,999.999)
61N+132	Y lower limit (-9,999.999 to 9,999.999)
61N+133	Area upper limit (0 to 9,999,999.999)
61N+134	Area lower limit (0 to 9,999,999.999)
61N+135	Skipping X (1 to 15)
61N+136	Skipping Y (1 to 15)
The following settings data is for [Gravity and area] and [Area (var. box)] measurement.	
61N+137	Fill profile (0: OFF 1: ON)
The following settings data is for [Gravity and axis] measurement.	
61N+138	Axis angle upper limit (-180.000 to 180.000)
61N+139	Axis angle lower limit (-180.000 to 180.000)
The following settings data is for [Area (var. box)] measurement.	
61N+140	Edge detection direction (left edge: 0: ↑ 1: ↓ 2: ← 3: →)
61N+141	Edge color (left edge) (0: Light →Dark 1: Dark →Light)
61N+142	Edge level (left edge: 0 to 100)
61N+143	Noise level (left edge) (0 to 255)
61N+144	Noise width (left edge) (0 to 255)
61N+145	Offset width (left edge) (-1023 to 1023)
61N+146	Edge detection direction (upper edge: 0: ↑ 1: ↓ 2: ← 3: →)
61N+147	Edge color (upper edge) (0: Light →Dark 1: Dark →Light)
61N+148	Edge level (upper edge) (0 to 100)
61N+149	Noise level (upper edge) (0 to 255)
61N+150	Noise width (upper edge) (0 to 255)
61N+151	Offset width (upper edge) (-1023 to 1023)
61N+152	Edge detection direction (right edge: 0: ↑ 1: ↓ 2: ← 3: →)
61N+153	Edge color (right edge) (0: Light →Dark 1: Dark →Light)
61N+154	Edge level (right edge) (0 to 100)
61N+155	Noise level (right edge) (0 to 255)
61N+156	Noise width (right edge) (0 to 255)
61N+157	Offset width (right edge) (-1023 to 1023)
61N+158	Edge detection direction (lower edge: 0: ↑ 1: ↓ 2: ← 3: →)
61N+159	Edge color (lower edge) (0: Light →Dark 1: Dark →Light)
61N+160	Edge level (lower edge) (0 to 100)
61N+161	Noise level (upper edge) (0 to 255)
61N+162	Noise width (lower edge) (0 to 255)

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Data type	Details
61N+163	Offset width (lower edge) (-1023 to 1023)
The following settings data is for processing item region and reference position measurement.	
61N+164	Region upper left X (0 to X_MAX) (See *2, *3)
61N+165	Region upper left Y (0 to Y_MAX) (See *2, *3)
61N+166	Region lower right X (0 to X_MAX) (See *2, *3.)
61N+167	Region lower right Y (0 to Y_MAX) (See *2, *3.)
61N+168	Region upper left X (left edge) (0 to X_MAX) (See *2.)
61N+169	Region upper left Y (left edge) (0 to Y_MAX) (See *2.)
61N+170	Region lower right X (left edge) (0 to X_MAX) (See *2.)
61N+171	Region lower right Y (left edge) (0 to Y_MAX) (See *2.)
61N+172	Region upper left X (upper edge) (0 to X_MAX) (See *2.)
61N+173	Region upper left Y (upper edge) (0 to Y_MAX) (See *2.)
61N+174	Region lower right X (upper edge) (0 to X_MAX) (See *2.)
61N+175	Region lower right Y (upper edge) (0 to Y_MAX) (See *2.)
61N+176	Region upper left X (right edge) (0 to X_MAX) (See *2.)
61N+177	Region upper left Y (right edge) (0 to Y_MAX) (See *2.)
61N+178	Region lower right X (right edge) (0 to X_MAX) (See *2.)
61N+179	Region lower right Y (right edge) (0 to Y_MAX) (See *2.)
61N+180	Region upper left X (lower edge) (0 to X_MAX) (See *2.)
61N+181	Region upper left Y (lower edge) (0 to Y_MAX) (See *2.)
61N+182	Region lower right X (lower edge) (0 to X_MAX) (See *2.)
61N+183	Region lower right Y (lower edge) (0 to Y_MAX) (See *2.)
61N+184	Reference position X (0 to X_MAX) (See *2)
61N+185	Reference position Y (0 to Y_MAX) (See *2)

*2: The range varies depending on the controller model.

Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

*3: If this data is changed, one rectangular region will be set and the previously drawn figures will be deleted.

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Classification

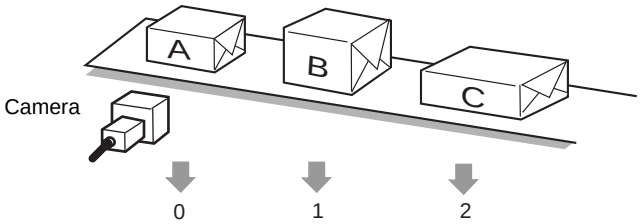
With the Classification processing item, products are classified or differentiated between when there are many types of products being handled on the same production line.

Sections that will serve as classification references are registered as models beforehand.

Registered to 0. Registered to 1. Registered to 2.

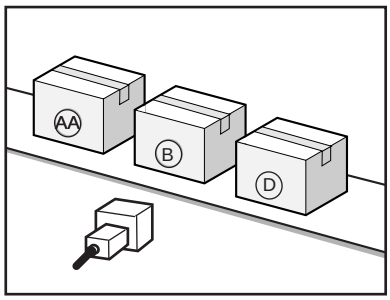


The number of the model that is most similar to the input image is output. If this data is retrieved by an external device, the products can be classified at the next stage of the process. If there is no model that matches the image, the output will be NG (-1).



The number of the most similar model is output.

Example: To classify the boxes



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Classification uses the image stored at [Image 0] for measurement; there is no menu for selecting the measurement image.

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Registering the Model

A section that will serve as the classification reference is registered as the model.
Up to 36 versions of a model can be registered with index numbers 0 to 35.
When the model has variations in printing quality or shape, register multiple models to the same index number. Up to 5 models can be registered to the same index number.
When a model is registered, the center position of the model is registered as the search coordinates.

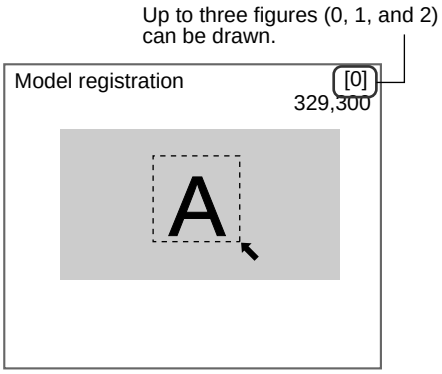
CHECK!

When multiple models are registered to the same index number, the Controller automatically creates auxiliary models between the models that are registered.
If the auxiliary models are added to the registered models when searches are performed, stable searches are possible even if there are variations between the registered models. Select whether or not to use auxiliary models in searches under Detailed settings.

▶ [Classification/Model registration/Index (No.)/Registration/New/figure/drawing mode]

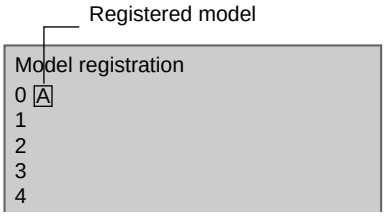
1. Draw the region to be registered as the model with the selected figure.

SECTION 1 Basic Operating Procedures, “Detailed Settings”



Use this operation to register models.
The registered model is displayed as a thumbnail.

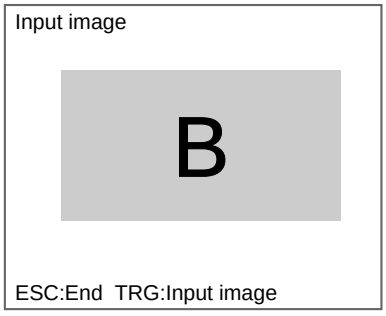
2. To register the next model, change the measurement object and press the SHIFT+ESC Keys.



The Input Image Screen will be displayed.

3. Press the TRIG Key to refresh the image.

4. Press the ESC Key.



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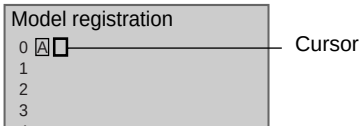
The display returns to the [Index (No.)] screen.

5. Repeat the above steps to register further models.

SHIFT+Up/Down Keys: Switches the index number.

CHECK!

To add models to the same index number, use the Right Key to move the cursor.



6. When all models have been registered, press the ESC Key.

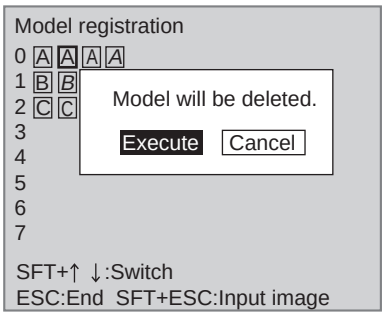
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Deleting Models

Use this operation to delete registered models.

▶ [Classification/Model registration/Delete]

1. Select [Execute].



Referencing Models

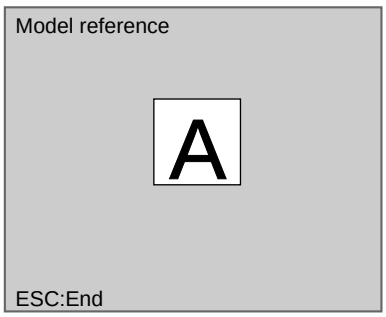
Use this operation to verify registered models.

▶ [Classification/Model registration/Model reference]

1. Referencing Models

The model will be displayed at the position where registered.

2. Press the ESC Key to exit.



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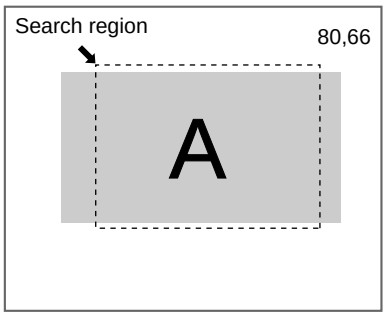
Setting the Search Region

Set the region in which the model is to be searched for. It is possible to perform a search for the entire input image, but the processing time can be shortened and the accuracy can be increased by setting limits on the search region.

▶ [Classification/Search region]

1. Draw a rectangular search region.

Draw a rectangular search region.



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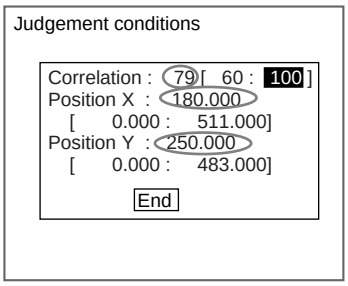
Setting Judgement Conditions

Set the judgement conditions for the correlation with the model and for the position (X, Y) where the object was detected.

▶ [Classification/Judgement conditions]

1. Set each item.

2. Select [End].



: Measurement results for the displayed image.
Use these values as a reference for setting upper and lower limits.

Setting data	Selection	Details
Correlation	0 to 100	Set the correlation lower limit. The judgement will be OK if the measured value is upper than this.
Position X	-9,999.999 to 9,999.999	Set the range of movement in the X direction for an OK judgement.
Position Y	-9,999.999 to 9,999.999	Set the range of movement in the Y direction for an OK judgement.

Search
SECTION 7 Appendix, “Search”

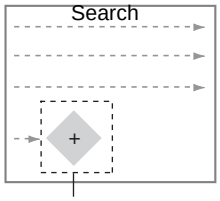
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Changing Detailed Conditions

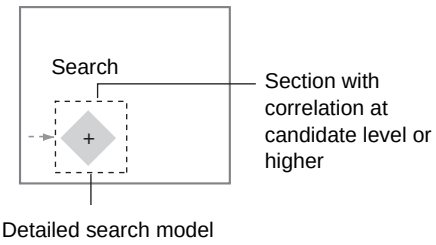
The search settings can be changed here. Change the conditions if the measurement results are unstable or if high-speed processing is required. Normally, the method can be left on the default setting. After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

The Controller performs the following 2-stage processing internally.

1. Rough search
   The rough search model is used to search every item in the measurement region.



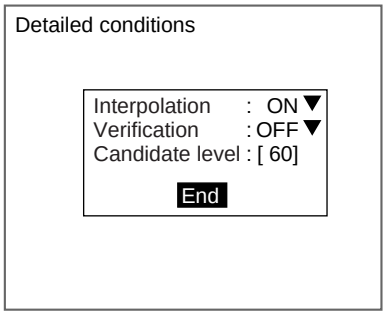
2. Detailed search
   Measures again using the detailed search model to compare to the images surrounding the section at the candidate level or higher.



▶ [Classification/Detailed conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Interpolation Mode	When 2 or more models are registered to in the same index, set whether or not to search using an auxiliary model.	
	ON (default setting.)	The registered models and auxiliary models will be used in searches. The measurement will be more stable. Processing time, however, will be longer.
	OFF	The searches will be performed with registered models only.

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Setting data	Selection	Details
Search verification	Set whether or not to perform detailed searches on models at the candidate level or higher. If model searches are unstable, set [Verification] to [ON] and adjust the candidate level.	
	OFF (default setting)	Performs a detailed search only on the image with the highest rough correlation within the measurement region.
	ON	Performs a detailed search on all images at the candidate level or higher within the measurement region. The measurements are more stable in comparison to when search verification is set to [OFF]. Processing time, however, will be longer.
Candidate level	0 to 99 (default setting: 60)	Set the correlation value for detailed search target images. Reduce the correlation level if the model searches are unstable. A detailed search will be performed on all images above this level in the rough. This setting item is enabled only when [Verification] is set to [ON].

Auxiliary model

Auxiliary models are models created between the registered models. Auxiliary models are automatically created by the Controller when multiple models have been registered to the same index number.

Number of registered models	Number of auxiliary models	Total number of models (See note.)
2	1	3
3	3	6
4	6	10
5	10	15

* Number of modes when [Interpolation Mode] is set to [ON]

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Setting the Coordinate Mode

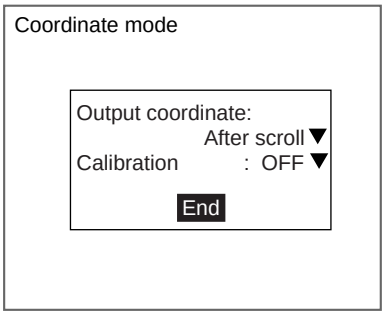
Select the type of coordinate values.

CHECK! If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [Classification/Coordinate mode]

1. Set each item.

2. Select [End].



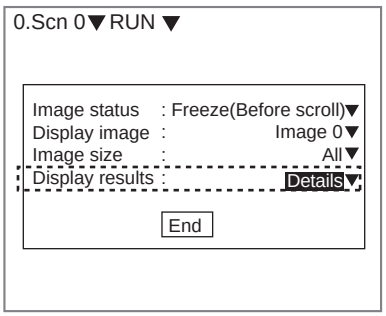
Settings Data
SECTION 7 Appendix, “Coordinate Handling Method”

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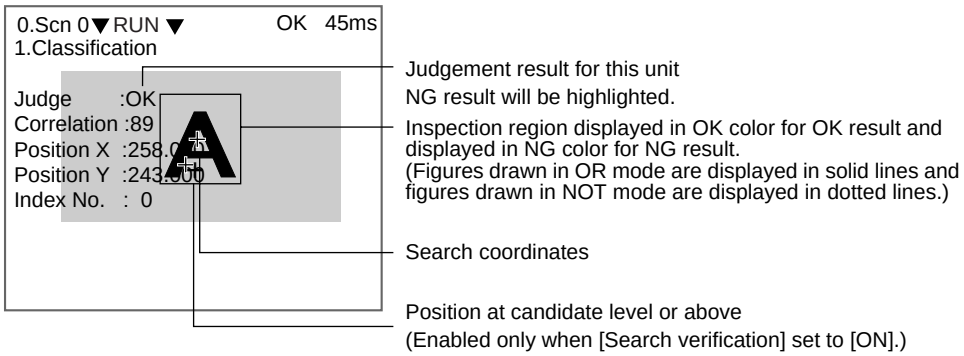
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Measured X	X	X coordinate of position where model found
Measured Y	Y	Y coordinate of position where model found
Correlation value	CR	Correlation value with model
Index number.	IN	Number of model with highest correlation

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	X coordinate of position where model found
2	Y coordinate of position where model found
3	Correlation value with model
4	Number of model with highest correlation

■ Setting Data

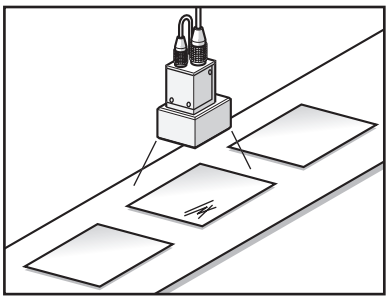
Data type	Details
16	Search region upper left X (0 to 511)
17	Search region upper left Y (0 to 483)
18	Search region lower right X (0 to 511)
19	Search region lower right Y (0 to 483)
20	Verification (0: ON 1: OFF)
21	Candidate level (0 to 99)
22	Interpolation (0: OFF 1: ON)
23	X coordinate judgement upper limit (-9,999.999 to 9,999.999)
24	X coordinate judgement lower limit (-9,999.999 to 9,999.999)
25	Y coordinate judgement upper limit (-9,999.999 to 9,999.999)
26	Y coordinate judgement lower limit (-9,999.999 to 9,999.999)
27	Correlation judgement upper limit (0 to 100)
28	Correlation judgement lower limit (0 to 100)
29	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF 2: After scroll, calibration ON 3: Before scroll, calibration ON)

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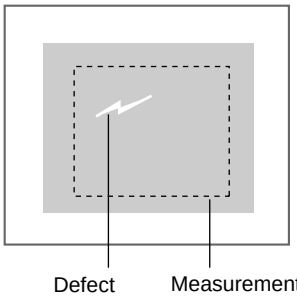
Density Defect Inspection/ Density Defect Inspection

The Density Defect processing item is used to inspect measurement objects using differences in density (brightness) in the measurement region. This processing item is suitable for external inspections for defects or dirt on unbuttoned measurement objects and defects or burrs on parts.

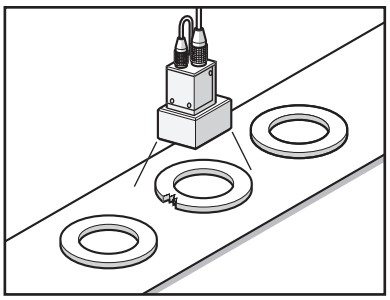
Example 1: Checking for Stains on Sheets



Defect found using density changes within measurement region.



Example 2: Inspecting for Defects or Burrs in O Rings



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Operational Flow

Selecting Measurement Images 3

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- Defect (Variable Box) 11
- Defect (Deviation) (only [Density defect inspection]) 21
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The operational flow will be described here using [Density Defect Inspection] as an example. Make adjustments as necessary when [Density Defect Inspection #] is selected.

Selecting Measurement Images

When Defect (Line), (Circum), (Arc), (Region), (Var. box) is set for the inspection region, This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

CHECK!

Select [Image 0] if any one of the 8 regions has Defect (deviation) registered. Defect (deviation) uses the image stored at [Image 0] for measurement.

▶ [Density defect/Measurement image]

1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.



Set the measurement region

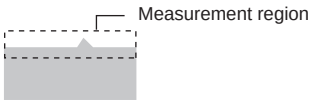
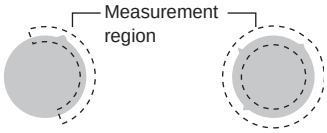
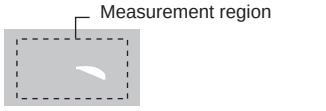
Up to 8 regions can be set.
There are 6 measurement methods for [Density defect inspection] and 5 measurement methods for [Density defect inspection #], and different methods can be set for each region. Select the best method for the inspection.

Defect	Details
Defect (Line, Circumference, Arc and Region)	Use this function to inspect for defects, blemishes, chips, or burrs on unpatterned measurement objects. Select either line, circumference, arc, or region depending on the shape of the measurement object and the inspection details.
Defect (Variable Box)	Use the Defect (Variable Box) processing item to adjust the measurement region (a box) for measurement objects with varying sizes or positions to inspect for defects.
Defect (Deviation)	This item can be selected only if [Density Defect] is selected. Use a Defect (Deviation) measurement to quickly measure multiple regions. Defect (Deviation) measurement can measure other regions on the same unit in parallel, making the total processing time shorter when multiple regions are registered to the same unit and measured.

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Defect (Line, Circumference, Arc, and Region)

Select either line, circumference, arc, or region depending on the shape of the measurement object and the inspection details.

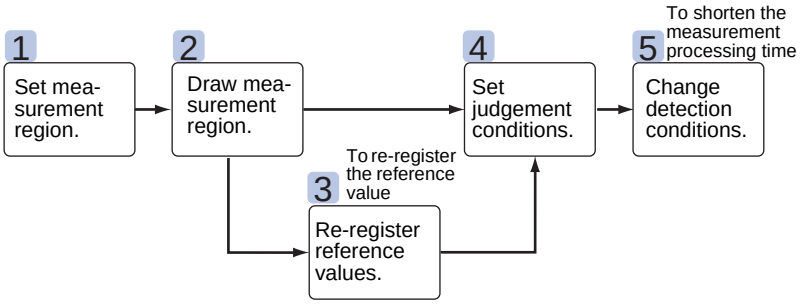
Inspection name	Details
Line	Select to detect chipping or burrs on the measurement object. 
Circumference/ Arc	Select to detect chipping or burrs on the circular measurement object. 
Region defects	Select to detect the defects on the whole measurement object. Up to 3 figures can be combined when drawing the measurement region (box, ellipse, circle, circumference, or polygon). 

CHECK!

Inspections cannot be performed correctly on measurement objects that are patterned or marked. The inspection is performed using changes in density and any pattern or mark in the measurement region will be detected as a surface defect. Use the Fine Matching inspection item to inspect regions with patterns or marks.
Use [Defect (Var. Box)] processing item for measurement objects with varying measurement region sizes or positions.

The Defect processing items are explained in this section using the Defect (Line) processing item as an example. The same procedure can be used for Defect (Circum, Arc, Region).

■ Operational Flow



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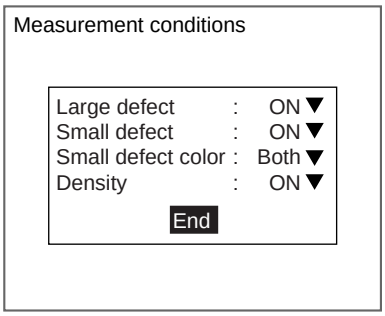
1 Setting Measurement Conditions

The Controller detects defect positions using density variations in the measurement region.
Set the conditions for calculating density variations in measurement regions.

▶ [Density defect/Select region/Region No./Inspection/Measurement conditions]

1. Set each item.

2. Select [End].



Setting item	Selection	Details
Large defect inspections	ON (default setting) OFF	Set to [ON] when inspecting for large defects (defects, blemishes, chips, burrs).
Small defect inspections	ON (default setting) OFF	Set to ON when inspecting for small defects (defects, blemishes, chips, burrs). Inspection of small defects will be more stable than if the large defect inspection setting is used.
Small defect color	White Black Both (default setting)	Set the color of the defect to be inspected. This setting is enabled only when small defect inspection is set to ON.
Density	ON (default setting) OFF	Set to ON to measure for the existence of a measurement object.

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2 Drawing Measurement Regions

Draw a figure in the section to be inspected.

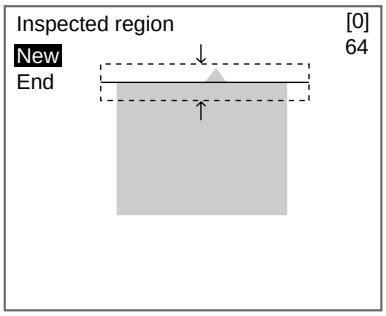
Do not include areas with marks and patterns in the measurement region. It will not be possible to distinguish them from surface detects, and measurement will not be performed properly.

When the region is drawn, a + cursor will appear at the position of each detected defect.

CHECK!

Position detection can be also performed using algorithms for detecting defects.
When a measurement region is drawn, measurement is performed for the displayed image and the results are registered as the reference values (X and Y coordinates of the position where the defect was found). This position becomes the reference position, so be sure to place the measurement object in the correct position before drawing the measurement region.

▶ [Density defect/Select region/Region No./Inspection/Inspected region/New]



1. Draw a figure in the region to be measured.

CHECK!

Up to 3 figures can be drawn to create a region if [Defect (region)] has been selected.

2. Select [End].

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3 Re-registering Reference Values

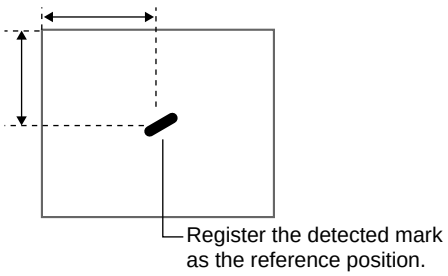
Position detection can also be performed using algorithms for detecting defects.
When a measurement region is drawn, the measurement is performed for the displayed image and the results are registered as the reference values. If the re-registering function explained here is used, only the reference values for the image currently displayed will be registered.

Re-registering Reference Values: The X and Y coordinates of the position found as the large defect
The X and Y coordinates of the position found as the small defect

CHECK! Reference values for 2 positions can be registered, regardless of the settings for large and small defect inspections under Measurement conditions.

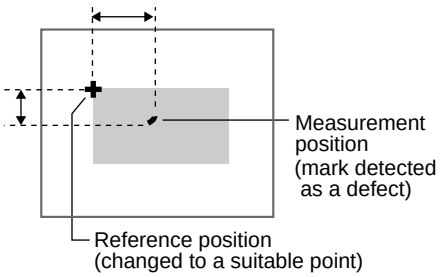
Example: Inspecting Whether or Not the Measurement Object Is Always in the Same Position

Display a measurement object in the correct position, detect a mark, and register that position as the reference position.



CHECK! The reference position can be changed to enable the following function.

- Inspecting Positions from a Specified Point
  Once the reference values (area and center of gravity) have been obtained for the image currently displayed, the reference position is changed to an suitable point. Position inspection can be performed by calculating the difference between this reference position and the measurement position.

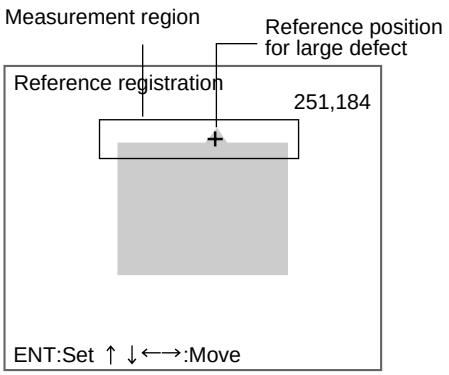


CHECK! When the measurement region is changed, the reference value returns to the default setting.

▶ [Density defect/Select region/Region No./Inspection/Reference registration]

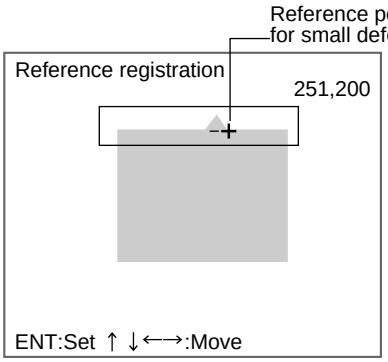
1. Use the Up/Down/Left/Right Keys to move the cursor to change the reference position as for large defects

2. Press the ENT Key.



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A display cursor will appear at the position where a small defect was found.



3. Press the Up/Down and Right/Left Keys to move the cursor to change the position.

4. Press the ENT Key.

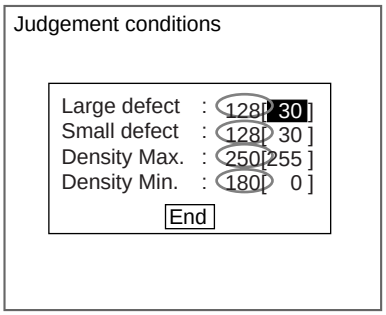
4 Setting Judgement Conditions

Set the conditions for determining defects.
For the measurement values set at 1, set a deviation value for an OK judgement.
The clearer the defect, the higher the defect level is. Measure several samples and set the judgement conditions while referring to the measurement results.

▶ [Density defect/Select region/Region No./Inspection/Judgement conditions]

1. Set each item.

2. Select [End].



: Measurement result for the displayed image. Use as reference for setting conditions.

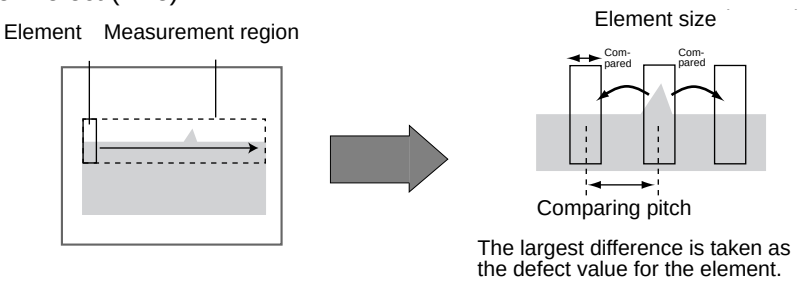
Setting data	Selection	Details
Large defect	0 to 255	Set the upper limit for an OK judgement. (The lower limit is fixed at “0”.) When [Defect level] is set to 30, the judgement will be OK if the measured value is between 0 and 30.
Small defect	0 to 255	Set the upper limit for an OK judgement. (The lower limit is fixed at “0”.) When [Defect level] is set to 30, the judgement will be OK if the measured value is between 0 and 30.
Density Max.	0 to 255	Set the density upper limit.
Density Min.	0 to 255	Set the density lower limit.

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5 Changing Detection Conditions (Changing Detailed Conditions)

To shorten measurement processing time, change the conditions for detecting defects. When a measurement region is drawn, rectangular areas called elements are created automatically. The average densities in these elements are calculated and compared to the average densities of surrounding elements as the elements are moved across the measurement region. The differences in the average densities of the elements are called the defect values. The defect values for all elements are calculated, and if the largest defect value is equal to or greater than the judgement condition, a defect will be detected for the measurement region.

Example: Defect (Line)

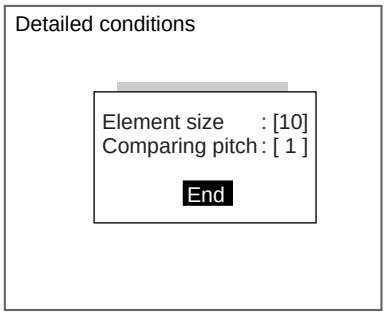


The greater [Element size] and [Comparing pitch], the shorter the processing time. However, the accuracy of the measurement will decrease.
Once the element size or comparing pitch setting has been changed, perform measurements to check that they can be performed correctly.

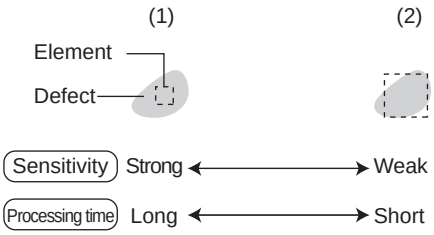
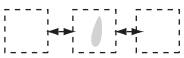
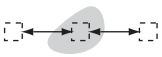
▶ [Density defect/Select region/Region No./Inspection/Detailed conditions]

1. Set each item.

2. Select [End].

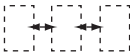
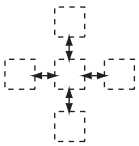


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Setting data	Selection	Details
Element size	4 to 80 (default setting: 10)	Determine the element size according to the size of the defect to be detected. Setting a smaller element size increases detection sensitivity. Setting a larger element size decreases detection sensitivity. Example:  If density that is not part of the defect is included in the calculations as shown in (2), the differences with areas that are not part of the defect will be reduced. In other words, the more the background is included in the element, the weaker the sensitivity will be.
Comparing pitch	1 to 6 (default setting: 1)	Determine the comparing pitch based on the size of the defects and the size of the elements. The larger the comparing pitch, the shorter the processing time will be. If the element size is larger than the defect size: Set a smaller comparing pitch. To find line-shaped defects, set it to about 1 or 2.B  If the defect size is larger than the element size: Set a somewhat larger comparing pitch. If the comparing pitch is too small, comparisons will be made for elements on the edges of defects, reducing the defect value. 

CHECK!

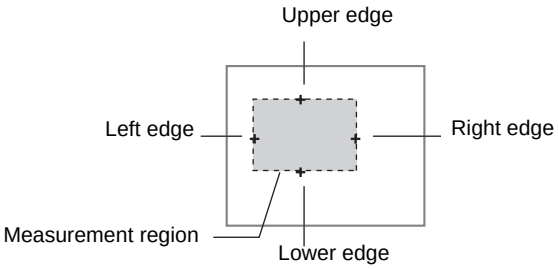
Differences That Depend on the Shape of the Region

Shape of region	Element size	Comparing direction
Line, circumference, or arc defects	Element size 	Left, right 
Region defects	Element size 	Up, down, left, right 

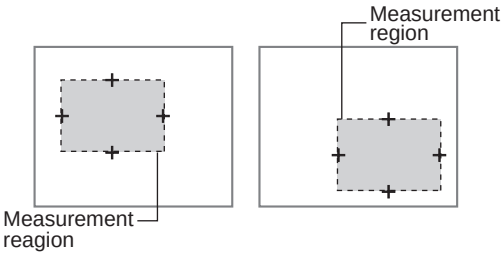
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Defect (Variable Box)

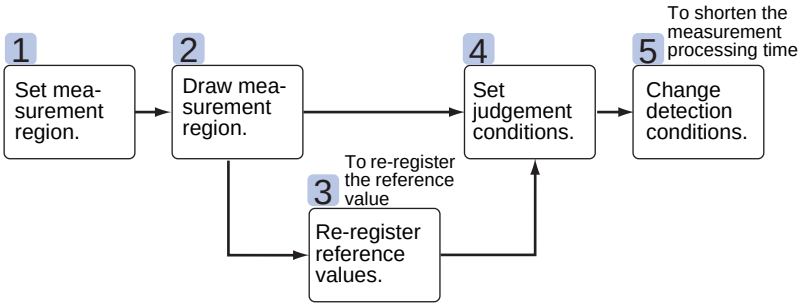
Use the Defect (Variable Box) processing item to adjust the measurement region (a box) for measurement objects with varying sizes or positions to inspect for defects. Find the edges in the density image, and set the inner area enclosed by the edge as the measurement region.



The area within the edges becomes the measurement region. The location of the measurement object can be determined using the edge detection points so the measurement region can be adapted to suit if the size or position of the measurement object changes.



■ Operational Flow



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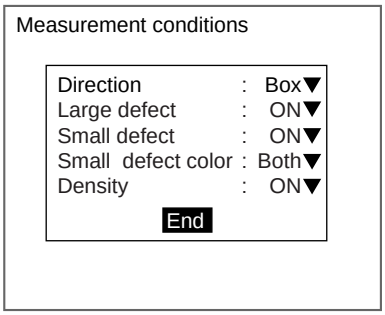
1 Setting Measurement Conditions

Set the conditions for calculating density changes in measurement regions.

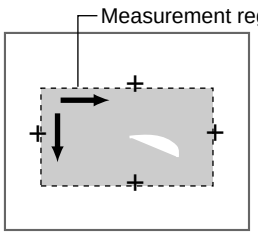
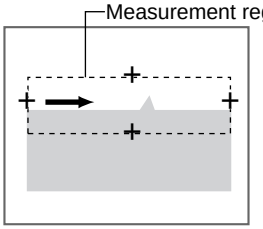
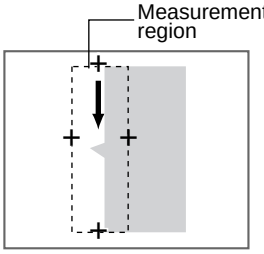
▶ [Density defect/Select region/Region No./Defect (var. box)/Measurement conditions]

1. Set each item.

2. Select [End].



The settings are the same as for Defect (Line, Circum, Arc, and Region), except for the measurement direction.
p.5

Setting data	Selection	Details
Measurement direction	2-dimensional	Select to detect the defects for the whole measurement region. Calculates the variation in density in the X direction and Y direction. 
	X line	Select to detect defects or burrs in the upper or lower section of the measurement region. p.15 Calculates the variation in density in the X direction. 
	Y line	Select to detect defects or burrs in the right or left section of the measurement region. p.15 (Calculates the variation in density in the Y direction.) 

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2 Set the measurement region

The measurement region is drawn by specifying the upper, lower, left, and right edges of the measurement object.

If even one of the edges cannot be located, the judgement result will be NG.

When one of the edges is selected, the settings for the conditions for the selected edge will be displayed. In this example, the settings for [Left edge] will be explained. Make adjustments as necessary when setting conditions for [Upper edge], [Lower edge], and [Right edge].

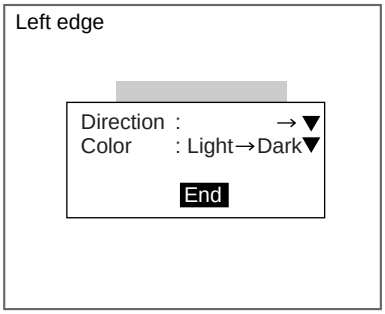
2 1.Set the edge detection conditions

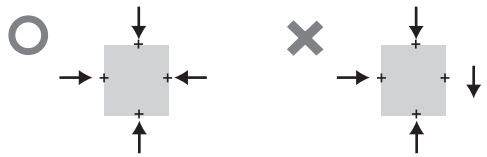
Set the direction for edge detection and the density changes.

▶ [Density defect/Select region/Region No./Defect (var. box) Left edge/Measurement conditions]

1. Set each item.

2. Select [End].

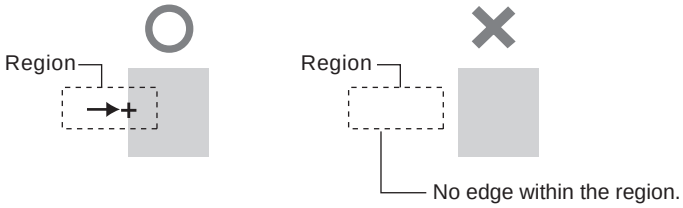


Setting data	Selection	Details
Direction	↑ , ↓, ←, →	Select the edge detection direction. Set a combination of upper, lower, right, and left edge detection directions that surround the area to be measured. Example: 
Color	Light to Dark Dark to Light	Select the density change.

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2 2.Drawing Measurement Regions

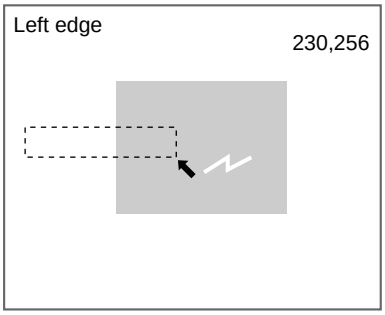
Draw a measurement region to include all the edges for detection.



▶ [Density defect/Select region/Region No./Defect (var. box) Left edge/Region]

1. Draw a box-shaped region.

Specify the upper left and lower right coordinates.

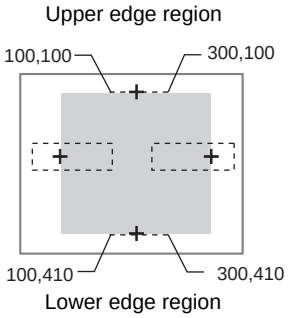


CHECK!

Use the following procedure to fix the measurement region

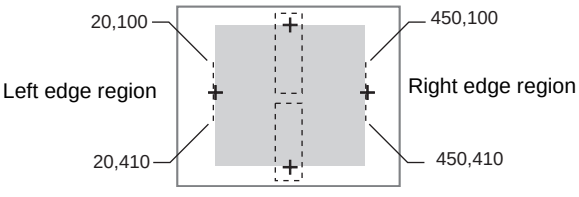
- Measurement Objects with Variable Widths Only

  Draw the edge detection region so that the measurement region Y coordinates will remain the same for both the upper and lower edges.Draw the edge detection region so that the measurement region Y coordinates will remain the same for both the upper and lower edges.



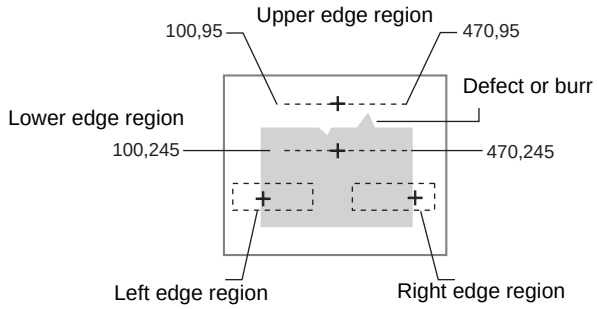
- Measurement Objects with Variable Heights Only

  Draw the edge detection region so that the measurement region X coordinates will remain the same for both the left and right edges. Draw the edge detection region so that the measurement region Y coordinates will remain the same for both the left and right edges.



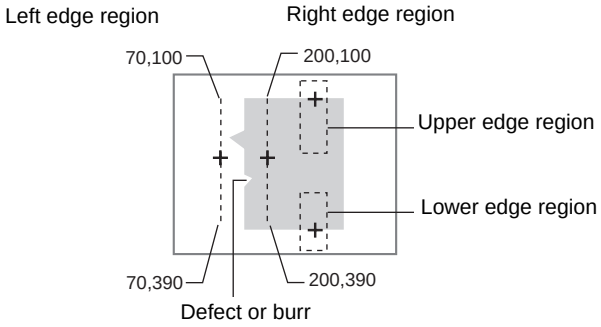
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- To measure defects and burrs in the upper section of measurement regions with variable widths only:
  Draw the edge detection region so that the measurement region Y coordinates will remain the same for both the upper and lower edges.
  The upper and lower edges will always have these edge points.
  * Specify X line under [Measurement conditions/Measurement direction].



- To measure defects and burrs in the left section of measurement regions with variable heights only:

  Draw the edge detection region so that the measurement region X coordinates will remain the same for both the left and right edges.
  The left and right edges will always have these edge points.
  * Specify Y line under Measurement conditions/Measurement direction.



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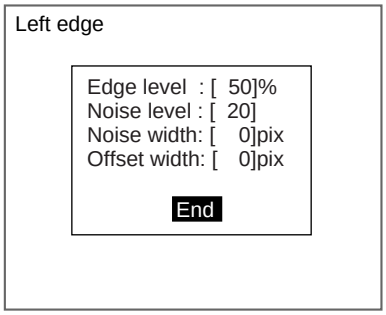
2 3. Changing Detailed Conditions as Required

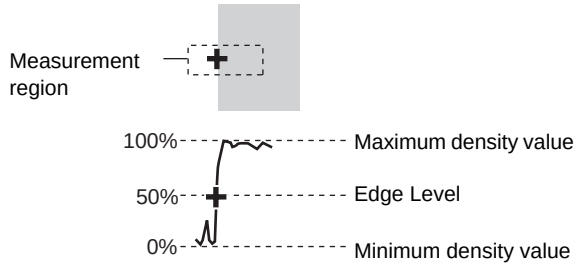
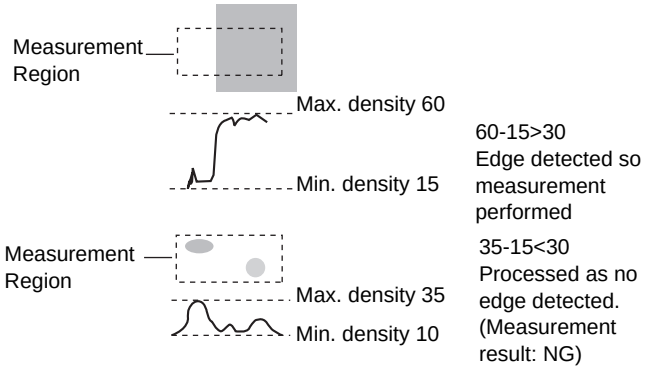
Change the detailed conditions when the measurement results are unstable. Normally, the method can be left on the default setting. After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

▶ [Density defect/Select region/Region No./Defect (var. box)/Left edge/Detailed conditions]

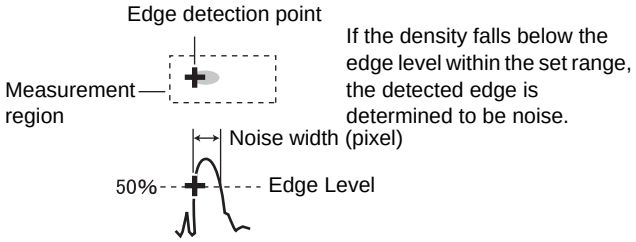
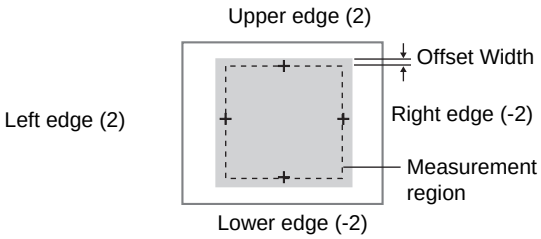
1. Set each item.

2. Select [End].



Setting data	Selection	Details
Edge Level	0 to 100 (default setting: 50)	Set a density change level between 0 and 100 that will indicate the edge. 
Noise Level	0 to 255 (default setting: 20)	Noise level used to make judgement if edges are present or not. The maximum density and minimum density within the edge detection area is calculated and if the difference between the two values is less than the noise level, then the Controller determines that there is no edge. If noise is causing incorrect detection, make this value higher. (Within the edge detection region) Max. density - min. density < noise level →no edge →NG measurement result Max. density - min. density ≥ noise level →Edge →Used for measurement Example: When [Noise level] is set to 30 

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Setting data	Selection	Details
Noise Width	0 to 255 (default setting: 0)	Set the width of objects that are to be judged as noise. If the density distribution from the position where the edge was first detected falls to below the edge level within the noise width range, the detected point is judged as noise.If noise is causing incorrect detection, make this value higher. Example: 
Offset Width	-1023 to 1023 (default setting: 0)	Set the adjustment width (in pixel units) for the detected edge position. Example: To Measure from 2 Pixel-widths Inside the Edge Detection Point 

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3 Registering Reference Positions

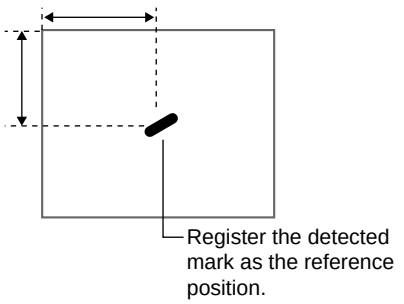
Position detection can also be performed using algorithms for detecting defects.
Register the reference values when performing position detection.

Re-registering Reference Values: The X and Y coordinates of the position found as the large defect
The X and Y coordinates of the position found as the small defect

CHECK! Reference values for 2 positions can be registered, regardless of the settings for large and small defect inspections under Measurement conditions.

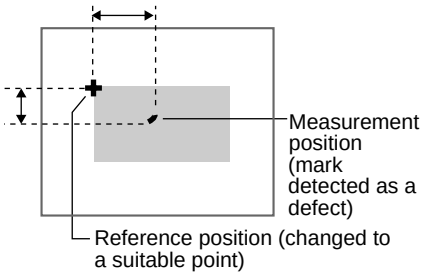
Example: Inspecting Whether or Not the Measurement Object Is Always in the Same Position

Display a measurement object in the correct position, detect a mark, and register that position as the reference position.



CHECK!

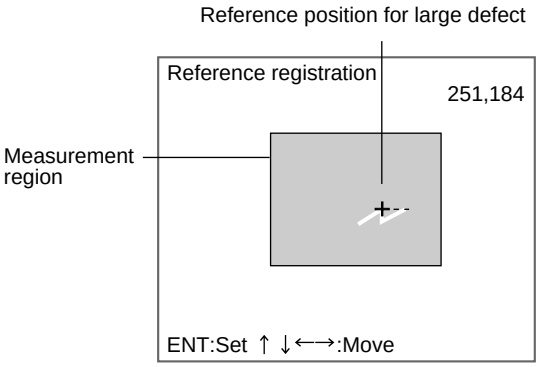
- The reference position can be changed to enable the following function.
- Inspecting Positions from a Specified Point
  Once the reference values (area and center of gravity) have been obtained for the image currently displayed, the reference position is changed to an suitable point. Position inspection can be performed by calculating the difference between this reference position and the measurement position.



▶ [Density defect/Select region/Region No./Area (var. box)/Reference registration]

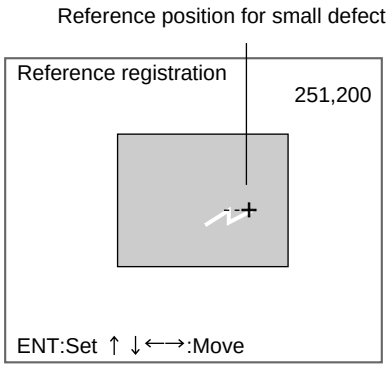
1. Use the Up/Down/Left/Right Keys to move the cursor to change the reference position as for large defects

2. Press the ENT Key.



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A display cursor will appear at the position where a small defect was found.



3. Press the Up/Down and Right/Left Keys to move the cursor to change the position.

4. Press the ENT Key.

4 Setting Judgement Conditions

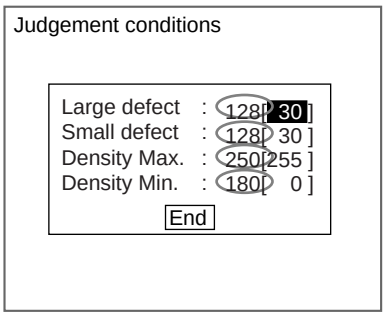
Set the conditions for determining defects.
Set a deviation for an OK judgement.
Measure several samples and set the judgement conditions while referring to the measurement results.

▶ [Density defect/Select region/Region No./Area (var. box)/Judgement conditions]

1. Set each item.

Settings Data
p.8

2. Select [End].



: Measurement result for the displayed image.
Use as a reference for setting conditions.

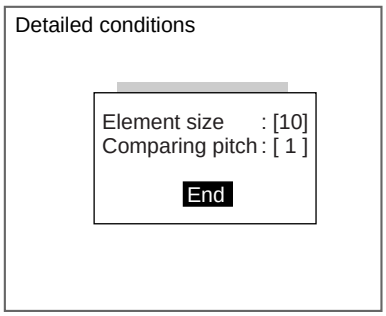
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5 Changing Detection Conditions (Changing Detailed Conditions)

To shorten measurement processing time, change the conditions for detecting defects. The greater [Element size] and [Comparing pitch], the shorter the processing time. However, the accuracy of the measurement will decrease.

Once the element size or comparing pitch setting has been changed, perform measurements to check that they can be performed correctly.

▶ [Density defect/Select region/Region No./Area (var. box)/Detailed conditions]



1. Set each item.

Settings Data
p.9

2. Select [End].

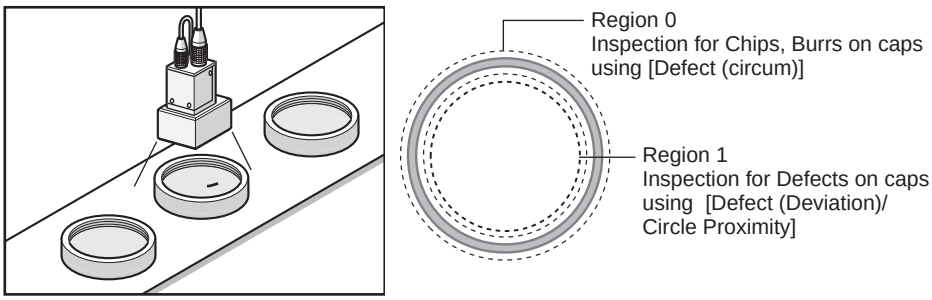
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Defect (Deviation) (only [Density defect inspection])

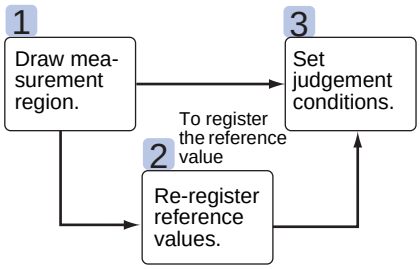
This function can be selected for [Density Defect] only.
Use a Defect (Deviation) measurement to quickly measure multiple regions.
Defect (Deviation) measurement can measure other regions on the same unit in parallel, making the total processing time shorter when multiple regions are registered to the same unit and measured.

Example: Inspecting for Chips, Burrs, or Defects on Caps

Chips and burrs on caps are measured using [Defect (circum)] inspection and defects are measured using [Defect (Deviation)/Circle Proximity].



■ Operational Flow



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1 Drawing Measurement Regions

Draw a figure in the section to be inspected.

When the region is drawn, a + cursor will appear at the position of each detected defect.

CHECK!

Do not include areas with marks and patterns in the measurement region. It will not be possible to distinguish them from surface detects, and measurement will not be performed properly.

CHECK!

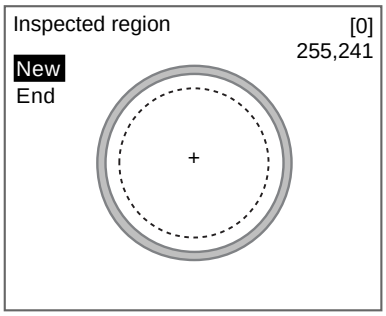
Position detection can be also performed using algorithms for detecting defects.

When a measurement region is drawn, measurement is performed for the displayed image and the results are registered as the reference values (X and Y coordinates of the position where the defect was found). This position becomes the reference position, so be sure to place the measurement object in the correct position before drawing the measurement region.

▶ [Density defect/Select region/Region No./Defect (Deviation)/Inspected region/Figure/New]

1. Draw a figure in the region to be measured.

2. Select [End].



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2 Re-registering Reference Values

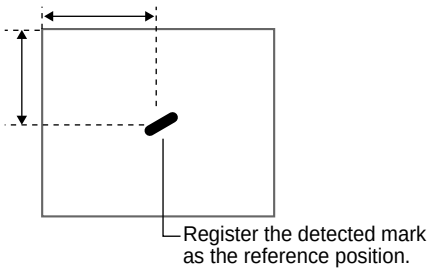
Position detection can be also performed using algorithms for detecting defects.

When a measurement region is drawn, the measurement is performed for the displayed image and the results are registered as the reference values. If the re-registering function explained here is used, only the reference values for the image currently displayed will be registered.

The following reference values must be registered: The X and Y coordinates of the position found as a defect

Example: Inspecting Whether or Not the Measurement Object Is Always in the Same Position

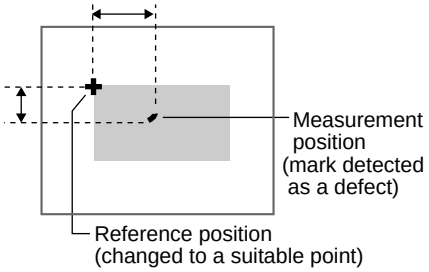
Display a measurement object in the correct position, detect a mark, and register that position as the reference position.



CHECK!

The reference position can be changed to enable the following function.

- Inspecting Positions from a Specified Point
  Once the reference values (area and center of gravity) have been obtained for the image currently displayed, the reference position is changed to an suitable point. Position inspection can be performed by calculating the difference between this reference position and the measurement position.



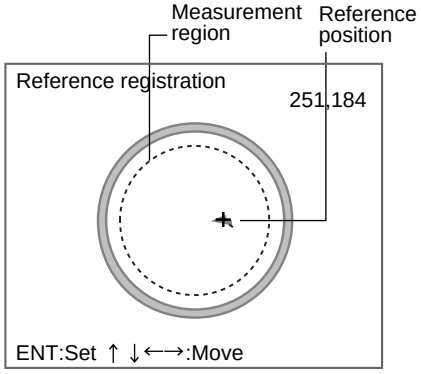
CHECK!

When the measurement region is changed, the reference value returns to the default setting.

▶ [Density defect/Select region/Region No./Defect (Deviation)/Inspected region/ Reference registration]

1. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.



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3 Setting Judgement Conditions

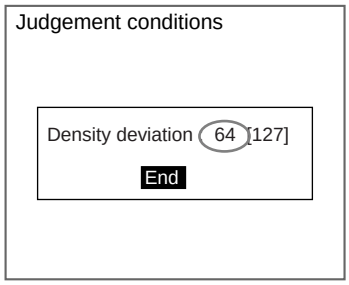
The Controller uses the density deviation of each element in the measurement region to determine if a defect exists.
Measure several samples and set the OK judgement conditions while referring to the measurement results.

Element p.9

▶ [Density defect/Select region/Region No./Defect (Deviation)/Inspected region/ Judgement conditions]

1. Set a density deviation value.

2. Select [End].



: Measurement result for the displayed image. Use as reference for setting conditions.

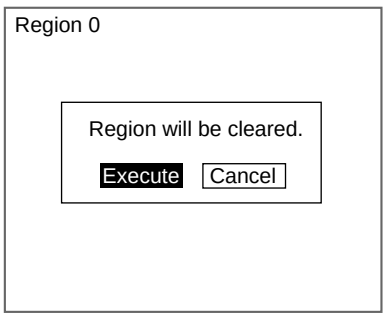
Setting data	Selection	Details
Density deviation value	0 to 127	If the density deviation of all elements is at or below the set value, the judgement result will be OK. If even one of the elements exceeds the value, the judgement result will be NG.

Clearing the Set Regions

The clear operation is executed for each region.

▶ [Density defect inspection/Select region/Region No./Clear]

1. Select [Execute].



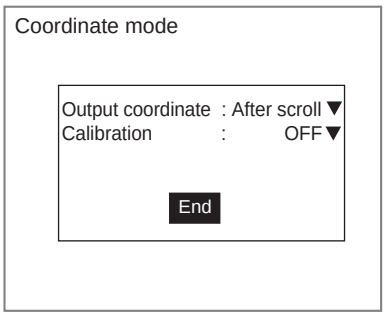
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Setting the Coordinate Mode

Select the type of coordinate values.

CHECK! If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [Density defect/Coordinate mode]



1. Set each item.

2. Select [End].

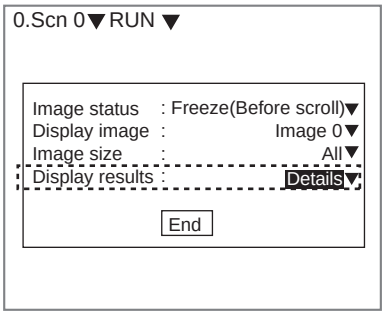
Settings Data

SECTION 7 Appendix, “Output coordinates”

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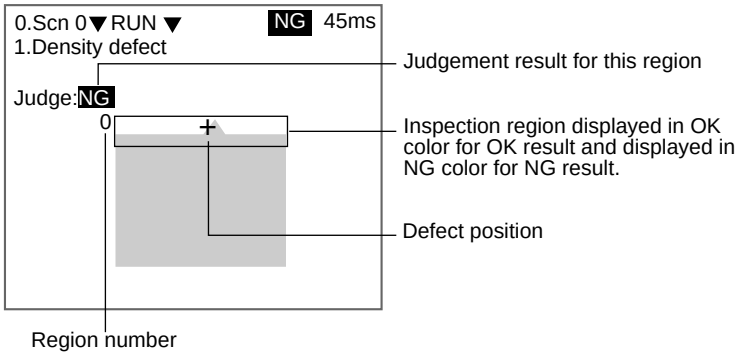
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.
Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



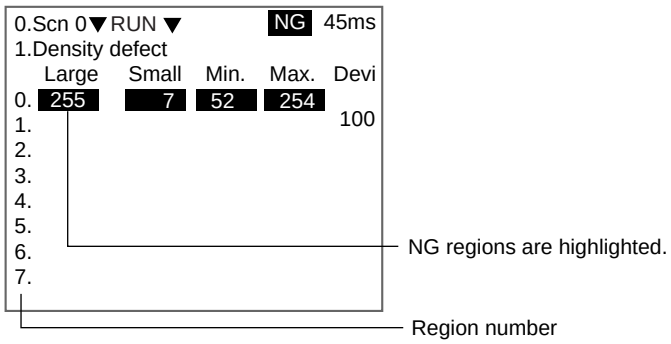
Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed. Use the SHIFT+Right or Left Keys to switch in order between the two screens.

(1) Measurement Region and Position Display



(2) Measurement Value Display

The measurement values for each region are displayed in a list.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, “4.1 Calculation”.

Measurement item	String	Details
Judgement	JG	Unit judgement result (-2: Not measured. -1: NG 0: OK)
The following measurement data is for Region N (0 to 7).		
Judgement	R**JG	Judgement result (-2: Not measured -1: NG 0: OK)
Measurement region	R**X1	Upper left X coordinate of measurement region (See *1.)
Measurement region	R**Y1	Upper left Y coordinate of measurement region (See *1.)
Measurement region	R**X2	Lower right X coordinate of measurement region (See *1.)
Measurement region	R**Y2	Lower right Y coordinate of measurement region (See *1.)
Large defect	R**BD	Large defect
Small defect	R**LD	Small defect
Max. density	R**GA	Max. density
Min. density	R**GI	Min. density
Deviation	R**DV	Deviation (See *2.)
Large defect position	R**BX	X coordinate of large defect position
Large defect position	R**BY	Y coordinate of large defect position
Small defect position	R**LX	X coordinate of small defect position
Small defect position	R**LY	Y coordinate of small defect position
Deviation position	R**VX	X coordinate of deviation position (See *2.)
Deviation position	R**VY	Y coordinate of deviation position (See *2.)
Large reference position	R**SBX	X coordinate of position of large defect when region drawn
Large reference position	R**SBY	Y coordinate of position of large defect when region drawn
Small reference position	R**SLX	X coordinate of position of small defect when region drawn
Small reference position	R**SLY	Y coordinate of position of small defect when region drawn
Deviation reference position	R**SVX	X coordinate of deviation position when region drawn (See *2.)
Deviation reference position	R**SVY	Y coordinate of deviation position when region drawn (See *2.)

*1 The upper left and lower right coordinates of the calculated measurement region will be output whenever Area (Variable Box) is set for any of the regions 0 to 7. These coordinates will be output in pixels regardless of the setting for calibration.

*2 FIn the case of [Density Defect #], this data cannot be referred to.

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Unit judgement result (-2: Not measured. -1: NG 0: OK)
The following measurement data is for Region N (0 to 7).	
22N+1	Judgement result (-2: Not measured -1: NG 0: OK)
22N+2	Upper left X coordinate of measurement region (See *1.)
22N+3	Upper left Y coordinate of measurement region (See *1.)
22N+4	Lower right X coordinate of measurement region (See *1.)
22N+5	Lower right Y coordinate of measurement region (See *1.)
22N+6	Large defect
22N+7	Small defect
22N+8	Max. density
22N+9	Min. density
22N+10	Deviation (See *2.)
22N+11	X coordinate of large defect position
22N+12	Y coordinate of large defect position
22N+13	X coordinate of small defect position
22N+14	Y coordinate of small defect position
22N+15	X coordinate of deviation position (See *2.)
22N+16	Y coordinate of deviation position (See *2.)
22N+17	X coordinate of position of large defect when region drawn
22N+18	Y coordinate of position of large defect when region drawn
22N+19	X coordinate of position of small defect when region drawn
22N+20	Y coordinate of position of small defect when region drawn
22N+21	X coordinate of deviation position when region drawn (See *2.)
22N+22	Y coordinate of deviation position when region drawn (See *2.)

*1: The upper left and lower right coordinates of the calculated measurement region will be output whenever Area (Variable Box) is set for any of the regions 0 to 7. These coordinates will be output in pixels regardless of the setting for calibration.

*2: FIn the case of [Density Defect #], this data cannot be referred to.

■ Setting Data

Data type	Details
180	Measurement image (0: Image 0 1: Image 1)
181	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF, 2: After scroll, calibration ON, 3: Before scroll, calibration ON)

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Data type	Details
The following measurement data is for Region N (0 to 7).	
The following setting data is for [Defect] and [Area (var. box)]	
84N+182	Large defect flag (0: OFF 1: ON)
84N+183	Small defect flag (0: OFF 1: ON)
84N+184	Small defect color (0: White 1: Black 2: Both)
84N+185	Density flag (0: OFF 1: ON)
84N+186	Large defect judgement (0 to 255)
84N+187	Small defect judgement (0 to 255)
84N+188	Density upper limit (0 to 255)
84N+189	Density lower limit (0 to 255)
84N+190	Element size (4 to 80)
84N+191	Comparing pitch (1 to 6)
The following settings data is for [Area (var. box)] measurement.	
84N+192	Measurement direction (0: X line 1: Y line 2: Box)
84N+193	Edge detection direction (left edge: 0: ↑ 1: ↓ 2: → 3: ↔)
84N+194	Edge color (Left edge 0: Light →dark 1: Dark →light)
84N+195	Edge level (left edge: 0 to 100)
84N+196	Noise level (left edge, 0 to 255)
84N+197	Noise width (left edge, 0 to 255)
84N+198	Offset width (left edge, -1023 to 1023)
84N+199	Edge detection direction (upper edge, 0: ↑ 1: ↓ 2: → 3: ↔)
84N+200	Edge color (upper edge, 0: Light →Dark 1: Dark →Light)
84N+201	Edge level (upper edge, 0 to 100)
84N+202	Noise level (upper edge, 0 to 255)
84N+203	Noise width (upper edge, 0 to 255)
84N+204	Offset width (upper edge, -1023 to 1023)
84N+205	Edge detection direction (right edge, 0: ↑ 1: ↓ 2: → 3: ↔)
84N+206	Edge color (right edge, 0: Light →Dark 1: Dark →Light)
84N+207	Edge level (right edge, 0 to 100)
84N+208	Noise level (right edge, 0 to 255)
84N+209	Noise width (right edge, 0 to 255)
84N+210	Offset width (right edge, -1023 to 1023)
84N+211	Edge detection direction (lower edge, 0: ↑ 1: ↓ 2: → 3: ↔)
84N+212	Edge color (left edge, 0: Light →Dark 1: Dark →Light)
84N+213	Edge level (lower edge, 0 to 100)
84N+214	Noise level (lower edge, 0 to 255)
84N+215	Noise width (lower edge, 0 to 255)
84N+216	Offset width (lower edge, -1023 to 1023)
The following settings data is for [Defect (deviation)] measurement.	
84N+217	Defect judgement (0 to 127) (See *5.)
The following data is for the [Defect (line)] inspection region.	
84N+218	Start X (0 to X_MAX) (See *4.)

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Data type	Details
84N+219	Start Y (0 to Y_MAX) (See *4.)
84N+220	End X (0 to X_MAX) (See *4.)
84N+221	End Y (0 to Y_MAX) (See *4.)
84N+222	Width (1 to 64)
The following data is for the [Defect (circumference)] inspection region.	
84N+223	Center X (0 to X_MAX) (See *4.)
84N+224	Center Y (0 to Y_MAX) (See *4.)
84N+225	Radius (1 to R_MAX) (See *4.)
84N+226	Width (1 to 64)
The following data is for the [Defect (arc)] inspection region.	
84N+227	Center X (0 to X_MAX) (See *4.)
84N+228	Center Y (0 to Y_MAX) (See *4.)
84N+229	Radius (1 to R_MAX) (See *4.)
84N+230	Width (1 to 64)
84N+231	Start angle (-180.00 to 180.00)
84N+232	End angle (-180.00 to 180.00)
The following data is for the [Defect (region)] inspection region.	
84N+233	Region upper left X (0 to X_MAX) (See *3, *4)
84N+234	Region upper left Y (0 to Y_MAX) (See *3, *4)
84N+235	Region lower right X (0 to X_MAX) (See *3, *4.)
84N+236	Region lower right Y (0 to Y_MAX) (See *3, *4.)
The following data is for the [Defect (variable box)] inspection region.	
84N+237	Region upper left X (left edge) (0 to X_MAX) (See *4.)
84N+238	Region upper left Y (left edge) (0 to Y_MAX) (See *4.)
84N+239	Region lower right X (left edge) (0 to X_MAX) (See *4.)
84N+240	Region lower right Y (left edge) (0 to Y_MAX) (See *4.)
84N+241	Region upper left X (upper edge) (0 to X_MAX) (See *4.)
84N+242	Region upper left Y (upper edge) (0 to Y_MAX) (See *4.)
84N+243	Region lower right X (upper edge) (0 to X_MAX) (See *4.)
84N+244	Region lower right Y (upper edge) (0 to Y_MAX) (See *4.)
84N+245	Region upper left X (right edge) (0 to X_MAX) (See *4.)
84N+246	Region upper left Y (right edge) (0 to Y_MAX) (See *4.)
84N+247	Region lower right X (right edge) (0 to X_MAX) (See *4.)
84N+248	Region lower right Y (right edge) (0 to Y_MAX) (See *4.)
84N+249	Region upper left X (lower edge) (0 to X_MAX) (See *4.)
84N+250	Region upper left Y (lower edge) (0 to Y_MAX) (See *4.)
84N+251	Region lower right X (lower edge) (0 to X_MAX) (See *4.)
84N+252	Region lower right Y (lower edge) (0 to Y_MAX) (See *4.)
The following data is for the [Defect (deviation/box)] inspection region.	
84N+253	Region upper left X (0 to 511) (See *5.)
84N+254	Region upper left Y (0 to 483) (See *5.)
84N+255	Region lower right X (0 to 511) (See *5.)

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Data type	Details
84N+256	Region lower right Y (0 to 483) (See *5.)
The following data is for the [Defect (deviation/circumference)] inspection region.	
84N+257	Center X (0 to 511) (See*5.)
84N+258	Center Y (0 to 483) (See *5.)
84N+259	Radius (10 to 242) (See *5.)
The following data is for the inspection region other than [Defect (deviation)].	
84N+260	Large defect reference position X (0 to X_MAX) (See *4)
84N+261	Large defect reference position Y (0 to Y_MAX) (See *4)
84N+262	Small defect reference position X (0 to X_MAX) (See *4)
84N+263	Small defect reference position Y (0 to Y_MAX) (See *4)
The following data is for the [Defect (deviation)] inspection region.	
84N+264	Deviation reference position X (0 to 511) (See *5.)
84N+265	Deviation reference position Y (0 to 483) (See *5.)

*3: If this data is changed, one rectangular region will be set and the previously drawn figures will be deleted.

*4: The range varies depending on the controller model.

Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483
1 to R_MAX	1 to 1024	1 to 512

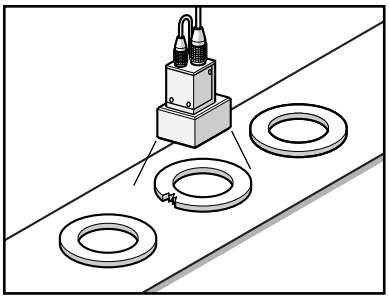
*5: In the case of [Density Defect #], this data cannot be set.

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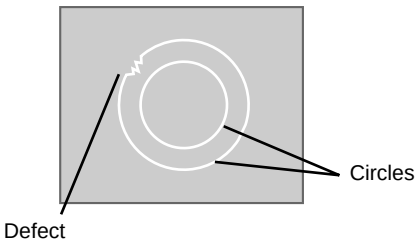
EC Defect Inspection

The EC Defect processing item enable detecting with great accuracy minute defects or defects with low contrast on circle- or line-shaped measurement objects.
Rubber packing or other items that may have distorted shapes can be stably detected.

Example: Detecting defects or burrs on O rings



Edge-extracted image



These images are recognized as circles, even if they are slightly out of shape.



Edge Code (EC)
SECTION 7 Appendix, “Terminology”

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Operational Flow

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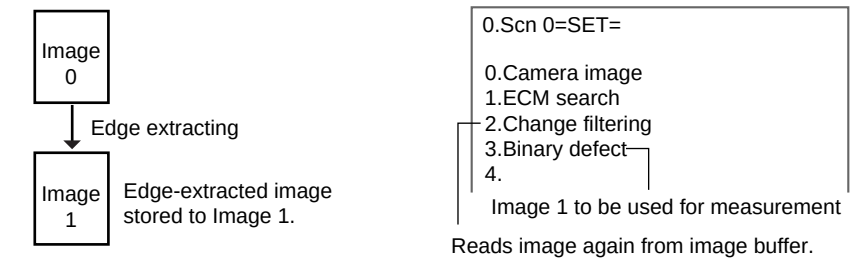
Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

CHECK!

The edges are extracted for the image number selected here and this image is then stored at the other image number. Set [Change Filtering] as the next processing item to use this image for measurement for units after the unit for which this processing item was set. Then store the image stored in the image buffer to [Image 0] or [Image 1].

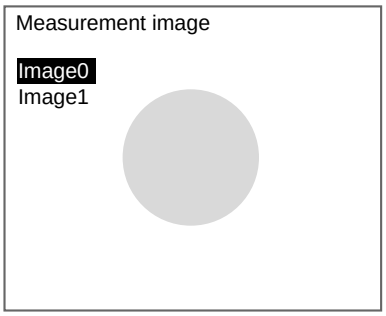
Example: When Image 0 Is Selected as Measurement Image



▶ [EC defect/Measurement image]

1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.



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Extracting Edges

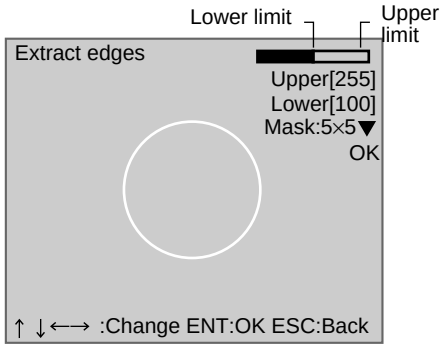
This processing Item is performed for images for which the edges have been extracted.
Adjust the upper and lower levels for edge extraction if there is low contrast between the measurement object and the background and to remove noise.

▶ [EC defect/Extract edges]

1. Set the upper and lower limits.

2. Select the desired mask size.

3. Select [OK].



Setting data	Selection	Details
Upper and Lower Limits	10 to 255 (default setting 100:255).	Set the level to which the background will be cut. Adjust the upper and lower levels for edge extraction if there is low contrast between the measurement object and the background and to remove noise.
Mask Size	5 × 5 (default setting) 3 × 3	The mask size function is used when searching for edges to judge edges using peripheral information. The greater the mask size, the more the variations in surrounding pixels can be absorbed. CHECK! This setting will be enabled only if [Camera image] is set to [Frame].

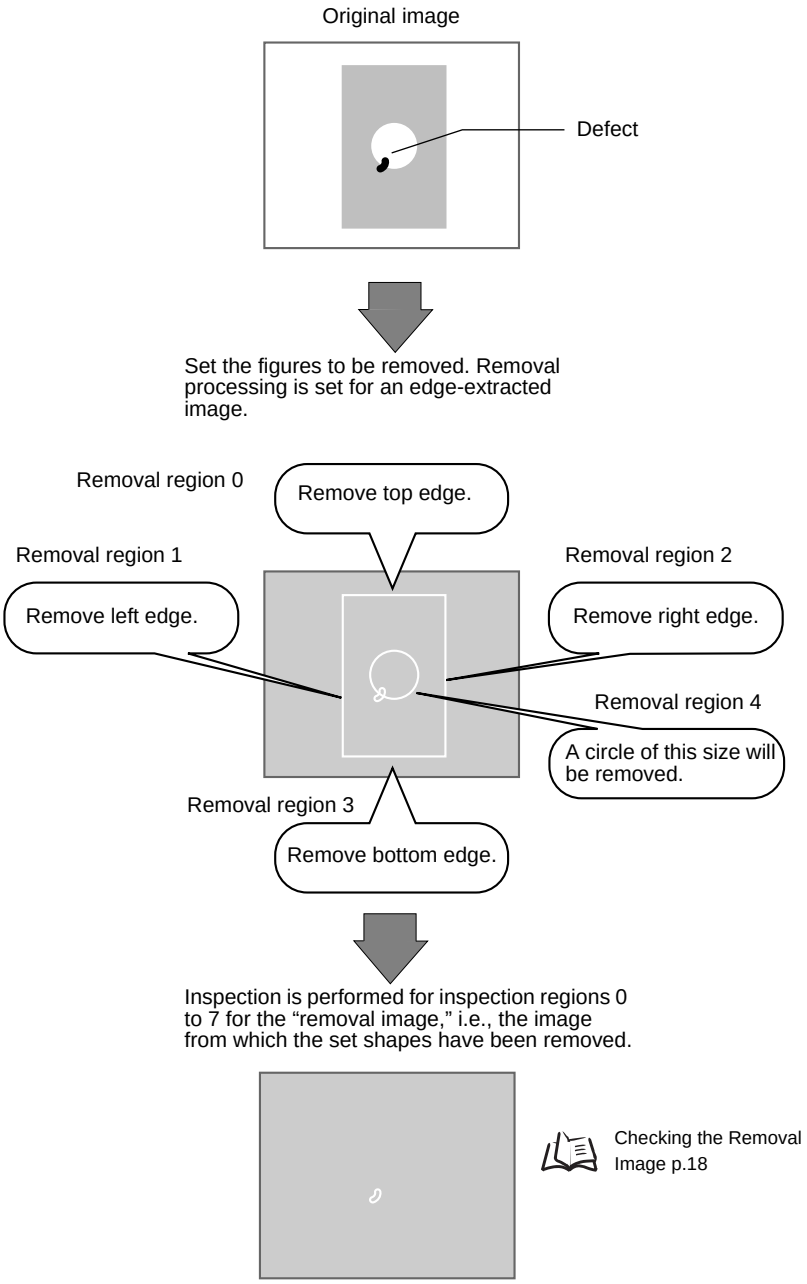
Settings Data

SECTION 7 Appendix, “EC (Edge Code) Image Measurement”

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Setting Removal Regions

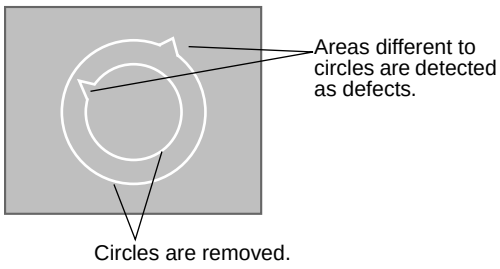
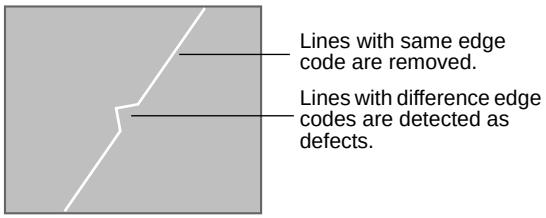
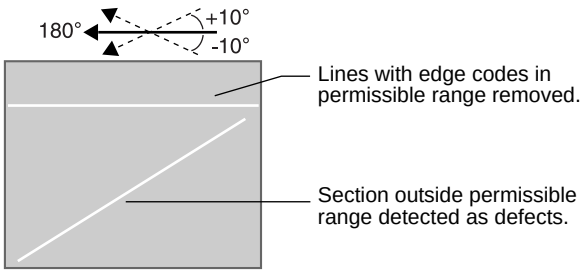
Specify what shapes are to be removed from which range.
The inspection target can be limited to the defect if the outline of the measurement object or other regions are set to be removed.



Checking the Removal Image p.18

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The following 3 types of figures can be set for removal.
Up to 8 regions can be set, and figures can be selected independently for each region.

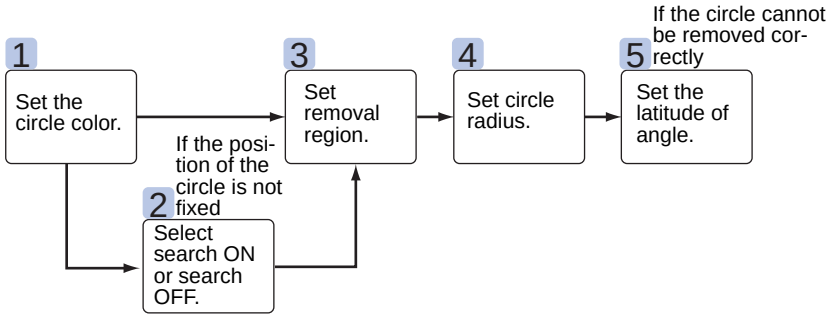
Figure	Details
Circular	Removes circles of the specified size from the edge-extracted image. With the EC algorithm, circles that are slightly deformed can still be removed. 
Line	Lines with the most common edge code (direction) will be deleted from the edge-extracted image. 
Oriented line	The direction of the line and the permissible range are set and only the lines within that range are removed the edge-extracted image. Example: Removing lines angled at 180°±10° 

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Removing Circles

Circles are detected using edge codes.
To remove circles of a different size, set the removal region for each size.

■ Operational Flow



Circle Extracting Algorithms Using Edge Codes
SECTION 7 Appendix, “EC (Edge Code) Image Measurement”

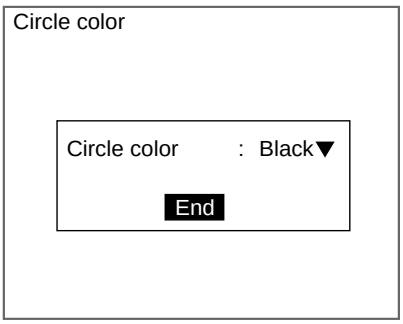
1 Setting the Circle Color

Set the color of the circle to be removed.

▶ [EC defect/Removal regions/Region (No.)/Circle/Circle color]

1. Select the circle color.

2. Select [End].



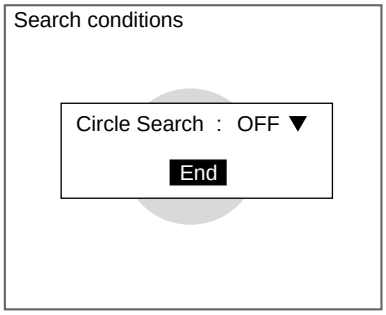
Setting data	Selection	Details
Circle color	Black (default setting) White Both	Select whether the circle color will be white or black compared to the background. Select [Both] if the circle color is not fixed to either black or white.

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2 Selecting Search ON or Search OFF

Circles that fit the conditions can be searched for and removed from the removal region if the position of the circle is not fixed.

▶ [EC defect/Removal regions/Region (No.)/Circle/Search conditions]



1. Select [ON] or [OFF].

2. Select [End].

Setting data	Selection	Details
Circle search	ON	Change the [Circle search] to [ON] (execute) if the position of the circle is not fixed.Circles that fit the conditions can be searched for.
	OFF (default setting)	Select the circle search to [OFF] if the position of the measurement object is fixed or if position displacement compensation is set and the circle is compensated to a fixed position. CHECK! If the [Circle search] is set to [OFF], the center of the circle will be [Radius] specified here. Setting [Radius] p.9

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3 Setting Removal Ranges

Circles that match the removal conditions within the removal region set here will be removed.

CHECK!

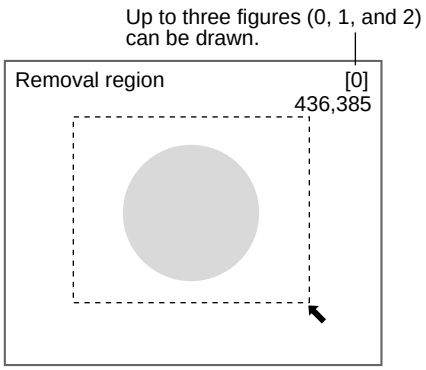
When edges are extracted, the pixels at the edges of the screen cannot be processed accurately.Do not include the outer edges of the screen when setting the removal region.
In particular, when performing position displacement compensation, adjust so that the scrolled image or the measurement range will not overlap with this region. Furthermore, if the number of lines to be read has been set in the case of F160-S2 camera, there are restrictions on the setting range.

SECTION 2, 1.1 Inputting Camera Images, “Filtering”

▶ [EC defect/Removal regions/Region (No.)/Removal region/New/figure/drawing mode]

1. Draw the figure in the circle removal region.

SECTION 1 Basic Operating Procedures, “Drawing a Region”



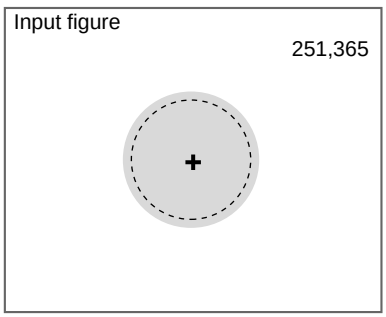
4 Setting the Radius of the Circle

Set the radius and the permissible radius range for the circle to be removed.
If the [Circle search] is set to [OFF], the center of the circle will be the position specified here.

▶ [EC defect/Removal regions/Region (No.)/Radius]

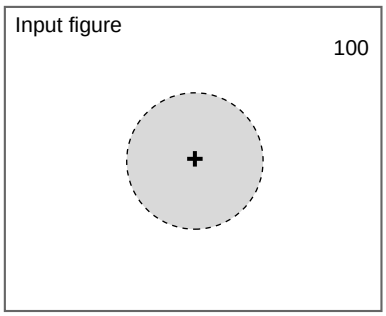
1. Specify the center position of the circle.

Up/Down/Left/Right Keys: Move the cursor.
ENT Key: Confirms the setting.



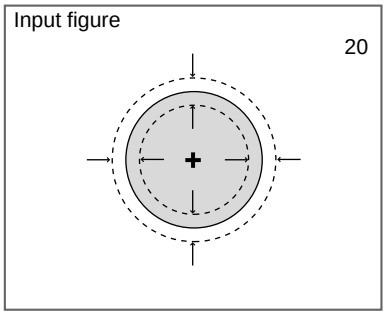
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The screen for setting the radius will be displayed.



2. Setting the radius.

Up/Right Keys: Larger
Down/Left Keys: Smaller
ENT Key: Confirms the setting.



3. Set the permissible radius range.

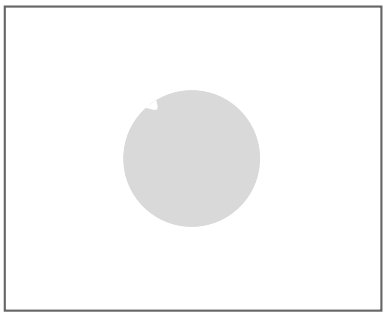
Up/Right Keys: Larger
Down/Left Keys: Smaller
ENT Key: Confirms the setting.

5 Changing the Latitude of the Angles

If circles are deformed, interfering with removal or causing removal of incorrect elements, the latitude of the angles of the edge codes judged to be a circle can be changed.

▶ [EC defect/Removal regions/Region (No.)/Latitude of angle]

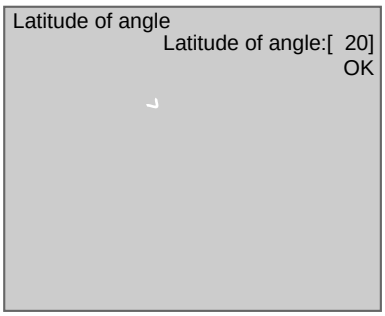
Original image

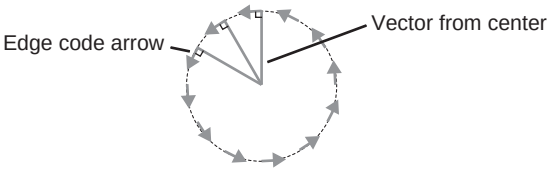
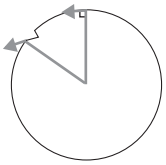


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1. Set the latitude of angle to remove circles that are not required.

2. Select [OK].



Setting data	Selection	Details
Latitude of angle	0 to 99 (default setting: 20)	The latitude of angle is set for the 90° between the edge code arrow and a vector from the center of the circle. If, for example, the latitude is set to 15°, points at 75° to 105° will be judged to be edge points on the circumference.  As shown below, the angle of the edge code changes when there is an irregularity on the circumference of the circle. 

CHECK!

Set the latitude of angle to a small value to detect even small irregularities in the circle.

Set the latitude of angle to a large value to ignore small irregularities in the circle and detect only large defects.

The following functions can be used simultaneously to increase efficiency.

- Use a mask size of 5x5 to extract edges.

p.4

- Set smoothing for filtering the image.

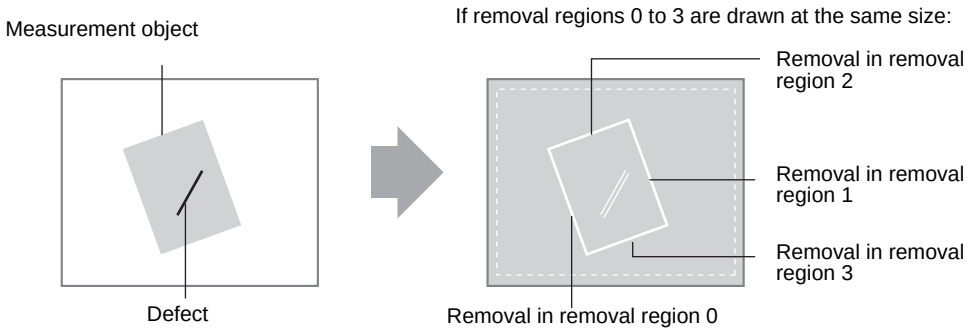
SECTION 2, 1. Input image Items

- Inputting Camera Images
- Changing Filtering
- Filtering Again (smoothing can be set to be executed twice)

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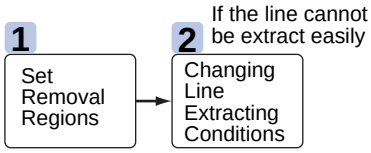
Removing Lines

Lines are detected using edge codes.
The lines with the most common edge code (direction) will be deleted from the edge-extracted image so this function can be used even if the measurement object is at a different orientation.



Line Extracting Algorithm Using Edge Codes
SECTION 7 Appendix, “EC (Edge Code) Image Measurement”

■ Operational Flow



1 Setting Removal Ranges

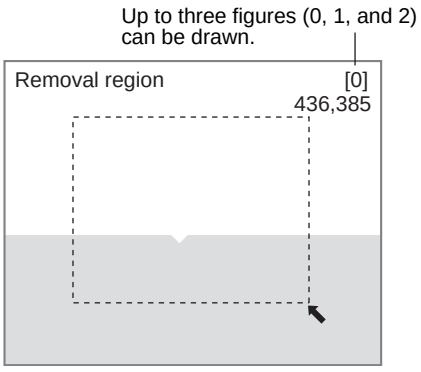
Lines that match the removal conditions will be removed from the range set here.

CHECK! When edges are extracted, the pixels at the edges of the screen cannot be processed accurately. Do not include the outer edges of the screen when setting the search region. Refer to [Circles].
p.9

▶ [EC defect/Removal regions/Region (No.)/Line/Removal region/New/figure/drawing mode]

1. Draw the figure in the line removal region.

SECTION 1 Basic Operating Procedures, “Drawing a Region”



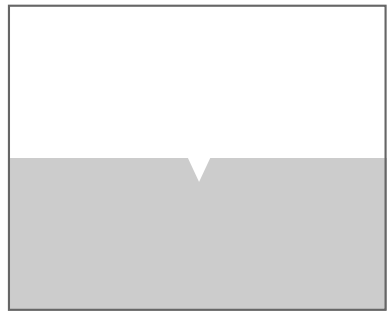
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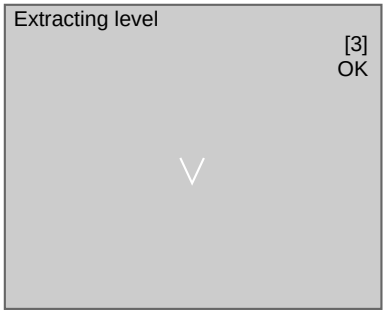
2 Changing Line Extracting Conditions

The level for line extracting can be changed.

▶ [EC defect/Removal regions/Region (No.)/Line/Extracting level]

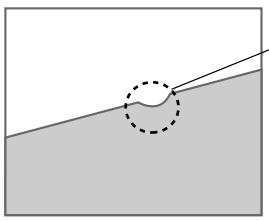
Original image





1. Set the line extracting level so that the lines that are not required are removed.

2. Select [OK].

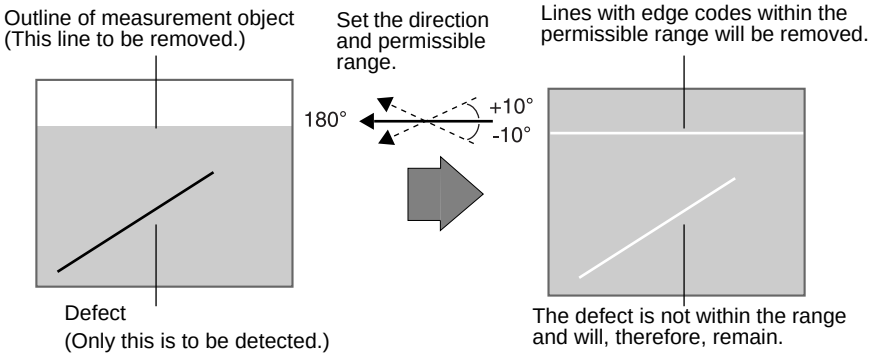
Setting data		Details
Extracting level	1 to 5 (default setting: 3)	Set the extracting level for edges to be deemed as straight lines. Example:  • To detect this kind of small defect as a defect, reduce the line extracting level. • To detect this kind of uneven edge as a line and remove it, increase the line extracting level.

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Removing Lines with Line Angle Specified

The direction of the line and the permissible range are set and only the lines within that range are removed.

Correct measurement cannot be performed if the measurement object has rotated. Therefore, if position displacement occurs, set position displacement compensation earlier than the unit for which EC defect inspection is set.



Oriented Line Extracting Algorithm Using Edge Codes

SECTION 7 Appendix, “EC (Edge Code) Image Measurement”

■ Operational Flow

1 Setting Removal Ranges → 2 Setting the Radius of the Circle

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1 Setting Removal Ranges

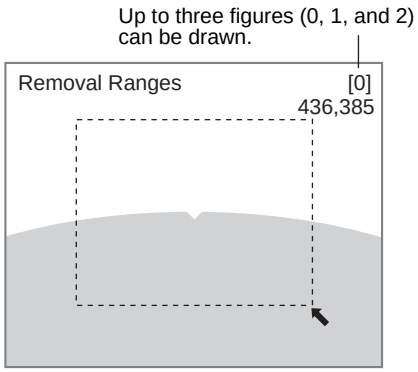
Lines that match the removal conditions will be removed from the range set here.

CHECK! When edges are extracted, the pixels at the edges of the screen cannot be processed accurately. Do not include the outer edges of the screen when setting the search region.Refer to [Circles].
p.9

▶ [EC defect/Removal regions/Region (No.)/Oriented line/Removal region/New/figure/drawing mode]

1. Draw the figure in the line removal region.

SECTION 1 Basic Operating Procedures, “Drawing a Region”



2 Setting the Direction

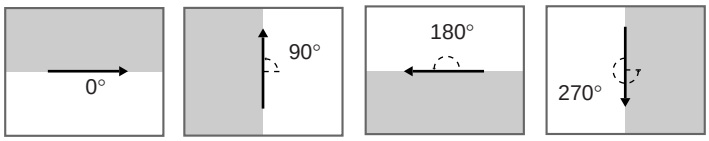
Set the line direction and the permissible range for oriented lines to be detected and removed.

There are two methods for registering the size of the circle.

Setting Procedure	Details
Inputting Figures	The measurement object is displayed and arrows are placed on it to set the direction and latitude of angle.
Inputting Parameters	The direction and latitude of angle are input numerically.In the background, an image with lines removed corresponding to the angle settings is displayed.

Line Directions and Angles

The positions where the brightness changes are extracted as edges and the directions of the changes in brightness are found. These directions are called the edge codes and they indicate the directions of the edges. The way in which black and white meet determines the direction of an edge code, and the angle is calculated as shown below.

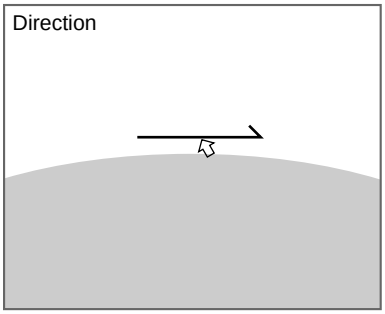


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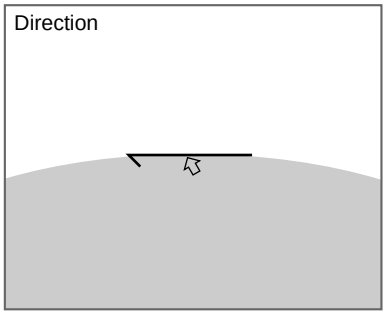
■ Inputting Figures

▶ [EC defect/Removal regions/Region (No.)/Oriented line/Direction/Input figure]

1. Press the TRIG Key.



The arrow will point in the direction that indicates the edge code for the displayed image.

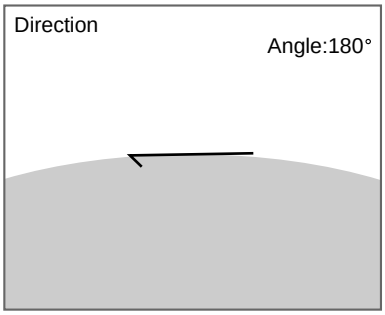


2. Move the arrow to on top of the line to be removed.

Up/Down/Left/Right Keys: Move the line up, down, left, and right.

3. Press the ENT Key.

The screen for setting the angle of the arrow will be displayed.



4. Align the arrow with the angle of the line.

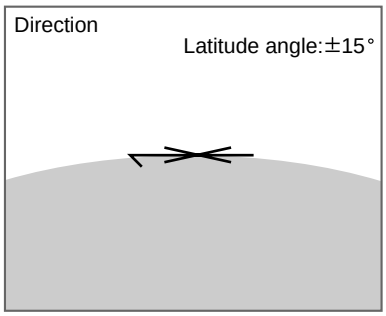
Down/Right Keys: Move the arrow clockwise.
Up/Left Keys: Move the arrow counterclockwise.

CHECK! The line will not be extracted correctly if the arrow is rotated so that it is the reverse of the arrow direction shown in step 4.
Press the TRIG Key to return the arrow to the correct direction if the arrow direction has become unclear.

5. Press the ENT Key.

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The screen for setting the permissible range will be displayed.



6. Set the permissible angle range.

Up/Left Keys: Increase the range.
Down/Right Keys: Decrease the range.

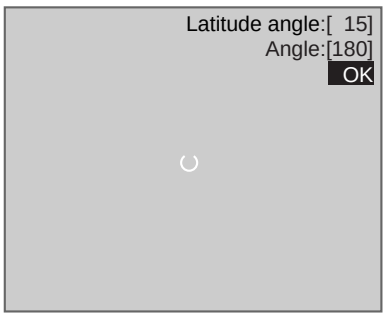
7. Press the ENT Key.

■ Inputting Parameters

▶ [EC defect/Removal regions/Region (No.)/Oriented line/Direction/Input parameter]

1. Set the parameters so that the lines that are not needed are removed.

2. Select [OK].



Setting data	Selection	Details
Latitude of angle	0 to 45	The [Latitude angle] is set on both sizes of the [Angle]. If the [Angle] is set to 180° and the [Latitude angle] is set to 15°: Lines at 165° to 195° will be removed.
Angle	0 to 359	Set the angle of the edge code. p.15

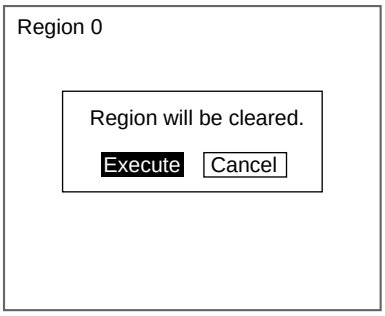
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Clearing Removal Regions

The clear operation is executed for each region.

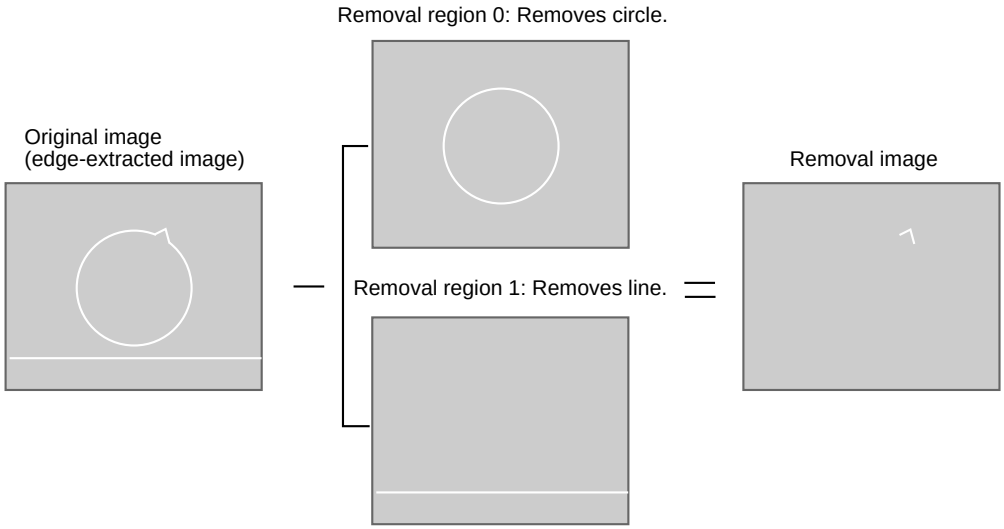
▶ [EC defect/Removal regions/Region (No.)/Clear]

1. Select [Execute].



Checking the Removal Image

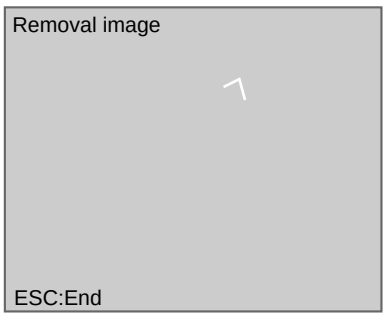
The removal image with the settings for removal regions 0 to 7 can be displayed on the screen for checking.



▶ [EC defect/Removal image]

1. Checking the removal image

2. Press the ESC Key.



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Setting Inspection Regions

There are 3 inspection methods available for selection.

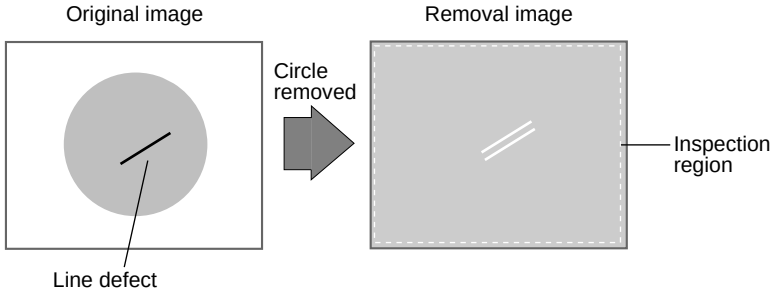
Up to 8 regions can be set and separate inspection methods can be chosen for each region.

Inspection	Details
Defect	Detects line defects for the removal image produced from the settings for removal regions 0 to 7. Only the 2 parallel lines in the edge-extracted image are detected as defects.
Labeling	Performs labeling on the removal image produced from the settings for removal regions 0 to 7. The total white pixel area is found and evaluated for defects.
Gravity and Area	Performs labeling on the removal image produced from the settings for removal regions 0 to 7. The total white pixel area is found and evaluated for defects.

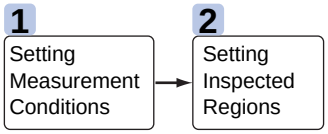
Defect

This defect inspection operation detects line defects on a removal image.

Only the 2 parallel lines in the edge-extracted image are detected as defects.

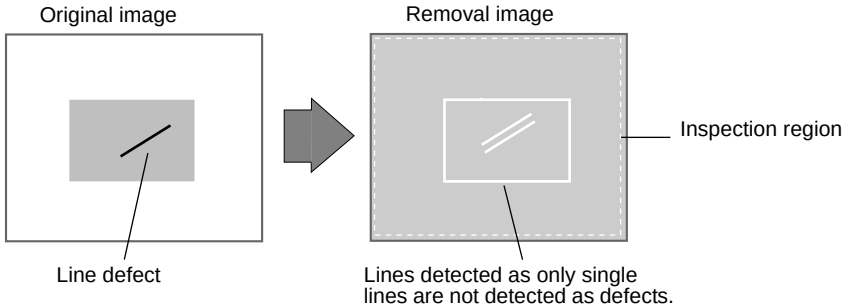


■ Operational Flow



CHECK!

Any lines in the measurement object that are detected as only single lines, such as the exterior, are ignored. In this case, it is not necessary to set removal regions.



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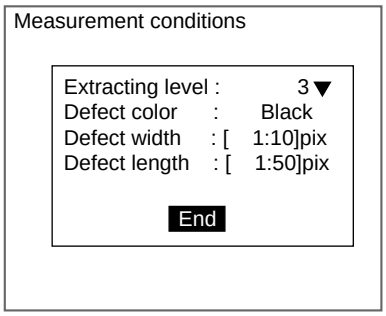
1 Setting Measurement Conditions

Set the conditions for detecting lines as defects.

▶ [EC defect/Inspected regions/Region (No.)/Defect/Measurement conditions]

1. Set each item.

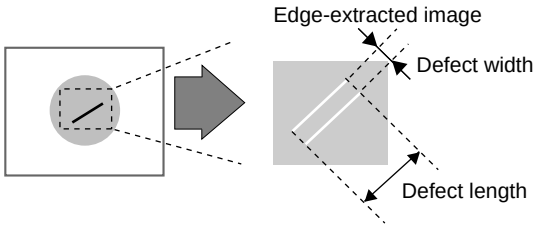
2. Select [End].



Setting data	Selection	Details
Extracting level	1 to 5 (default setting: 5)	Reduce this number if the lines to be detected as defects are broken and detected as multiple lines. Increase this number if defect lines are not found.
Defect color	Black (default setting) White	Select whether the defect will be white or black compared to the measurement object.
Defect width	0 to 200 (default setting 01:10:00 AM)	Parallel lines are detected as defects. Set the edge widths of defects in pixel units so that two quite separate lines are not detected as defects.
Defect length	0 to 1450 (default setting 1:50)	Set the length of lines to be detected as defects in pixel units.

CHECK!

Only parallel lines that match the set defect width and length will be detected as defects.
Width and length conditions can be set to exclude measurement outlines from being detected as defects, even if the outline is box-shaped and the edges are parallel.



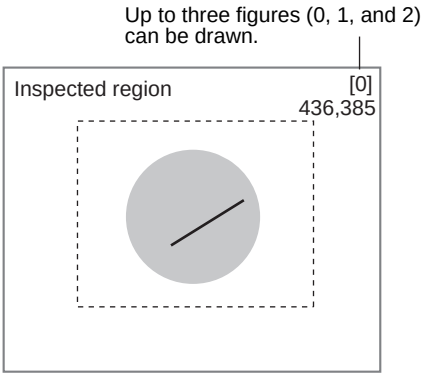
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2 Setting Inspected Regions

▶ [EC defect/Inspected regions/Region (No.)/Defect/Inspected region/New/figure/drawing mode]

1. The method for drawing the region is the same as for removal regions.

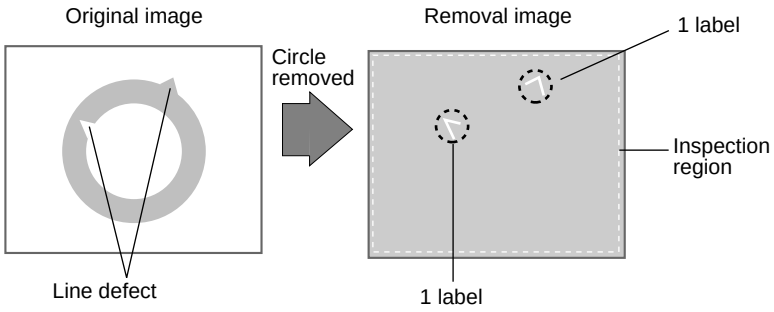
SECTION 1 Basic Operating Procedures, “Drawing a Region”



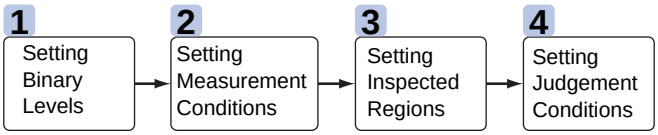
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Labeling

Labeling is performed on the removal image.One group of white pixels is detected as one label. The Controller will judge whether or not labels that match the set conditions are defects.



■ Operational Flow



1 Setting Binary Levels

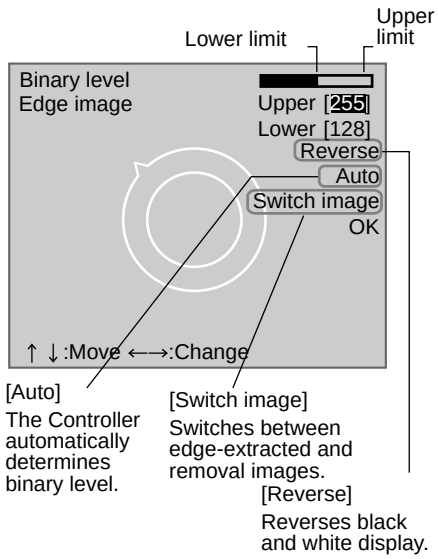
Adjust the binary levels so that the area to be measured appears as white pixels.

▶ [EC defect/Inspected regions/Region (No.)/Labeling/Binary]

1. Move the cursor to the upper value and use the Left and Right Keys to adjust the value.

2. Use the same method to change the lower value.

3. Select [OK].



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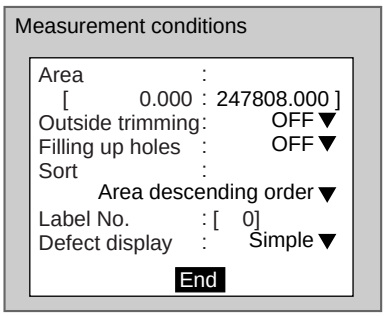
2 Setting Measurement Conditions

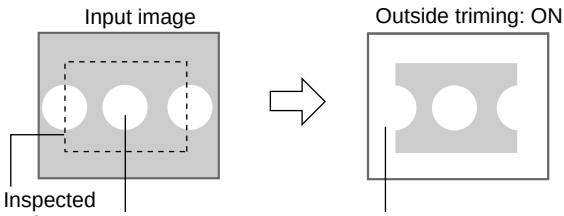
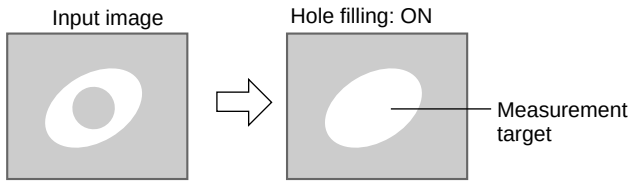
Set the [Area], [Sort], and [Label No.] as conditions for label measurement.

▶ [EC defect/Inspected regions/Region (No.)/Labeling/Measurement conditions]

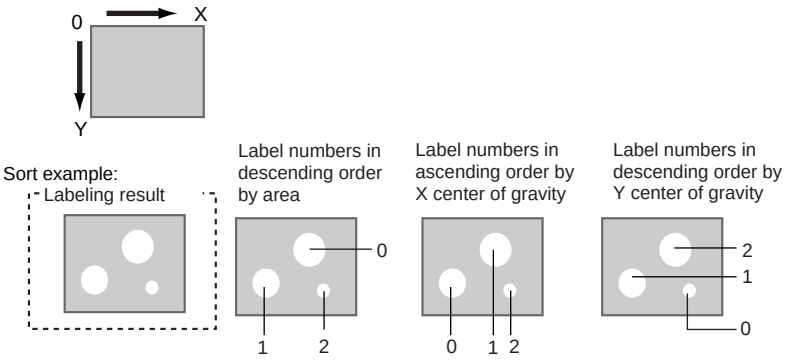
1. Set each item.

2. Select [End].



Setting data	Selection	Details
Area	0 to 9,999,999.999 (default setting: 0)	Set the range of areas to be judged as a label.
Outside trimming	Select Outside trimming when there is a white-pixel area inside the measurement region that is not to be measured.  The area outside the inspected region changes to white pixels. (The whole input image area is used for measurement.) The position and the size of the middle label will be found if the following conditions are set: Sort conditions: Area, ascending order Label number: 1	
	OFF (default setting)	Measures the binary image.
	ON	Measures all pixels outside the inspected region as white pixels.
Filling up holes	Use the Filling up holes setting to specify how areas of black pixels contained inside donut-shaped areas of white pixels are processed. If selected, the black pixels will be processed as white pixels.  	
	OFF (default setting)	Outputs area and center of gravity coordinates before filling holes.
	ON	Outputs area and center of gravity coordinates after filling holes.

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Setting data	Selection	Details
Sort	Set the label number re-assignment conditions. The upper left corner will be used as the origin when sorting by center of gravity X and Y. The coordinates set using calibration are not affected by labeling. 		
	Area descending order (default setting)	Sorts in descending order by area
	Area ascending	Sorts in ascending order by area.
	X gravity descending	Sorts in descending order by center of gravity X.
	X gravity ascending	Sorts in ascending order by center of gravity X.
	Y gravity descending	Sorts in descending order by center of gravity Y.
	Y gravity ascending	Sorts in ascending order by center of gravity Y.
Label No.	0 to 2499 (default setting: 0)	Sets label number for defect evaluation.
Defect display	Defect display method on measurement screen (regions displayed separately): p.27	
	Simple (default setting)	A display cursor will appear at the defect position.
	Detail	Defects will appear in the NG color. This option requires longer processing time than [Simple] display.

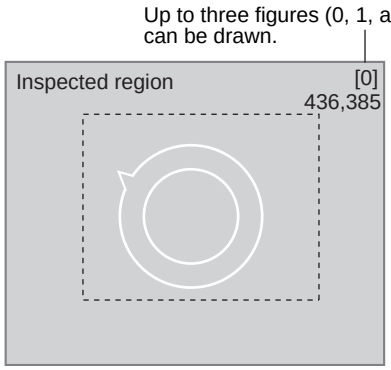
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3 Setting Inspected Regions

▶ [EC defect/Inspected regions/Region (No.)/Labeling/Inspected region/New/figure/drawing mode]

1. The method for drawing the region is the same as for labeling.

SECTION 1 Basic Operating Procedures, “Drawing a Region”



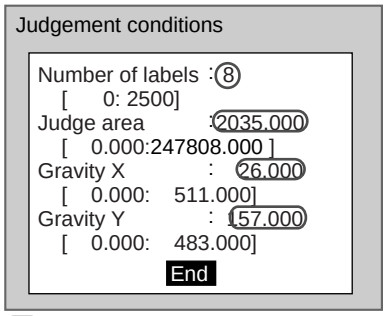
4 Setting Judgement Conditions

Set the ranges for the number of labels, area and center of gravity for an OK judgement.

▶ [EC defect/Inspected regions/Region (No.)/Labeling/Judgement conditions]

1. Set each item.

2. Select [End].



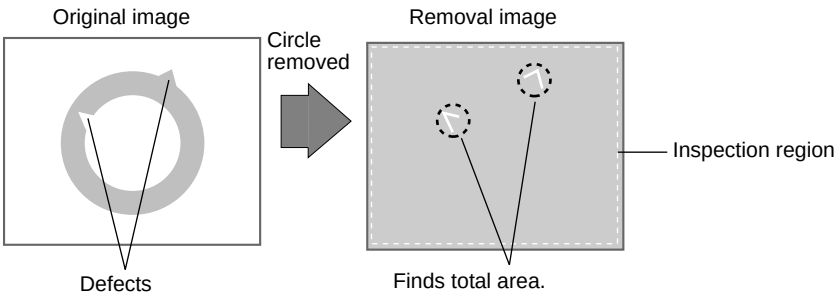
: The measurement results for the displayed image.

Setting data	Selection	Details
Number of labels	0 to 2,500	Set the number of labels in measurement region.
Judge area	0 to 9,999,999.999	Area range of the specified label number
Gravity X	-9,999.999 to 9,999.999	Range of movement of the specified label number in the X direction
Gravity Y	-9,999.999 to 9,999.999	Range of movement of the specified label number in the Y direction

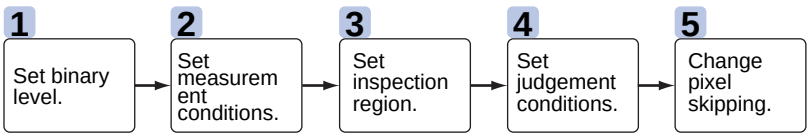
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Gravity and Area

Gravity and area processing is performed on the removal image. The total white pixel area is found and evaluated for defects.



■ Operational Flow



1 Setting Binary Levels

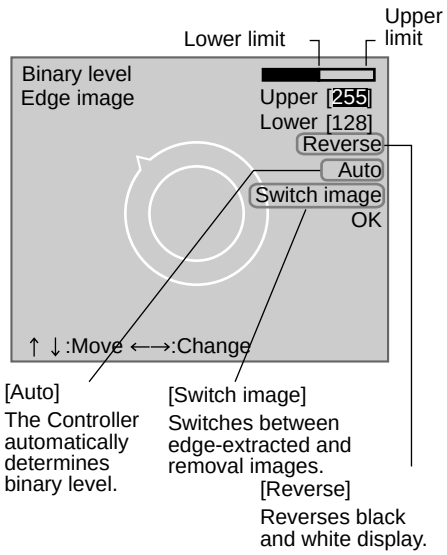
Adjust the binary levels so that the area to be measured appears as white pixels.

▶ [EC defect/Inspected regions/Region (No.)/Gravity and area/Binary]

1. Move the cursor to the upper value and use the Left and Right Keys to adjust the value.

2. Use the same method to change the lower value.

3. Select [OK].



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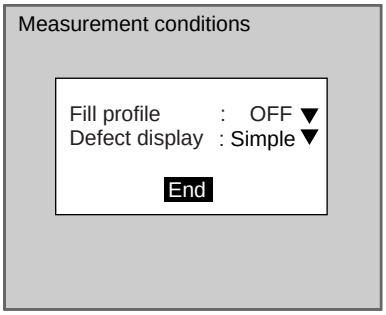
2 Setting Measurement Conditions

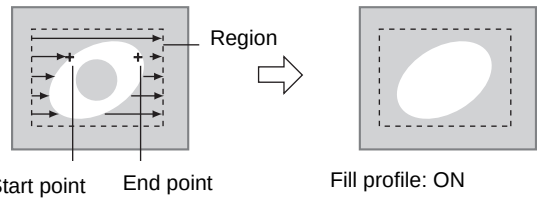
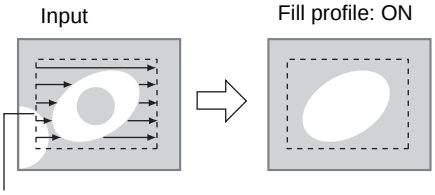
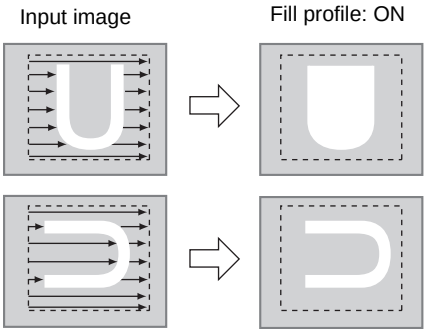
Set the measurement conditions if using [Fill profile] or [Defect display] functions.

▶ [EC defect/Inspected regions/Region (No.)/Gravity and area/Measurement conditions]

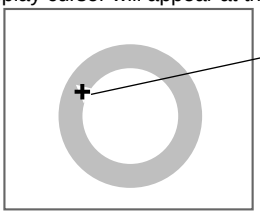
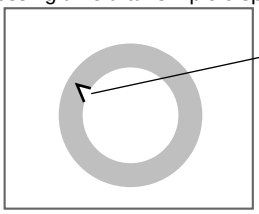
1. Set each item.

2. Select [End].



Setting data	Selection	Details
Fill Profile Function	ON OFF (default setting)	Turn [ON] the [Fill profile] function to measure the whole area between the start point (black pixels to white) and the end point (white pixels to black) in the measurement region as white pixels.  • When a White-pixel Section Encroaches on the Measurement Region  Not recognized as start point because change from white to black. • Measuring Open-form Measurement Objects The measurement result changes depending on the orientation of the measurement object. 

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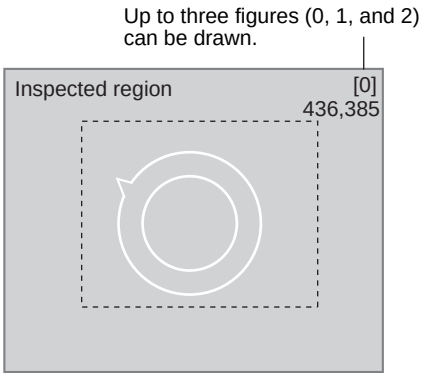
Setting data	Selection	Details
Defect Display	Select the method for displaying defects on the measurement screen (where regions are displayed separately). p.32	
	Simple (default setting)	A display cursor will appear at the defect position.  When there are defects at multiple positions, the display cursor will appear at the center of gravity of the total white pixel area and may not, therefore, appear exactly at the defect position.
	Detail	Defects will appear in the NG color. This option requires longer processing time than simple display. 

3 Setting Inspected Regions

▶ [EC defect/Inspected regions/Region (No.)/Gravity and area/Inspected region/New/figure/drawing mode]

1. The method for drawing the region is the same as for gravity and area.

SECTION 1 Basic Operating Procedures, “Drawing a Region”



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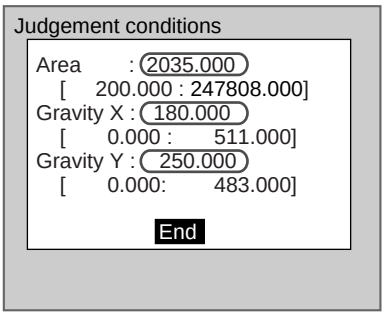
4 Setting Judgement Conditions

Make settings for the area and center of gravity.

▶ [EC defect/Inspected regions/Region (No.)/Gravity and area/Judgement conditions]

1. Set each item.

2. Select [End].



( ): The measurement results for the displayed image.
Use these values as references in setting the upper and lower limits.

Setting data	Selection	Details
Area	0 to 9,999,999.999	Area range of the specified label number
Gravity X	-9,999.999 to 9,999.999	Range of movement of the specified label number in the X direction
Gravity Y	-9,999.999 to 9,999.999	Range of movement of the specified label number in the Y direction

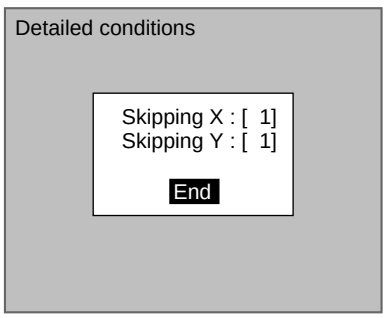
5 Changing Pixel Skipping (Changing Detailed Conditions)

To shorten measurement processing time, change the number of pixels to be skipped. The greater the skipping setting, the shorter the processing time. However, the accuracy of the measurement will decrease.
After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

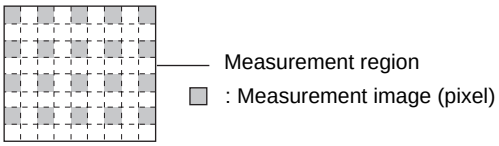
▶ [EC defect/Inspected regions/Region (No.)/Gravity and area/Detailed conditions]

1. Set each item.

2. Select [End].



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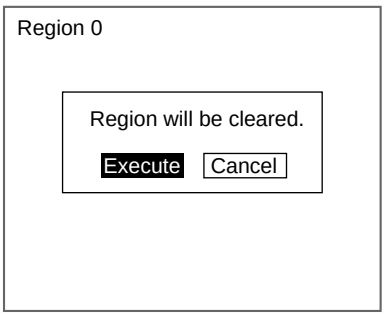
Setting data	Selection	Details
Skipping X Skipping Y	1 to 15 (default setting: 1)	Set how many pixels to skip in the measurement region during measurement. The default setting is 1, which means that all of the measurement region will be measured. Example: Skipping X and Skipping Y are set to 2: 

Clearing Inspection Regions

The clear operation is executed for each region.

▶ [EC defect/Inspected regions/Region No./Clear]

1. Select [Execute].



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Setting the Coordinate Mode

Select the type of coordinate values.

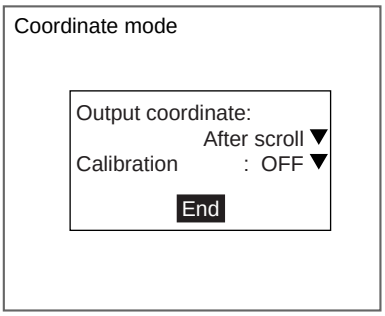
CHECK!

If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [EC defect/Coordinate mode]

1. Set each item.

2. Select [End].



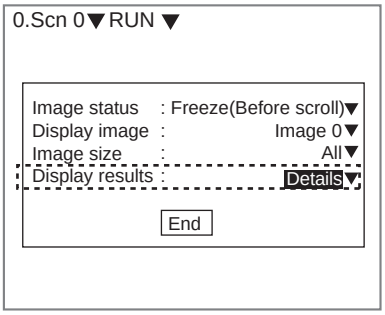
Settings Data

SECTION 7 Appendix, “Coordinate Handling Method”

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Checking the Measurement Image

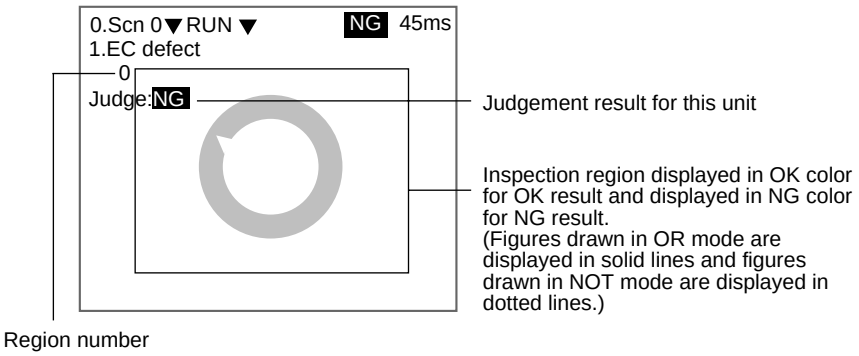
Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.
Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed. Use the SHIFT+Right or Left Keys to switch in order between the two screens.

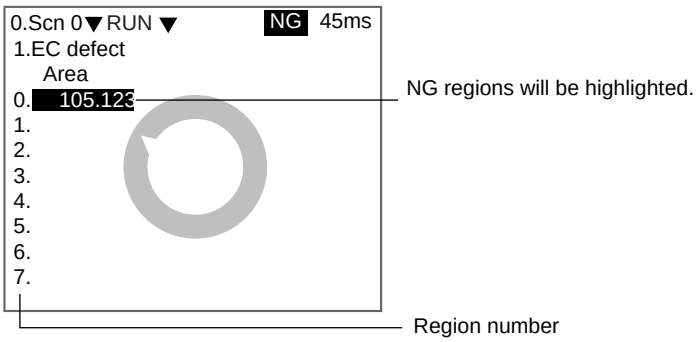
(1) Judgement Result

Judgement result for this unit



(2) Defect Area

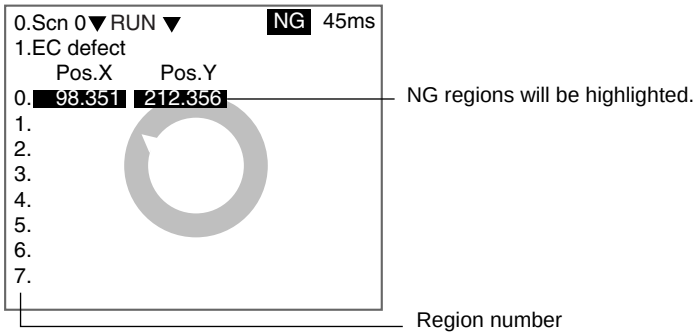
A list of the area of defects will be displayed for each region.



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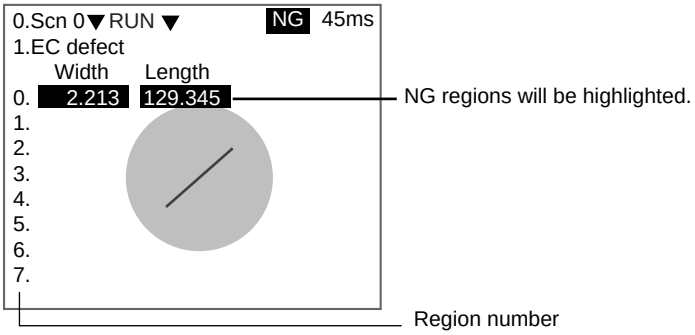
(3) Defect Position

A list of defect positions for each region will be displayed.



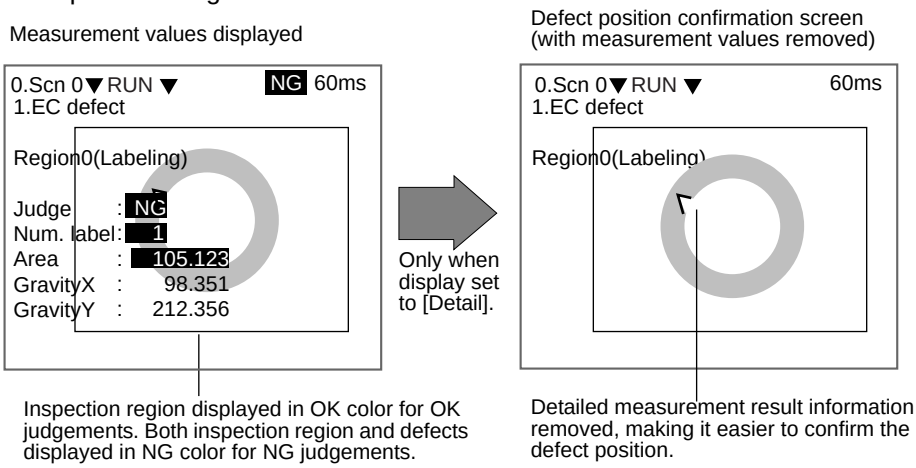
(4) Defect Width and Length

A list of defect widths and lengths for each region will be displayed.
This screen will be displayed even if defect inspection has not been set.



(5) Individual Region Display

More detailed measurement results are displayed for each region.
Press the SHIFT+ Right or Left Keys to display the set regions in order.
When defect display is set to Detail, the measurement values will be displayed followed by the image minus the measurement values.
Example: Labeling



CHECK! When individual region display is selected, the position of defects can be confirmed on screen but the processing time is longer than other display screens. The processing time is shown in the upper right corner of the screen.

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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Unit judgement result (-2: Not measured. -1: NG 0: OK)
The following measurement data is for Region N (0 to 7).		
Judgement N	R**JG	Judgement result (-2: Not measured -1: NG 0: OK)
Defect width N	R**SW	Defect width for measurement result (See *1.)
Defect length N	R**SL	Defect length for measurement result (See *1.)
Gravity position NX	R**X	X coordinate of center of gravity for measurement result
Gravity position NY	R**Y	Y coordinate of center of gravity for measurement result
Area N	R**AR	Area for measurement result
Number of Labels N	R**DA	Number of measured labels

*1: These values will be output in pixels regardless of the setting for calibration.

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Unit judgement result (-2: Not measured. -1: NG 0: OK)
The following measurement data is for Region N (0 to 7).	
7N+1	judgement result (-2: Not measured -1: NG 0: OK)
7N+2	Defect width for measurement result (See *1.)
7N+3	Defect length for measurement result (See *1.)
7N+4	X coordinate of center of gravity for measurement result
7N+5	Y coordinate of center of gravity for measurement result
7N+6	Area for measurement result
7N+7	Number of measured labels

*1: These values will be output in pixels regardless of the setting for calibration.

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■ Setting Data

Data type	Details
60	Measurement image (0: Image 0 1: Image 1)
61	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF 2: After scroll, calibration ON 3: Before scroll, calibration ON)
62	Edge extraction mask size (0: 3 × 3 1: 5× 5)
63	Edge extraction lower limit (10 to 255)
64	Edge extraction upper limit (10 to 255)
The following measurement data is for removal region N (0 to7).	
The following settings data is common to all measurements.	
14N+65	Region upper left X (0 to X_MAX) (See *2, *3)
14N+66	Region upper left Y (0 to Y_MAX) (See *2, *3)
14N+67	Region lower right X (0 to X_MAX) (See *2, *3.)
14N+68	Region lower right Y (0 to Y_MAX) (See *2, *3.)
The following settings data is for [Circle] removal.	
14N+69	Circle color (0: Black 1: White 2: Both)
14N+70	Latitude of angle (0 to 99)
14N+71	Circle search (0: OFF 1: ON)
14N+72	Circle center X coordinate (0 to X_MAX) (See *3.)
14N+73	Circle center Y coordinate (0 to Y_MAX) (See *3.)
14N+74	Circumference radius (3 to R_MAX) (See *3.)
14N+75	Circumference width (1 to 64)
The following settings data is for [Line] removal.	
14N+76	Extracting level (0: Level 1 1: Level 2 2: Level 3 3:Level 4 4: Level 5)
The following settings data is for [Oriented line] removal.	
14N+77	Range of angle (0 to 359)
14N+78	Limits of angle (0 to 45)
The following measurement data is for inspection region N (0 to7).	
The following settings data is common to all measurements.	
31N+177	Region upper left X (0 to X_MAX) (See *2, *3)
31N+178	Region upper left Y (0 to Y_MAX) (See *2, *3)
31N+179	Region lower right X (0 to X_MAX) (See *2, *3.)
31N+180	Region lower right Y (0 to Y_MAX) (See *2, *3.)
The following settings data is for [Defect] measurement.	
31N+181	Extracting level (0: Level 1 1: Level 2 2: Level 3 3:Level 4 4: Level 5)
31N+182	Defect color (0: Black 1: White)
31N+183	Defect width upper limit (0 to 200)
31N+184	Defect width lower limit (0 to 200)
31N+185	Defect length upper limit (0 to 1450)
31N+186	Defect length lower limit (0 to 1450)
The following settings data is for [Gravity and area] and [Labeling] measurement.	
31N+187	X upper limit (-9,999.999 to 9,999.999)
31N+188	X lower limit (-9,999.999 to 9,999.999)

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Data type	Details
31N+189	Y upper limit (-9,999.999 to 9,999.999)
31N+190	Y lower limit (-9,999.999 to 9,999.999)
31N+191	Area upper limit (0 to 9,999,999.999)
31N+192	Area lower limit (0 to 9,999,999.999)
31N+193	Binary level upper limit (0 to 255)
31N+194	Binary level lower limit (0 to 255)
31N+195	Reverse binary level (0: Not reversed 1: Reversed)
31N+196	Defect color display (0: OFF 1: ON)
The following settings are for [Labeling] measurement.	
31N+197	No. of labels upper limit (0 to 2,500)
31N+198	No. of labels lower limit (0 to 2,500)
31N+199	Noise area upper limit (0 to 9,999,999.999)
31N+200	Noise area lower limit (0 to 9,999,999.999)
31N+201	Fill Holes Mode (0: OFF 1: ON)
31N+202	Sort mode (0: Area descending 1: Area ascending 2: X gravity descending 3: X gravity ascending 4: Y gravity descending 5: Y gravity ascending)
31N+203	Outside trimming (0: OFF 1: ON)
31N+204	Label number (0 to 2,499)
The following settings data is for [Gravity and area].	
31N+205	Skipping X (1 to 15)
31N+206	Skipping Y (1 to 15)
31N+207	Fill profile (0: OFF 1: ON)

*2: If these settings are changed, one rectangular region will be set and the previously drawn figures will be deleted.

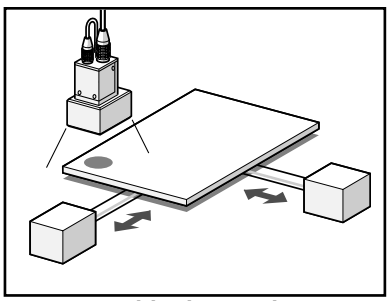
*3: The range varies depending on the controller model.

Setting range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483
3 to R_MAX	3 to 1024	3 to 512

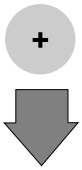
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EC Positioning

The EC Positioning processing item finds positioning marks using shape information, such as “round” or “angular”. Accurate positioning is still possible even if the figure is deformed or partially chipped.
This processing item can also be used with low contrast images.



Positioning Marks



Positioning marks can be found even under the following conditions.



This function can be used for positioning of a variety of shapes.



Edge Code (EC)

SECTION 7 Appendix, "Terminology"

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Operational Flow

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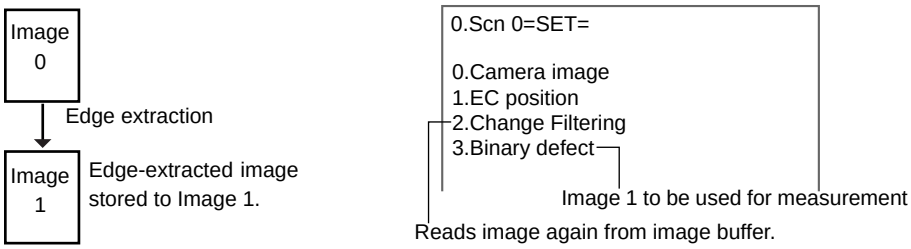
Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

CHECK!

The edges are extracted for the image number selected here and this image is then stored at the other image number. Set [Change Filtering] as the next processing item to use this image for measurement for units after the unit for which this processing item was set. Then store the image stored in the image buffer to [Image 0] or [Image 1].

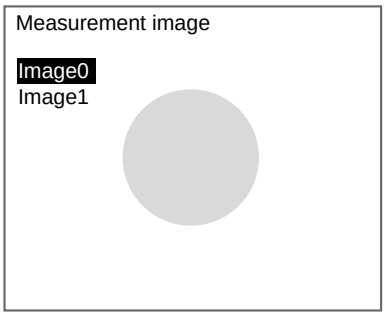
Example: When Image 0 Is Selected as Measurement Image



▶ [EC position/Measurement image]

1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.

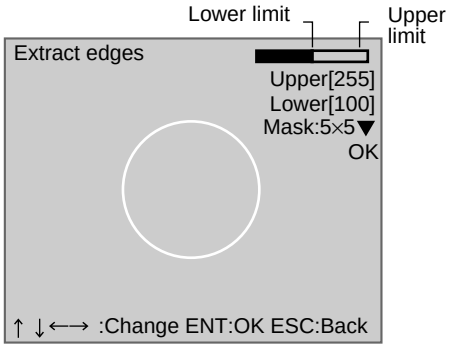


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Extracting Edges

This processing Item is performed for images for which the edges have been extracted.
Adjust the upper and lower levels for edge extraction if there is low contrast between the measurement object and the background and to remove noise.

▶ [EC Positioning/Extract edges]



1. Set the upper and lower limits.

2. Select the desired mask size.

3. Select [OK].

Setting data	Selection	Details
Upper and Lower Limits	10 to 255 (default setting 100:255).	Set the level to which the background will be cut. Adjust the upper and lower levels for edge extraction if there is low contrast between the measurement object and the background and to remove noise.
Mask Size	5 × 5 (default setting) 3 × 3	The mask size function is used when searching for edges to judge edges using peripheral information. The greater the mask size, the more the variations in surrounding pixels can be absorbed. CHECK! This setting will be enabled only if [Camera image] is set to [Frame].

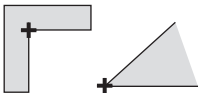
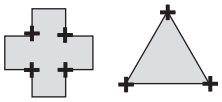
Settings Data

SECTION 7 Appendix, “EC (Edge Code) Image Measurement”

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Setting the Measurement Region

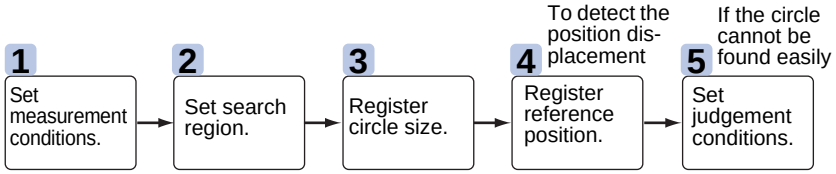
The following four figures can be chosen for measurement regions, depending on the shape of the positioning mark.
Up to 8 regions can be set, and figures can be selected independently for each region.

Positioning mark		Figure	Details	Page
Circular 		Circular	Searches for a circle of a specified size and can output the position coordinates (center of the circle).	p.6
Box 		Box	Searches for a rectangle of a specified size and can output the position coordinates. The center or one of the four corners can be selected for the position coordinates.	p.17
Other figures	One angle used as a mark 	Cross point	Outputs the position coordinates for the intersection of two lines. If there are multiple lines, the following conditions can be set: • Output the cross point only for intersections at a certain angle. • Output the cross point only for intersections of lines of a certain length.	p.12
	Several angles are used to one set of coordinates 	Multiple cross points	Up to 20 cross point coordinates can be found. The detection conditions can be changed to suit any purpose.	p.22

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Circles

■ Operational Flow



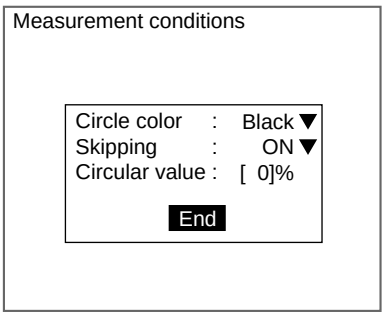
1 Setting Measurement Conditions

Set the conditions for searching for the positioning mark.

▶ [EC position/Select region/Region (No.)/Circle/Measurement conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Circle color	Black (default setting) White Both	Select whether the circle color for the positioning mark will be white or black compared to the background. Select “white/black” if the circle color is not fixed to either black or white.
Skipping	ON (default setting) None	Select whether pixel skipping (1 pixel) will be used when searching for the circle. Processing is faster if pixel skipping is turned ON, so normally “ON” is appropriate. However, if the measurement values are inconsistent, set to “OFF.”
Circular value	0 to 100 (default setting: 0)	Select the lower limit of the circle to be extracted. The value drops if the circle is deformed or chipped. The object is not extracted as a circle if the value is lower than the set value.

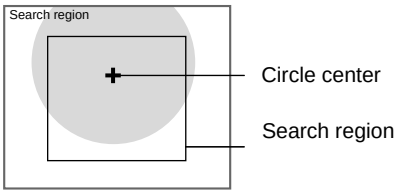
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2 Setting the Search Region

Set the region to search for the positioning mark.

Adjust the search region if there are areas not to be included in circle searches.

The search can be performed even if the whole circle is not within the search region, as long as the center of the circle is within the region.



CHECK!

When edges are extracted, the pixels at the edges of the screen cannot be processed accurately. Do not include the outer edges of the screen when setting the search region.

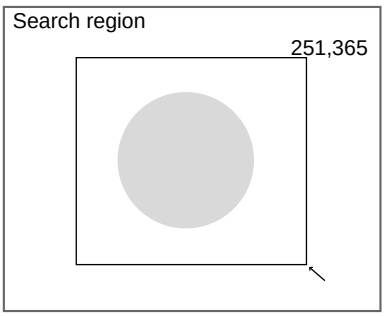
In particular, when performing position displacement compensation, adjust so that the scrolled image or the measurement range will not overlap with this region. Furthermore, if the number of lines to be read has been set in the case of F160-S2 camera, there are restrictions on the setting range.

SECTION 2, 1.1 Inputting Camera Images, “Filtering”

▶ [EC position/Select region/Region (No.)/Circle/Search region]

1. Draw a rectangular search region.

Specify the upper left and lower right coordinates.



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3 Registering the Size of the Circle

There are two methods for registering the size of the circle.

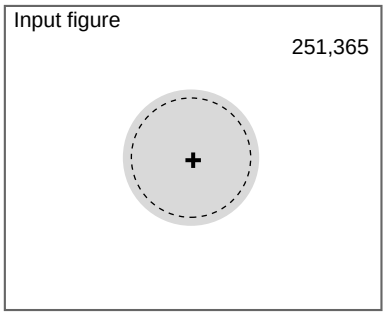
Registration method	Details
Inputting Figures	The measurement object is displayed on the screen, a circle is drawn on the exterior edge of the object and the size of the circle is registered.
Inputting Parameters	The radius of the circle and the permissible range are entered as parameters (in pixel units).

■ Inputting Figures

▶ [EC position/Select region/Region (No.)/Circle/Radius/Input figure]

1. Specify the center position of the circle.

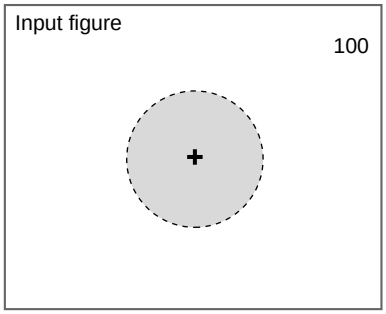
Up/Down/Left/Right Keys: Move the cursor.
ENT Key: Confirms the setting.



The screen for setting the radius will be displayed.

2. Specify the radius.

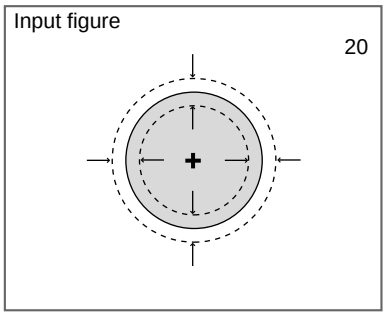
Up/Right Keys: Larger
Down/Left Keys: Smaller
ENT Key: Confirms the setting.



The screen for setting the latitude of the radius will be displayed.

3. Specify the latitude of the radius (1 to 64 pixels).

Up/Right Keys: Larger
Down/Left Keys: Smaller
ENT Key: Confirms the setting.



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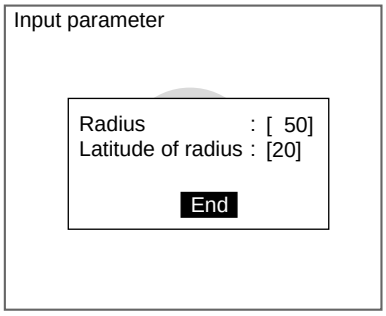
■ Inputting Parameters

Input the parameters in pixel units for the radius and latitude of the search circle.

▶ [EC position/Select region/Region (No.)/Circle/Radius/Input parameter]

1. Set each item.

2. Select [End].



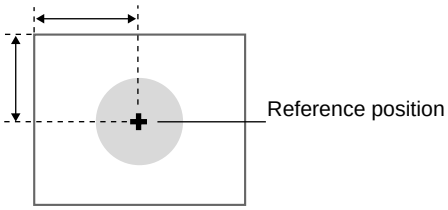
Setting data	Selection	Details
Radius of search circle	3 to RMAX	Set the radius and the permissible radius range for the circle to be searched. The settable maximum value (RMAX) varies depending on the controller model. p.31
Latitude of radius	1 to 64	Set the permissible width for [Latitude of radius].

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4 Registering Reference Positions

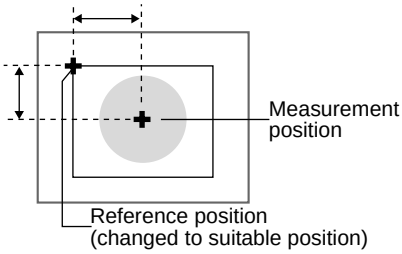
Register reference positions here to detect position displacement. Positions can be inspected if the difference between the reference position and the measurement position is obtained from a calculation.

Example 1: Inspections to Detect If the Measurement Object is in the Same Position



Place the measurement object in the correct position before executing reference position registration.

Example 2: Inspecting Position from a Specified Position

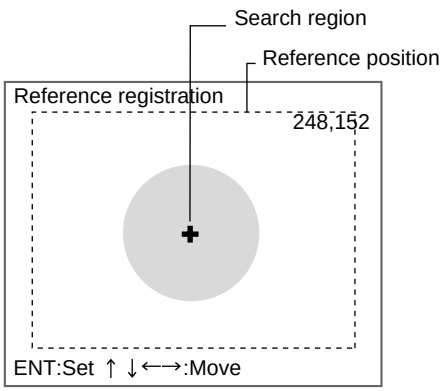


Change the reference position to a suitable position.

▶ [EC position/Select region/Region (No.)/Circle/Reference registration]

1. The Controller will search for the circle in the displayed image that matches the conditions and a display cursor will appear at that position. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.



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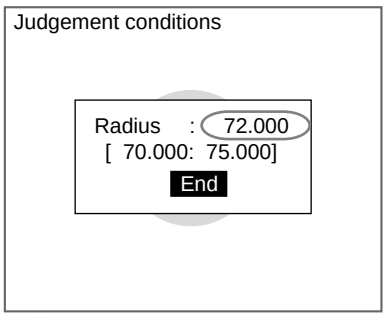
5 Setting Judgement Conditions

Set the conditions for judging whether or not a circle of the registered size has been found.
This has to be set if a circle of a different size is found as a circle.

▶ [EC position/Select region/Region (No.)/Circle/Radius/Judgement conditions]

1. Set the radius range for an OK circle.

2. Select [End].



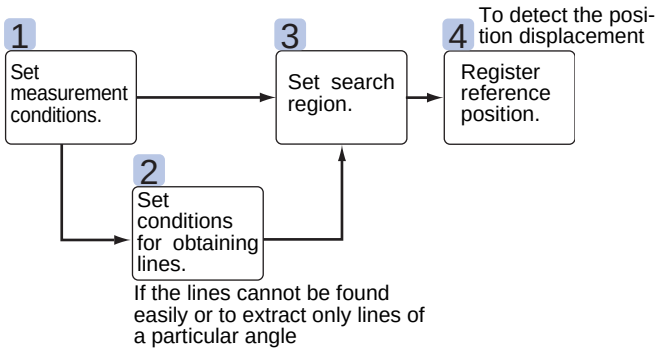
: Measurement results for the displayed image

Setting data	Selection	Details
Radius	0.000 to 9999.999	Set in pixel units the radius of circles to receive an OK judgement.

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Cross Points

■ Operational Flow



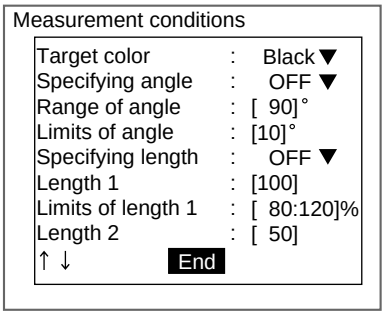
1 Setting Measurement Conditions

Set the conditions for searching for the positioning mark.

▶ [EC position/Select region/Region (No.)/Cross point/Measurement conditions]

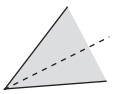
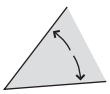
1. Set each item.

2. Select [End].



Setting data		Selection	Details
Target color		Black (default setting) White	Select whether the positioning mark color will be white or black compared to the background.
Angles	Specifying angle	ON OFF (default setting)	Use the following settings to set the angle of intersection and thus find the coordinates of only the desired intersection even though many lines exist on the screen. Select [ON] if you want to find the cross point by specifying the angle. To find the coordinates of the cross point of lines regardless of their angle, set [Specifying angle] to OFF. (The settings for the angle will be ignored.)
	Range of angle	0 to 359	Angle of the section in the target color. If [Target color] changes, change the [Range of angle] setting too.
	Limits of angle	0 to 99 (default setting: 10)	Set the permissible range for [Range of angle].

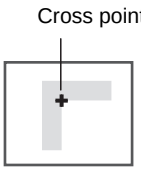
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Setting data		Selection	Details
Length	Specifying length	ON OFF (default setting)	Use the following settings to set the length and thus find the coordinates of only the desired intersection even though many lines exist on the screen. Select [ON] if you want to find the cross point by specifying the lengths of the lines. To find the coordinates of the cross point of the lines regardless of their lengths, set [Specifying angle] to OFF. The settings of the line lengths and the limits of the lengths will be ignored.
	Length	1 to 1450	Set the line length in pixels.
	Limits of length	1 to 200 (default setting 80 : 120)	Set the permissible range for the length.
Select which position θ will be obtained.		Midline of Corner (default setting) Side 1 Side 2	Only one angle (q) will be output as the measurement results for the lines that are found. Select the position for which the angle will be obtained.  [Side 1] and [Side 2] [Side 1] and [Side 2] Side 2  Side 1 With the target color between the two sides, the side in the clockwise direction is side 1 and the side in the counterclockwise direction is side 2.

CHECK!

Specifying Angle

Example: To find this cross point





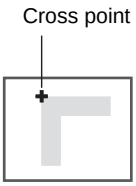
[Target color]: Black
[Specifying angle]: ON
[Range of angle]: 90°
[Limits of angle]: 270°



CHECK!

Specifying Length

Example: To find this cross point





Set the [Length 1] and [Length 2] to the lengths

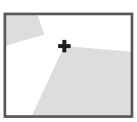
[Length 1]

[Length 2]



CHECK!

If both [Specifying angle] and [Specifying length] are set to [OFF] and there are multiple lines displayed on the screen, the cross point of the longest line and the line that crosses it will be found.



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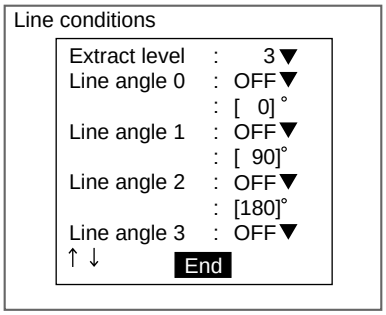
2 Setting Conditions for Obtaining Lines

Adjust the line conditions if the lines cannot be found easily or to extract only lines of a particular angle.

▶ [EC position/Select region/Region (No.)/Cross point/Line conditions]

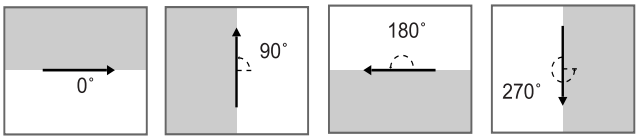
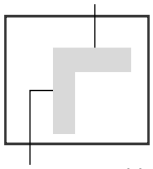
1. Set each item.

2. Select [End].



Setting data	Selection	Details
The level for extracting lines can be changed.	1 to 5 (default setting: 3)	The level for extracting lines can be changed. To make a broken line into a single line, change the extraction level to a larger value.  To extract as separate lines, change the extraction level to a smaller value  To ignore noise, change the extraction level to a smaller value.  When the measurement object is small and cannot be detected easily, change the extraction level to a larger value. 

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Setting data	Selection	Details
Line angle 0	ON OFF (default setting)	By setting [Line angle□] to [ON] and specifying the desired angle, only the lines of the specified angle can be extracted. The way in which black and white meet determines the direction of an edge code, and the angle is calculated as shown below.  0 to 360° can be set. Example: Use 180° to extract this line  Use 270° to extract this line
	0 to 359 (default setting: 0)	
Line angle 1	ON OFF (default setting)	
	0 to 359 (9o: default setting)	
Line angle 2	ON OFF (default setting)	
	0 to 359 (default setting: 180)	
Line angle 3	ON OFF (default setting)	
	0 to 359 (default setting: 270)	

3 Setting the Search Region

Set the region to search for the positioning mark.

Adjust the search region if there are areas not to be included in cross point searches.

CHECK!

When edges are extracted, the pixels at the edges of the screen cannot be processed accurately. Do not include the outer edges of the screen when setting the search region.

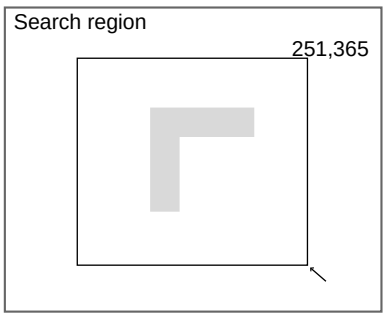
In particular, when performing position displacement compensation, adjust so that the scrolled image or the measurement range will not overlap with this region. Furthermore, if the number of lines to be read has been set in the case of F160-S2 camera, there are restrictions on the setting range.

SECTION 2, 1.1 Inputting Camera Images, “Filtering”

▶ [EC position/Select region/Region (No.)/Cross point/Search region]

1. Draw a rectangular search region.

Specify the upper left and lower right coordinates.



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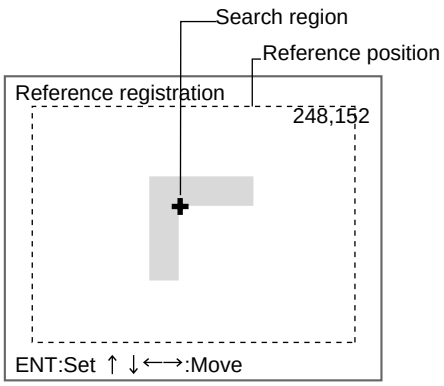
4 Registering Reference Positions

Register reference positions here to detect position displacement. Positions can be inspected if the difference between the reference position and the measurement position is obtained from a calculation.
Refer to [Circles] for an outline.
p.10

▶ [EC position/Select region/Region (No.)/Cross point/Reference registration]

1. The Controller will search for the cross point in the displayed image that matches the conditions and a display cursor will appear at that position. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

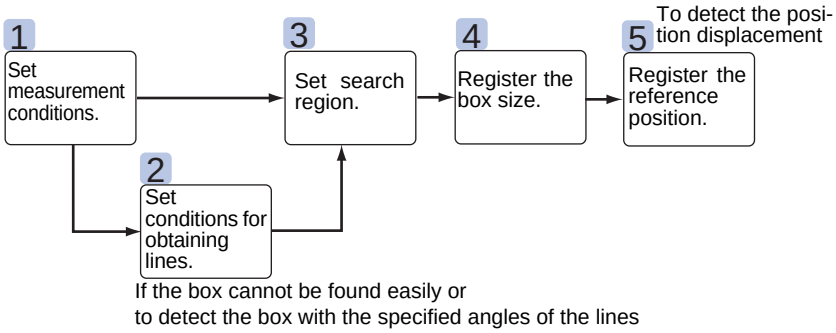
2. Press the ENT Key.



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Boxes

■ Operational Flow



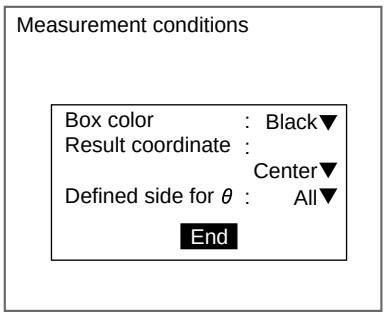
1 Setting Measurement Conditions

Set the conditions for searching for the positioning mark.

▶ [EC position/Select region/Region (No.)/Box/Measurement conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Box color	Black (default setting) White	Select whether the positioning mark color will be white or black compared to the background.
Result coordinate	Center (default setting) Upper left Lower left Upper right Lower right	Select which position coordinates will be obtained. Center Upper left Lower left Upper right Lower right
Select which position θ will be obtained.	All (default setting) Upper Lower Left Right	The angle of one side of the box can be output as a measurement result. Select the side for which the angle will be obtained. Output in the range of -90,000 to 90,000. All Upper Lower Left Right (Long side)

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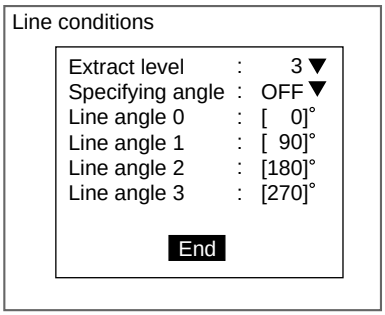
2 Setting Conditions for Obtaining Lines

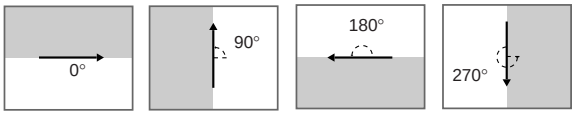
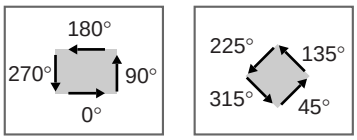
The Controller detects 4 lines and searches for a box. Adjust the conditions for detecting the lines so that desired lines are detected.

▶ [EC position/Select region/Region (No.)/Box/Line conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Extracting level	1 to 5 (default setting: 3)	The level for extracting lines can be changed. p.14
Specifying angle	ON OFF (default setting)	Specify values if a lot of noise or foreign matter results in boxes not being detected with stability. Specifying angle: Set to ON. Line angle☐: Set the angles of the lines to detect. The way in which black and white meet determines the direction of an edge code, and the angle is calculated as shown below.  0 to 360° can be set. Set the angles as a combination of the four sides of the box to be found (angles 0 to 3). Example: The following examples are for black boxes.  However, this function cannot be used if the positioning mark is likely to rotate.
Line angle 0	0 to 359 (default setting: 0)	
Line angle 1	0 to 359 (9o: default setting)	
Line angle 2	0 to 359 (default setting: 180)	
Line angle 3	0 to 359 (default setting: 270)	

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3 Setting the Search Region

Set the region to search for the positioning mark.

Adjust the search region if there are areas not to be included in box searches.

CHECK!

When edges are extracted, the pixels at the edges of the screen cannot be processed accurately. Do not include the outer edges of the screen when setting the search region.

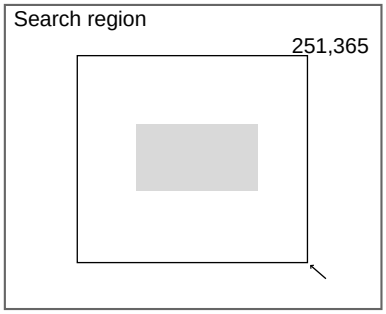
In particular, when performing position displacement compensation, adjust so that the scrolled image or the measurement range will not overlap with this region. Furthermore, if the number of lines to be read has been set in the case of F160-S2 camera, there are restrictions on the setting range.

SECTION 2, 1.1 Inputting Camera Images, “Filtering”

▶ [EC position/Select region/Region (No.)/Box/Search region]

1. Draw a rectangular search region.

Specify the upper left and lower right coordinates.



4 Registering the Size of the Box

There are two methods for registering the size of the circle.

Registration method	Details
Inputting Figures	The measurement object is displayed on the screen, a box is drawn on the exterior edge of the object and the size of the box is registered. Adjust the permissible range by inputting parameters.
Inputting Parameters	The lengths of sides of the box and the permissible range are entered as parameters (in pixel units).

■ Inputting Figures

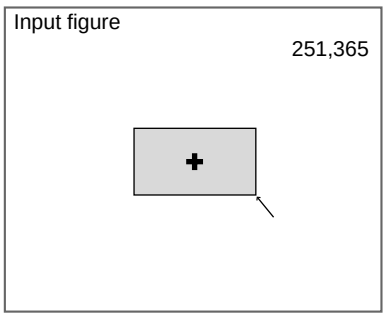
▶ [EC position/Select region/Region (No.)/Box/Box size/Input figure]

1. Draw a box-shaped region.

Specify the upper left and lower right coordinates.

CHECK!

Figures can be input to make settings only for the Long size and Short size of the box. Use the parameter input screen to make permissible size range and other detailed settings.



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■ Inputting Parameters

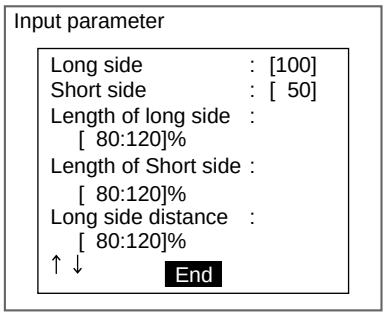
Set the size of the box and the permissible range using parameter input.

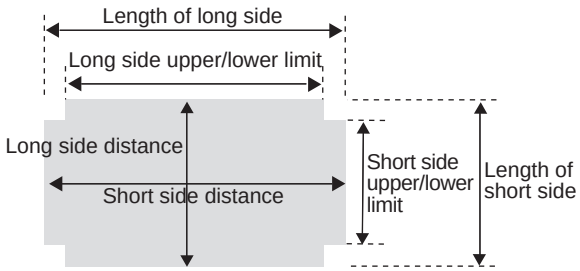
If the size of the box is entered using figure input, those parameters will be reflected under [Long size] and [Short size] on the Input Parameter Screen.

▶ [EC position/Select region/Region (No.)/Box/Box size/Input parameter]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Length of long side	1 to X_SIZE	Set the box size and permissible range for OK judgement.  X SIZE and Y SIZE values vary depending on the controller model. p.34
Length of short side	1 to Y_SIZE	
Length of long side	1 to 200 (default setting 80 : 120)	
Length of short side	1 to 200 (default setting 80 : 120)	
Long side distance	1 to 200 (default setting 80 : 120)	
Short side distance	1 to 200 (default setting 80 : 120)	
Line parallelism	1 to 99 (default setting: 20)	Set the long side and short side parallelism for OK judgement.

CHECK!

If the size of the box changes:

- Increase [Length of long side] and [Length of short side].
- Increase [Long side distance] and [Short side distance].



When a Box Is Chipped

- Reduce the lower limit of [Length of long side] and [Length of short side].

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5 Registering Reference Positions

Register reference positions here to detect position displacement. Positions can be inspected if the difference between the reference position and the measurement position is obtained from a calculation.

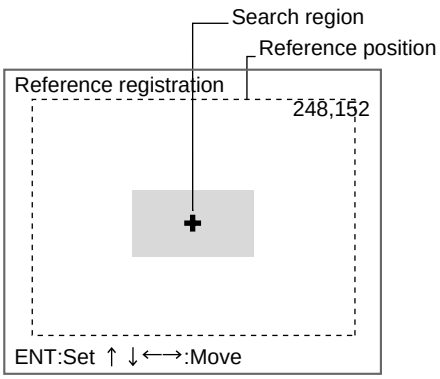
Refer to [Circles] for an outline.

p.10

▶ [EC position/Select region/Region (No.)/Box/Reference registration]

1. The Controller will search for the box in the displayed image and a display cursor will appear at that position. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

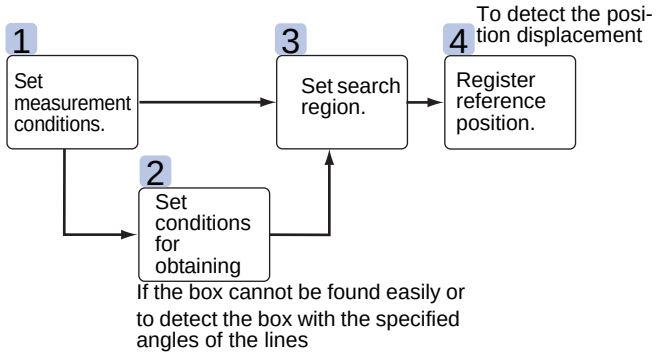
2. Press the ENT Key.



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Multi-points

■ Operational Flow



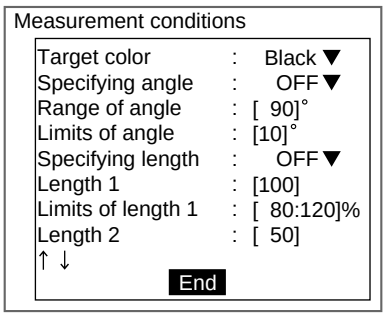
1 Setting Measurement Conditions

Set the conditions for searching for the positioning mark.

▶ [EC position/Select region/Region (No.)/Multi-points/Measurement conditions]

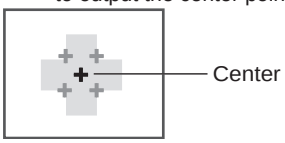
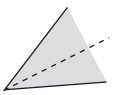
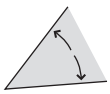
1. Set each item.

2. Select [End].



Setting data		Selection	Details
Target color		Black (default setting) White	Select whether the positioning mark color will be white or black compared to the background.
Angles	Specifying angle	ON OFF (default setting)	Use the following settings to set the angle of intersection and thus find the coordinates of only the desired intersection even though many lines exist on the screen. Select [ON] if you want to find the cross point by specifying the angle. To find the coordinates of the cross point of lines regardless of their angle, set [Specifying angle] to OFF. (The settings for the angle will be ignored.)
	Range of angle	0 to 359	Angle of the section in the target color. If [Target color] changes, change the [Range of angle] setting too.
	Limits of angle	0 to 99 (default setting: 10)	Set the permissible range for [Range of angle].

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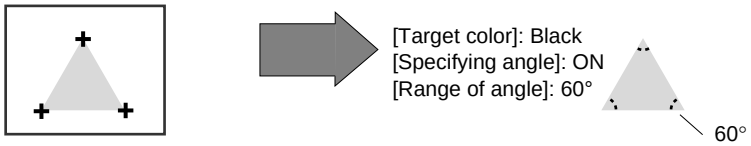
Setting data		Selection	Details
Length	Specifying length	ON OFF (default setting)	Use the following settings to set the length and thus find the coordinates of only the desired intersection even though many lines exist on the screen. Select [ON] if you want to find the cross point by specifying the lengths of the lines. To find the coordinates of the cross point of the lines regardless of their lengths, set [Specifying angle] to OFF. The settings of the line lengths and the limits of the lengths will be ignored.
	Length	1 to 1450	Set the line length in pixels.
	Length Limits of length	1 to 200 (default length 80:120)	Set the permissible range for the length.
Cross point extracting conditions		X ascending order (default setting) X descending order Y ascending order Y descending order	Select the sorting conditions for determining which cross point coordinates will be output. Up to 20 points can be obtained. The coordinates for the first point matching the selected conditions will be output. To output the coordinates for the second and subsequent points or to output the center, use Calculation or other processing items and set the formula. Example: Find the average of 4 points to output the center point.  SECTION 2, 4. Measurement Support Items, “Calculation”
Select which position θ will be obtained.		Midline of Corner (default setting) Side 1 Side 2	Only one angle (θ) will be output as the measurement results for the lines that are found. Select the position for which the angle will be obtained. (The lines that are considered are the two lines meeting at the intersection point.)  [Side 1] and [Side 2] [Side 1] and [Side 2] Side 2  Side 1 With the target color between the two sides, the side in the clockwise direction is side 1 and the side in the counterclockwise direction is side 2.

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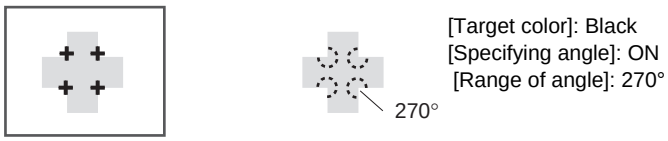
CHECK!

Specifying Angle

Example: To extract the following 3 cross points:



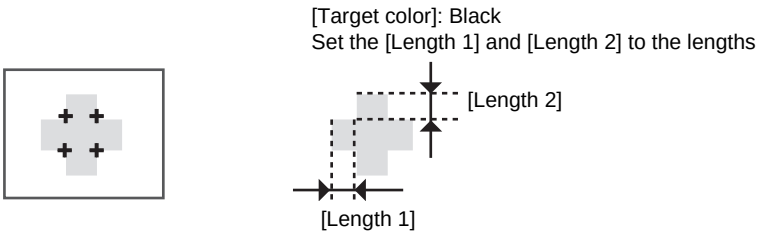
Example: To extract the following 4 cross points:



CHECK!

Specifying Length

Example: To extract the following 4 cross points:



2 Setting Conditions for Obtaining Lines

Adjust the line conditions if the lines cannot be found easily or to extract only lines of a particular angle.

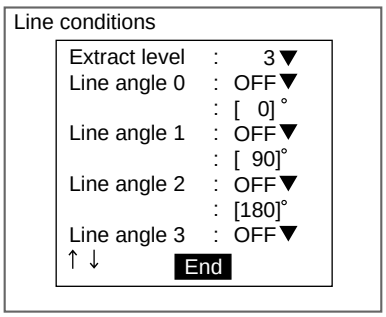
Refer to the page of [Cross Point] for an outline.

p.14

▶ [EC position/Select region/Region (No.)/Multi-points/Line conditions]

1. Set each item.

2. Select [End].



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3 Setting the Search Region

Set the region to search for the positioning mark.

Adjust the search region if there are areas not to be included in multi-point searches.

CHECK!

When edges are extracted, the pixels at the edges of the screen cannot be processed accurately. Do not include the outer edges of the screen when setting the search region.

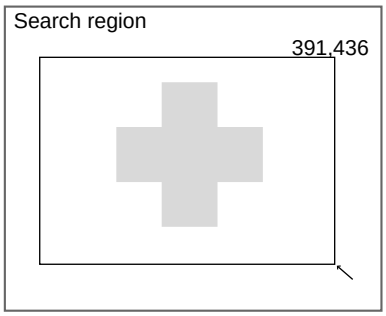
In particular, when performing position displacement compensation, adjust so that the scrolled image or the measurement range will not overlap with this region. Furthermore, if the number of lines to be read has been set in the case of F160-S2 camera, there are restrictions on the setting range.

SECTION 2, 1.1 Inputting Camera Image, “Filtering”

▶ [EC position/Select region/Region (No.)/Multi-point/Search region]

1. Draw a rectangular search region.

Specify the upper left and lower right coordinates.



4 Registering Reference Positions

Register reference positions here to detect position displacement. Positions can be inspected if the difference between the reference position and the measurement position is obtained from a calculation.

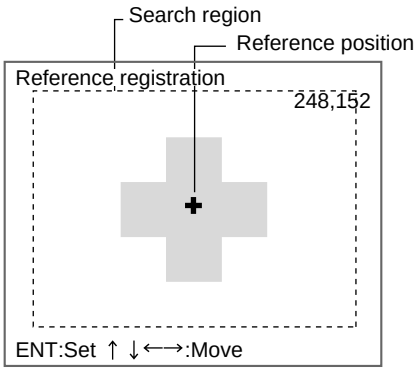
Refer to [Circles] for an outline.

p.10

▶ [EC position/Select region/Region (No.)/Multi-points/Reference registration]

1. The Controller will search for the cross point in the displayed image that matches the conditions and a display cursor will appear at that position. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.



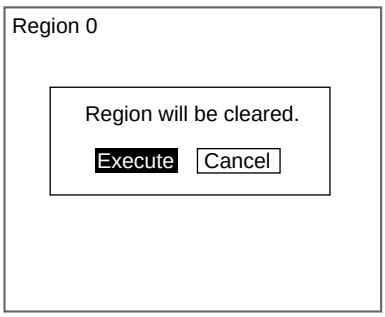
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Clearing the Set Regions

The clear operation is executed for each region.

▶ [EC position/Select region/Region (No.)/Clear]

1. Select [Execute].



Setting the Coordinate Mode

Select the type of coordinate values.

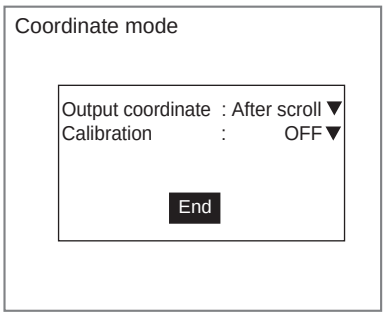
CHECK!

If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [EC position/Coordinate mode]

1. Set each item.

2. Select [End].



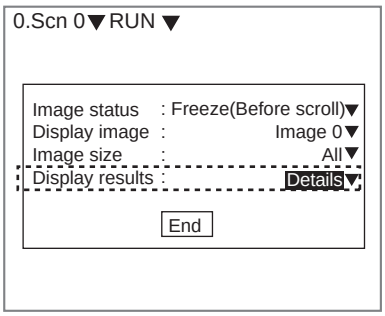
Settings Data

SECTION 7 Appendix, “Coordinate Handling Method”

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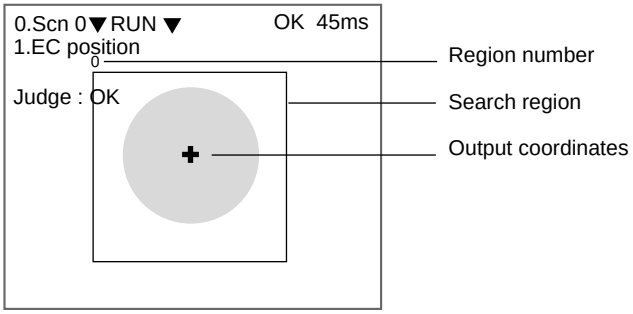
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.
Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



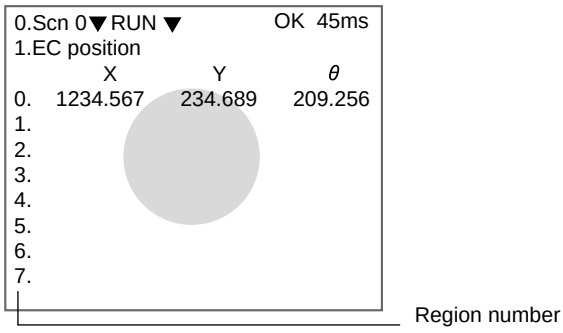
Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed. Use the SHIFT+Right or Left Keys to switch in order between the two screens.

(1) Judgement Result



(2) Detailed Display

The measurement values for each region will be displayed.

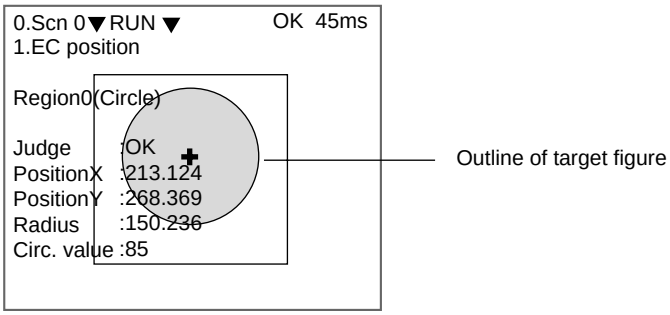


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(3) Individual Region Display

More detailed measurement results are displayed for each region.
Press the SHIFT+ Right or Left Keys to display the set regions in order.

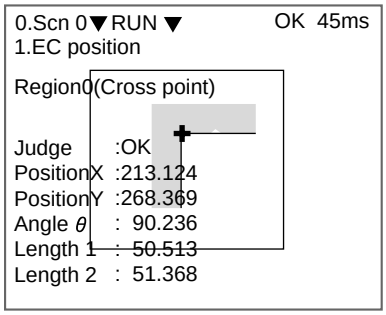
- Circular



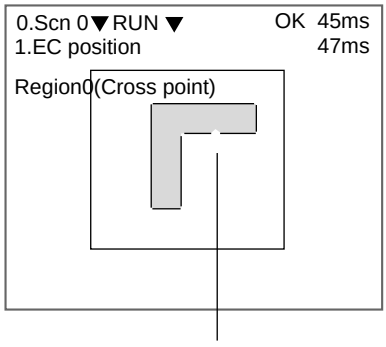
- Cross points, boxes, and multiple cross points

Once the measurement values for the region have been displayed, the screen for confirming the line extraction status will be displayed.

Example: Cross points
Measurement values display



Screen for confirming extracted line status



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Unit judgement result (-2: Not measured -1: NG 0: OK)
The following measurement data is for Region N (0 to 7).		
Judgement	R**JG	Judgement result (-2: Not measured -1: NG 0: OK)
Measured X	R**X	X coordinate of position where tag found
Measured Y	R**Y	Y coordinate of position where tag found
Measurement angle	R**TH	Axis angle of found tag
Reference X	R**SX	X coordinate of reference position
Reference Y	R**SY	Y coordinate of reference position
Reference angle	R**ST	Reference angle (cross point, box, multiple cross points)
Radius	R**R	Radius of measured circle (for circles)
Circular value	R**CV	Evaluation results for measured circle (for circles)
Line length 1	R**L1	Length of measured edge 1 (for cross points and multiple cross points)
Line length 2	R**L2	Length of measured edge 2 (for cross points and multiple cross points)
Upper left apex X	R**PX1	X coordinate of measured upper left corner (for boxes)
Upper left apex Y	R**PY1	Y coordinate of measured upper left corner (for boxes)
Lower left apex X	R**PX2	X coordinate of measured lower left corner (for boxes)
Lower left apex Y	R**PY2	Y coordinate of measured lower left corner (for boxes)
Upper right apex X	R**PX3	X coordinate of measured upper right corner (for boxes)
Upper right apex Y	R**PY3	Y coordinate of measured upper right corner (for boxes)
Lower right apex X	R**PX4	X coordinate of measured lower right corner (for boxes)
Lower right apex Y	R**PY4	Y coordinate of measured lower right corner (for boxes)
Number of point	R**CN	Number of measured cross points (for multiple cross points)
Cross point 1X	R**CX1	X coordinate of 1st measured cross point (for multiple cross points) (See *1.)
Cross point 1Y	R**CY1	Y coordinate of 1st measured cross point (for multiple cross points) (See *1.)
Cross point 2X	R**CX2	X coordinate of 2nd measured cross point (for multiple cross points) (See *1.)

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Measurement item	String	Details
Cross point 2Y	R**CY2	Y coordinate of 2nd measured cross point (for multiple cross points) (See *1.)
Cross point 3X	R**CX3	X coordinate of 3rd measured cross point (for multiple cross points) (See *1.)
Cross point 3Y	R**CY3	Y coordinate of 3rd measured cross point (for multiple cross points) (See *1.)
Cross point 4X	R**CX4	X coordinate of 4th measured cross point (for multiple cross points) (See *1.)
Cross point 4Y	R**CY4	Y coordinate of 4th measured cross point (for multiple cross points) (See *1.)
Cross point 5X	R**CX5	X coordinate of 5th measured cross point (for multiple cross points) (See *1.)
Cross point 5Y	R**CY5	Y coordinate of 5th measured cross point (for multiple cross points) (See *1.)
Cross point 6X	R**CX6	X coordinate of 6th measured cross point (for multiple cross points) (See *1.)
Cross point 6Y	R**CY6	Y coordinate of 6th measured cross point (for multiple cross points) (See *1.)
Cross point 7X	R**CX7	X coordinate of 7th measured cross point (for multiple cross points) (See *1.)
Cross point 7Y	R**CY7	Y coordinate of 7th measured cross point (for multiple cross points) (See *1.)
Cross point 8X	R**CX8	X coordinate of 8th measured cross point (for multiple cross points) (See *1.)
Cross point 8Y	R**CY8	Y coordinate of 8th measured cross point (for multiple cross points) (See *1.)
Cross point 9X	R**CX9	X coordinate of 9th measured cross point (for multiple cross points) (See *1.)
Cross point 9Y	R**CY9	Y coordinate of 9th measured cross point (for multiple cross points) (See *1.)
Cross point AX	R**CXA	X coordinate of 10th measured cross point (for multiple cross points) (See *1.)
Cross point AY	R**CYA	Y coordinate of 10th measured cross point (for multiple cross points) (See *1.)
Cross point BX	R**CXB	X coordinate of 11th measured cross point (for multiple cross points) (See *1.)
Cross point BY	R**CYB	Y coordinate of 11th measured cross point (for multiple cross points) (See *1.)
Cross point CX	R**CXC	X coordinate of 12th measured cross point (for multiple cross points) (See *1.)
Cross point CY	R**CYC	Y coordinate of 12th measured cross point (for multiple cross points) (See *1.)
Cross point DX	R**CXD	X coordinate of 13th measured cross point (for multiple cross points) (See *1.)
Cross point DY	R**CYD	Y coordinate of 13th measured cross point (for multiple cross points) (See *1.)
Cross point EX	R**CXE	X coordinate of 14th measured cross point (for multiple cross points) (See *1.)
Cross point EY	R**CYE	Y coordinate of 14th measured cross point (for multiple cross points) (See *1.)
Cross point FX	R**CXF	X coordinate of 15th measured cross point (for multiple cross points) (See *1.)
Cross point FY	R**CYF	Y coordinate of 15th measured cross point (for multiple cross points) (See *1.)
Cross point GX	R**CXG	X coordinate of 16th measured cross point (for multiple cross points) (See *1.)
Cross point GY	R**CYG	Y coordinate of 16th measured cross point (for multiple cross points) (See *1.)
Cross point HX	R**CXH	X coordinate of 17th measured cross point (for multiple cross points) (See *1.)
Cross point HY	R**CYH	Y coordinate of 17th measured cross point (for multiple cross points) (See *1.)
Cross point IX	R**CXI	X coordinate of 18th measured cross point (for multiple cross points) (See *1.)
Cross point IY	R**CYI	Y coordinate of 18th measured cross point (for multiple cross points) (See *1.)
Cross point JX	R**CYJ	X coordinate of 19th measured cross point (for multiple cross points) (See *1.)
Cross point JY	R**CYJ	Y coordinate of 19th measured cross point (for multiple cross points) (See *1.)
Cross point KX	R**CYK	X coordinate of 20th measured cross point (for multiple cross points) (See *1.)
Cross point KY	R**CYK	Y coordinate of 20th measured cross point (for multiple cross points) (See *1.)

*1: The order will be based on the sorting order set under cross point extraction conditions. (0 to 20)These values will be output in pixels regardless of the setting for calibration.

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Unit judgement result (-2: Not measured -1: NG 0: OK)
The following measurement data is for Region N (0 to 7).	
60N+1	Judgement result (-2: Not measured -1: NG 0: OK)
60N+2	X coordinate of position where tag found
60N+3	Y coordinate of position where tag found
60N+4	Axis angle of found tag
60N+5	X coordinate of reference position
60N+6	Y coordinate of reference position
60N+7	Reference angle (cross point, box, multiple cross points)
60N+8	Radius of measured circle (for circles)
60N+9	Evaluation results for measured circle (for circles)
60N+10	Length of measured side 1 (for cross points and multiple cross points) (See *1.)
60N+11	Length of measured side 2 (for cross points and multiple cross points) (See *1.)
60N+12	X coordinate of measured upper left corner (for boxes) (See *1.)
60N+13	Y coordinate of measured upper left corner (for boxes) (See *1.)
60N+14	X coordinate of measured lower left corner (for boxes) (See *1.)
60N+15	Y coordinate of measured lower left corner (for boxes) (See *1.)
60N+16	X coordinate of measured upper right corner (for boxes) (See *1.)
60N+17	Y coordinate of measured upper right corner (for boxes) (See *1.)
60N+18	X coordinate of measured lower right corner (for boxes) (See *1.)
60N+19	Y coordinate of measured lower right corner (for boxes) (See *1.)
60N+20	Number of measured cross points (for multiple cross points)
60N+21	X coordinate of 1st measured cross point (for multiple cross points) (See *1.)
60N+22	Y coordinate of 1st measured cross point (for multiple cross points) (See *1.)
60N+23	X coordinate of 2nd measured cross point (for multiple cross points) (See *1.)
60N+24	Y coordinate of 2nd measured cross point (for multiple cross points) (See *1.)
60N+25	X coordinate of 3rd measured cross point (for multiple cross points) (See *1.)
60N+26	Y coordinate of 3rd measured cross point (for multiple cross points) (See *1.)
60N+27	X coordinate of 4th measured cross point (for multiple cross points) (See *1.)
60N+28	Y coordinate of 4th measured cross point (for multiple cross points) (See *1.)
60N+29	X coordinate of 5th measured cross point (for multiple cross points) (See *1.)
60N+30	Y coordinate of 5th measured cross point (for multiple cross points) (See *1.)
60N+31	X coordinate of 6th measured cross point (for multiple cross points) (See *1.)
60N+32	Y coordinate of 6th measured cross point (for multiple cross points) (See *1.)

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Data type	Details
60N+33	X coordinate of 7th measured cross point (for multiple cross points) (See *1.)
60N+34	Y coordinate of 7th measured cross point (for multiple cross points) (See *1.)
60N+35	X coordinate of 8th measured cross point (for multiple cross points) (See *1.)
60N+36	Y coordinate of 8th measured cross point (for multiple cross points) (See *1.)
60N+37	X coordinate of 9th measured cross point (for multiple cross points) (See *1.)
60N+38	Y coordinate of 9th measured cross point (for multiple cross points) (See *1.)
60N+39	X coordinate of 10th measured cross point (for multiple cross points) (See *1.)
60N+40	Y coordinate of 10th measured cross point (for multiple cross points) (See *1.)
60N+41	X coordinate of 11th measured cross point (for multiple cross points) (See *1.)
60N+42	Y coordinate of 11th measured cross point (for multiple cross points) (See *1.)
60N+43	X coordinate of 12th measured cross point (for multiple cross points) (See *1.)
60N+44	Y coordinate of 12th measured cross point (for multiple cross points) (See *1.)
60N+45	X coordinate of 13th measured cross point (for multiple cross points) (See *1.)
60N+46	Y coordinate of 13th measured cross point (for multiple cross points) (See *1.)
60N+47	X coordinate of 14th measured cross point (for multiple cross points) (See *1.)
60N+48	Y coordinate of 14th measured cross point (for multiple cross points) (See *1.)
60N+49	X coordinate of 15th measured cross point (for multiple cross points) (See *1.)
60N+50	Y coordinate of 15th measured cross point (for multiple cross points) (See *1.)
60N+51	X coordinate of 16th measured cross point (for multiple cross points) (See *1.)
60N+52	Y coordinate of 16th measured cross point (for multiple cross points) (See *1.)
60N+53	X coordinate of 17th measured cross point (for multiple cross points) (See *1.)
60N+54	Y coordinate of 17th measured cross point (for multiple cross points) (See *1.)
60N+55	X coordinate of 18th measured cross point (for multiple cross points) (See *1.)
60N+56	Y coordinate of 18th measured cross point (for multiple cross points) (See *1.)
60N+57	X coordinate of 19th measured cross point (for multiple cross points) (See *1.)
60N+58	Y coordinate of 19th measured cross point (for multiple cross points) (See *1.)
60N+59	X coordinate of 20th measured cross point (for multiple cross points) (See *1.)
60N+60	Y coordinate of 20th measured cross point (for multiple cross points) (See *1.)

*1: The order will be based on the sorting order set under cross point extraction conditions. (0 to 20) These values will be output in pixels regardless of the setting for calibration.

■ Setting Data

Data type	Details
500	Measurement memory (0: Image 0 1: Image 1)
501	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF 2: After scroll, calibration ON 3: Before scroll, calibration ON)
502	Edge extraction mask size (0: 3 × 3 1: 5 × 5)
503	Edge extraction lower limit (10 to 255)
504	Edge extraction upper limit (10 to 255)
The following measurement data is for region N (0 to 7).	
53N+505	Search region upper left X (0 to X_MAX) (See *2.)

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Data type	Details
53N+506	Search region upper left Y (0 to Y_MAX) (See *2.)
53N+507	Search region lower right X (0 to X_MAX) (See *2.)
53N+508	Search region lower right Y (0 to Y_MAX) (See *2.)
53N+509	Reference position X (0 to X_MAX) (See *2)
53N+510	Reference position Y (0 to Y_MAX) (See *2)
53N+511	Reference angle (0 to 359)
The following settings data is for [Circle] measurement.	
53N+512	Circle color (0: Black 1: White 2: Both)
53N+513	Skipping (0: OFF 1: ON)
53N+514	Circular value (0 to 100)
53N+515	Circle center X coordinate (0 to X_MAX) (See *2.)
53N+516	Circle center Y coordinate (0 to Y_MAX) (See *2.)
53N+517	Circumference radius (3 to R_MAX) (See *2.)
53N+518	Circumference width (1 to 64)
53N+519	Radius judgement upper limit (0 to 9,999.999)
53N+520	Radius judgement lower limit (0 to 9,999.999)
The following settings are for [Line conditions] common to [Cross point], [Box] and [Multi-points].	
53N+521	Extracting level (0: Level 1 1: Level 2 2: Level 3 3: Level 4 4: Level 5)
53N+522	Line angle specification (0: OFF 1: ON)
53N+523	Line angle 0 specification (0: OFF 1: ON)
53N+524	Line angle 0 (0 to 359)
53N+525	Line angle 1 specification (0: OFF 1: ON)
53N+526	Line angle 1 (0 to 359)
53N+527	Line angle 2 specification (0: OFF 1: ON)
53N+528	Line angle 2 (0 to 359)
53N+529	Line angle 3 specification (0: OFF 1: ON)
53N+530	Line angle 3 (0 to 359)
The following settings data is for [Cross point] and [Multi-points] measurements.	
53N+531	Target color (0: Black 1: White)
53N+532	Angle specification (0: OFF 1: ON)
53N+533	Range of angle (0 to 359)
53N+534	Limits of angle (0 to 99)
53N+535	Length specification (0: OFF 1: ON)
53N+536	Length 1 (1 to 1450)
53N+537	Length 1 lower limit (0 to 200)
53N+538	Length 1 upper limit (0 to 200)
53N+539	Length 2 (1 to 1450)
53N+540	Length 2 lower limit (0 to 200)
53N+541	Length 2 upper limit (0 to 200)
53N+542	Defined side of θ (0: Midline of corner 1: Side 1 2: Side 2)
The following settings data is for [Box] measurement.	
53N+543	Box color (0: Black 1: White)

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Data type	Details
53N+544	Result coordinate (0: Center 1: Upper left 2: Lower left 3: Upper right 4: Lower right)
53N+545	Defined side of q (0: All 1: Upper 2: Lower 3: Left 4: Right)
53N+546	Long side (I to X_SIZE) (See *2.)
53N+547	Short side (I to Y_SIZE) (See *2.)
53N+548	Long side lower limit (1 to 200)
53N+549	Long side upper limit (1 to 200)
53N+550	Short side lower limit (1 to 200)
53N+551	Short side upper limit (1 to 200)
53N+552	Long side distance lower limit (1 to 200)
53N+553	Long side distance upper limit (1 to 200)
53N+554	Short side distance lower limit (1 to 200)
53N+555	Short side distance upper limit (1 to 200)
53N+556	Line parallelism (1 to 99)
The following settings data is for [Multi-points] measurement.	
53N+557	Sorting method (0: X ascending order 1: X descending order 2: Y ascending order 3: Y descending order)
"##" and subsequent numbers indicate hidden parameters.	

*2: The setting range varies depending on the controller model.

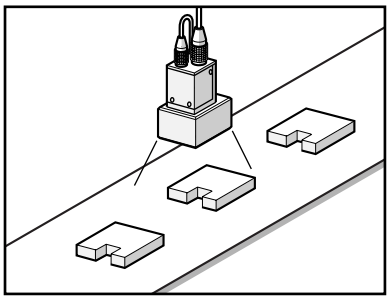
Setting range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483
1 to X_SIZE	1 to 1024	1 to 512
1 to Y_SIZE	1 to 1024	1 to 484
3 to R_MAX	3 to 1024	3 to 512

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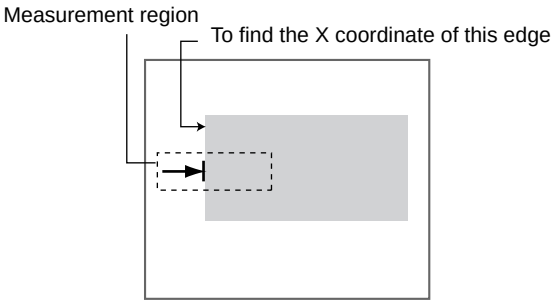
Edge Position_8

The Edge Position processing item uses the density (brightness) in the measurement region to find the position of the measurement object.
Use this processing item to find the edge coordinates or width of the measurement object.

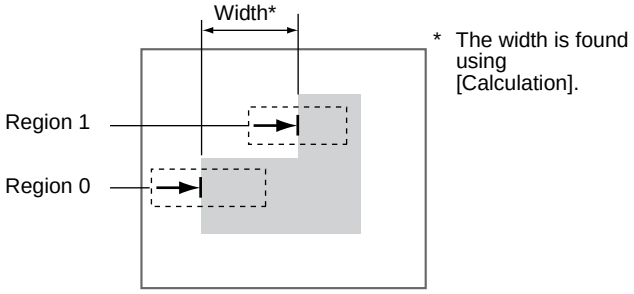
Example: Finding the size of a molded product.



The edge is found using density changes in the measurement region.



The size (dimensions) of the edge can also be obtained if multiple regions are registered.



* The width is found using [Calculation].

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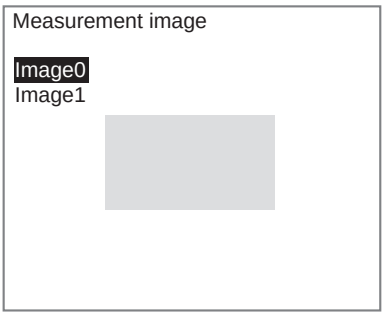
External Reference Table 14

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Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [Edge position_8/Measurement image]



1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

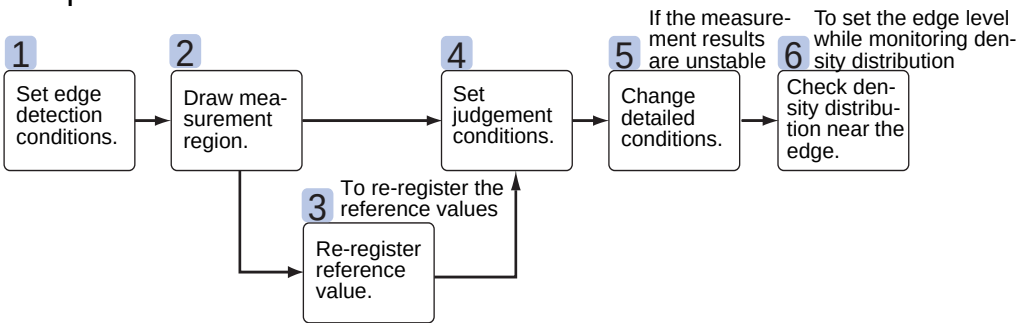
2. Press the ENT Key.

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Set the measurement region

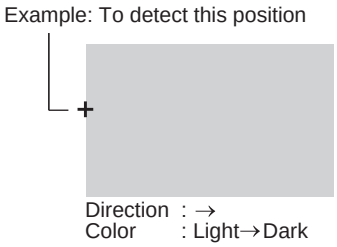
Up to 8 regions can be set.

■ Operational Flow



1 Setting Edge Detection Conditions

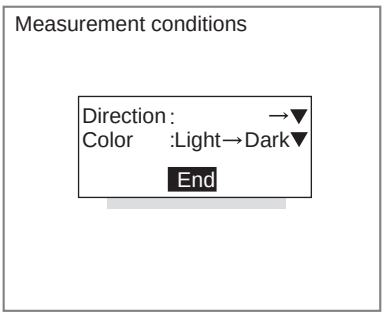
Set the direction for edge detection and the density changes.



▶ [Edge position_8/Select region/Region (No.)/Measurement conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Direction	→ ← ↑ ↓	Select the edge detection direction.
Color	Light to Dark Dark to Light	Select the density change.

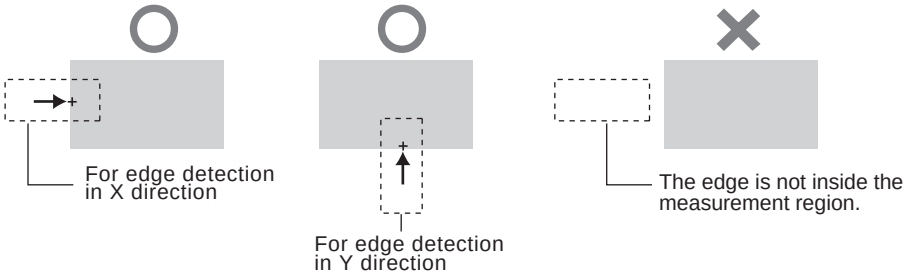
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2 Drawing Measurement Regions

Draw a measurement region to include all the edges for detection.
When a measurement region is drawn, measurement is performed for the displayed image and the result is registered as the reference value (edge position).

CHECK!

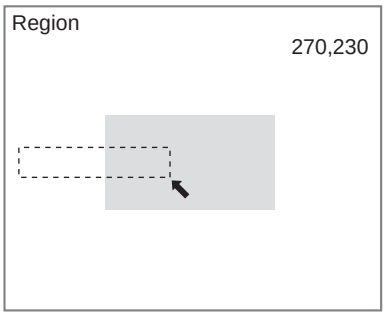
If the edge is not in the measurement region, measurement will not be possible. Make a region of a size and position that allows for movement of the range of the measurement object.



▶ [Edge position_8/Select region/Region (No.)/Region]

1. Draw a box-shaped region.

Specify the upper left and lower right coordinates.



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3 Re-registering Reference Values

This operation is performed when only the reference value is to be re-registered.

When a measurement region is drawn, the measurement is performed for the displayed image and the results are registered as the reference values. If the re-registering function explained here is used, only the reference values for the image currently displayed will be registered.

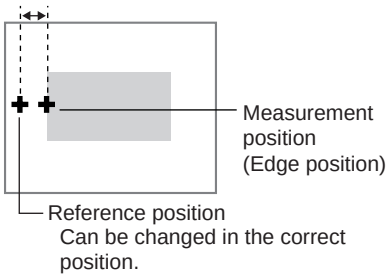
Edge position is registered for the reference value.

CHECK!

The reference position can be changed to enable the following function.

- Measuring Positions from a Specified Position

  Once the reference values have been obtained for the image currently displayed, the reference position is changed to an suitable point. Position inspection can be performed by calculating the difference between this reference position and the measurement position.



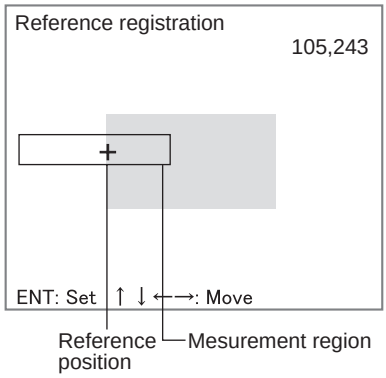
CHECK!

When the measurement region is changed, the reference value returns to the default setting.

▶ [Edge position_8/Select region/Region (No.)/Reference registration]

1. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.



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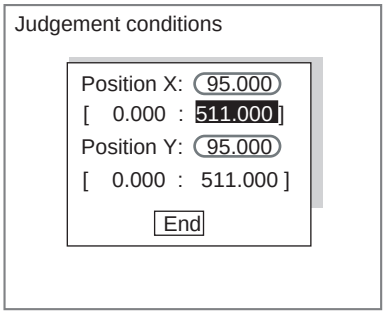
4 Setting Judgement Conditions

Set the position ranges for an OK judgement.

▶ [Edge position_8/Select region/Region (No.)/Judgement conditions]

1. Set each item.

2. Select [End].

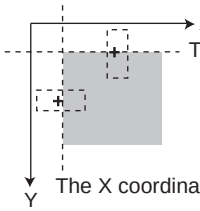


: Measurement result for the displayed image.
Use as a reference for setting conditions.

Setting data	Selection	Details
Position X	-9999.999 to 9999.999	Set the range of movement in the X direction for an OK judgement.
Position Y	-9999.999 to 9999.999	Set the range of movement in the Y direction for an OK judgement.

CHECK!

Position X and Position Y will change depending on the settings under [Measurement/Direction].



The Y coordinate is set when [↑] and [↓] are selected.

The X coordinate is set when [←] and [→] are selected.

* The origin and coordinate system vary with the calibration setting.

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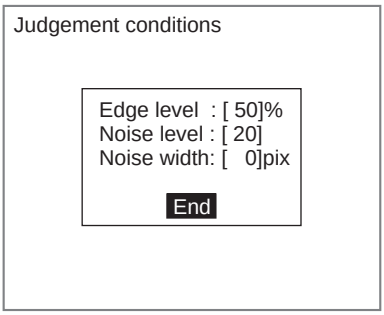
5 Changing Detailed Conditions

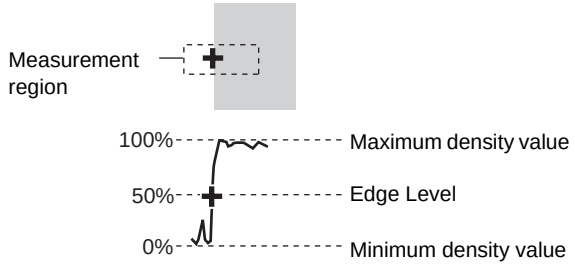
Change the detailed conditions when the measurement results are unstable. Normally, the method can be left on the default setting. After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

▶ [Edge position_8/Select region/Region (No.)/Detailed conditions]

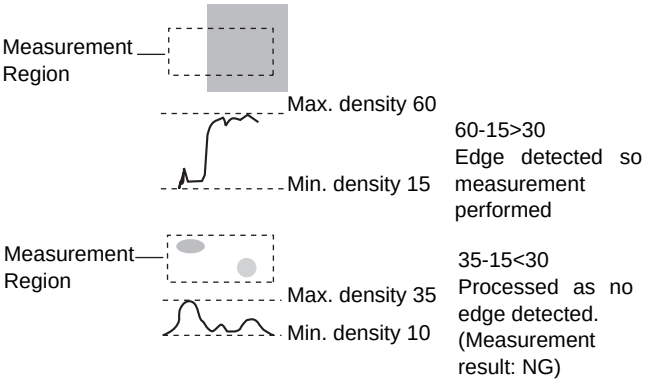
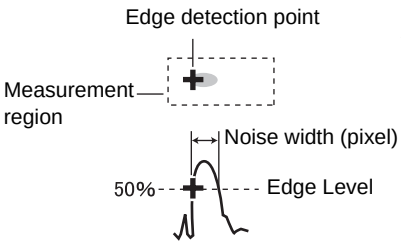
1. Set each item.

2. Select [End].



Setting data	Selection	Details
Edge Level	0 to 100 (default setting: 50)	Set a density change level between 0 and 100 that will indicate the edge. 

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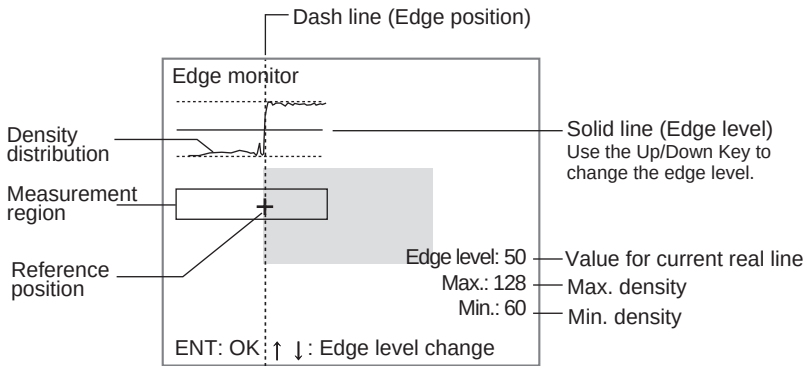
Setting data	Selection	Details
Noise Level	0 to 255 (default setting: 20)	Noise level used to make judgement if edges are present or not. The maximum density and minimum density within the edge detection area is calculated and if the difference between the two values is less than the noise level, then the Controller determines that there is no edge. If noise is causing incorrect detection, make this value higher. (Within the edge detection region) Max. density - min. density < noise level →no edge →NG measurement result Max. density - min. density ≥ noise level →Edge →Used for measurement Example: When [Noise level] is set to 30 
Noise Width	0 to 255 (default setting: 0)	Set the width of objects that are to be judged as noise. If the density distribution from the position where the edge was first detected falls to below the edge level within the noise width range, the detected point is judged as noise.If noise is causing incorrect detection, make this value higher. 

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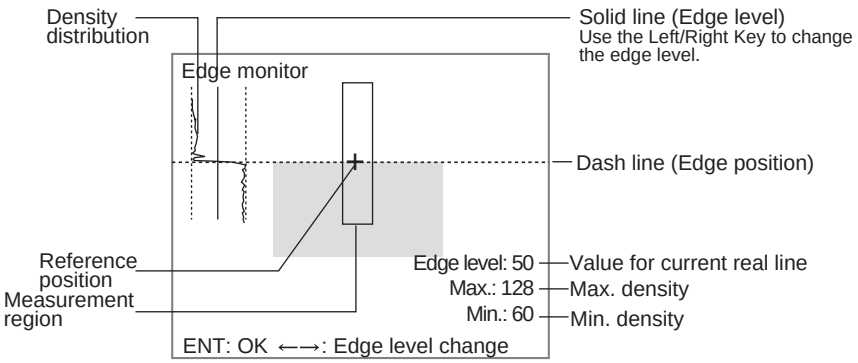
6 Checking the Density Distribution Near the Edge

The density distribution and edge level within the measurement region can be checked on the screen.
The edge level can also be set while monitoring density distribution.
After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

- When edge detection directions is Left or Right:

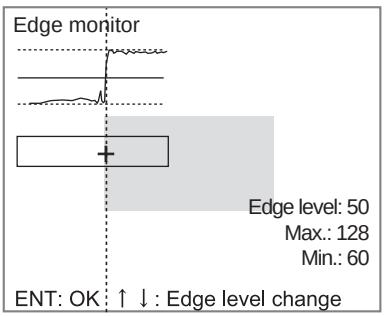


- When edge detection directions is Up or Down:



▶ [Edge position_8/Select region/Region (No.)/Edge monitor]

- To check density distribution and edge level
  Check the density distribution near the edge and press the ESC key to exit.
- To change the edge level
  Use the Up/Down/Left/Right Keys to move the cursor and press the ENT Key.



CHECK! The edge level can also be set in [Detailed conditions]. (The setting that has been specified the last will become effective.)
p.8

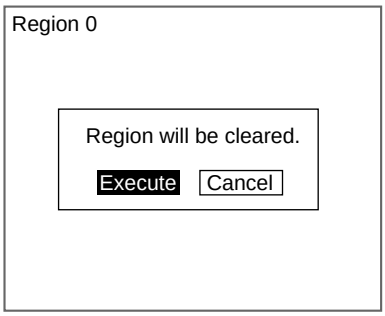
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Clearing the Set Regions

The clear operation is executed for each region.

▶ [Edge position_8/Select region/Region (No.)/Clear]

1. Select [End].



Setting the Coordinate Mode

Select the type of coordinate values.

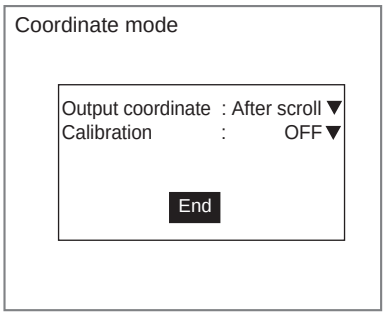
CHECK!

If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [Edge position_8/Coordinate mode]

1. Set each item.

2. Select [End].



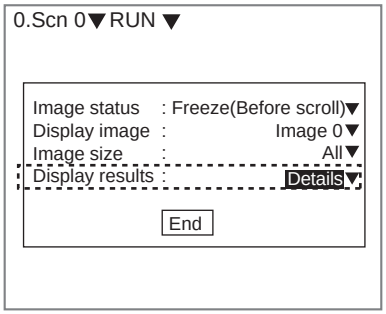
Settings Data

SECTION 7 Appendix, “Coordinate Handling Method”

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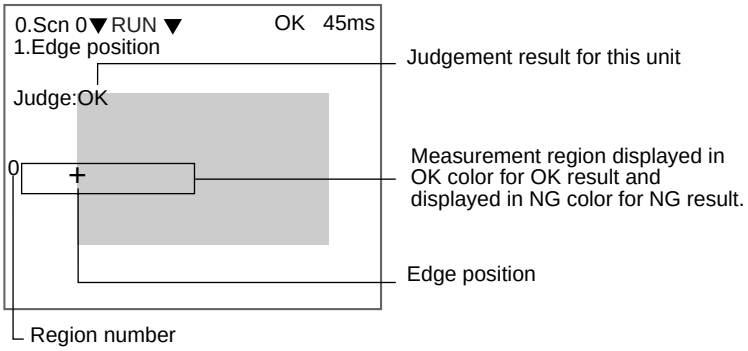
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.
Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



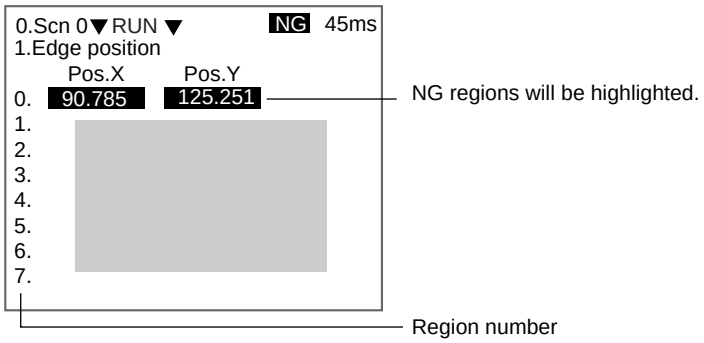
Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed. Use the SHIFT+Right or Left Keys to switch in order between the two screens.

(1) Judgement Result



(2) List of Positions

A list of edge positions for each region will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Unit judgement result (-2: Not measured -1: NG 0: OK)
The following measurement data is for Region N (0 to 7).		
Judgement	R**JG	Judgement result (-2: Not measured -1: NG 0: OK)
Edge position X	R**X	X coordinate of measured edge position
Edge position Y	R**Y	Y coordinate of measured edge position
Reference X	R**SX	X coordinate of reference position
Reference Y	R**SY	Y coordinate of reference position

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement Data

Data type	Details
0	Unit judgement result (-2: Not measured -1: NG 0: OK)
The following measurement data is for Region N (0 to 7).	
5N+1	Judgement result (-2: Not measured -1: NG 0: OK)
5N+2	X coordinate of measured edge position
5N+3	Y coordinate of measured edge position
5N+4	X coordinate of reference position
5N+5	Y coordinate of reference position

■ Setting Data

Data type	Details
50	Measurement image (0: Image 0 1: Image 1)
51	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF 2: After scroll, calibration ON 3: Before scroll, calibration ON)
The following measurement data is for region N (0 to 7).	
15N+52	Edge detection direction (0: ↑ 1: ↓ 2: → 3: ↔)
15N+53	Edge color (0: Light →Dark, 1: Dark →Light)
15N+54	X upper limit (-9,999.999 to 9,999.999)
15N+55	X lower limit (-9,999.999 to 9,999.999)
15N+56	Y upper limit (-9,999.999 to 9,999.999)
15N+57	Y lower limit (-9,999.999 to 9,999.999)
15N+58	Edge level (0 to 100)
15N+59	Noise level (0 to 255)
15N+60	Noise width (0 to 255)
15N+61	Region upper left X (0 to X_MAX) (See *1.)
15N+62	Region upper left Y (0 to Y_MAX) (See *1.)
15N+63	Region lower right X (0 to X_MAX) (See *1.)
15N+64	Region lower right Y (0 to Y_MAX) (See *1.)
15N+65	Reference position X (0 to X_MAX) (See *1)
15N+66	Reference position Y (0 to Y_MAX) (See *1)

*1: The setting range varies depending on the controller model.

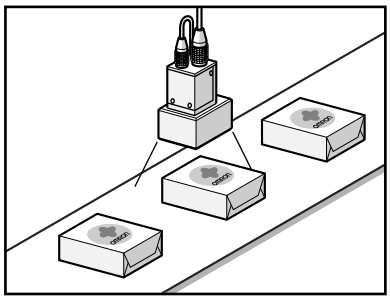
Setting range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

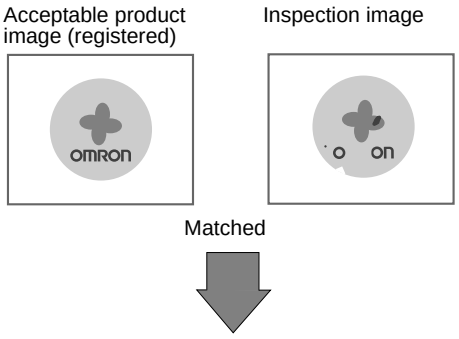
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Fine matching

The registered image for an acceptable product and the input image are overlaid (matched) and the differences are detected quickly and accurately. This enables small defects in the pattern and writing on the measurement object to be detected with a high level of accuracy.

Example: Label Defect Inspection





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Operational Flow

Select the method for matching with the model 3

Changing Labeling Conditions 5

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Changing Detailed Conditions as Required 9

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- Submenus for Expressions 15
- External Reference Table 15

CHECK!

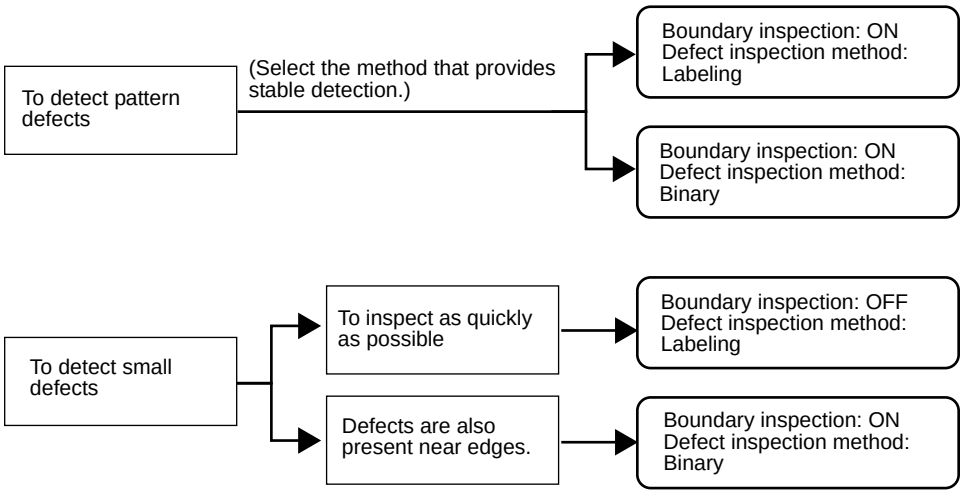
If processing items are set for units after the unit to which Fine Matching has been set, care must be taken when manipulating images. Refer to the pages describing “Handling Images”.

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Select the method for matching with the model

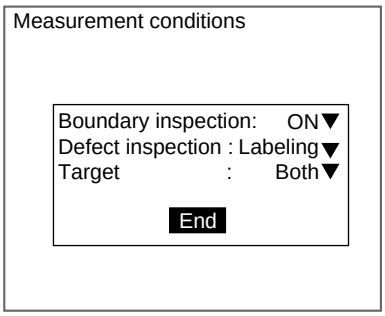
This section describes how to select a matching method suitable for the measurement object.



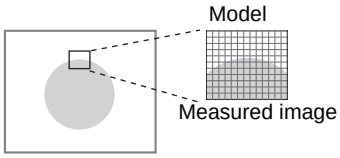
▶ [Fine matching/Measurement conditions]

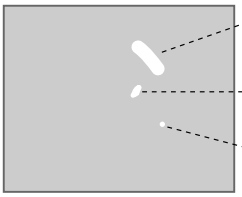
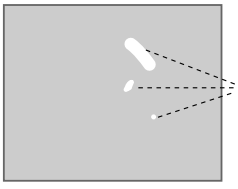
1. Set each item.

2. Select [End].



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<table>
<tr><th>Setting data</th><th>Selection</th><th>Details</th></tr>
<tr><td>Boundary inspections</td><td colspan="2">Boundary inspections match the boundary areas (areas where the density changes).
How to set the boundary level p.9</td></tr>
<tr><td></td><td>None</td><td>This method masks the boundary, excluding it from inspection. This means that any defects near the boundary will not be detected.
The boundary level sets the number of pixels near the boundary that will be excluded from the inspection.


(1 block = 1 pixel)
 If the object is shifted slightly upward, the boundary will be considered as the difference from the model.
 If [Boundary inspection] is set to [OFF], the area "model's boundary ± boundary level" will be excluded from inspection.
Example: When [Boundary Level] is set to 3
The area of 6-pixel width will be excluded from inspection.</td></tr>
<tr><td></td><td>ON
(default setting)</td><td>This method inspect all defects including, so any defects near the boundary will also be detected. The processing time, however, will be longer because eroded and dilated models are matched to prevent inspection mistakes caused by measurement object displacement.
Only defects detected for both models will be judged as defects. The size of dilation and erosion can be set using the boundary level.
Expansion model
 Example: When [Boundary Level] is set to 3
Expanded by three pixels.
Erosion model
 Example: When [Boundary Level] is set to 3
Shrunk by three pixels.</td></tr>
<tr><td>Defect inspection method</td><td colspan="2">An image showing the difference between the model image and inspection image will be converted internally to a binary image. The method for inspecting defects from those binary images is selected here.</td></tr>
<tr><td></td><td>Labeling area
(default setting)</td><td>One group of white pixels is detected as one label. The Controller will judge whether or not labels that match the set conditions are defects.

</td></tr>
<tr><td></td><td>Binary</td><td>The total area of the white pixels is evaluated to determine if there are defects or not.

</td></tr>
<tr><td>Target</td><td>Both (default setting)
White
Black</td><td>Set the colors to be considered as defects and dirt.
If the colors of defects are the same, processing time can be reduced by selecting [White] or [Black].</td></tr>
</table>

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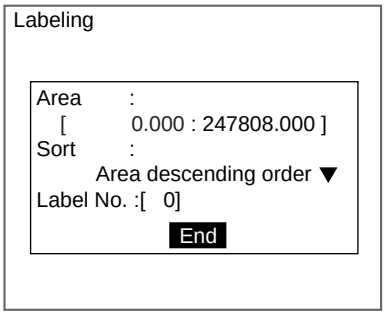
Changing Labeling Conditions

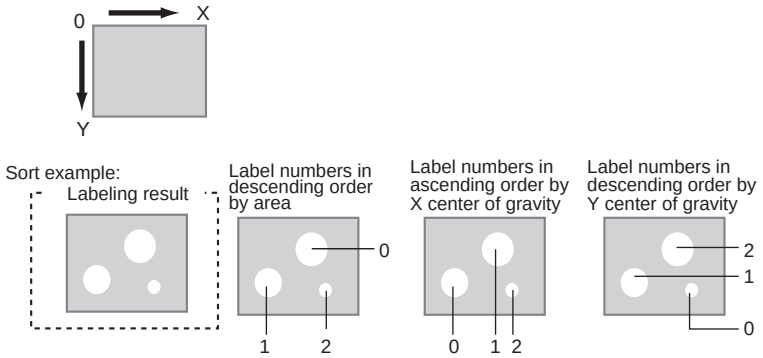
When Labeling area is selected as the defect inspection method, the following labeling conditions can be changed to match the inspection goals.

▶ [Fine matching/Labeling]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Area	0 to 9,999,999.999 (default setting 0:247808.000)	Set the range of areas to be judged as a label.
Sort	Set the label number re-assignment conditions. The upper left corner will be used as the origin when sorting by center of gravity X and Y. The coordinates set using calibration are not affected by labeling.  	
	Area descending order (default setting)	Sorts in descending order by area
	Area ascending	Sorts in ascending order by area.
	X gravity descending	Sorts in descending order by center of gravity X.
	X gravity ascending	Sorts in ascending order by center of gravity X.
	Y gravity descending	Sorts in descending order by center of gravity Y.
	Y gravity ascending	Sorts in ascending order by center of gravity Y.
Label No.	0 to 999 (default setting: 0)	Sets label number for defect evaluation.

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Registering the Model

An image of an acceptable product is registered as the model. The image of the measurement object read by the Camera is compared with this model and defects are detected where there are differences from the model.

CHECK!

The image stored to [Image 0] is used as the measurement image for Fine Matching.

The measurable range varies depending on the controller model. The models must be registered in this range.

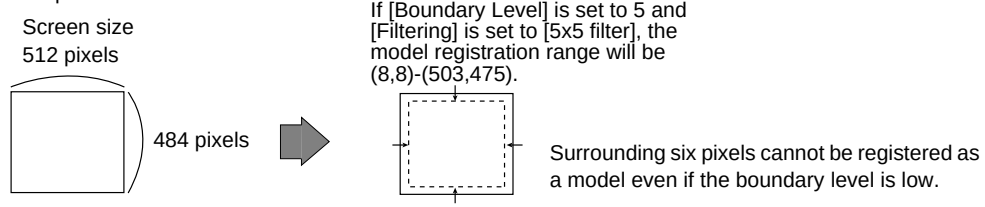
F500-C10: (1+L+M,1+L+M)–(1022-L-M, 1022-L-M)

For the other controllers: (1+L+M,1+L+M) - (510-L-M,482-L-M)

L: Boundary Level

M: Filtering (0: Filtering OFF, 1: 3 × 3 filter, 2: 5 × 5 filter)

Example: F250



Boundary Level p.10

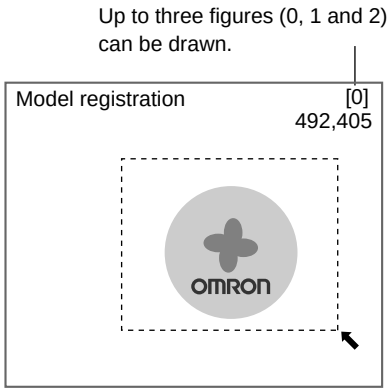
If pre-processing (filtering) is set for the measurement image, the range that can be registered will be reduced further. Furthermore, if the number of lines to be read has been set in the case of a camera with virtual scan function, there are restrictions on the removal range.

SECTION 2, 1.1 Inputting Camera Images, “Filtering”

▶ [Fine matching/Model registration/New/figure/drawing mode]

1. Draw the region to be registered as the model with the selected figure.

SECTION 1 Basic Operating Procedures, “Drawing a Region”



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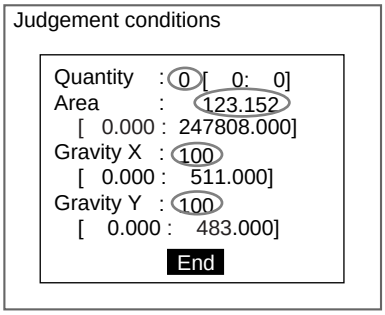
Setting Judgement Conditions

Set the ranges for the number of labels, area and center of gravity for an OK judgement.
Range for an OK judgement

▶ [Fine matching/Judgement conditions]

1. Set each item.

2. Select [End].



: Measurement results for the displayed image.
Use these values as a reference for setting upper and lower limits.

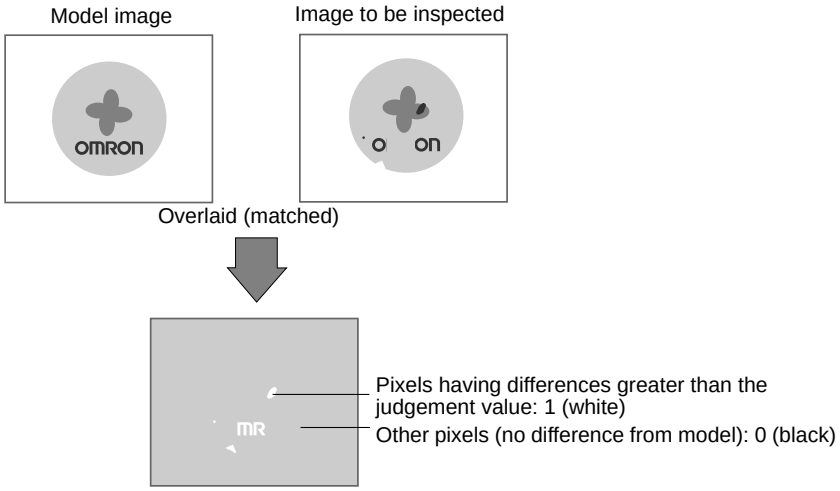
Setting data	Selection	Details
Quantity	0 to 1,000	Set the label count range for an OK judgement. If [Binary] is selected as the inspection method, each white pixel will be counted as one label.
Area	0 to 9,999,999.999	Set the area range for an OK judgement. If [Labeling] is selected as the inspection method, the area for the specified label No. will be used.
Gravity X	-9,999.999 to 9,999.999	Set the range of movement of the center of gravity in the X direction for an OK judgement. If [Labeling] is selected as the inspection method, the center of gravity for the specified label No. will be used.
Gravity Y	-9,999.999 to 9,999.999	Set the range of movement of the measurement object in the Y direction for an OK judgement. If [Labeling] is selected as the inspection method, the center of gravity for the specified label No. will be used.

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Changing Differential Judgements as Required

Differential judgement values use the basic gradation of the differences between the model and measurement object images.
Differential judgement values can be set between 1 and 255. Pixels in areas with a difference greater than the differential judgement value are converted to 1 (white) and all other pixels are converted to 0 (black). Thus, only the defects are converted to white pixels and are measured. The default differential judgement value is usually sufficient, but change this value if the defects are not being detected properly.

Display the image of an NG object to enable the differential judgement value to be adjusted while looking at the differential image.



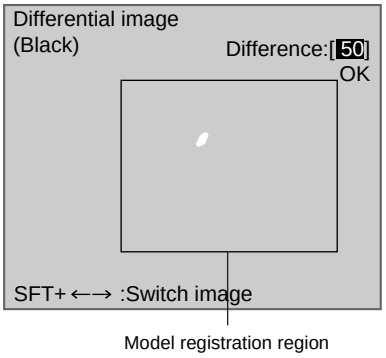
▶ [Fine matching/Differential image]

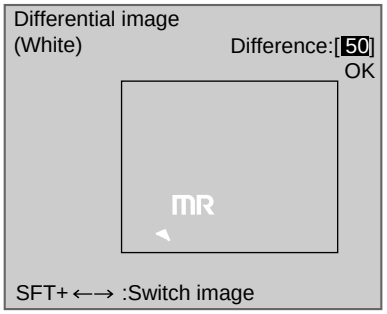
1. The setting screen appears.
The differential image will be shown within the model registration region. The rest of the screen will be black.

2. Use the SHIFT+Left and SHIFT+Right Keys to switch between the white defect and black defect images.

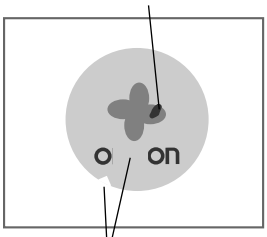
3. Move the cursor to the differential value (difference) and use the Left and Right Keys to change the value.
Change the value until the defect is displayed in white.
Repeat the steps **2.** to **3.** to adjust the differential value for the other image.

4. Select [OK].





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Setting data	Selection	Details
Differential judgement value:	1 to 255 (default setting: 50)	Differential judgement values use the basic gradation of the differences between the model and measurement object images. There are two differential images, one showing only black defects and the other showing only white defects. Example: Black scratch (More blackish than model image)  White scratch (More whitish than model image)

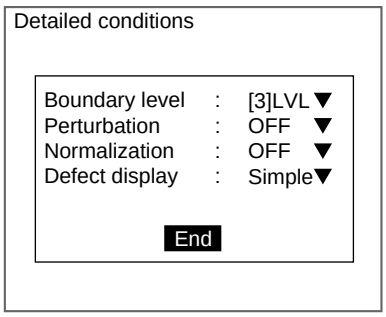
Changing Detailed Conditions as Required

Change the detailed conditions if required when matching is not stable.

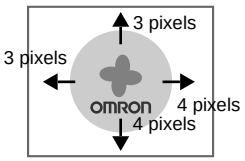
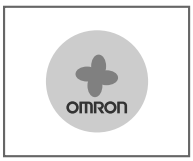
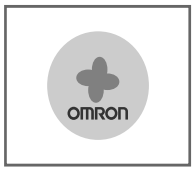
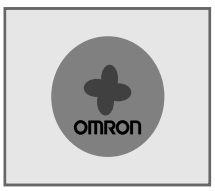
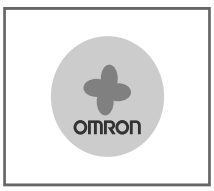
▶ [Fine matching/Detailed conditions]

1. Set each item.

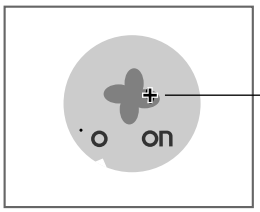
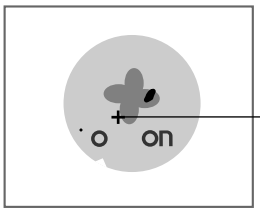
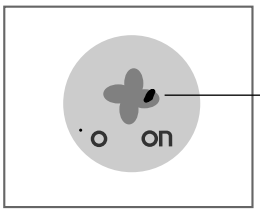
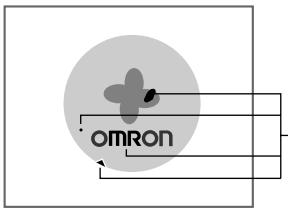
2. Select [End].



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Setting data	Selection	Details
Boundary Level	1 to 99 (default setting: 3)	Select the extent to which the boundary difference (change in density) will be absorbed. Re-register the model if the boundary level has been changed. The function will vary depending on whether [Boundary inspection] is set to ON or OFF. p.4
Perturbation	OFF (default setting) ON	Select whether or not to perform a search near the registered model position. If [OFF] is selected, matching is performed only at the registered position, which reduces processing time. ON  Matching is also performed around the model registration position. OFF  Matching is performed at the model registration position only.
Density Normalization	OFF (default setting) ON	This function is used to select whether or not to normalize the density in line with the brightness of the registered model. If [ON] is selected, matching is performed after the density is compensated, even if the overall brightness of the image has changed. This means that the measurement is less likely to be affected by lighting variations. Model image  Measured image (Totally darker)  Normalization  

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Setting data	Selection		Details
Defect Display	This function is used to select the display method for defects or burrs. The display will change depending on the settings for the defect inspection. Defect Inspection Method p.14		
	Simple	Labeling	 The cursor appears at the center of gravity of the specified label No. group.
		Binary	 The cursor appears at the center of gravity of defect. * When there are defects at multiple positions, the cursor will appear at the center of gravity of the total white pixel area and may not, therefore, appear exactly at the defect position.
	Detail	Labeling	 Only the specified label No. group will appear in the NG color.
		Binary	 Only the specified label No. group will appear in the NG color.

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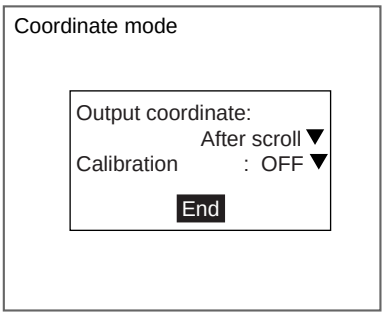
Setting the Coordinate Mode

Select the type of coordinate values.

CHECK!

If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [Fine matching/Coordinate mode]



1. Set each item.

2. Select [End].

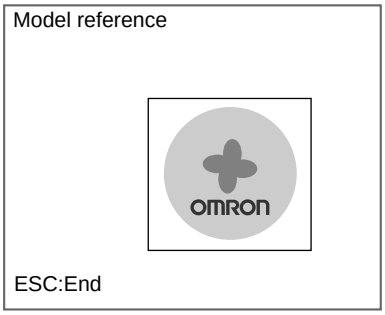
Settings Data

SECTION 7 Appendix, “Coordinate Handling Method”

Referencing Models

Models can be displayed on screen to check what kind of images are registered as models.

▶ [Fine matching/Model reference]



1. Referencing Models

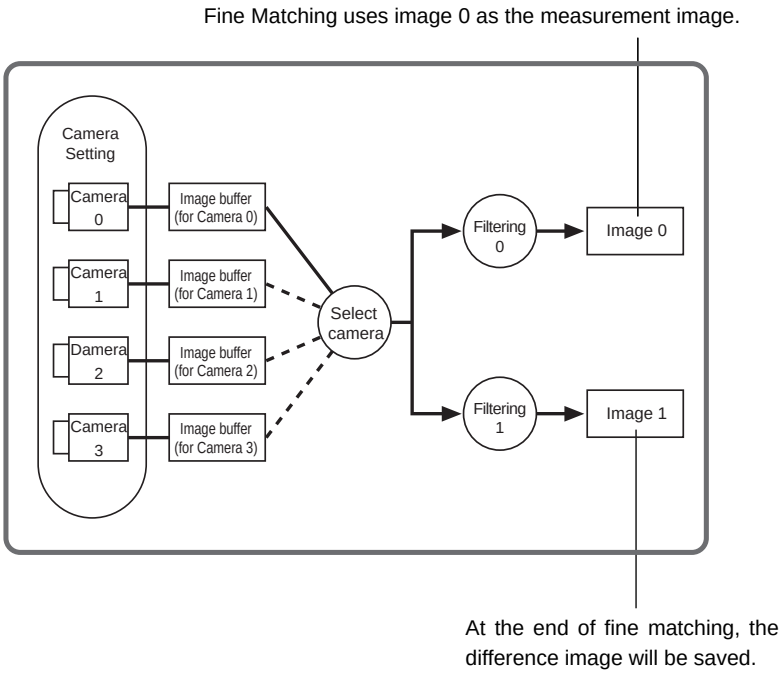
The model will be displayed at the position where registered.

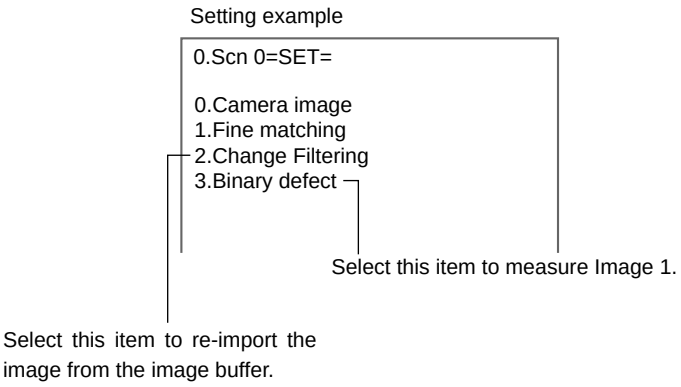
2. Press the ESC Key to exit.

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Handling Images

When Fine Matching is executed, the differential image (where only the difference between the model and inspection images has been extracted) is stored as [Image 1].
If [Image 1] is to be used for measurement for subsequent units, set [Change Filtering] before the next processing item and obtain the image stored in the image buffer again.

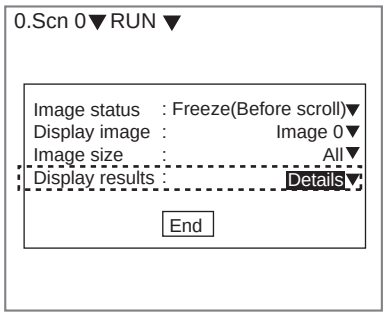




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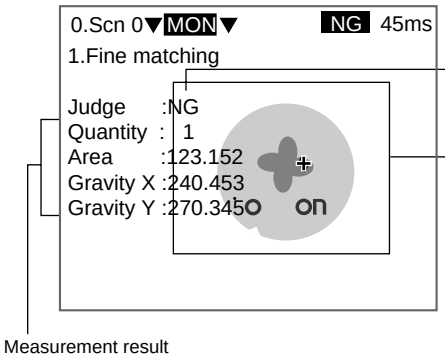
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.
Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].

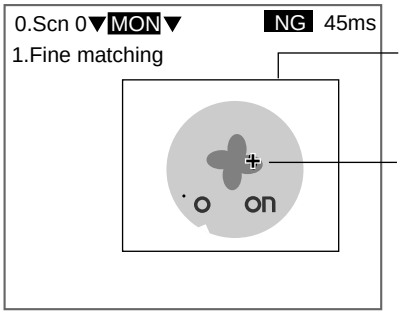


Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed. Use the SHIFT+Right or Left Keys to switch in order between the two screens.

(1) Judgement Result



(2) Defect Display



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
judgement	JG	Unit judgement result (-2: Not measured -1: NG 0: OK)
Quantity	DA	Number of Labels
Area	AR	Area
Gravity X	X	X coordinate of center of gravity
Gravity Y	Y	Y coordinate of center of gravity

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement Data

Data type	Details
0	Unit judgement result (-2: Not measured -1: NG 0: OK)
1	Number of Labels
2	Area
3	X coordinate of center of gravity
4	Y coordinate of center of gravity

■ Setting Data

Data type	Details
32	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF 2: After scroll, calibration ON 3: Before scroll, calibration ON)
33	Boundary inspection (0: OFF 1: ON)
34	Defect inspection (0: Labeling area 1: Binary area)
35	Target (0: Black 1: White 2: Both)
36	Area lower limit (0 to 9,999,999.999)
37	Area upper limit (0 to 9,999,999.999)

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Data type	Details
38	Sort (0: Area descending 1: Area ascending 2: X gravity descending 3: X gravity ascending 4: Y gravity descending 5: Y gravity ascending)
39	Label number (0 to 999)
40	Boundary level (1 to 99)
41	Difference (1 to 255) (See *1.)
42	Perturbation (0: OFF 1: ON)
43	Normalization (0: OFF 1: ON)
44	Defect display (0: Simple 1: Detail)
45	Model registration area upper left X (0 to X_MAX) (See *2, *3.)
46	Model registration area upper left Y (0 to Y_MAX) (See *2, *3.)
47	Model registration area lower right X (0 to X_MAX) (See *2, *3.)
48	Model registration area lower right Y (0 to Y_MAX) (See *2, *3.)
49	Quantity upper limit (0 to 1,000)
50	Quantity lower limit (0 to 1,000)
51	Area upper limit (0 to 9,999,999.999)
52	Area lower limit (0 to 9,999,999.999)
53	Position X upper limit (-9,999.999 to 9,999.999)
54	Position X lower limit (-9,999.999 to 9,999.999)
55	Position Y upper limit (-9,999.999 to 9,999.999)
56	Position Y lower limit (-9,999.999 to 9,999.999)
57	Difference (white) (0 to 255) (See *1.)
58	Difference (black) (0 to 255) (See *1.)

*1: The differential judgement values in data 41, 57, and 58 are as following when setting and reading the values.

Data No.	When setting	When reading
41	Reflected in the white defect and black defect differences.	The white defect difference is output.
57	Reflected in the white defect difference.	The white defect difference is output.
58	Reflected in the black defect difference.	The black defect difference is output.

*2 If this data is changed, one rectangular region will be set and the previously drawn figures will be deleted.

*3: The setting range varies depending on the controller model.

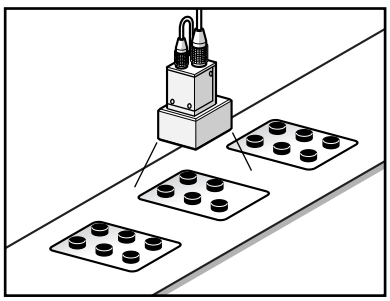
Setting range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

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EC Circle Count Inspection

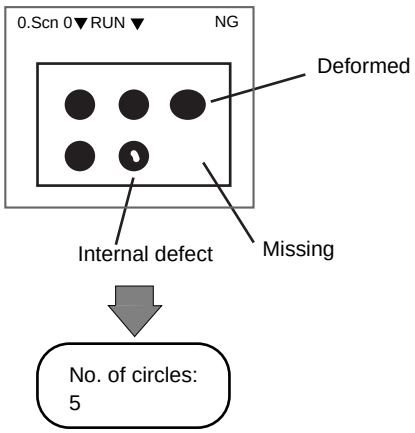
The EC circle count processing item counts the number of circles of a specified size. Circles are extracted using “round” shape information and the process is not affected even if the circles are deformed or there are internal defects.

Example: Counting Number of Circles



Circles are recognized and counted even if they are deformed or if there are internal defects.

The permissible range for defects can be changed.



Edge Code (EC)

SECTION 7 Appendix, “Terminology”

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Operational Flow

Selecting Measurement Images 3

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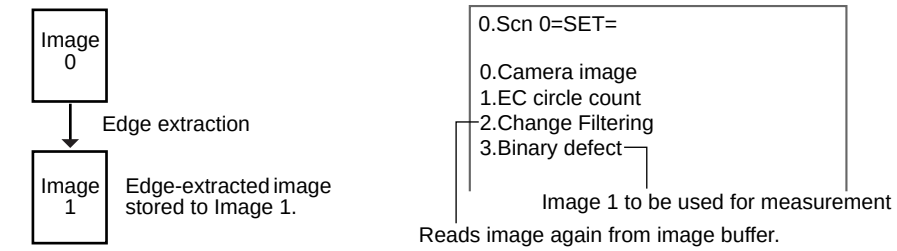
Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

CHECK!

The edges are extracted for the image number selected here and this image is then stored at the other image number. Set [Change Filtering] as the next processing item to use this image for measurement for units after the unit for which this processing item was set. Then store the image stored in the image buffer to [Image 0] or [Image 1].

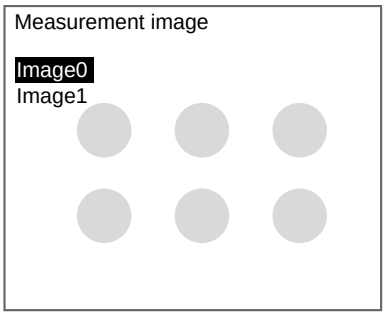
Example: When Image 0 Is Selected as Measurement Image



▶ [EC circle count/Measurement image]

1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.

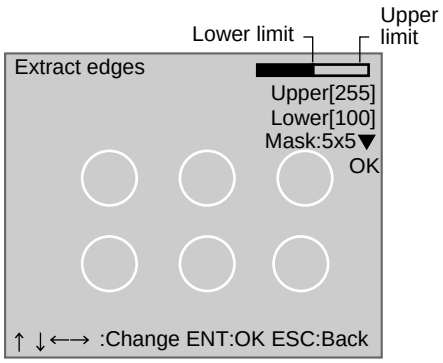


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Extracting Edges

This processing Item is performed for images for which the edges have been extracted.
Adjust the upper and lower levels for edge extraction if there is low contrast between the measurement object and the background and to remove noise.

▶ [EC circle count/Extract edges]



1. Set the upper and lower limits.

2. Select the desired mask size.

3. Select [OK].

Setting data	Selection	Details
Upper and Lower Limits	10 to 255 (default setting 100:255).	Set the level to which the background will be cut. Adjust the upper and lower levels for edge extraction if there is low contrast between the measurement object and the background and to remove noise.
Mask Size	5 × 5 (default setting) 3 × 3	The mask size function is used when searching for edges to judge edges using peripheral information. The greater the mask size, the more the variations in surrounding pixels can be absorbed. CHECK! This setting will be enabled only if [Camera image] is set to [Frame].

Settings Data

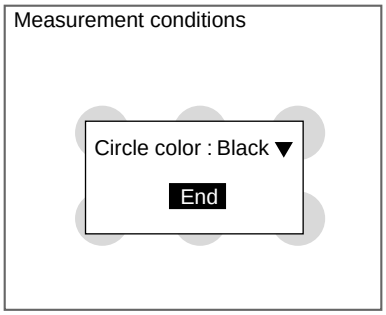
SECTION 7 Appendix, “EC (Edge Code) Image Measurement”

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Selecting Circle Color

Select the color of the circles to be inspected.

▶ [EC circle count/Measurement conditions]



1. Select the circle color.

2. Select [End].

Setting data	Selection	Details
Circle color	Black (default setting) White Both	Select whether the circle color will be white or black compared to the background. Select [Both] if the circle color is not fixed to either black or white.

Setting Inspected Regions

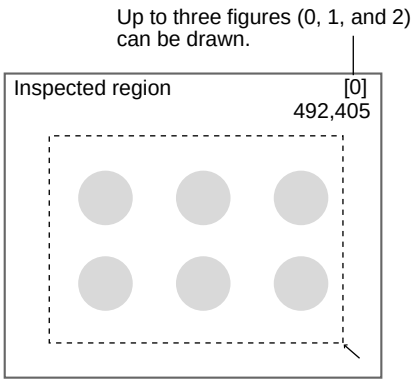
Circles that meet the set conditions will be found from the inspection region set here.

CHECK!

When edges are extracted, the pixels at the edges of the screen cannot be processed accurately.
Do not include the outer edges of the screen when setting the removal region.
In particular, when performing position displacement compensation, adjust so that the scrolled image or the measurement range will not overlap with this region. Furthermore, if the number of lines to be read has been set in the case of F160-S2 camera, there are restrictions on the setting range.

SECTION 2, 1.1 Inputting Camera Images, “Filtering”.

▶ [EC circle count/Inspected region/New/figure/drawing mode]



1. Draw the figure for the inspection region.

SECTION 1 Basic Operating Procedures, “Drawing a Region”

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Registering the Size of the Circle

There are two methods for registering the size of the circle.

Registration method	Details
Inputting Figures	The measurement object is displayed on the screen, a circle is drawn on the exterior edge of the object and the size of the circle is registered.
Inputting Parameters	The radius of the circle and the permissible range are entered as parameters (in pixel units).

CHECK!

The size of the circle registered here is used to find circle candidates.
If circles of different sizes are found or if the inspection is otherwise unstable, set the radius (radius of circles to be counted) under detailed conditions.

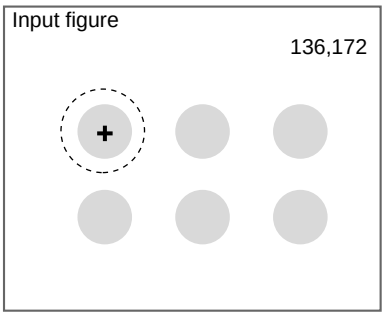
p.9

Inputting Figures

▶ [EC circle count/Candidate radius/Input figure]

1. Specify the center position of the circle.

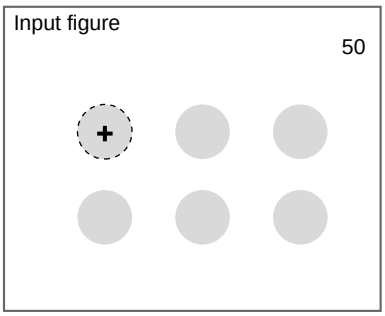
Up/Down/Left/Right Keys: Move the cursor.
ENT Key: Confirms the setting.



The screen for setting the radius will be displayed.

2. Specify the radius.

Up/Right Keys: Larger
Down/Left Keys: Smaller
ENT Key: Confirms the setting.

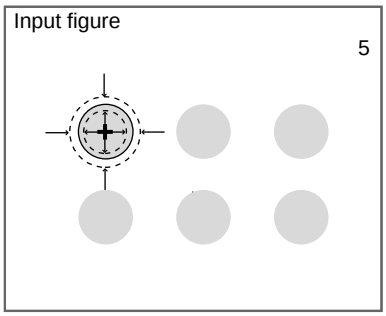


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The screen for setting the latitude of the radius will be displayed.

3. Specify the latitude of the radius (1 to 64 pixels).

Up/Right Keys: Larger
Down/Left Keys: Smaller
ENT Key: Confirms the setting.



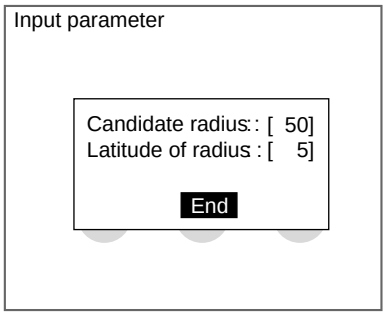
Inputting parameters

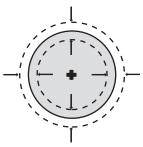
Input the parameters in pixel units for the radius and latitude of the circle.

▶ [EC circle count/Candidate radius/Input parameter]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Candidate radius	3 to RMAX	Set the radius and the permissible radius range for the circle to be found. The settable maximum value (RMAX) varies depending on the controller model. p.13 
Latitude of radius	1 to 64	Set the permissible width for [Candidate radius]. 

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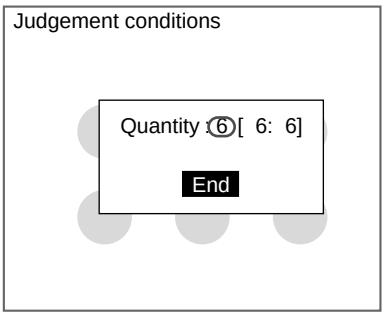
Setting Judgement Conditions

Set the number of circles for an OK judgement.

▶ [EC circle count/Judgement condition]

1. Set the number of circles for an OK judgement.

2. Select [End].



⬭:The measurement results for the displayed image.

Setting data	Selection	Details
Quantity	0 to 64	Set the number of circles for an OK judgement.

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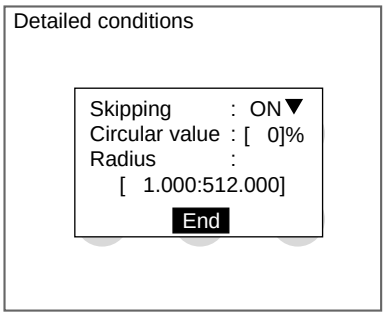
Setting Detailed Conditions

Adjust the detailed conditions if the circle detection is unstable or if circles of different sizes are counted.

▶ [EC circle count/Detailed conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Skipping	ON (default setting) None	Select whether pixel skipping (1 pixel) will be used when searching for circle candidates. Processing is faster if pixel skipping is turned ON, so normally “ON” is appropriate. However, if the measurement values are inconsistent, set to “OFF”.
Circular value	0 to 100 (default setting: 0)	Circle deformity check If the circle is deformed or chipped, the evaluation is lower. Any figure with an evaluation lower than the setting here will not be counted as a circle.
Radius	0.000 to 9999.999 (default setting 1.000 : 512.00)	Set the radius for circles to be counted. Candidate circles that do not fall within this radius range are not counted.

CHECK!

Finding Circles

1. Extracting Circle Candidates
   Size: Set under Candidate radius. Refer to p.6.
   Extraction: Performed based on pixel skipping setting.
2. Judging Whether or Not Candidate Circle Should Be Counted
   Deformity check: Is the circle within the circular value range?
   Size check: Is the circle within the radius range?

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Setting the Coordinate Mode

Select the type of coordinate values.

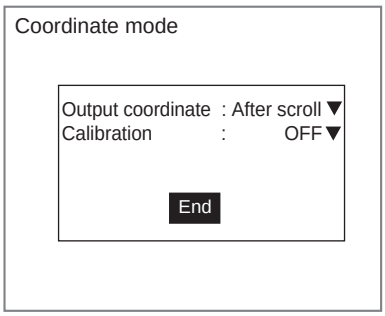
CHECK!

If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.Change the judgement conditions to enable correct measurement.

▶ [EC circle count/Coordinate mode]

1. Set each item.

2. Select [End].



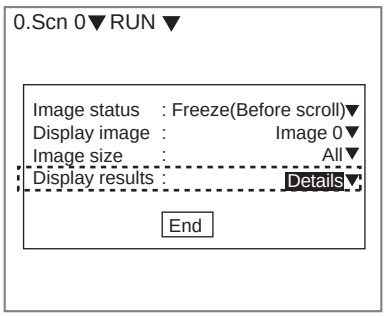
Settings Data

SECTION 7 Appendix, “Coordinate Handling Method”

Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

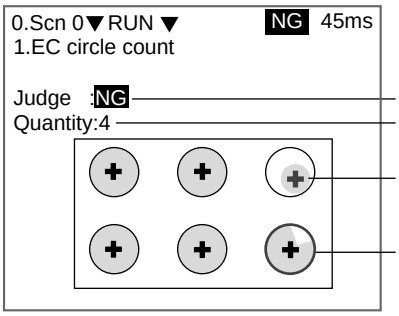
Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed. Use the SHIFT+Right or Left Keys to switch in order between the two screens.

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(1) Judgement Result



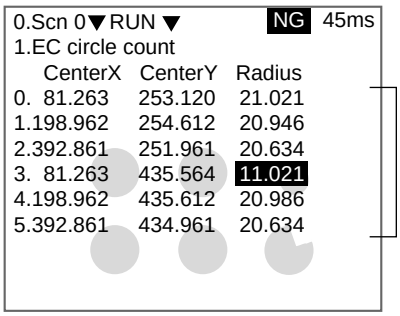
The measurement result for this unit (In this example, when number of circles set to 6 under Judgement conditions.)

No. of circles found.

NG radius
(The display cursor is shown in NG color.)

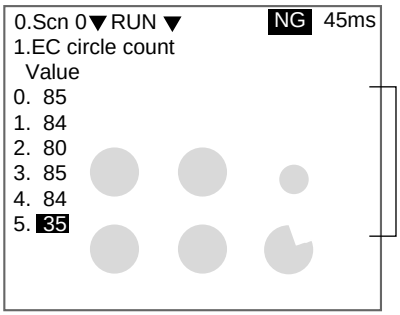
NG circular value
(The circumference is shown in NG color.)

Circle Information (Center Position and Radius)



Displays detailed information for candidate circles.
(Use the center X and center Y information to determine which circle the information is for.)

Circle Information (Circular Value)



Displays the circular values for candidate circles.

CHECK!

If the font size is set to small the circle information screens will be shown together.

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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
The following measurement data is for unit		
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Quantity	CN	Number of measured circles
The following measurement data is for Circle N (0 to 63).		
Circle center NX	CX**	X coordinate of center of measured circle
Circle center NY	CY**	Y coordinate of center of measured circle
Circle radius N	CR**	Radius of measured circle
Circular evaluation value N	CV**	Evaluation value of measured circle

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
The following measurement data is for unit	
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Number of measured circles
The following measurement data is for Circle N (0 to 63).	
4N+2	X coordinate of center of measured circle
4N+3	Y coordinate of center of measured circle
4N+4	Radius of measured circle
4N+5	Evaluation value of measured circle

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■ Setting Data

Data type	Details
270	Measurement image (0: Image 0 1: Image 1)
271	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF 2: After scroll, calibration ON 3: Before scroll, calibration ON)
272	Edge extraction mask size (0: 3 × 3 1: 5 × 5)
273	Edge extraction lower limit (10 to 255)
274	Edge extraction upper limit (10 to 255)
275	Region upper left X (0 to X_MAX) (See *1, *2)
276	Region upper left Y (0 to Y_MAX) (See *1, *2)
277	Region lower right X (0 to X_MAX) (See *1, *2.)
278	Region lower right Y (0 to Y_MAX) (See *1, *2.)
279	Circle color (0:Black 1:White 2:Both)
280	Circle center X coordinate (0 to X_MAX) (See *2.)
281	Circle center Y coordinate (0 to Y_MAX) (See *2.)
282	Circumference radius (3 to R_MAX) (See *2.)
283	Circumference width (1 to 64)
284	Quantity upper limit (0 to 64)
275	Quantity lower limit (0 to 64)
286	Skipping 0: OFF 1: ON
287	Circular value (0 to 100)
288	Radius upper limit (0 to 9,999.999)
289	Radius lower limit (0 to 9,999.999)

*1: If these settings are changed, one rectangular region will be set and the previously drawn figures will be deleted.

*2: The range varies depending on the controller model.

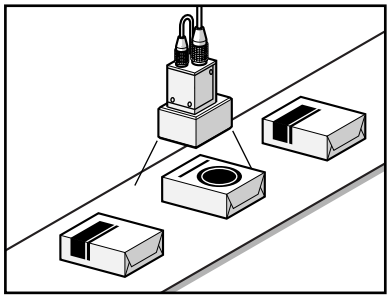
Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483
3 to R_MAX	3 to 1024	3 to 512

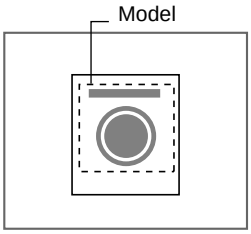
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Pattern Inspection

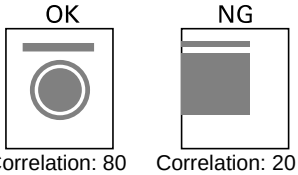
The Precise Search processing item is used to distinguish between measurement object shapes or positions.
The part of the input image that most corresponds to the special characteristics of the measurement image (model) is found and the correlation (degree of similarity) and position are detected. Up to 64 regions can be registered to 1 unit and search processing can be executed simultaneously for these regions.

Example: Detecting for Mixed Varieties of Packaging





When judgement value (correlation) set to 70



Correlation: 80 Correlation: 20

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Operational Flow

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Pattern inspection uses the image stored at [Image 0] as the measurement image; there is no menu for selecting the measurement image.

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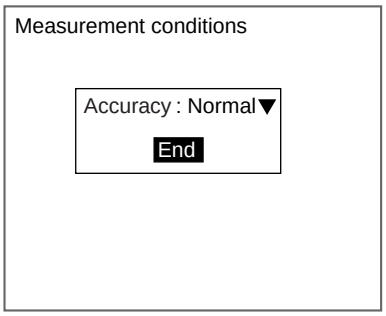
Changing Measurement Conditions

Select the degree of precision when searching for model positions. Change the settings for searches common to all measurement regions. Change these conditions for high-precision model position detection. Normally, the method can be left on the default setting.
After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

▶ [Pattern/Measurement conditions]

1. Select the accuracy.

2. Select [End].



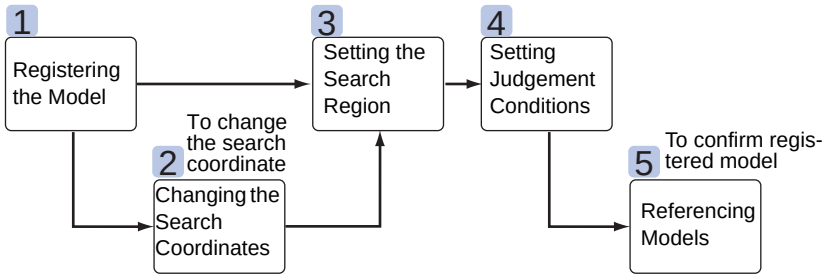
Setting data	Selection	Details
Accuracy	Normal (default setting)	Finds the position in pixel units.
	Precise	Finds the position in sub-pixel units. The measurement is performed with greater precision than [Normal]. Processing time, however, will be longer.

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Set the measurement region

Up to 64 regions can be set.

■ Operational Flow



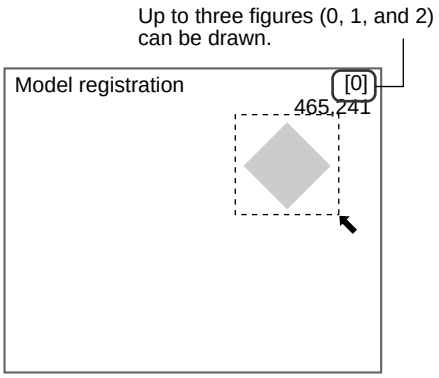
1 Registering the Model

The area of the image to be inspected is registered as a model.
When a model is registered, the center position of the model is registered as the search coordinates. (When several figures have been combined in the drawing, the center coordinates of circumscribing rectangle becomes the search coordinates.)

▶ [Pattern/Select region/Region (No.)/Model registration/figure/drawing mode]

1. Draw the region to be registered as the model with the selected figure.

SECTION 1 Basic Operating Procedures, “Drawing a Region”



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2 Changing the Search Coordinates

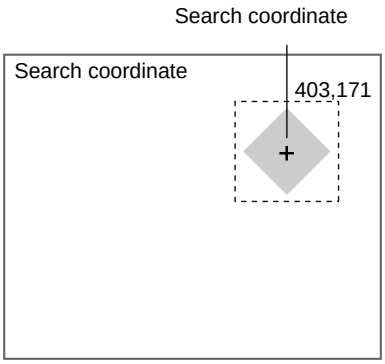
Use this function to change the search coordinates only.
When a model is registered, the center position of the model is registered as the search coordinates. This function can be used to register a point other than the center of the model as the search coordinates.

CHECK! The search coordinates are used for the point output as the measurement value. The search coordinates can be changed to an appropriate position.

▶ [Pattern/Select region/Region (No.)/Search coordinate]

1. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.

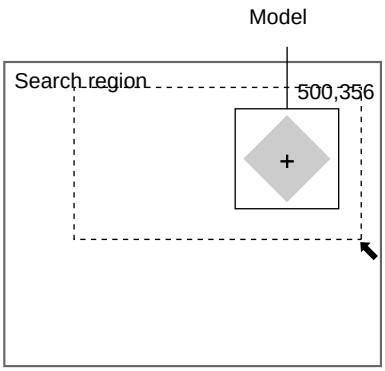


3 Setting the Search Region

Set the region in which the model is to be searched for.
It is possible to perform a search for the entire input image, but the processing time can be shortened and the accuracy can be increased by setting limits on the search region.

▶ [Pattern/Select region/Region (No.)/Search region]

1. Draw a rectangular search region.
Specify the upper left and lower right coordinates.



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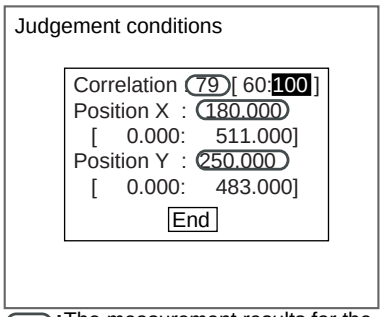
4 Setting Judgement Conditions

Set the judgement conditions for the correlation with the model and for the position (X, Y) where the object was detected.

▶ [Pattern/Select region/Region (No.)/Judgement conditions]

1. Set each item.

2. Select [End].



: The measurement results for the displayed image.
Use these values as references in setting the upper and lower limits.

Setting data	Selection	Details
Correlation	0 to 100	Set the correlation lower limit. The judgement will be OK if the measured value is upper than this.
Position X	-9,999.999 to 9,999.999	Set the range of movement in the X direction for an OK judgement.
Position Y	-9,999.999 to 9,999.999	Set the range of movement in the Y direction for an OK judgement.

Search
SECTION 7 Appendix, “Terminology”

5 Referencing Models

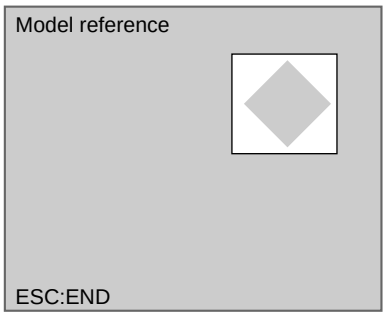
Use this operation to confirm registered models.

▶ [Pattern/Select region/Region (No.)/Model reference]

1. Referencing Models

The model will be displayed at the position where registered.

2. Press the ESC Key to exit.



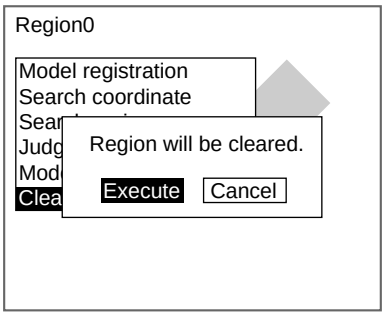
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Clearing Set Regions

The clear operation is performed separately for each region.

▶ [Pattern/Select region/Region (No.)/Clear]

1. If a confirmation message will be displayed, Select [Execute].



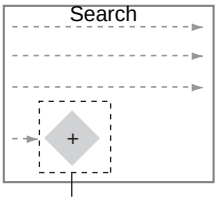
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Changing Detailed Conditions

The search settings can be changed here. Change the conditions if the measurement results are unstable or if high-speed processing is required. Normally, the method can be left on the default setting. After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

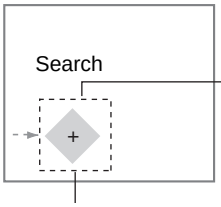
The Controller performs the following 2-stage processing internally.

1. Rough search
   The rough search model is used to search every item in the measurement region.



Rough search model

2. Detailed search
   Measures again using the detailed search model to compare to the images surrounding the section at the candidate level or higher.

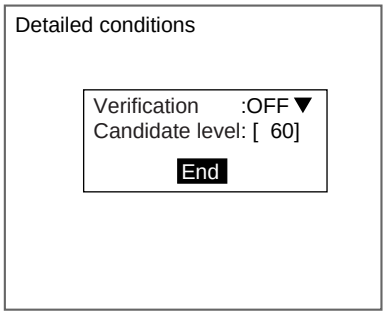


Detailed search model

▶ [Pattern/Detailed conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Search verification	Set whether or not to perform detailed searches on models at the candidate level or higher. If model searches are unstable, set [Verification] to [ON] and adjust the candidate level.	
	OFF (default setting)	Performs a detailed search only on the image with the highest rough correlation within the measurement region.
	ON	Performs a detailed search on all images at the candidate level or higher within the measurement region. The measurements are more stable in comparison to when search verification is set to [OFF]. Processing time, however, will be longer.
Candidate level	0 to 99 (default setting: 60)	Set the correlation value for detailed search target images. Reduce the correlation level if the model searches are unstable. A detailed search will be performed on all images above this level in the rough. This setting item is enabled only when [Verification] is set to [ON].

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Setting the Coordinate Mode

Select the type of coordinate values.

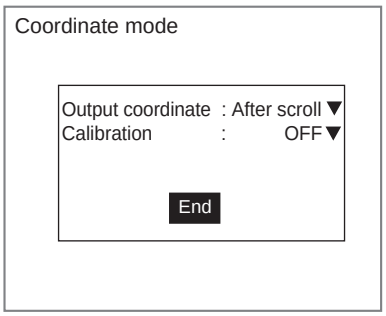
CHECK!

If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [Pattern/Coordinate mode]

1. Set each item.

2. Select [End].



Settings Data

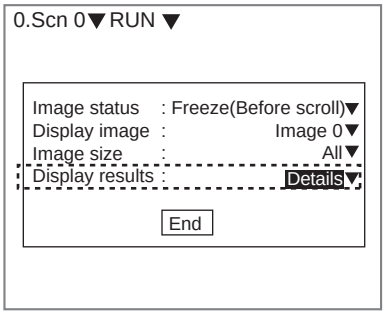
SECTION 7 Appendix, “Coordinate Handling Method”

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Checking the Measurement Image

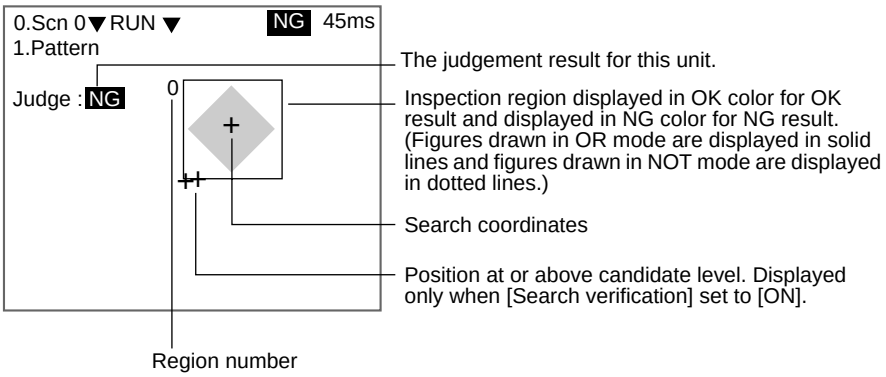
Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Pattern] is set and the following detailed screens will be displayed.
Use the SHIFT+Right or Left Keys to switch in order between the two screens.

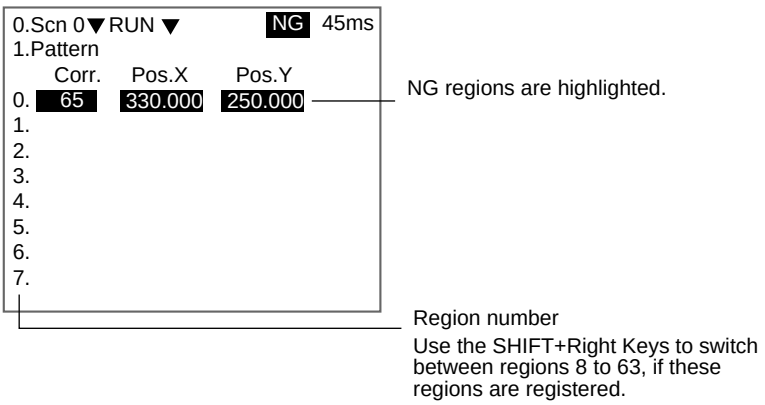
(1) Measurement Region and Position Display



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(2) Measurement Value Display

The measurement values for each region are displayed in a list.



CHECK! If the font size is set to small, regions 0 to 31 will be shown together.

When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.

This section describes each item displayed in the submenu.

For details on equation setting method, refer to SECTION 2, 4.1 Calculation

Measurement item	String	Details
Judgement	JG	Unit judgement result (-2: Not measured -1: NG 0: OK)
The following measurement data is for Region N (0 to 63).		
Judgement	R**JG	Judgement result (-2: Not measured -1: NG 0: OK)
Region N correlation	R**CR	Correlation value with model
Region N position X	R**X	X coordinate of position where model found
Region N position Y	R**Y	Y coordinate of position where model found
Region N reference position X	R**SX	X coordinate of reference position
Region N reference position Y	R**SY	Y coordinate of reference position

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Unit judgement result (-2: Not measured -1: NG 0: OK)
The following measurement data is for Region N (0 to 63).	
6N+1	Judgement result (-2: Not measured -1: NG 0: OK)
6N+2	Correlation value with model
6N+3	X coordinate of position where model found
6N+4	Y coordinate of position where model found
6N+5	X coordinate of reference position
6N+6	Y coordinate of reference position

■ Setting Data

Data type	Details
512	Accuracy (0: Normal 1: Precise)
513	Search verification (0: ON 1: OFF)
514	Candidate level (0 to 99)
515	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF 2: After scroll, calibration ON 3: Before scroll, calibration ON)
The following measurement data is for Region N (0 to 63).	
16N+516	Model position upper left X (0 to 511) (See *1.)
16N+517	Model position upper left Y (0 to 483) (See *1.)
16N+518	Model position lower right X (0 to 511) (See *1.)
16N+519	Model position lower right Y (0 to 483) (See *1.)
16N+520	Model reference position X (0 to 511)
16N+521	Model reference position Y (0 to 483)
16N+522	Search region upper left X (0 to 511)
16N+523	Search region upper left Y (0 to 483)
16N+524	Search region lower right X (0 to 511)
16N+525	Search region lower right Y (0 to 483)
16N+526	Correlation upper limit (0 to 100)
16N+527	Correlation lower limit (0 to 100)
16N+528	Position X upper limit (-9,999.999 to 9,999.999)
16N+529	Position Y lower limit (-9,999.999 to 9,999.999)
16N+530	Position X upper limit (-9,999.999 to 9,999.999)
16N+531	Position Y lower limit (-9,999.999 to 9,999.999)

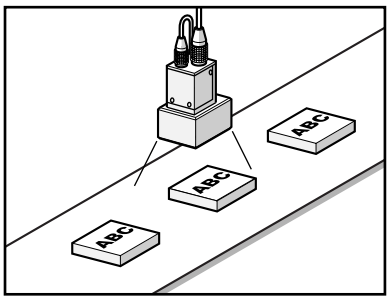
*1 If these settings are changed, one rectangular region will be set and the previously drawn figures will be deleted.

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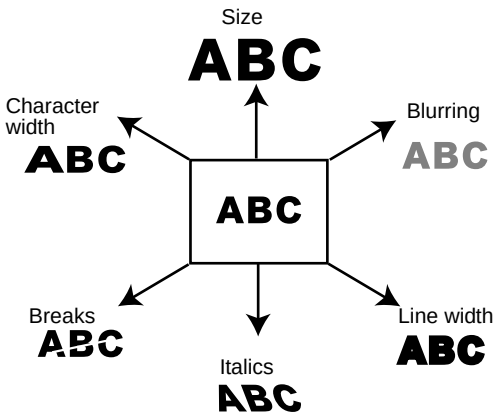
Quest Character Verification

The QUEST Character Verification processing item (QUEST OCV) is used to recognize alphanumeric characters and symbols.
Expiration dates, lot numbers, and other characters can be found (in a process called a "quest") without being affected by variations or deformities.
Standards characters do not need to be registered because the shape characteristics of many character fonts are registered in the internal dictionary.

Example: Recognition and Verification of Printed Characters



The following character variations are handled by the QUEST OCV.



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Performance

Setting data	Details	
Fonts	Ink jet printers	Hitachi, Marconi, Domino, Linx, Willet, Imaje, KGK (Kishu Giken Kogyo), EDM
	Laser printers	Gothic, OCRA, OCRB, SEMI
	Stamps	Gothic, Ming-style, OCRA, OCRB
Characters	Uppercase letters (A to Z), numerals (0 to 9), symbols (“-” “” “.” “/” “:”)	
No. of characters	Up to 2 rows per region with 20 characters max. per row. Up to 4 regions can be set.	
Background	Must be uniform in color. Background cut and shading are available as optional functions.	

Operational Flow

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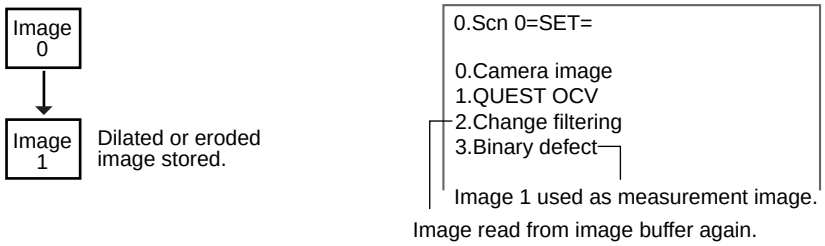
Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

CHECK!

If Shading is set under Extract conditions (i.e., the shading level has been set to 1 or higher), the image selected here will be dilated or eroded and stored at the other image number. Set [Change Filtering] as the next processing item to use this image for measurement for units after the unit for which this processing item was set. Then store the image stored in the image buffer to [Image 0] or [Image 1].

Example: Image 0 Selected as Measurement Image and Shading Set.



▶ [QUEST OCV/Measurement image]

1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

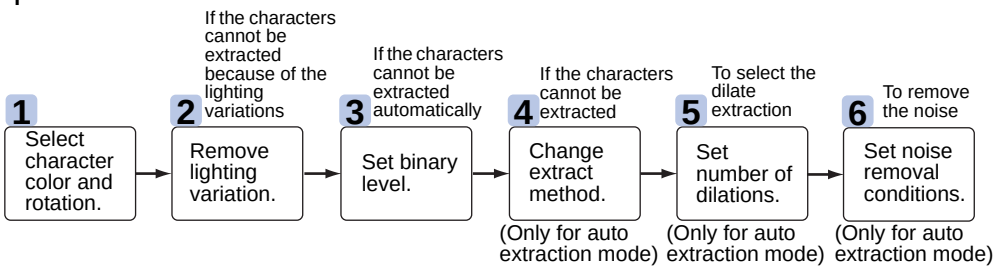
2. Press the ENT Key.



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Setting Extract Conditions

■ Operational Flow



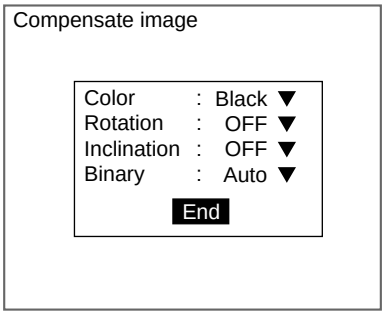
1 Selecting Character Color and Rotation

Set the character color and whether or not to use rotation compensation.

▶ [QUEST OCV/Extract conditions/Compensate image]

1. Set each item.

2. Select [End].

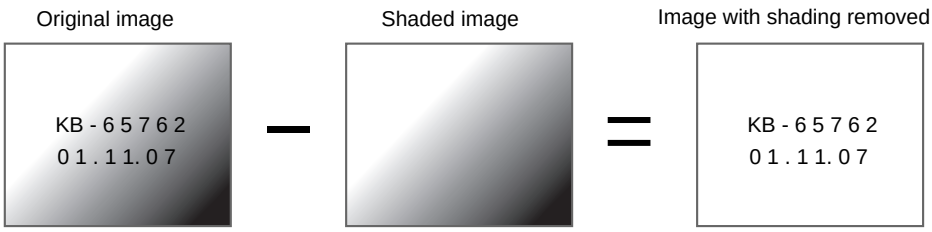


Setting data	Selection	Details
Color	Black (default setting) White	Select whether the font color will be white or black compared to the background.
Rotation compensation	OFF (default setting) ON	Select whether or not to use rotation compensation for total rotation of character string. If [ON] is selected, compensation will be made within the range of -15° to 15°. The noise removal settings are enabled only for regions for which automatic extraction is set under [Select region/Region/Mode].
Inclination	OFF (default setting) ON	Select whether or not to use compensation for inclination of character string. If [ON] is selected, compensation will be made within the range of -20° to 20°. The noise removal settings are enabled only for regions for which automatic extraction is set under [Select region/Region/Mode].
Binary	Auto (default setting) Manual	Set the method for setting binary levels for extraction. If [Automatic] is selected, threshold is automatically set from density histogram for whole image. If characters cannot be extracted successfully in the case where [Auto] is selected, select [Manual] and adjust the binary level by observing the image.

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2 Removing Lighting Variations

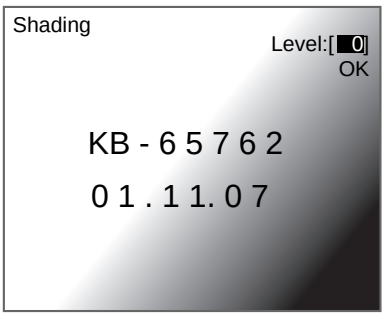
Characters cannot be extracted accurately if lighting variations cause the characters to become illegible. In such cases, use the shading function. Adjustments can also be made for shaded images.



▶ [QUEST OCV/Extract conditions/Shading]

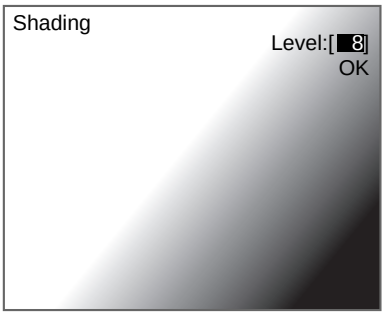
1. Place the cursor on the level and use the Left and Right Keys to change the level to between 0 and 10.

Right Key: Increases the level by one.
Left Key: Decreases the level by one.



CHECK!

The higher the level, the narrower the character lines in the image. Adjust the level until the lines start to disappear.
The higher the level, the longer the processing time.



2. Select [OK].

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3 Setting Binary Levels

This processing item converts density images to binary images and performs extraction on the binary images. The binary level set here is enabled only when the [Binary method] is set to [Manual]. Adjust the binary level so that the characters for verification are displayed as white pixels.

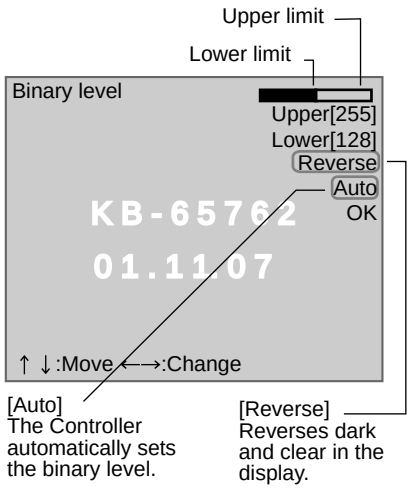
CHECK! When [Binary Method] Is Set to [Automatic]
Once measurement has been performed, enter this screen to display and check the image that was converted to binary using the automatically set binary levels.

▶ [QUEST OCV/Extract conditions/Binary]

1. Move the cursor to the upper value and use the Left and Right Keys to adjust the value.

2. Use the same method to change the lower value.

3. Select [OK].



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4 Changing Extract Methods

Change the extract method if the characters are not extracted accurately. Normally, the method can be left on the default setting.
After changing the setting, perform a measurement to check that the characters can still be extracted correctly.

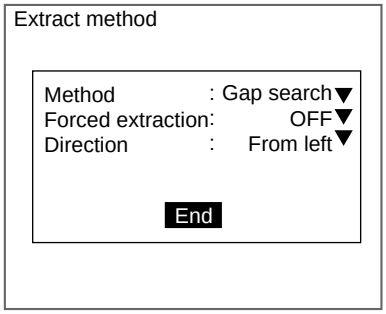
CHECK!

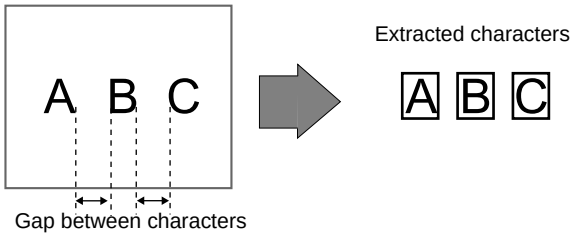
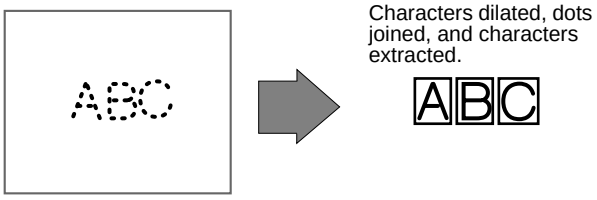
The noise removal settings are enabled only for regions for which automatic extraction is set under [Select region/Region/Mode].

▶ [QUEST OCV/Extract conditions/Extract method]

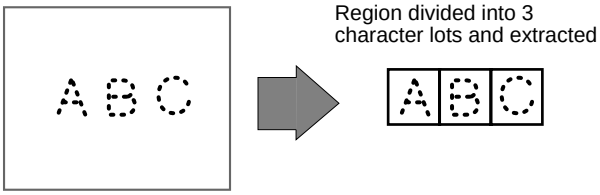
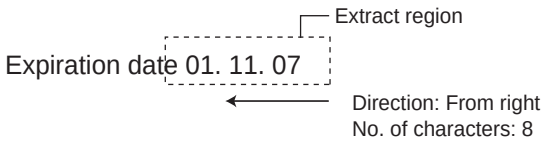
1. Set each item.

2. Select [End].



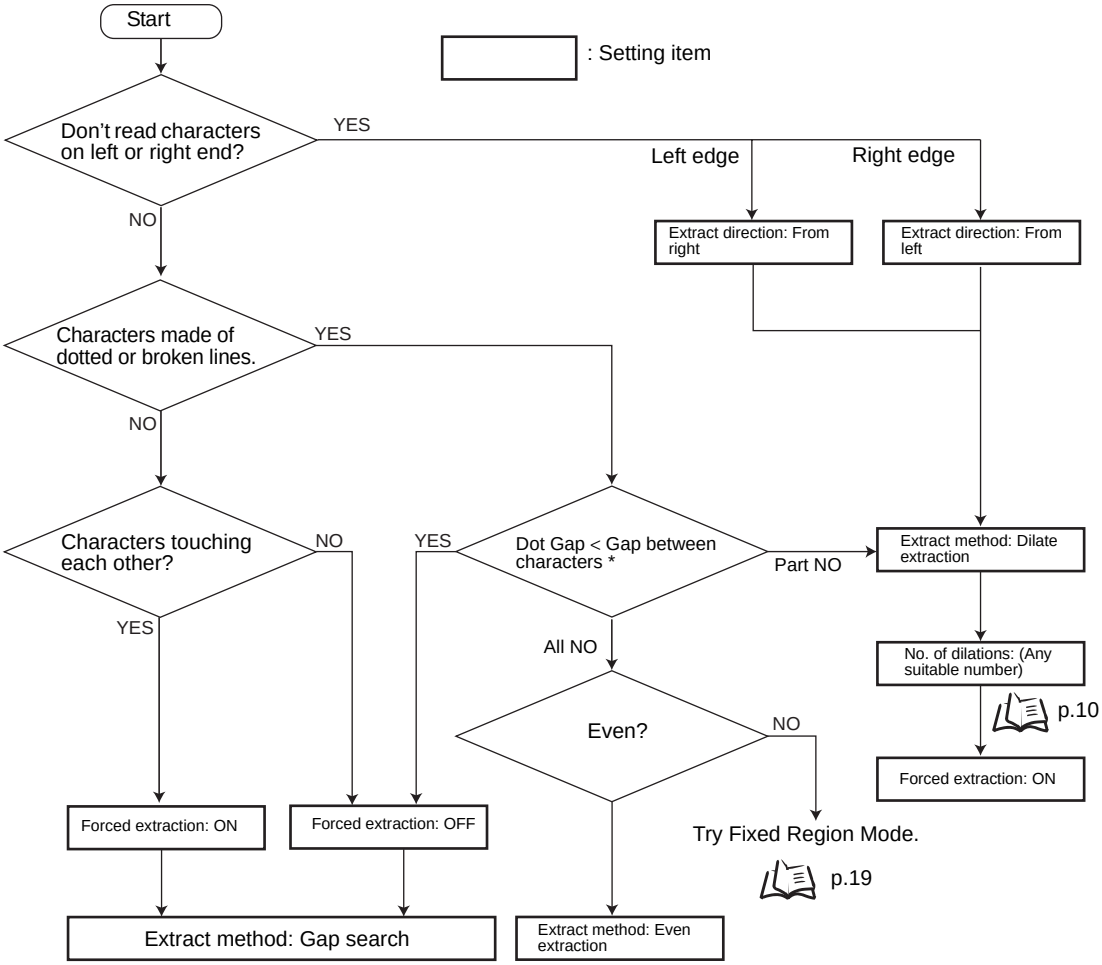
Setting data	Selection	Details
Extract Methods	Gap search (default setting)	Finds the gap between characters and extracts the characters. Normally, this method must be selected. 
	Dilate Extraction	With dot characters, the gap search may not extract correctly if the gap between dots is greater than the gap between characters. In such cases, set [Dilate Extraction]. The characters are dilated, the dot gaps joined, and then the characters are extracted. Set the number of dilations under [Extract conditions/Dilate level]. p.10 Use in conjunction with [Forced Extraction] because the gap between characters are also joined when the characters are dilated. 

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Setting data	Selection	Details
	Extraction at even intervals	The character string is divided into a specified number of characters and extracted at even intervals. This method must be selected if “gap among dots” is larger than “gap among characters” for every gap. 3 characters 
Forced Extraction	OFF (default setting) ON	If the set number of characters cannot be extracted, set whether or not to use forced extraction. The forced extraction function extracts characters that are joined due to printing errors or because they are inclined. Forced extraction is enabled only when [Gap search] or [Dilate Extraction] are selected as the extract method.
Direction	From left (default setting) From right	The direction setting is enabled only when [Dilate] is selected as the extract method. Set the direction to extract characters. Character extraction is performed only until the set number of characters have been extracted. If there are extra characters in the extracting region, these characters can be ignored (excluded from the extracting process) by starting extracting from the opposite direction.  Extraction is performed on 8 characters starting from the right, so final “e” in “Expiration date” is ignored.

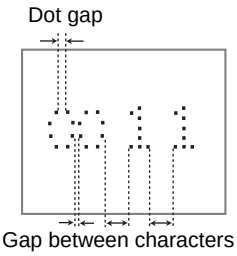
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■ Guide to Setting Conditions

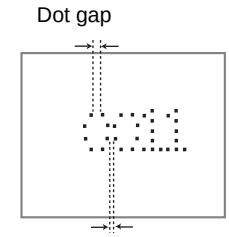


* Select the extract methods according to the relationship between the dot gap and the gap between characters as follows:

• If there are only portions where the dot gap is larger than the gap between characters, set dilation extraction.



• If without exception the dot gap is larger than the gap between characters, set even extraction.



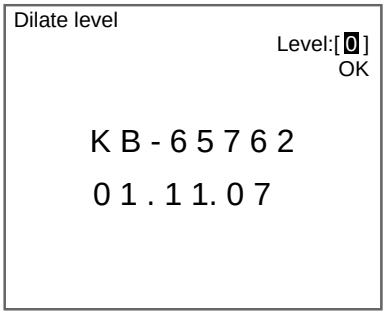
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5 Setting Number of Dilations

Set the number of dilations if [Dilate extraction] has been chosen to extract characters. Dilation is performed until the width between dots is eliminated, and then the extraction is performed.

CHECK! The noise removal settings are enabled only for regions for which automatic extraction is set under [Select region/Region/Mode].

▶ [QUEST OCV/Extract conditions/Dilate level]



1. Move the cursor to the level value and use the Left and Right Keys to change the value (0 to 9).

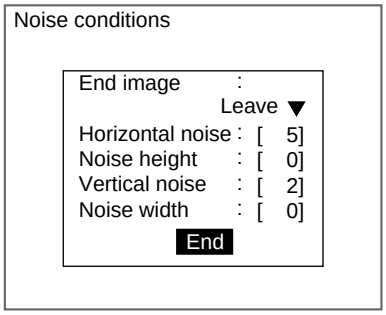
2. Select [OK].

6 Setting Noise Removal Conditions

Set the conditions for ignoring noise when executing character extraction.

CHECK! The noise removal settings are enabled only for regions for which automatic extraction is set under [Select region/Region/Mode].

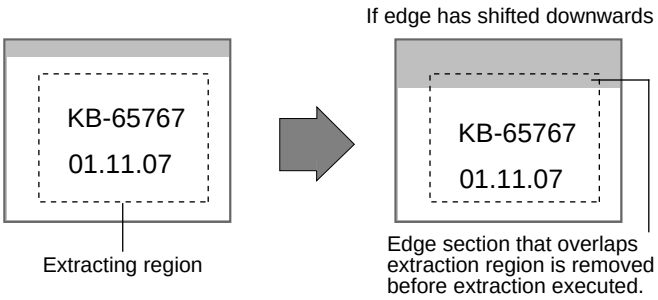
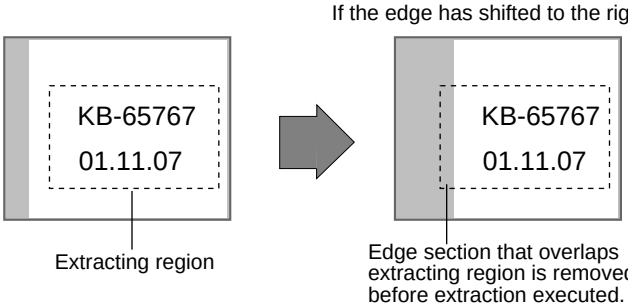
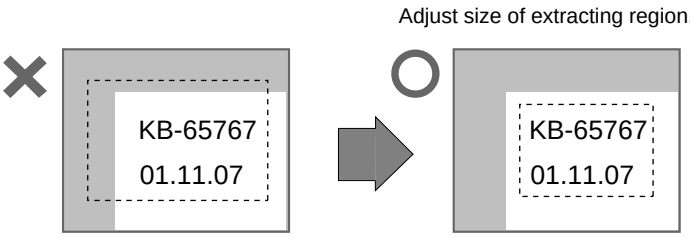
▶ [QUEST OCV/Extract conditions/Noise conditions]



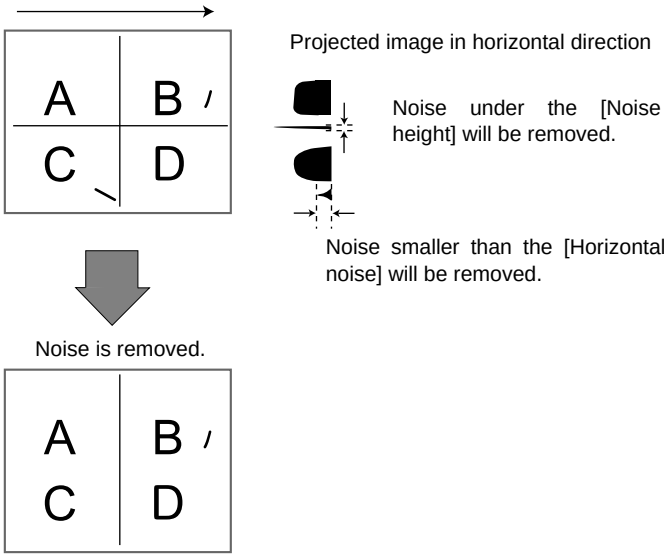
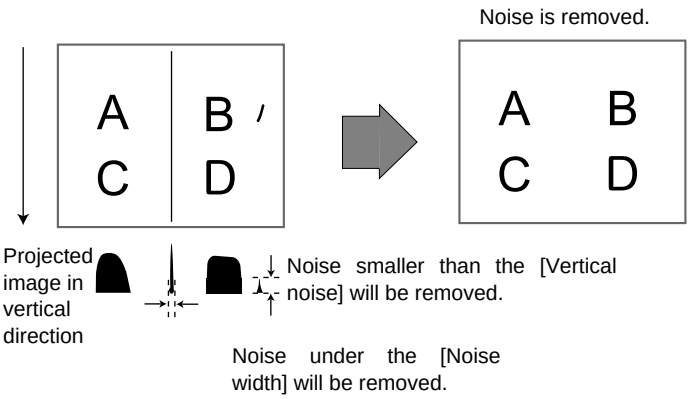
1. Set each item.

2. Select [End].

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Setting data	Selection	Details
End Images	Remain (default setting) Erase (Horizontal) Erase (Vertical)	Set whether to leave or remove the area adjacent to the extracting region. [Erase(Vertical)] must be selected if the object may move vertically.  [Erase(Horizontal)] must be selected if the object may move horizontally.  Only edges that overlap either vertically or horizontally can be removed. If the edges overlap both vertically and horizontally, the characters cannot be extracted correctly. If it is not certain in which direction the object may move, adjust the position and size of the extracting region so that only the characters to be extracted fall within the extracting region. 

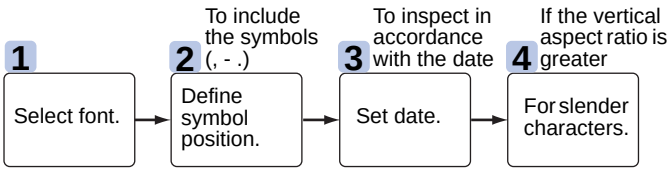
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<table>
<tr><th>Setting data</th><th>Selection</th><th>Details</th></tr>
<tr><td>Horizontal noise</td><td>0 to 512 (default setting: 5)</td><td rowspan="2">To extract lines, a projected image in the horizontal direction must be created.
Set the size to be removed as noise from this projected image.

</td></tr>
<tr><td>Noise height</td><td>0 to 484 (default setting: 0)</td></tr>
<tr><td>Vertical noise</td><td>0 to 484 (default setting: 2)</td><td rowspan="2">To extract characters in an image after lines have been extracted, a projected image must be created in the vertical direction.
Set the size to be removed as noise from this projected image.

</td></tr>
<tr><td>Noise width</td><td>0 to 512 (default setting: 5)</td></tr>
</table>

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Setting Character Conditions

■ Operational Flow



1 Selecting Fonts

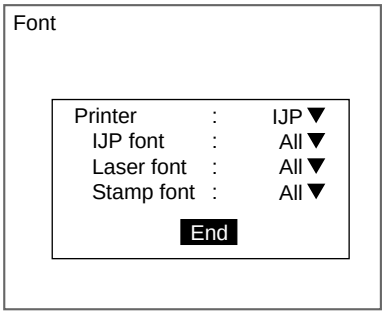
Set the font type to be verified.

If the font is unknown, change [IJP font], [Laser font], and [Stamp font] settings to [All].

▶ [QUEST OCV/Character conditions/Font]

1. Set each item.

2. Select [End].



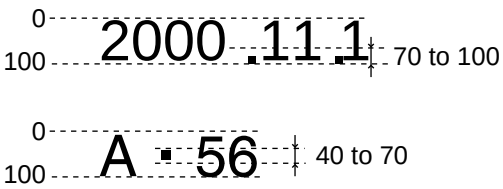
Setting data	Selection
Printer	IJP (Ink jet printer) (default setting) Laser (laser printer) Stamp
IJP font	OFF (default setting) 5dot(Common), 5dot(Hitachi), 5dot(Marconi), 5dot(Domino), 5dot(Linx), 5dot(Willet), dot(Imaje), 5dot(KGK)*, 7dot(Common) 7dot(Hitachi), 7dot(Marconi), 7dot(Domino), 7dot(Linx), 7dot(Willet), 7dot(Imaje), 7dot(KGK)*, 7dot(EDM), 9-12dot, Over 14dot (* KGK: Kishu Giken Kogyo)
Laser font	All (default), Gothic, OCRA, OCRB, SEMI
Stamp font	All (default), Gothic, Ming-style, OCRA, OCRB

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2 Defining Symbol Positions (“’”, “-”, “.”)

The meanings of the quotation (’), dash (-), and period (.) differ depending on their position. If the character string to be verified contains any of these symbols, the correct position of the whole character string must be set.
The lowest position in the character string is 100 and the highest position is 0. Set the range within these limits for the symbols to be evaluated.

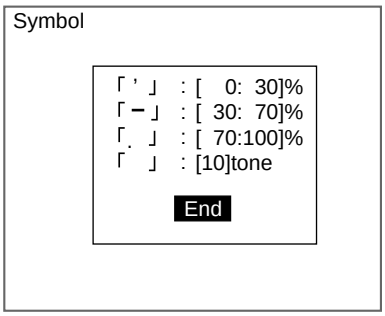
Example:



▶ [QUEST OCV/Character conditions/Symbol]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
'	0 to100% (default setting 0:30)	Quotation (') position
-	0 to 100% (default setting 30 : 70)	Dash (-) position
.	0 to 100% (default setting 70 : 100)	Period (.) position
	0 to 127 tone (default setting: 10)	Density deviation to evaluate asterisks (*), underscores (_), and question marks (?) in character strings as spaces or symbols: If the density deviation is lower than the setting, it will be evaluated as a space. The measurement value for density deviation can be checked under the detailed results display on the measurement screen.

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3 Setting Dates

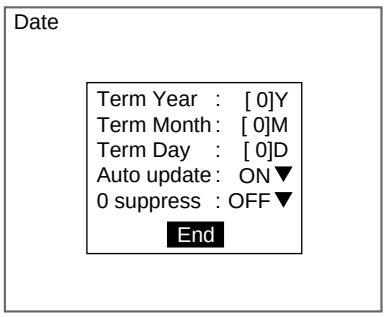
The Controller has a built in calendar. Character strings that are inspected in accordance with this calendar can be updated automatically. The expiration date from the production date can be set so that the expiration date can be automatically updated.

Setting Dates
SECTION 5 System Settings, “Setting the Calendar Date and Time (Date/Time)”

▶ [QUEST OCV/Character conditions/Date]

1. Set each item.

2. Select [End].

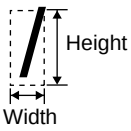


Setting data	Selection	Details
Term Year	0 to 99 (default setting: 0)	Specifythe expiration date from the production date.
Term Month	0 to 99 (default setting: 0)	
Term Day	0 to 999 (default setting: 0)	
Auto update	ON (default setting) OFF	Select whether or not to automatically update inspection dates based on built-in calendar. If [Auto update] is set to [ON], verification will be performed when the date is changed. The date will also be updated automatically.
0 suppress	OFF (default setting) ON	Select whether or not to suppress “0” before single digit months and days. Example: Select OFF for “3” display. Select ON for “03” display.

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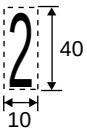
4 Slender Characters

The frame size of the extracted characters is checked during QUEST character verification and if the horizontal to vertical aspect ratio is greater than the set value, the verification will be performed using the "1", "I", "J", ":", and "/" dictionary models only.
If the font itself is slender, characters other than those listed above may be above the set aspect ratio and verification will not, therefore, be performed correctly. Set this value, the guide for the aspect ratio, to a higher value for slender fonts.



Aspect ratio (height ÷ width)

Example:



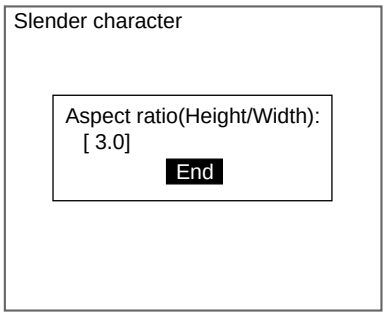
40 / 10 = 4

At the default aspect ratio setting of “3.0”, the slender character shown to the left will not be verified against the “2” in the dictionary model. Set the aspect ratio to a value higher than 4.

▶ [QUEST OCV/Character conditions/Slender character]

1. Select [Aspect ratio].

2. Select [End].



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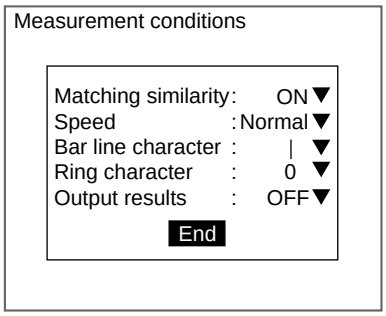
Setting Measurement Conditions

Change the conditions as required if the character verification is unstable or to increase processing speed.

▶ [Quest character verification/Measurement conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Matching similarity	ON (default setting) OFF	Select whether or not to distinguish between similar characters. Poor printing quality can cause an 8 to be read as a B. Characters like these are called similar characters. If only one of the matching characters will exist, [Matching similarity] can be turned OFF to eliminate discrepancies in verification results. There are five sets of similar characters for the this function: B/8, O/D, 0/D, S/5, and I/1. Example: Character string includes “8” OFF: 8 will not be matched to the dictionary model for B, its similar character. ON: Matching will be performed for both the dictionary models 8 and B and the one with the highest similarity will be the 1st candidate.
Speed	Select whether or not to decrease the number of matching models and increase execution speed. This speed setting is ignored if “?” is set for the characters (OCR mode).	
	Normal (default setting)	Matching performed against all dictionary models.
	High speed	No matching against dictionary models with vastly different shapes.
	Quickest	Matching only against dictionary model for target character.
Bar line character	I (default setting) 1	If “?” has been set in the character setting (OCR Mode), select whether bar line characters will be evaluated as an alphabet “I” or number “1”.

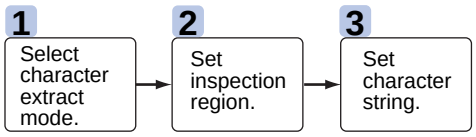
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Setting data	Selection	Details
Ring character	0 (default setting) O	If “?” has been set in the character setting (OCR Mode), select whether ring characters will be evaluated as an alphabet “O” or number “0”. The slash zero, 0, will be read as the number 0 regardless of this setting.
Output results	OFF (default setting) ON	Select whether or not to output to a serial port the 1st candidate character strings. Output format: <unit number>, <region number>, <line number>, <number of characters>, <1st candidate character string> Delimiter QUEST verification results are output using the results output processing items, the character code is output. If, however, output result is set to ON here, the character string itself will be output to the serial port.

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Setting Regions

■ Operational Flow



1 Selecting Character Extraction Mode

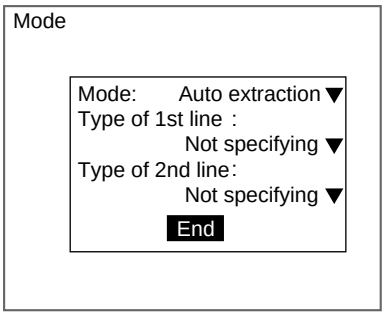
The Auto Extraction Mode, where characters within the specified region are extracted automatically, and the Fixed Region Mode, where regions are set with fixed positions for each character.

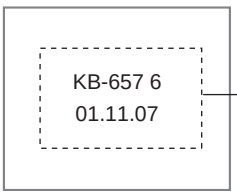
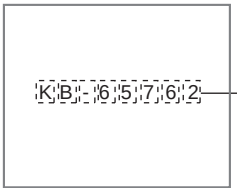
Up to 4 regions can be set. Select the extract mode for each region.

▶ [QUEST OCV/Select region/Region No./Mode]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Mode	Set the extract mode for each region.	
	Auto Extraction	 Characters are extracted automatically from this region.The numbers of characters and lines that can be extracted are shown below. Characters: Up to 20 characters per line Lines: Two lines
	Fixed region	 The inspection region is set for each character. Up to 20 characters can be set. Verification can be performed to check if a particular character is at a particular position.
Type of 1st line Type of 2nd line	Specify the matching method for alphanumeric characters.	
	Specifying	Numerals are matched only with the numeral dictionary models and letters are matched only with the alphabet dictionary models.
	Not specifying (default setting)	Matching performed against all dictionary models.

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2 Setting Inspected Regions

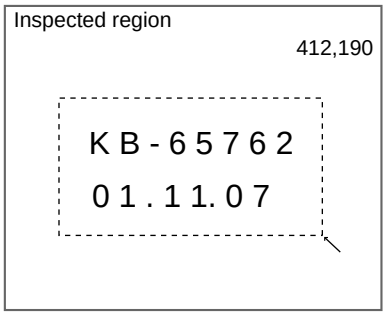
■ When Automatic Extraction Mode Is Selected

Draw one region for extracting characters.

▶ [QUEST OCV/Select region/Region No./Inspected region]

1. Draw the inspected region as a square block.

Specify the upper left and lower right coordinates.



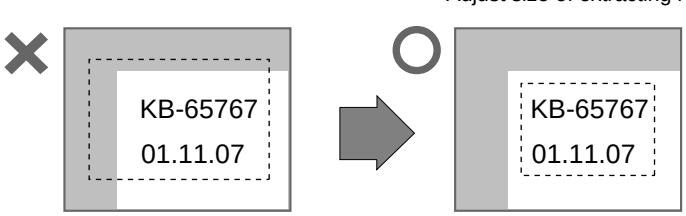
CHECK!

Draw the region so that only the target characters fall within the region. Use End Image to remove anything other than the target characters that overlap either vertically or horizontally on the inspection region.

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If the edges overlap both vertically and horizontally, the characters cannot be extracted correctly.

If the edges overlap in both directions, adjust the position and size of the extracting region so that only the characters to be extracted fall within the extracting region.



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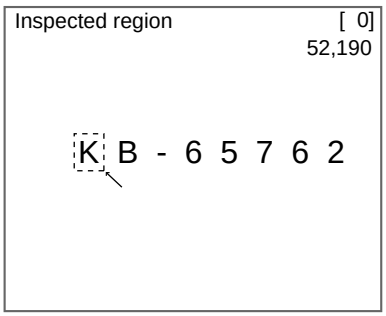
■ When Fixed Region Mode Is Selected

Draw a region for each character. Up to 20 regions can be drawn.

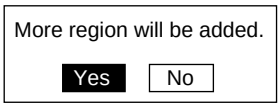
▶ [QUEST OCV/Select region/Region No./Inspected region]

1. Draw the inspected region as a square block.

Specify the upper left and lower right coordinates.



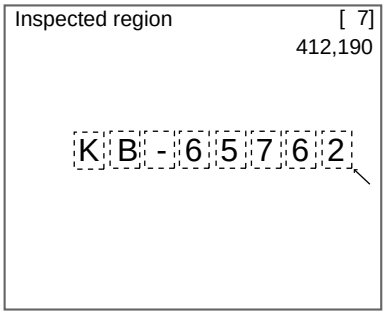
When the lower right coordinates have been set, a confirmation message will appear.



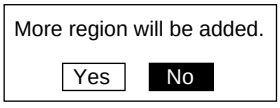
2. Select Yes.

3. Repeat steps **2.** and **3.** to draw the remaining regions.

Up to 20 regions can be drawn.



4. When enough regions have been drawn, select [No] from the confirmation message.



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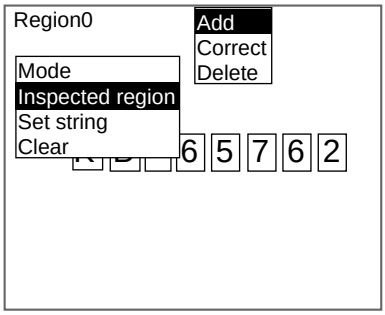
- Adding, Correcting, and Deleting Fixed Regions

  The edit menu appears when [Inspection region] is selected. This occurs only if settings have been drawn.

▶ [QUEST OCV/Select region/Region No./Inspected region]

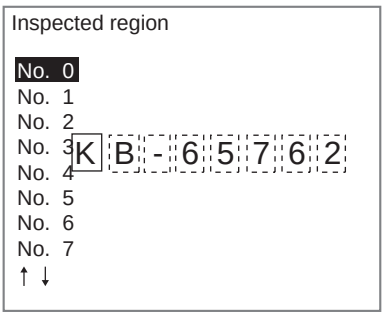
1. Select Correct or Delete.

When [Add] is selected, the screen for drawing inspection regions will be displayed. Repeat the steps outlined above to add inspection regions.



The screen for selecting regions will be displayed.

2. Select the number of the region to be edited.



Correct: The screen for correcting the selected region will be displayed.
Delete: A confirmation message will be displayed.

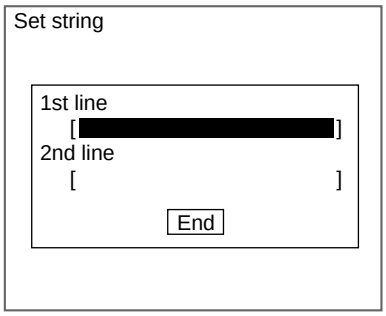
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3 Setting Characters Strings

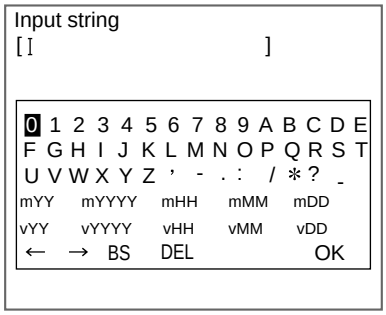
Register the correct character string that will be the reference for verification.
Character strings can be set as outlined below.

▶ [QUEST OCV/Select region/Region No./Set string]

1. Place the cursor in the square brackets for the character string and press the ENT Key.



A software keyboard will be displayed.



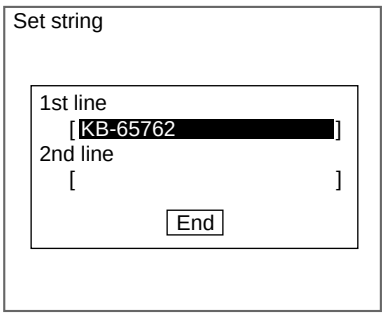
2. Set up to 20 characters for the character string.

The "m" and "v" of lines starting with these characters will not be counted in the number of characters.
E.g., "mYY" will be counted as 2 characters.

3. Select [OK].

The screen in **1.** will returun.

Repeat steps **1.** to **3.** to set the character string for the second line.



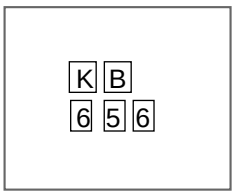
4. Select [End].

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CHECK!

For [Fixed region] extraction, set all of the characters under 1st line, even if the input runs over multiple lines. The characters will appear in the order that the regions were drawn.

Example: 1st line: [KB656]



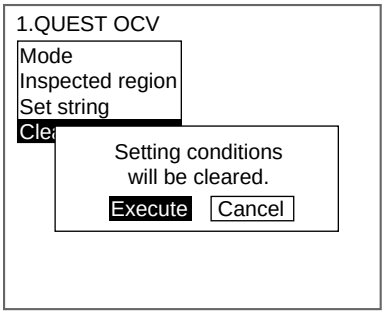
The string that can be set	Details
0 to 9 A to Z ' – . : /	Characters in this group will be set as is.
*	Evaluated (OK if detected)
?	Evaluated (OK if not detected)
_	Recognized by degree of similarity of 1st and 2nd candidates, without character being specified (OCR mode).
mYY	Expiry year (2-digit)
mYYYY	Expiry year (4-digit)
mHH	Japanese year (00 to 99)
mMM	Month (00 to 12)
mDD	Day (00 to 31)
vYY	Expiry year (2-digit)
vYYYY	Expiry year (4-digit)
vHH	Japanese expiry year (00 to 99)
vMM	Expiry month (00 to 12)
vDD	Expiry day (00 to 31)

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Clearing the Set Regions

▶ [QUEST OCV/Select region/Region No./Clear]

1. A confirmation message appears. Select [Execute].



Setting judgement Conditions

Set the conditions for judging the 1st candidate character.
There are two types of judgement conditions: [Common judgement] and [Individual judgement]. In normal circumstances, adjust the [Common judgement].
Set the [Individual judgement] to perform strict or lenient judgement for a particular character.

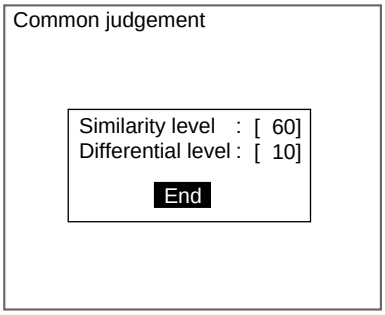
Common judgement

Use this function to set common judgement conditions for all models.

▶ [QUEST OCV/Judgement conditions/Common judgement]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Similarity level	0 to 100 (default setting: 60)	Similarity level for OK result for 1st candidate. The judgement will be OK if this value is exceeded.
Diff. level	0 to 100 (default setting: 10)	Similarity level difference between 1st and 2nd candidates for OK result. The judgement will be OK if this value is exceeded.

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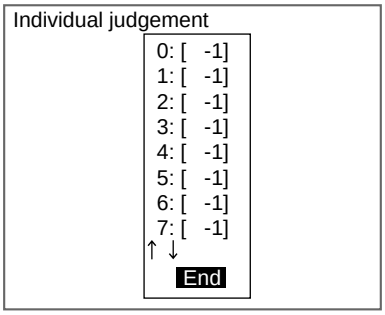
Individual judgement conditions

Use this function to set the similarity level for each model.
Use individual judgement to perform particularly strict or lenient inspections of a particular character.

▶ [QUEST OCV/Judgement conditions/Individual judgement]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
0 to 9 A to Z : /	-1, 0 to 100 (default setting: -1)	Similarity level for OK result for 1st candidate. The judgement will be OK if this value is exceeded. -1: Judged based on common judgement conditions.

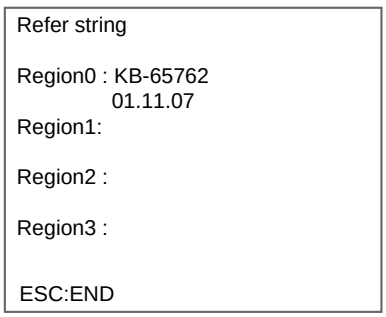
Checking Set Character Strings

Use this function to check what characters have been set as the reference for verification.

▶ [QUEST OCV/Refer string]

1. Check the characters that have been set as the verification reference.

2. Press the ESC Key to exit.

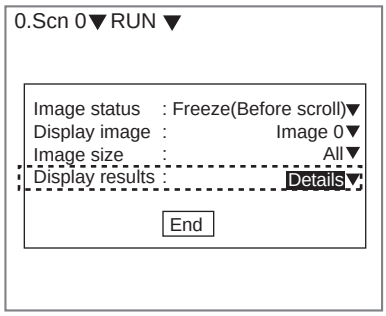


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Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

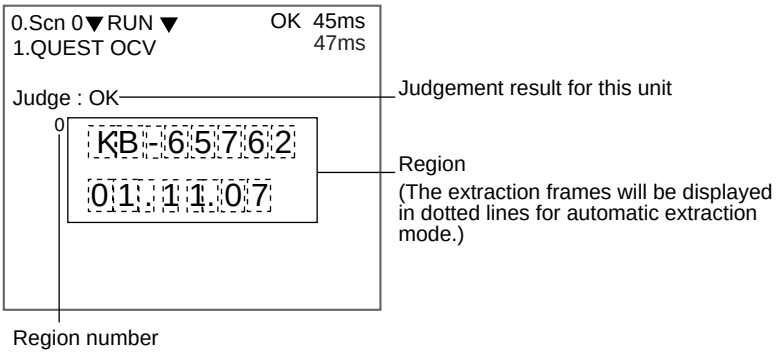
Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed. Use the SHIFT+Right or Left Keys to switch in order between the two screens.

(1) Measurement Regions

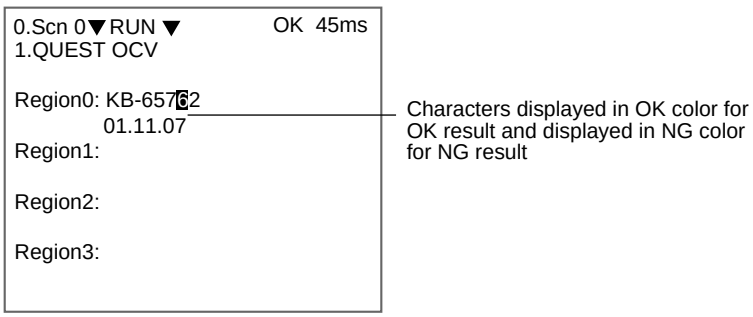
The judgement result for this unit, the set regions, and the extraction frame for each character will be displayed.



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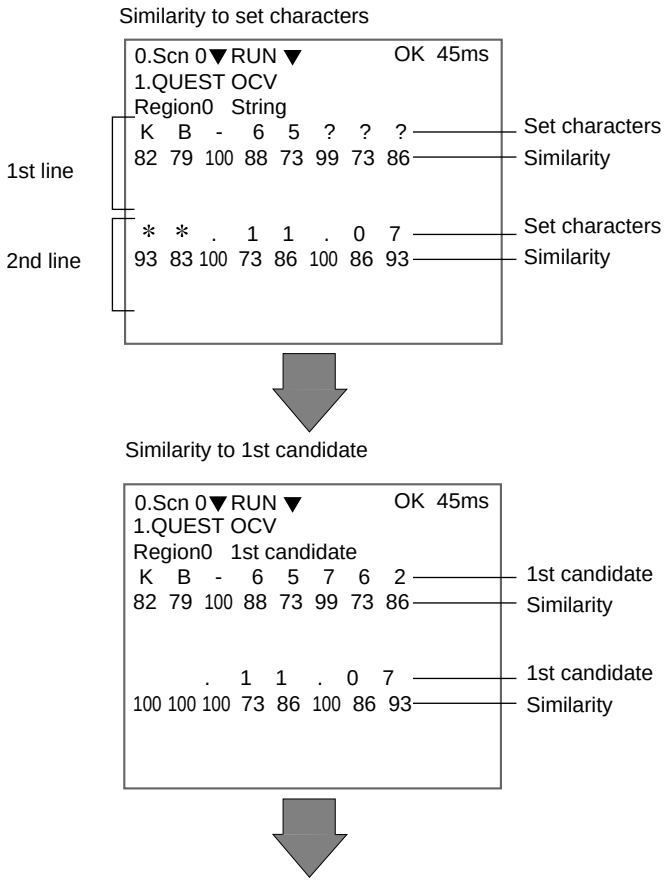
(2) Set Character Strings

A list of character strings set as the reference for verification will be displayed.



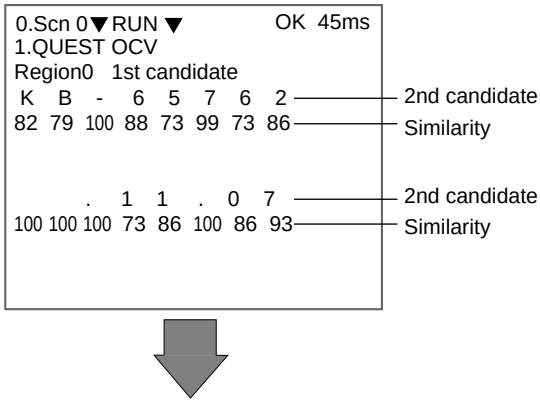
(3) Measurement Values for Each Region

The detailed measurement results for each region will be displayed. Press the SHIFT+ Right or Left Keys to display the following four screens in order.

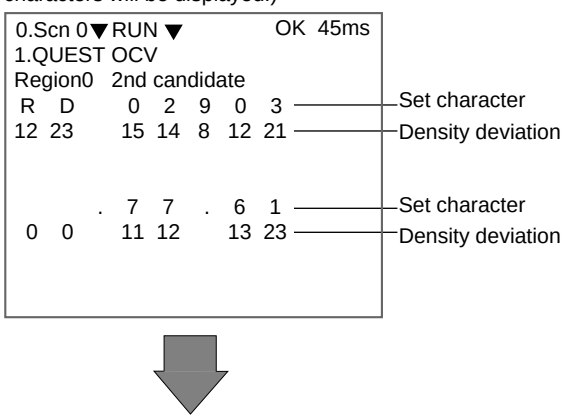


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Similarity to 2nd candidate



Density deviation (Only sections with “*”, “_”, and “?” characters will be displayed.)



To next region number

CHECK!

If the font size is set to [Small], regions 0 to 3 will be shown together.

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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

■ Understanding the Menu

"#" indicates the region No. and "**" indicates the character No.

Measurement item	String	Details
Judgement	JG	Unit judgement result (-2: Not measured -1: NG 0: OK)
The following measurement data is for Region N (0 to 3).		
Judgement	R#JG	Judgement result (-2: Not measured -1: NG 0: OK)
Measurement data for Mth character (M= 1 to 40)		
M=1 to 20 (line 1) / M=21 to 40 (line 2)		
Similarity	R#VO**	Similarity for candidate set for character
Candidate 1	R#CF**	Character code for 1st candidate
Similarity 1	R#VF**	Similarity of 1st candidate
Candidate 2	R#CS**	Character code for 2nd candidate
Similarity 2	R#VS**	Similarity of 2nd candidate

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Unit judgement result (-2: Not measured -1: NG 0: OK)
The following measurement data is for Region N (0 to 3).	
201N+1	Judgement result (-2: Not measured -1: NG 0: OK)
Measurement data for Mth character (M= 1 to 40)	
M=1 to 20 (line 1) / M=21 to 40 (line 2)	
201N+5M-3	Similarity for candidate set for character
201N+5M-2	Character code for 1st candidate
201N+5M-1	Similarity of 1st candidate
201N+5M	Character code for 2nd candidate
201N+5M+1	Similarity of 2nd candidate

■ Setting Data

Data type	Details
897	Measurement image (0: Image 0 1: Image 1)
898	Character color (0: Black 1: White)
899	Rotation compensation (0: OFF 1: ON)
900	Inclination compensation (0: OFF 1: ON)
901	Shading level compensation (0 to 10)
902	Binary method (0: Manual 1: Auto)
903	Binary lower limit threshold (0 to 255)
904	Binary upper limit threshold (0 to 255)
905	Reverse binary (0: OFF 1: ON)
906	Extraction method (0: Gap search 1: Dilate extraction 2: Even extraction)
907	Forced extraction (0: OFF 1: ON)
908	No. of dilations (0 to 9)
909	Extraction direction (0: From left 1: From right)
910	End image (0: Leave 1: Erase (horizontal) 2: Erase (vertical))
911	Horizontal noise (0 to 512)
912	Noise height (0 to 484)
913	Vertical noise (0 to 484)
914	Noise width (0 to 512)
915	Printer (0: IJP 1: Laser 2: Stamp)

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Data type	Details
916	IJP font (0: All 1: 5 dot (Common) 2: 5 dot (Hitachi) 3: 5 dot (Marconi) 4: 5 dot (Domino) 5: 5 dot (Linx) 6: 5 dot (Willet) 7: 5 dot (Imaje) 8: 5 dot (KGK) 9: 7 dot (Common) 10: 7 dot (Hitachi) 11: 7 dot (Marconi) 12: 7 dot (Domino) 13: 7 dot (Linx) 14: 7 dot (Willet) 15: 7 dot (Imaje) 16: 7 dot (KGK) 17: 7 dot (EDM) 18: 9 to 12 dot 19: Over 14 dot)
917	Laser font (0: All 1: Gothic 2: OCRA 3: OCRB 4: SEMI)
918	Stamp font (0: All 1: Gothic 2: Ming-style 3: OCRA 4: OCRB)
919	‘ start postilion (0 to 100)
920	‘ end position (0 to 100)
921	- start position (0 to 100)
922	- end position (0 to 100)
923	, start position (0 to 100)
924	, end position (0 to 100)
925	(space) judgement value (0 to 127)
926	Term year (0 to 99)
927	Term month (0 to 99)
928	Term day (0 to 999)
929	Auto update (0: OFF 1: ON)
930	0 Suppress (0: ON 1: OFF)
931	Aspect ratio (height/width) (0 to 99.9)
932	Matching similarity (0: OFF 1: ON)
933	Speed (0: Normal 1: High speed 2: Quickest)
934	Bar line character (0: I 1: 1)
935	Output (0: No 1: Yes)
Common judgement	
936	Similarity level (0 to 100)
937	Differential level (0 to 100)
Individual judgement conditions	
938	0 (-1 to 100)
939	1 (-1 to 100)
940	2 (-1 to 100)
941	3 (-1 to 100)
942	4 (-1 to 100)
943	5 (-1 to 100)
944	6 (-1 to 100)
945	7 (-1 to 100)
946	8 (-1 to 100)
947	9 (-1 to 100)
948	A (-1 to 100)
949	B (-1 to 100)
950	C (-1 to 100)
951	D (-1 to 100)
952	E (-1 to 100)

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Data type	Details
953	F (-1 to 100)
954	G (-1 to 100)
955	H (-1 to 100)
956	I (-1 to 100)
957	J (-1 to 100)
958	K (-1 to 100)
959	L (-1 to 100)
960	M (-1 to 100)
961	N (-1 to 100)
962	O (-1 to 100)
963	P (-1 to 100)
964	Q (-1 to 100)
965	R (-1 to 100)
966	S (-1 to 100)
967	T (-1 to 100)
968	U (-1 to 100)
969	V (-1 to 100)
970	W (-1 to 100)
971	X (-1 to 100)
972	Y (-1 to 100)
973	Z (-1 to 100)
974	: (-1 to 100)
975	/ (-1 to 100)
Setting data for region N (0 to 3)	
89N+976	Mode (0: Fixed region 1: Auto extraction)
89N+977	Type of 1st line (0: Not specifying 1: Specifying)
89N+978	Type of 1st line (0: Not specifying 1: Specifying)
89N+979	1st line string (See *1.)
89N+980	2nd line string (See *1.)
Setting data for auto extraction	
89N+981	Upper left X coordinate (0 to X_MAX) (See *2.)
89N+982	Upper left Y coordinate (0 to Y_MAX) (See *2.)
89N+983	Lower right X coordinate (0 to X_MAX) (See *2.)
89N+984	Lower right Y coordinate (0 to Y_MAX) (See *2.)
Setting data for fixed Mth character (M=1 to 20)	
89N+4M+981	Upper left X coordinate (0 to X_MAX) (See *2.)
89N+4M+982	Upper left Y coordinate (0 to Y_MAX) (See *2.)
89N+4M+983	Lower right X coordinate (0 to X_MAX) (See *2.)
89N+4M+984	Lower right Y coordinate (0 to Y_MAX) (See *2.)
1332	Ring characters (0: 0 1: O)

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*1: Can be set only by normal command UNITDAT2.

*2: The range varies depending on the controller model.

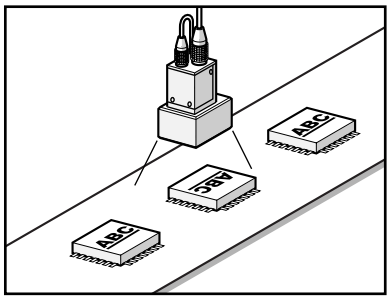
Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

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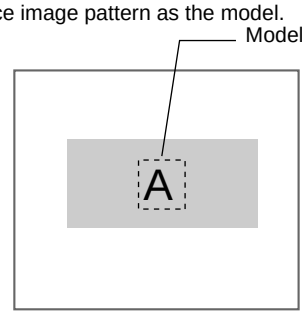
Rotation Positioning

The Rotation Search processing item is used to detect the angle of inclination and the position of the measurement object.

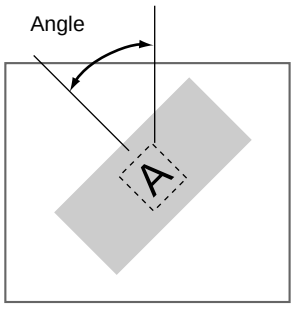
Example: Recognition of the position and angle of parts.



Register a reference image pattern as the model.



The Controller detects the angle of inclination of the input image compared to the reference image (model).



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Operational Flow

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Rotation positioning uses the image stored at [Image 0] for measurement; there is no menu for selecting the measurement image.

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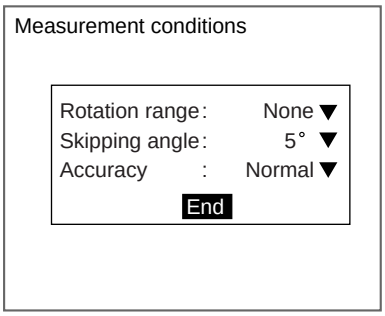
Setting Measurement Conditions

Set the search conditions.
A search is performed using a model that rotates in skipping angle increments within the rotation range.
The settings are used for all measurement regions.

▶ [Rotation Position/Measurement conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details	
Rotation range	None (default setting) ±2° ±5° ±8° ±10° ±15° ±30° ±45° ±60° ±90° All angles	Select the range for model rotation.	A search is performed using a model that rotates in skipping angle increments within the rotation range. Example: Rotation range: Creates a model that rotates 15° at a time between -30° and 30°. (Coordinate system: Left-hand) Image  +30° +15° 0° −15° −30°
Skipping angle	1° 2° 3° 5° (default setting) 6° 10° 15° 20° 30°	Set the skipping angle for the model. The smaller the angle, the more precise the search. Processing time, however, will be longer.	
Accuracy	Precise	Finds the measurement value in decimal point units. Processing time, however, will be longer. Position X and position Y: Sub-pixel units Angle: 0.01° units.	
	Normal (default setting)	Finds the measurement value in integer units. Position X and position Y: Pixel units Angle: 1° units.	

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CHECK!

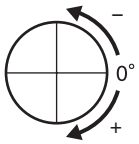
Coordinates and Rotation Angle Direction

Depending on whether a right-hand or left-hand coordinate system has been set, the rotation angle direction changes.

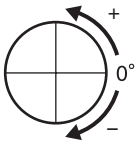
Check the rotation angle direction before making rotation search settings.

- When [Calibration] of [Rotation position/Coordinate mode] is set to [OFF]:
  Left-hand coordinate system
- When [Calibration] of [Rotation position/Coordinate mode] is set to [ON]:
  The coordinate system that has been set in [Calibration]

Left-handed system



Right-handed system



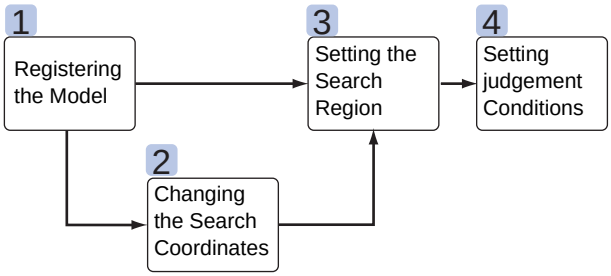
Coordinate system checking and changing method
SECTION 2, 1.1 Inputting Camera Images, “Calibration”

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Set the measurement region

Up to 8 regions can be set.

■ Operational Flow



1 Registering the Model

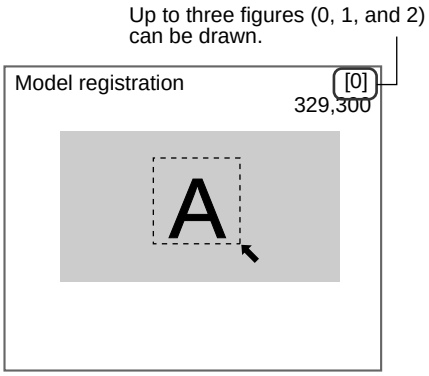
The area of the image to be inspected is registered as a model.

When a model is registered, the center position of the model is registered as the search coordinates. (When several figures have been combined in the drawing, the center coordinates of circumscribing rectangle becomes the search coordinates.)

▶ [Rotate position/Select region/Region (No.)/Model registration/figure/drawing mode]

1. Draw the region to be registered as the model with the selected figure.

SECTION 1 Basic Operating Procedures, “Drawing a Region”

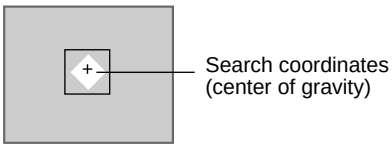
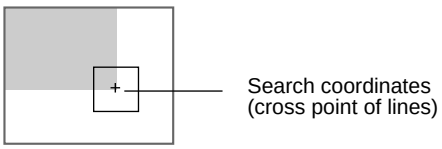


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2 Changing the Search Coordinates

Use this function to change the search coordinates only.
When a model is registered, the center position of the model is registered as the search coordinates. This function can be used to register a point other than the center of the model as the search coordinates.
The search coordinates are used for the point output as the measurement value. The search coordinates can be changed to an appropriate position.

There are 3 registration methods available: Manual, Gravity, and Edge.

Registration method	Details
Manual	Any position inside the model rectangle can be registered.
Gravity	The image is converted to binary and the center of gravity of the white pixel area in the model rectangle is registered as the search coordinates. Select this method to use the center of gravity of the measurement object as the search coordinates. 
Edge	The edge position is used for registration. The edge registration method can be used when the measurement object is rectangular. Select this method to register the edge or corner of the measurement object as the search coordinates. 

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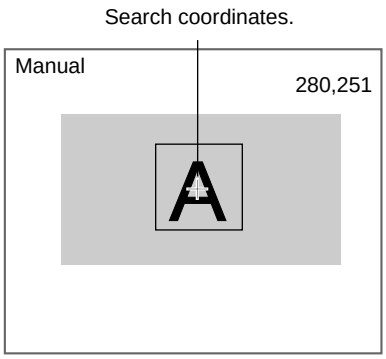
■ Manual

Any position in the model rectangle can be specified (in pixel units) as the search coordinates.

▶ [Rotate position/Select region/Region (No.)/Search coordinate/Manual]

1. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.



■ Gravity

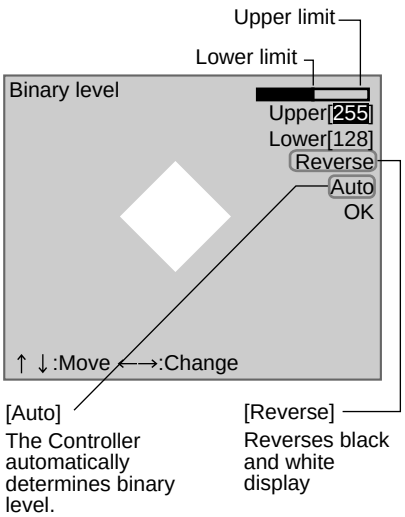
The image will be converted to binary and the center of gravity of the white pixel area in the model rectangle will be set as the search coordinates.

▶ [Rotate position/Select region/Region (No.)/Search coordinate/Gravity]

1. Move the cursor to the upper value and use the Left and Right Keys to adjust the value.

2. Use the same method to change the lower value.

3. Select [OK].

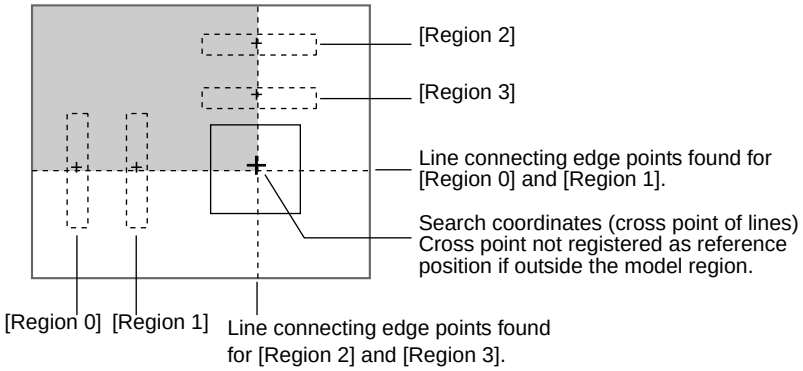


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■ Edge

The edge registration method can be used when the measurement object is rectangular.

Draw 4 regions. One edge is detected from each region and that becomes the reference position.



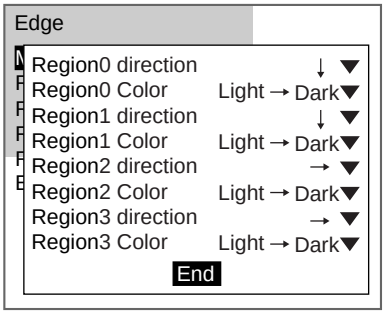
• Setting Edge Detection Conditions

Set the direction to search for the 4 edges and the density change as the measurement conditions.

▶ [Rotate position/Select region/Region (No.)/Search coordinate/Edge/Measurement conditions]

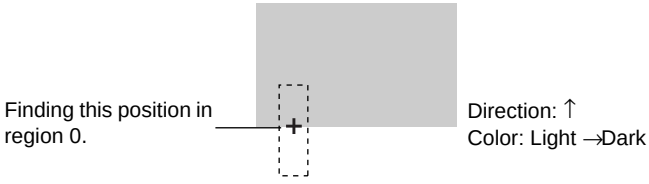
1. Set each item.

2. Select [End].



Setting data	Selection	Details
Region ☐ direction	→ ← ↑ ↓	Select the edge detection direction.
Region ☐ Color	Light →Dark Dark →Light	Select the edge detection direction.

Example:



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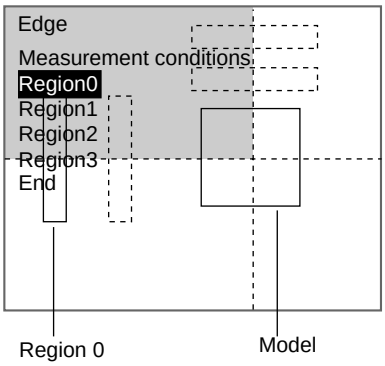
- Drawing Measurement Regions

  Draw 4 regions to include all edges.

▶ [Rotate position/Select region/Region (No.)/Search coordinate/Edge]

1. Select [Region 0].

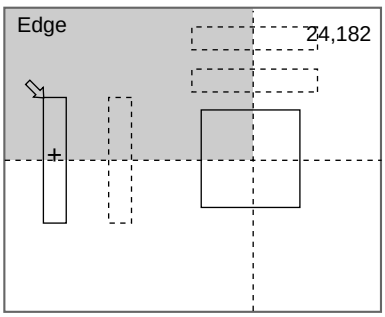
The region at the cursor position will be displayed in solid lines.
The model will also be displayed in solid lines.



The Region Settings Screen will be displayed.

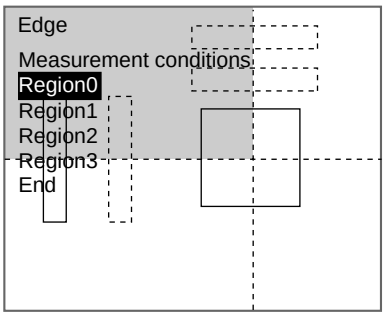
2. Draw a box-shaped region.

Specify the upper left and lower right coordinates.



The region will be registered.

3. Repeat steps **1.** and **2.** until the **4.** regions are drawn.



4. Once the 4 regions have been drawn, Select [End].

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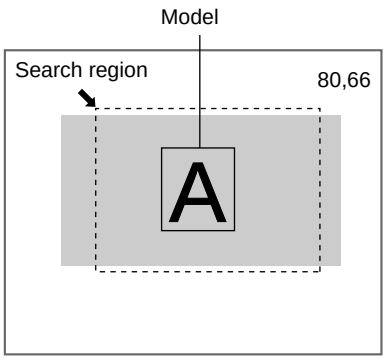
3 Setting the Search Region

Set the region in which the model is to be searched for.
It is possible to perform a search for the entire input image, but the processing time can be shortened and the accuracy can be increased by setting limits on the search region.

▶ [Rotate position/Select region/Region (No.)/Search region]

1. Draw a rectangular search region.

Specify the upper left and lower right coordinates.



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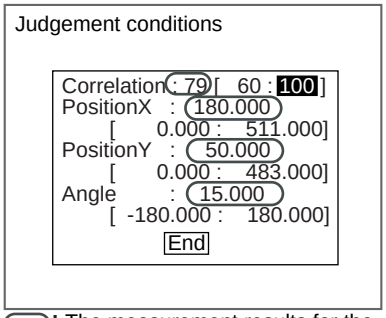
4 Setting judgement Conditions

Set the judgement conditions for the correlation between the measurement object and the models, the position (X, Y) where the object was detected, and the angle.

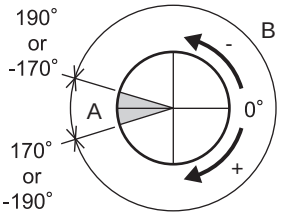
▶ [Rotate position/Select region/Region (No.)/Judgement conditions]

1. Set each item.

2. Select [End].



: The measurement results for the displayed image.
Use these values as references in setting the upper and lower limits.

Setting data	Selection	Details
Correlation	0 to 100	Set the correlation lower limit. The judgement will be OK if the measured value is upper than this.
Position X	-9,999.999 to 9,999.999	Set the range of movement in the X direction for an OK judgement.
Position Y	-9,999.999 to 9,999.999	Set the range of movement in the Y direction for an OK judgement.
Angle	-360.000 to 360.000	Set the angle range for measurement object. Output in the range of –180.000 to 180.000. Two values between -360° and 360° can be set. The value on the right, however, must be higher than the value on the left. Example: When setting the following range A (coordinate system: left-hand)  Angle: [190 : 170] ○ OK ┐ [-190 : -170] ○ OK ┘ (Give the same result.) [170 : -170] ✕ The value on the right is smaller. [-170 : -170] ✕ Setting within the B range. The measurement value is output between -180° and 180°, so a measurement value of 190° becomes -170°.

Search
SECTION 7 Appendix, “Terminology”

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Referencing Models

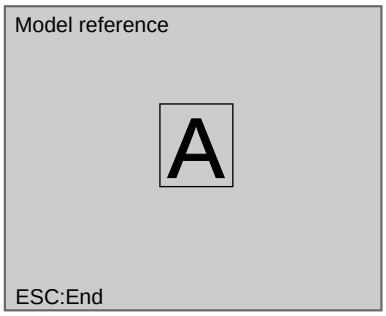
Use this operation to confirm registered models.

▶ [Rotate position/Select region/Region (No.)/Model reference]

1. Referencing Models

The model will be displayed at the position where registered.

2. Press the ESC Key to exit.

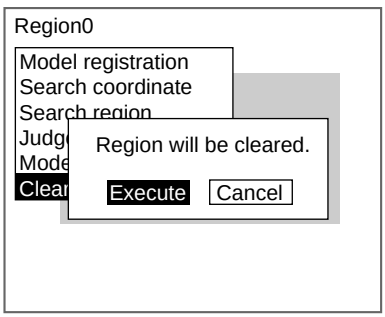


Clearing the Set Regions

The clear operation is performed separately for each region.

▶ [Rotate position/Select region/Region (No.)/Clear]

1. A confirmation message appears. Select [Execute].



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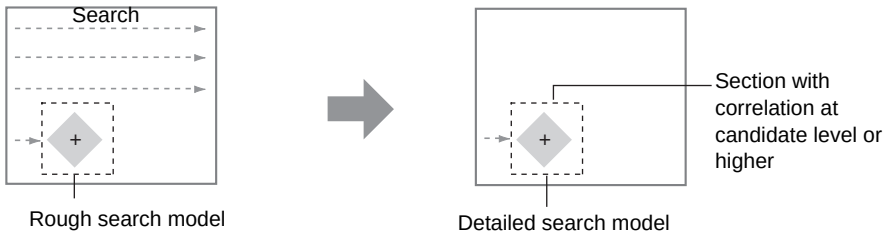
Changing Detailed Conditions

The search settings can be changed here. Change the conditions if the measurement results are unstable or if high-speed processing is required. Normally, the method can be left on the default setting. After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

The Controller performs the following 2-stage processing internally.

1. Rough search
   The rough search model is used to search every item in the measurement region.

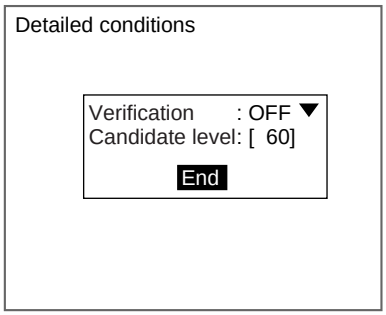
2. Detailed search
   Measures again using the detailed search model to compare to the images surrounding the section at the candidate level or higher.



▶ [Rotation Positioning/Detailed conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Verification	Set whether or not to perform detailed searches on models at the candidate level or higher. If model searches are unstable, set [Verification] to [ON] and adjust the candidate level.	
	OFF (default setting)	Performs a detailed search only on the image with the highest rough correlation within the measurement region.
	ON	Performs a detailed search on all images at the candidate level or higher within the measurement region. The measurements are more stable in comparison to when search verification is set to [OFF]. Processing time, however, will be longer.
Candidate level	0 to 99 (default setting: 60)	Set the correlation value for detailed search target images. Reduce the correlation level if the model searches are unstable. A detailed search will be performed on all images above this level in the rough. This setting item is enabled only when [Verification] is set to [ON].

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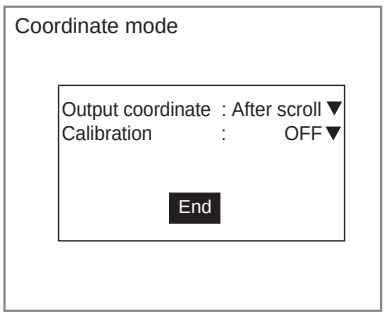
Setting the Coordinate Mode

Select the type of coordinate values.

CHECK!

If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [Rotate position/Coordinate mode]



1. Set each item.

2. Select [End].

Settings Data

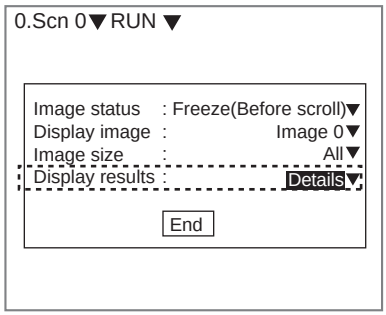
SECTION 7 Appendix, “Coordinate Handling Method”

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Checking the Measurement Image

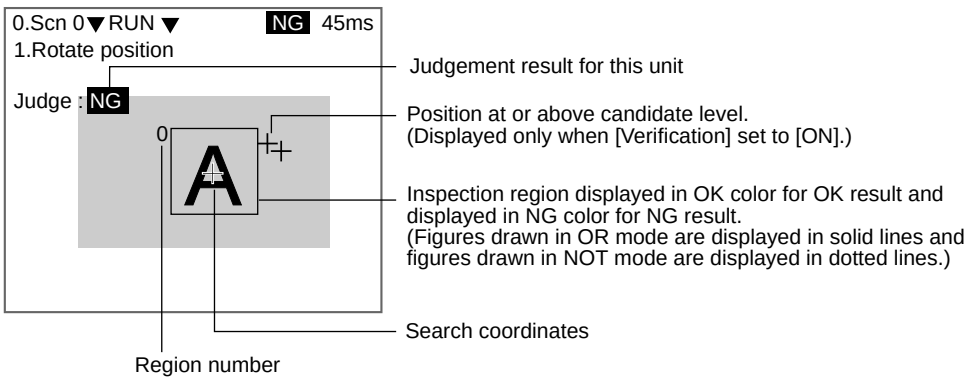
Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed. Use the SHIFT+Right or Left Keys to switch in order between the two screens.

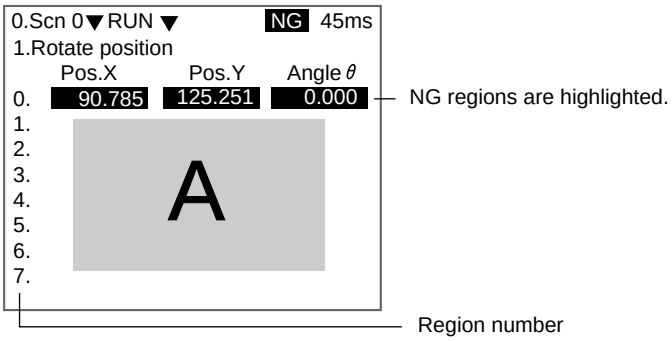
(1) Judgement Result



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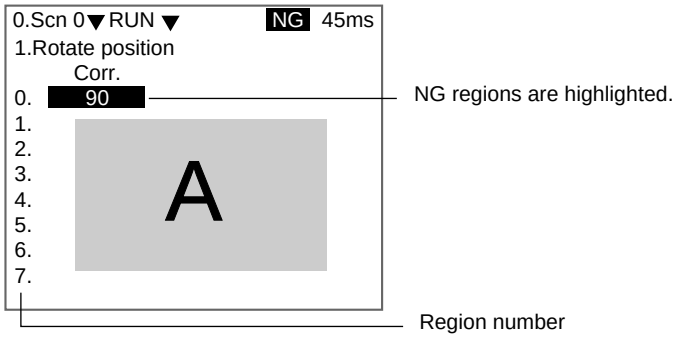
Position and Angle

A list of search positions and angles for each region will be displayed.



(3) Correlation Value

A list of correlations for each region will be displayed.



CHECK!

If the font size is set to [Small], the position and angle and correlation screens will be shown together. If the font size is set to [Normal], these two screens will be displayed consecutively.

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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Unit judgement result (-2: Not measured -1: NG 0: OK)
The following measurement data is for Region N (0 to 7).		
Judgement	R##JG	Judgement result (-2: Not measured -1: NG 0: OK)
Correlation value	R##CR	Correlation value with model
Search position X	R##X	X coordinate of position where model found
Search position Y	R##Y	Y coordinate of position where model found
Search angle	R##TH	Angle of found model
Reference X	R##SX	X coordinate of reference position
Reference Y	R##SY	Y coordinate of reference position

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Unit judgement result (-2: Not measured -1: NG 0: OK)
The following measurement data is for Region N (0 to 7).	
7N+1	Judgement result (-2: Not measured -1: NG 0: OK)
7N+2	Correlation value with model
7N+3	X coordinate of position where model found
7N+4	Y coordinate of position where model found
7N+5	Angle of found model
7N+6	X coordinate of reference position
7N+7	Y coordinate of reference position

■ Setting Data

Data type	Details
72	Rotation range (0: None 1: ±25° 2: ± 5° 3: ±8° 4: ±10° 5: ± 15° 6: ±30° 7: ±45° 8: 0 ±60° 9: ±90° 10: All)
73	Skipping angle (0: 1° 1: 2° 2: 3° 3: 5° 4: 6° 5: 10° 6: 15° 7: 20° 8: 30°)
74	Accuracy (0: Normal 1: Precise)
75	Verification (0: ON 1: OFF)
76	Candidate level (0 to 99)
77	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF 2: After scroll, calibration ON 3: Before scroll, calibration ON)
The following measurement data is for region N (0 to 7).	
18N+78	Model position upper left X (0 to 511) (See *1.)
18N+79	Model position upper left Y (0 to 483) (See *1.)
18N+80	Model position lower right X (0 to 511) (See *1.)
18N+81	Model position lower right Y (0 to 483) (See *1.)
18N+82	Model reference position X (0 to 511)
18N+83	Model reference position Y (0 to 483)
18N+84	Search region upper left X (0 to 511)
18N+85	Search region upper left Y (0 to 483)
18N+86	Search region lower right X (0 to 511)
18N+87	Search region lower right Y (0 to 483)
18N+88	Correlation upper limit (0 to 100)
18N+89	Correlation lower limit (0 to 100)
18N+90	Position X upper limit (-9,999.999 to 9,999.999)

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Data type	Details
18N+91	Position X lower limit (-9,999.999 to 9,999.999)
18N+92	Position Y upper limit (-9,999.999 to 9,999.999)
18N+93	Position Y lower limit (-9,999.999 to 9,999.999)
18N+94	Angle upper limit (-360.000 to 360.000)
18N+95	Angle lower limit (-360.000 to 360.000)

*1 If these settings are changed, one rectangular region will be set and the previously drawn figures will be deleted.

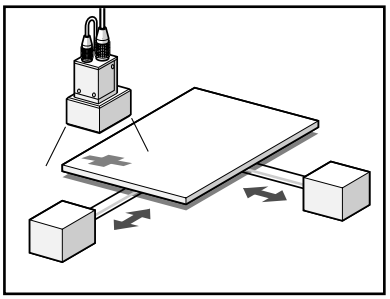
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ECM Search (Edge Code Model Search)

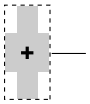
The Edge Code Model (ECM) Search processing item finds the section of the input image that is closest to the mark to be found (model) and detects its correlation (similarity) and position.

This processing item can perform stable searches even for low contrast images or images with a lot of noise.

Example: Finding Positioning Marks on Liquid Crystal Substrate



Positioning mark



Registered model



Positioning mark found even in the following conditions.

A lot of noise



Chipped



Low contrast



Edge Code (EC)

SECTION 7 Appendix, “Terminology”

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Operational Flow

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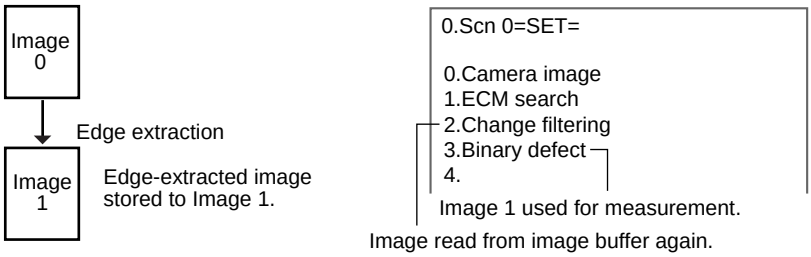
Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

CHECK!

The edges are extracted for the image number selected here and this image is then stored at the other image number. Set [Change Filtering] as the next processing item to use this image for measurement for units after the unit for which this processing item was set. Then store the image stored in the image buffer to [Image 0] or [Image 1].

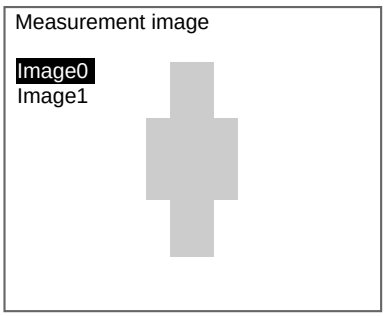
Example: When Image 0 Is Selected as Measurement Image



▶ [ECM search/Measurement image]

1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.



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Extracting Edges

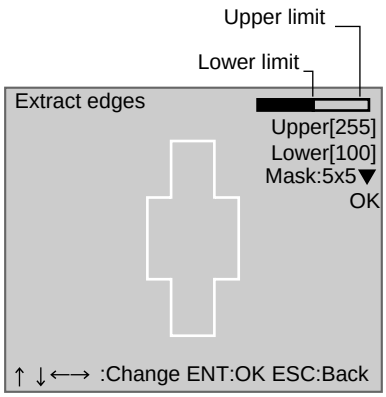
This processing Item is performed for images for which the edges have been extracted.
Adjust the upper and lower levels for edge extraction if there is low contrast between the measurement object and the background and to remove noise. Adjust the upper and lower levels so that the edges of the mark to be found are extracted.

▶ [ECM search/Extract edges]

1. Set the upper and lower limits.

2. Select the desired mask size.

3. Select [OK].



Setting data	Selection	Details
Upper and Lower Limits	10 to 255 (default setting 100:255).	Set the level to which the background will be cut. Adjust the upper and lower levels for edge extraction if there is low contrast between the measurement object and the background and to remove noise.
Mask Size	5 × 5 (default setting) 3 × 3	The mask size function is used when searching for edges to judge edges using peripheral information. The greater the mask size, the more the variations in surrounding pixels can be absorbed. CHECK! This setting will be enabled only if [Camera image] is set to [Frame].

Settings Data

SECTION 7 Appendix, “EC (Edge Code) Image Measurement”

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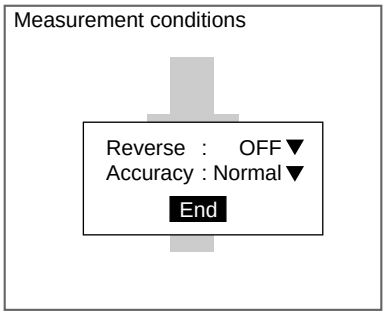
Setting Measurement Conditions

Set the conditions for searching for the model.

▶ [ECM search/Measurement conditions]

1. Set each item.

2. Select [End].

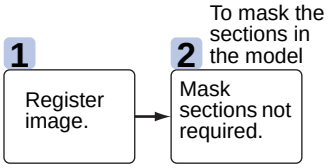


Setting data	Selection	Details
Reverse	OFF (default setting)	Searches for the registered model. The search is not performed if black and white are reversed.
	ON	Performs the search even if black and white are reversed for the model.
Accuracy	Normal (default setting)	Finds the measurement value in integers (pixel units).
	Precise	Finds the measurement value in decimals (sub-pixel units).

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Registering the Model

Register the mark to be found as a model.

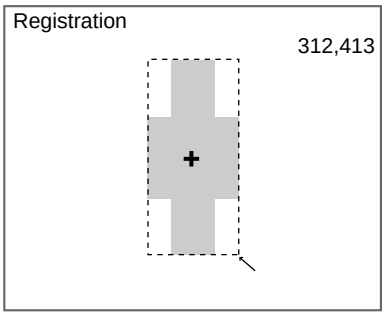


1 Registering Images

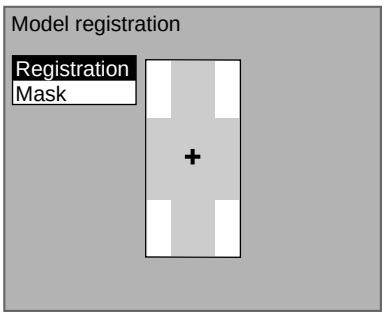
Specify the region to be used for model registration by enclosing it in a box.

▶ [ECM search/Model registration/Model registration]

1. Draw a box that encloses the mark.



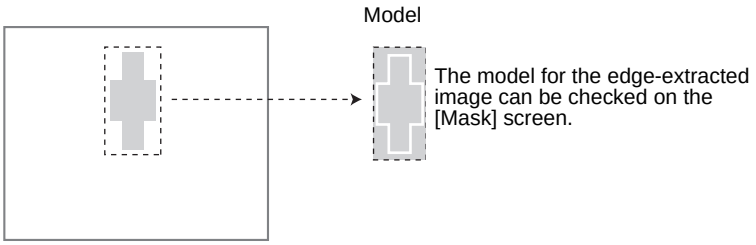
The image inside the box is registered.



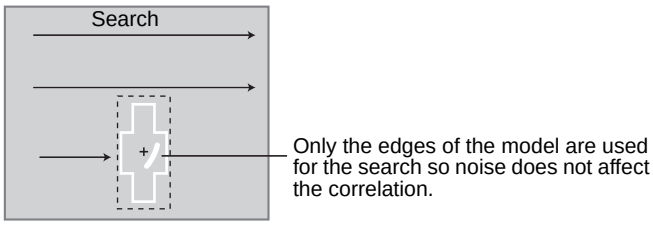
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CHECK!

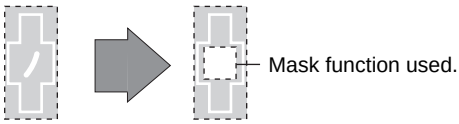
The model is registered internally using the edge-extracted image.



The section in the input image that is closest to the model is found. The degree of similarity is expressed as the correlation, and the search coordinates (X, Y) are found.



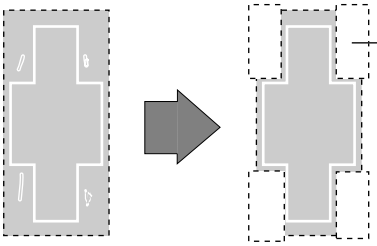
If, however, there is noise in the model itself, the correlation will be reduced because noise becomes part of the search. In such cases, use the mask function to remove noise from the model before registration.



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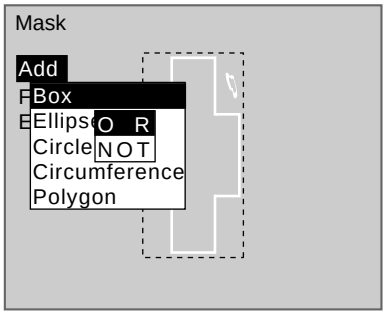
2 Masking Sections Not Required

Sections in the model that are not required can be masked and removed from the model.
The registered model image does not get cleared when using this function so the image can be used repeatedly to try different model shapes to find the most suitable one.



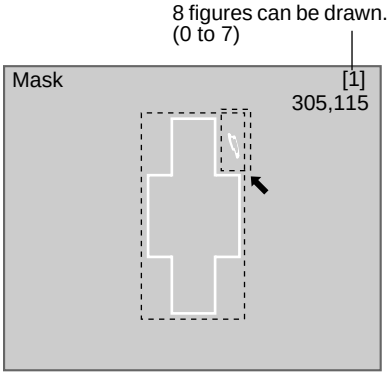
▶ [ECM search/Model registration/Mask/Add/figure/drawing mode]

1. Select [NOT] to use the mask function.
Select [OR] to draw a different figure.



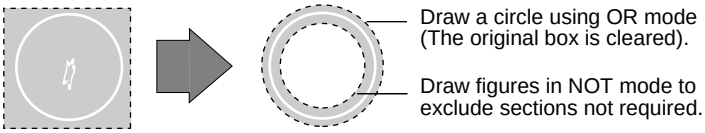
An arrow cursor will appear.

2. Draw the figure.



CHECK!

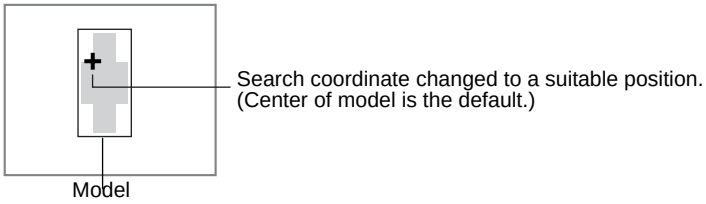
The box drawn using [Registration] is registered as Figure 0 and the position and size of that box can be adjusted. If a box figure is not suitable, clear the box and use OR mode to draw a circle or polygon. (Up to 8 figures can be drawn.)



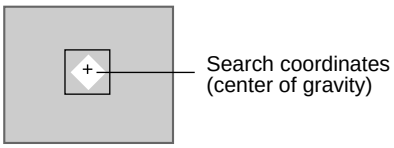
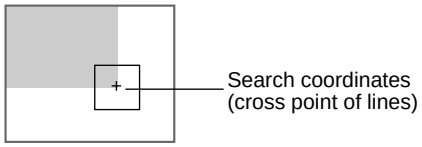
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Changing the Search Coordinates

Use this function to change the search coordinates only.
When a model is registered, the center position of the model is registered as the search coordinates. This function can be used to register a point other than the center of the model as the search coordinates.



There are 3 methods available for changing search coordinates.

Registration method	Details
Manual	Any position can be specified for registration.
Gravity	The image is converted to binary and the center of gravity of the white pixel area in the model is registered as the search coordinates. Select this method to use the center of gravity of the measurement object as the search coordinates. 
Edge	The edge position is used for registration. The edge registration method can be used when the measurement object is rectangular. Select this method to register the edge or corner of the measurement object as the search coordinates. 

CHECK!

If the model image has been re-registered or the mask function used to change the model shape, the search coordinates will return to the default position (center of the model).

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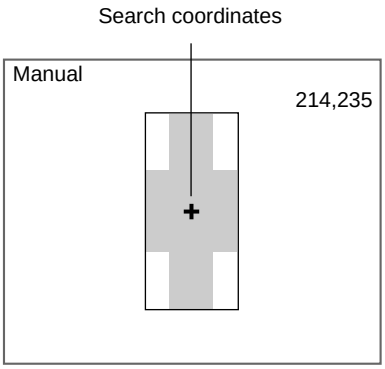
Manual

Any position can be specified (in pixel units) for the search coordinates.

▶ [ECM search/Search coordinate/Manual]

1. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.



Gravity

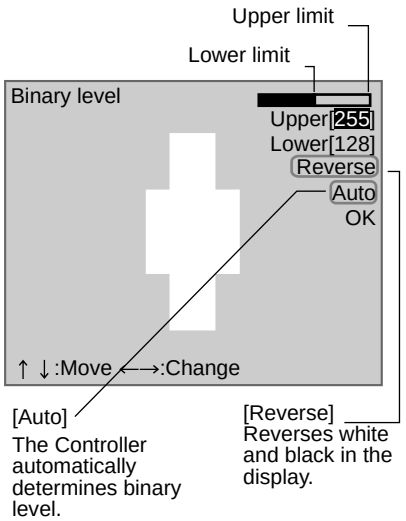
The image will be converted to binary and the center of gravity of the white pixel area in the model rectangle will be registered as the search coordinates.
The Controller uses the white pixels to measure the object. Adjust the binary level so that the object is displayed as white pixels.

▶ [ECM search/Search coordinate/Gravity]

1. Move the cursor to the upper value and use the Left and Right Keys to adjust the value.

2. Use the same method to change the lower value.

3. Select [OK].

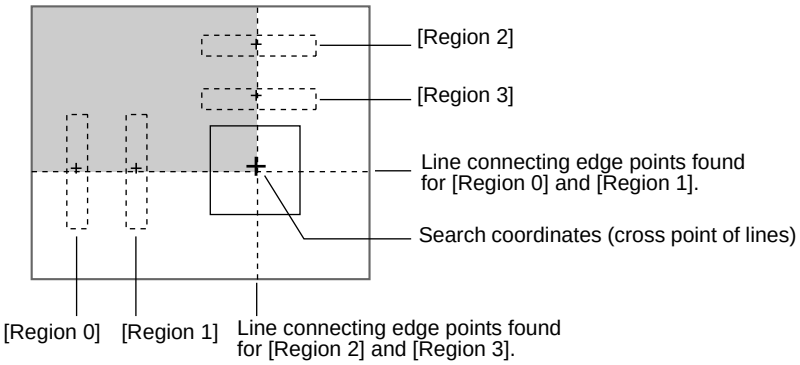


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Edge

The edge registration method can be used when the measurement object is rectangular.

Draw 4 regions. One edge is detected from each region and that becomes the reference position.



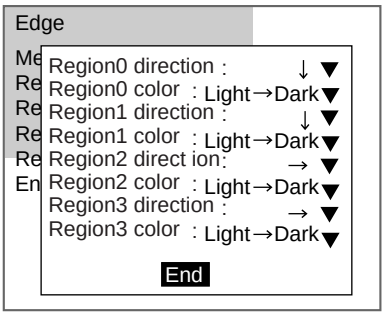
■Setting Edge Detection Conditions

Set the direction for edge detection and the density changes.

▶ [ECM search/Search coordinate/Edge/Measurement conditions]

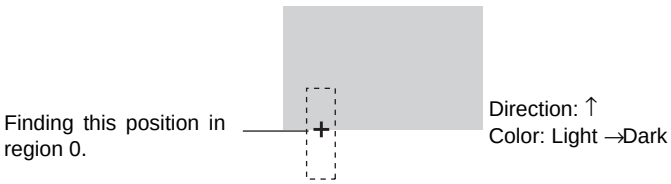
1. Set each item.

2. Select [End].



Setting data	Selection	Details
Region ☐ direction	→ ← ↑ ↓	Select the edge detection direction.
Region ☐ Color	Light →Dark Dark →Light	Select the density change.

Example:



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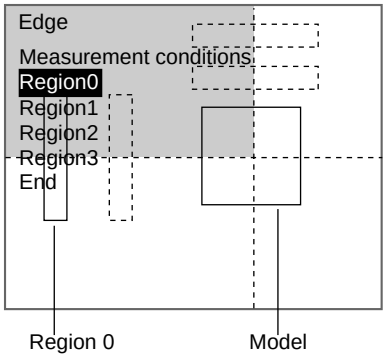
■ Drawing Measurement Regions

Draw 4 regions to include all edges.

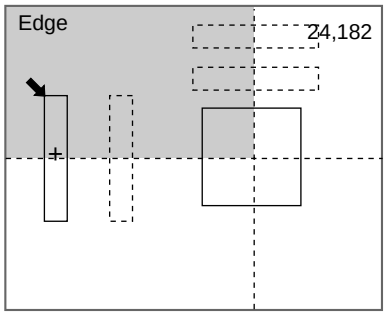
▶ [ECM search/Search coordinate/Edge]

1. Select [Region 0].

The region at the cursor position will be displayed in solid lines.
The model will also be displayed in solid lines.



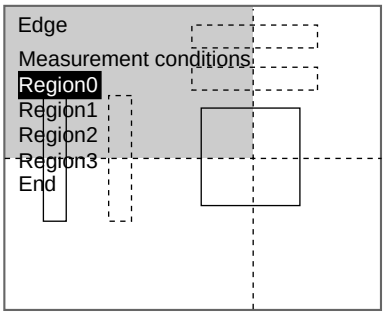
The Region Settings Screen will be displayed.



2. Draw a box-shaped region.

Specify the upper left and lower right coordinates.

The region will be registered.



3. Repeat steps **1.** and **2.** until the 4 regions are drawn.

4. Once the 4 regions have been drawn, Select [End].

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Setting the Search Region

Set the region in which the model is to be searched for.
It is possible to perform a search for the entire input image, but the processing time can be shortened and the accuracy can be increased by setting limits on the search region.

CHECK!

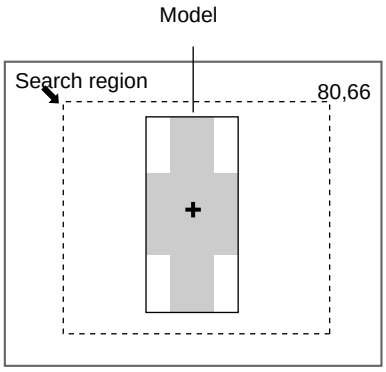
When edges are extracted, the pixels at the edges of the screen cannot be processed accurately.
Do not include the outer edges of the screen when setting the removal region.
In particular, when performing position displacement compensation, adjust so that the scrolled image or the measurement range will not overlap with this region. Furthermore, if the number of lines to be read has been set in the case of F160-S2 camera, there are restrictions on the removal range.

SECTION 2, 1.1 Inputting Camera Images, “Filtering”

▶ [ECM search/Search coordinate/Search region]

1. Draw a rectangular search region.

Specify the upper left and lower right coordinates.



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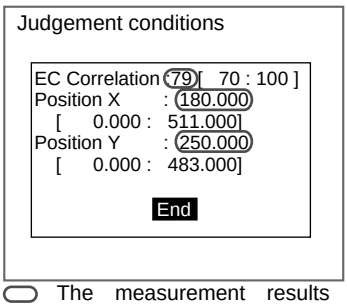
Setting Judgement Conditions

Set the judgement conditions for the correlation with the model and for the position (X, Y) where the object was detected.

▶ [ECM search/Search coordinate/Judgement conditions]

1. Set each item.

2. Select [End].



The measurement results for the displayed image.

Setting data	Selection	Details
EC Correlation	0 to 100	The edge-extracted image is used for matching with the model. The EC correlation value indicates the degree of similarity for the edge-extracted image. Set the correlation lower limit. The judgement will be OK if the measured value is upper than this. Model / Image 0 / Image 1 / Image 2 For judgement values between 70 and 100 EC correlation: 96 OK / 55 NG / 90 OK
Position X	-9,999.999 to 9,999.999	Set the range of movement in the X direction for an OK judgement.
Position Y	-9,999.999 to 9,999.999	Set the range of movement in the Y direction for an OK judgement.

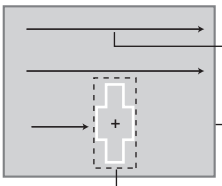
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Changing Detailed Conditions

The search settings can be changed here. Change the conditions if the measurement results are unstable or if high-speed processing is required. Normally, the method can be left on the default setting. After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

The Controller performs the following 2-stage processing internally.

① Rough Search
Searches for the model in the search region. Detailed searches are not performed if the highest correlation is at or below the candidate level. The result will be NG.



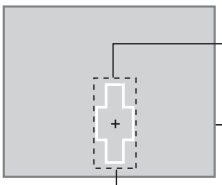
Searches while skipping the number of pixels set under [Search skipping].

Image reduced by the amount set under [Reduction].

Model

- Model reduced by the amount set under [Reduction].
- Model where number of pixels set under [Model skipping] have been skipped.

② Detailed Search
Measurements are taken again in area of highest correlation.



Measures again in area of highest correlation.

Image reduced by the amount set under [Reduction].

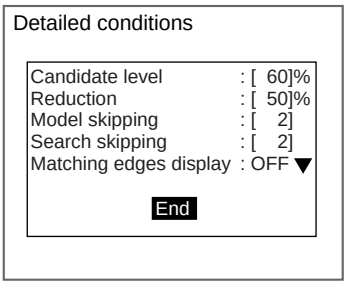
Model

- Model reduced by the amount set under [Reduction].
- Model where number of pixels set under [Model skipping] have been skipped.

▶ [ECM search/Search coordinate/Detailed conditions]

1. Set each item.

2. Select [End].



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Setting data	Selection	Details
Candidate level	0 to 100 (default setting: 60)	Set the threshold for the correlation when executing rough searches. If the highest correlation is at or below the candidate level, detailed searches will not be executed. The judgement result will be NG. Reduce the correlation level if the model searches are unstable. The processing speed, however, will be slower.
Reduced	25 to 100 (default setting: 50)	Set the percentage to reduce the input and model images when search is executed. The processing time is shorter the more the image is reduced. However, the searches may become unstable when the model is small.
Model skipping	1 to 19 (default setting: 2)	Set the number of pixels to be skipped for the model.
Search skipping	1 to 9 (default setting: 2)	Set the number of pixels to be skipped in the search region when performing rough searches.
Matching Edges	ON	The sections where the edge codes match are displayed in color. The processing time is longer than when set to [OFF].
	OFF (default setting)	The matching edge codes are not displayed.



When Accuracy Set to [Normal]

The position found using detailed search will be the measurement value. (Reductions will be converted back to original size and output.)

When Accuracy Set to [Precise]

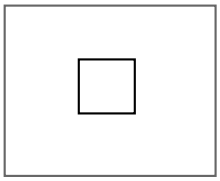
The image and the model are returned to the original size and the detailed search is executed again. The position is found in sub-pixel units. (Model skipping is not performed.)

Accuracy setting method p.5



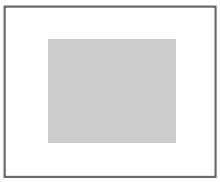
The following parameters can be adjusted in line with the measurement object to increase processing speed.

When the model is a line drawing



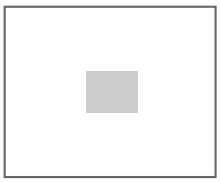
Increase the model skipping setting.

When the model is large
(1/4 of the screen or more)



Reduce the reduction setting.

When the model is small
(less than 1/4 of the screen)



Increase the model skipping setting.

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Setting the Coordinate Mode

Select the type of coordinate values.

CHECK! If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

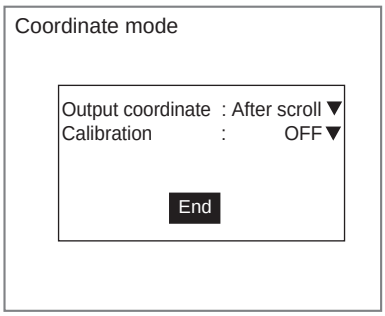
▶ [ECM search/Coordinate mode]

3. Set each item.

4. Select [End].

Settings Data

SECTION 7 Appendix, “Coordinate Handling Method”

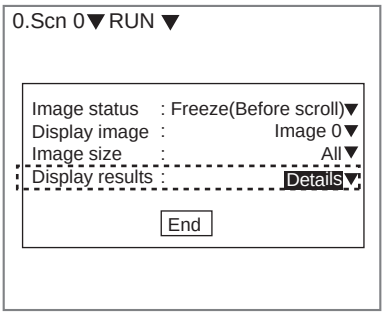


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Checking the Measurement Image

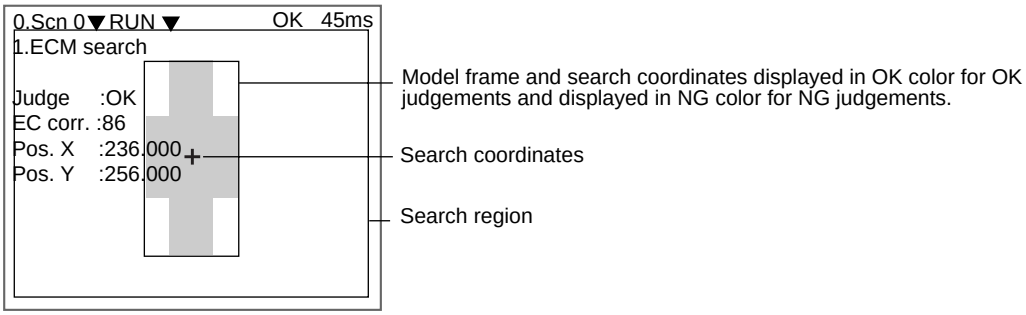
Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



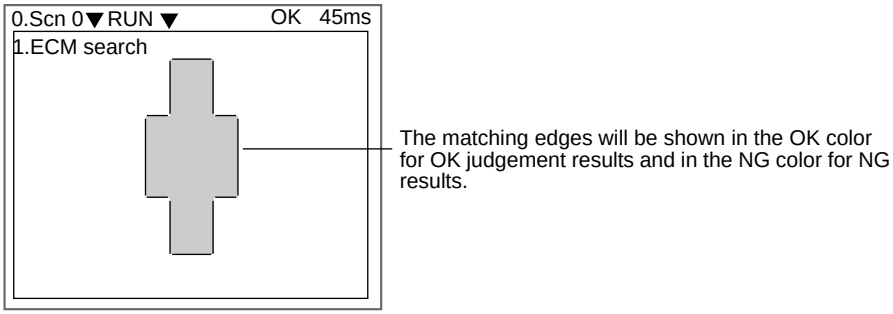
Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed. Use the SHIFT+Right or Left Keys to switch in order between the two screens.

(1) Measurement Values and Position Display



(2) Matching Edges Display

If [Detailed conditions/Matching edges display] is set to [ON], the following screen will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JD	Unit judgement result (-2: Not measured -1: NG 0: OK)
EC Correlation	CR	EC correlation with model
Search position X	X	X coordinate of position where model found
Search position Y	Y	Y coordinate of position where model found
Reference X	SX	X coordinate of reference position
Reference Y	SY	Y coordinate of reference position

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Unit judgement result (-2: Not measured -1: NG 0: OK)
1	EC correlation with model
2	X coordinate of position where model found
3	Y coordinate of position where model found
4	X coordinate of reference position
5	Y coordinate of reference position

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■ Setting Data

Data type	Details
16	Measurement image (0: Image 0 1: Image 1)
17	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF 2: After scroll, calibration ON 3: Before scroll, calibration ON)
18	mask size (0: 3 × 3 1: 5 × 5)
19	Edge extraction lower limit (10 to 255)
20	Edge extraction upper limit (10 to 255)
21	Black/white reverse (0: OFF 1: ON)
22	Accuracy (0: Normal 1: Precise)
23	Model region upper left X (0 to X_MAX) (See *1, *2.)
24	Model region upper left Y (0 to Y_MAX) (See *1, *2.)
25	Model region lower right X (0 to X_MAX) (See *1, *2.)
26	Model region lower right Y (0 to Y_MAX) (See *1, *2.)
27	Reference position X (0 to X_MAX) (See *2)
28	Reference position Y (0 to Y_MAX) (See *2)
29	Search region upper left X (0 to X_MAX) (See *2.)
30	Search region upper left Y (0 to Y_MAX) (See *2.)
31	Search region lower right X (0 to X_MAX) (See *2.)
32	Search region lower right Y (0 to Y_MAX) (See *2.)
33	Correlation judgement upper limit (0 to 100)
34	Correlation judgement lower limit (0 to 100)
35	X judgement upper limit (-9,999.999 to 9,999.999)
36	X judgement lower limit (-9,999.999 to 9,999.999)
37	Y judgement upper limit (-9,999.999 to 9,999.999)
38	Y judgement lower limit (-9,999.999 to 9,999.999)
39	Candidate level (0 to 99)
40	Reduction ratio (25 to 100)
41	Model skipping (1 to 19)
42	Search skipping (1 to 9)
43	Matching edges display (0: OFF 1: ON)

*1: Mask figures cannot be registered.

*2: The range varies depending on the controller model.

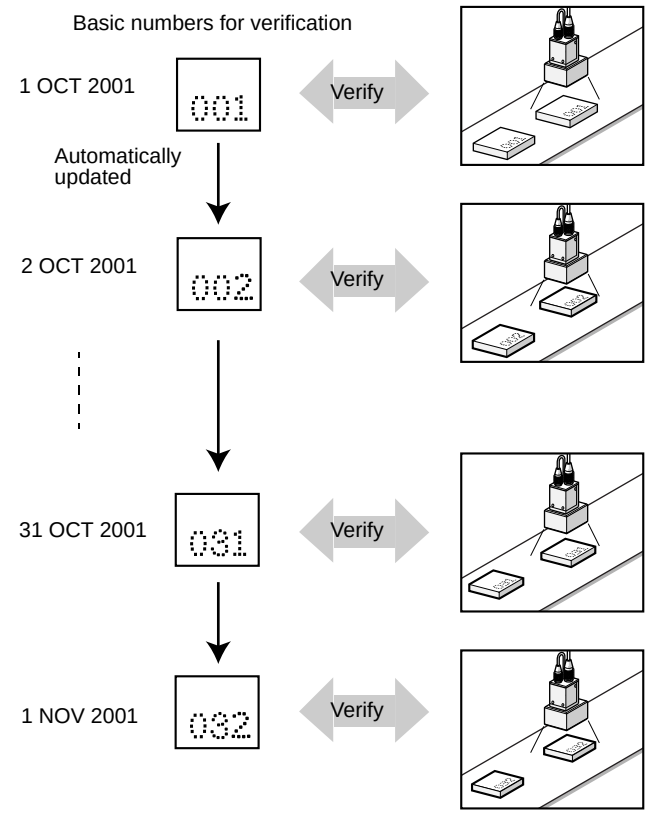
Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

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Lot Number OCV1

The Lot Number OCV 1 processing item verifies whether or not lot numbers are printed correctly.
Lot numbers can be used that change daily, weekly, monthly, or yearly.
The Controller has a built-in calendar that is used to automatically increment the numbers used in verification; settings do not need to be changed manually.
The Controller also has built-in dictionaries of the shape characteristics of various fonts so that basic characters do not need to be registered.

Example: Lot number that are incremented by 1 daily.



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Performance

Setting data	Details	
Fonts	Ink jet printers	Hitachi, Marconi, Domino, Linx, Willet, Imaje, KGK (Kishu Giken Kogyo), EDM
	Laser printers	Gothic, OCRA, OCRB, SEMI
	Stamps	Gothic, Ming-style, OCRA, OCRB
Characters	Numerals (0 to 9) (Letters and symbols are not supported.)	
Number of digits	1 to 4	
Background	Must be uniform in color. Background cut and shading are available as optional functions.	

Operational Flow

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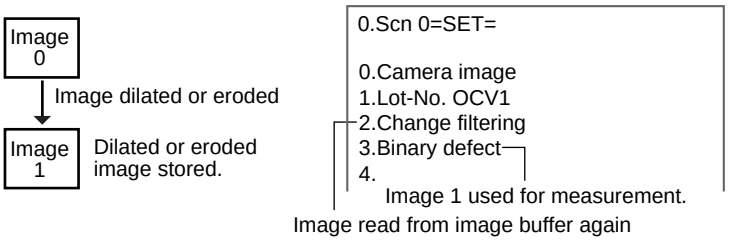
Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

CHECK!

If Shading is set under Extract conditions (i.e., the shading level has been set to 1 or higher), the image selected here will be dilated or eroded and stored at the other image number. Set [Change Filtering] as the next processing item to use this image for measurement for units after the unit for which this processing item was set. Then store the image stored in the image buffer to [Image 0] or [Image 1].

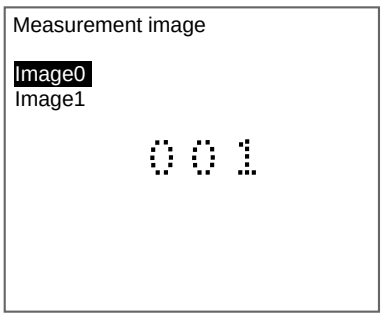
Example: Image 0 Selected as Measurement Image and Shading Set



▶ [Lot-No. OCV1/Measurement image]

1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

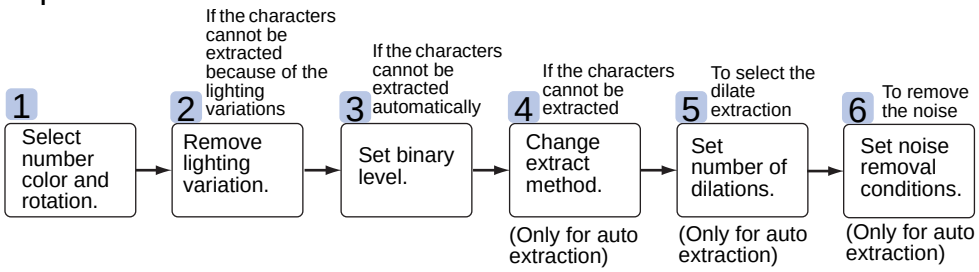
2. Press the ENT Key.



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Setting Number Extract Conditions

■ Operational Flow



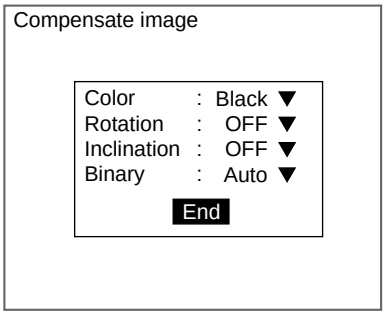
1 Selecting Number Color and Rotation

Set the color of the lot number and rotational corrections.

▶ [Lot-No. OCV1/Extract conditions/Compensate image]

1. Set each item.

2. Select [End].

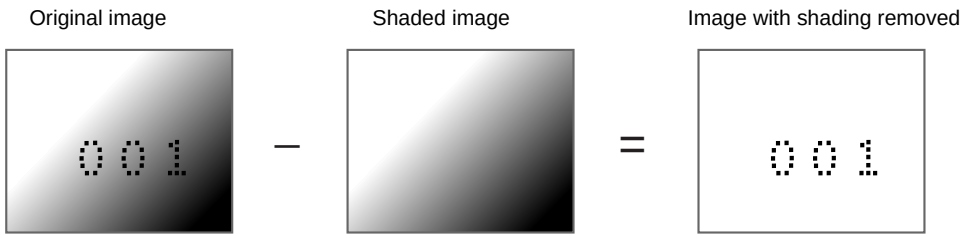


Setting data	Selection	Details
Color	Black (default setting) White	Select whether the font color will be white or black compared to the background.
Rotation	OFF (default setting) ON	Select whether or not to use rotation compensation for total rotation of character string. If [ON] is selected, compensation will be made within the range of -15° to 15°. The noise removal settings are enabled only for regions for which automatic extraction is set under [Select region/Region/Mode].
Inclination	OFF (default setting) ON	Select whether or not to use compensation for inclination of character string. If [ON] is selected, compensation will be made within the range of -20° to 20°. The noise removal settings are enabled only for regions for which automatic extraction is set under [Select region/Region/Mode].
Binary	Auto (default setting) Manual	Set the method for setting binary levels for extraction. If [Automatic] is selected, threshold is automatically set from density histogram for whole image. If characters cannot be extracted successfully in the case where [Auto] is selected, select [Manual] and adjust the binary level by observing the image.

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2 Removing Lighting Variations

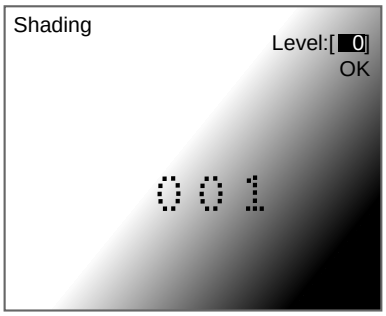
Characters cannot be extracted accurately if lighting variations cause the characters to become illegible. In such cases, use the shading function. Adjustments can also be made for shaded images.



▶ [Lot-No. OCV1/Extract conditions/Shading]

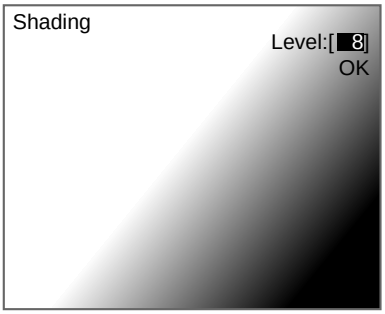
1. Place the cursor on the level and use the Left and Right Keys to change the level to between 0 and 10.

Right Key: Increases the level by one.
Left Key: Decreases the level by one.



CHECK!

The higher the level, the narrower the character lines in the image. Adjust the level until the lines start to disappear.
The higher the level, the longer the processing time.



2. Select [OK].

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3 Setting Binary Levels

This processing item converts density images to binary images and performs extraction on the binary images. The binary level set here is enabled only when the [Binary method] is set to [Manual]. Adjust the binary level so that the characters for verification are displayed as white pixels.

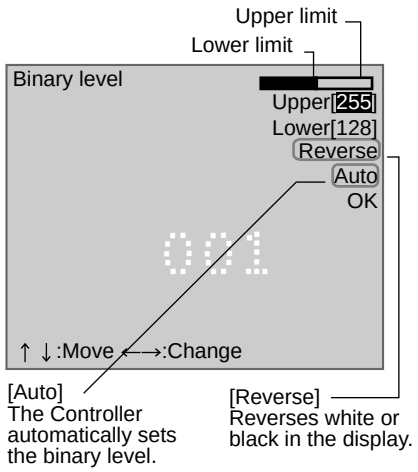
CHECK! When [Binary Method] Is Set to [Automatic]
Once measurement has been performed, enter this screen to display and check the image that was converted to binary using the automatically set binary levels.

▶ [Lot-No. OCV1/Extract conditions/Binary]

1. Move the cursor to the upper value and use the Left and Right Keys to adjust the value.

2. Use the same method to change the lower value.

3. Select [OK].



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4 Changing Extract Methods

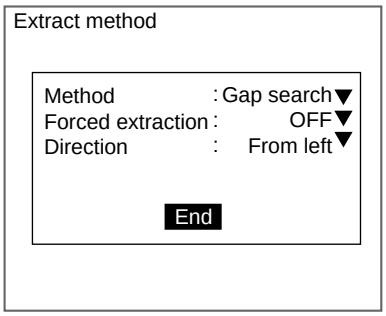
Change the extract method if the characters are not extracted accurately. Normally, the method can be left on the default setting.
After changing the setting, perform a measurement to check that the characters can still be extracted correctly.

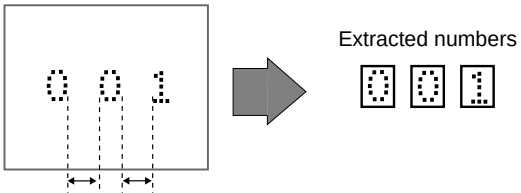
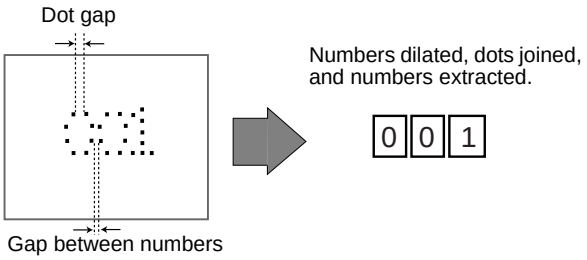
CHECK! This setting is effective only if [Automatic] is set under [Measurement conditions/Extract method].

▶ [Lot-No. OCV1/Extract conditions/Extract method]

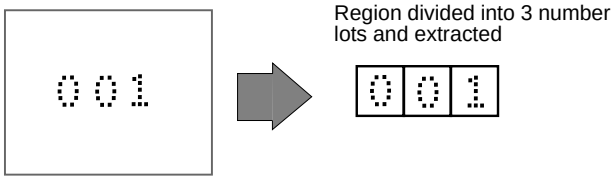
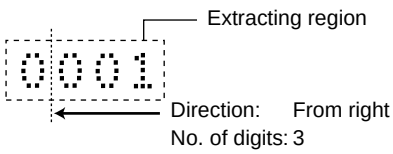
1. Set each item.

2. Select [End].



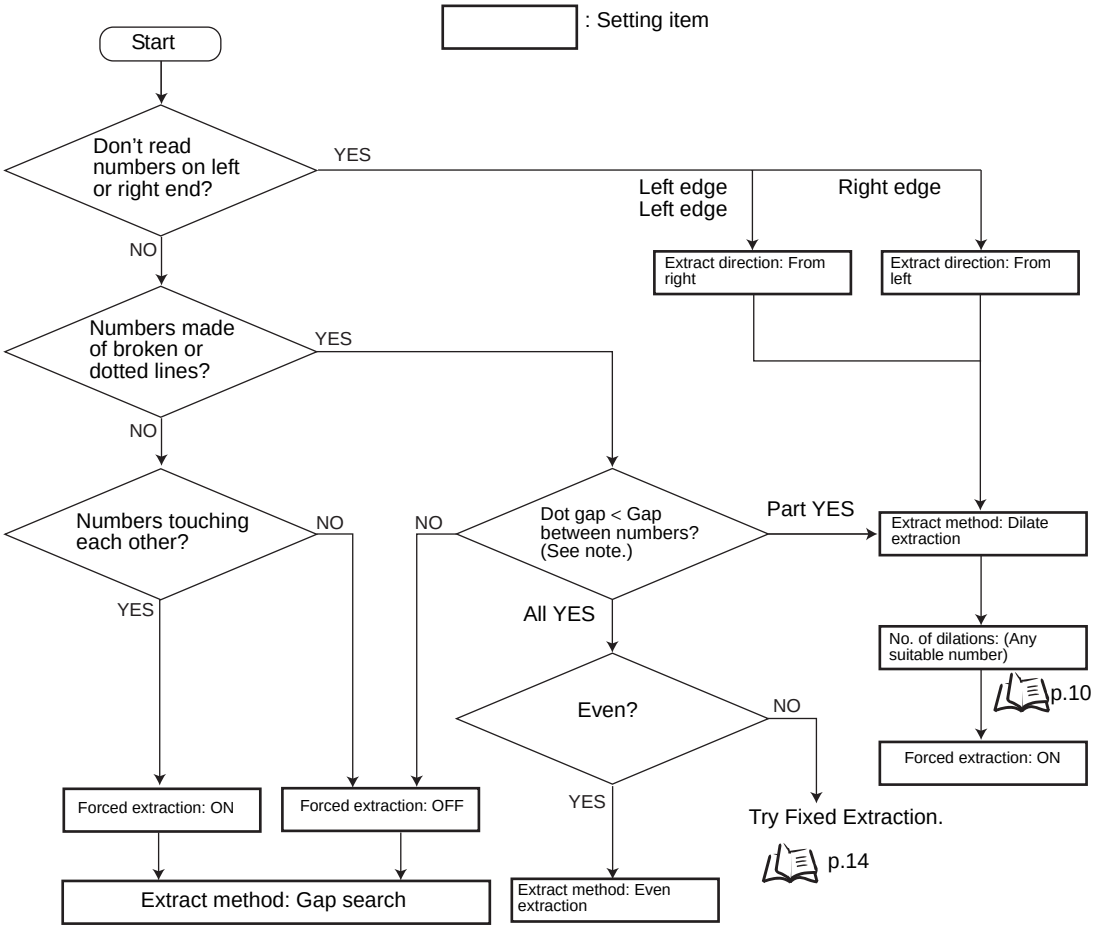
Setting data	Selection	Details
Extract Methods	Gap search (default setting)	Finds the gap between characters and extracts the characters. Normally, this method must be selected. 
	Dilate Extraction	With dot characters, the gap search may not extract correctly if the gap between dots is greater than the gap between characters. In such cases, set [Dilate Extraction]. The characters are dilated, the dot gaps joined, and then the characters are extracted. Set the number of dilations under [Extract conditions/Dilate level]. p.10 Use in conjunction with [Forced Extraction] because the gap between characters are also joined when the characters are dilated. 

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Setting data	Selection	Details
	Extraction at even intervals	The character string is divided into a specified number of characters and extracted at even intervals. This method must be selected if “gap among dots” is larger than “gap among characters” for every gap. 3 digits 
Forced Extraction	OFF (default setting) ON	If the set number of characters cannot be extracted, set whether or not to use forced extraction. The forced extraction function extracts characters that are joined due to printing errors or because they are inclined. Forced extraction is enabled only when [Gap search] or [Dilate Extraction] are selected as the extract method.
Direction	From left (default setting) From right	The direction setting is enabled only when [Dilate] is selected as the extract method. Set the direction to extract characters. Character extraction is performed only until the set number of characters have been extracted. If there are extra characters in the extracting region, these characters can be ignored (excluded from the extracting process) by starting extracting from the opposite direction.  Extraction is performed on 3 numbers starting from the right, so the “0” on the left is ignored.

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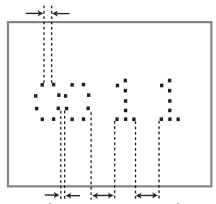
■ Guide to Setting Conditions



* Select the extract methods according to the relationship between the dot gap and the gap between numbers as follows:

- If there are only portions where the dot gap is larger than the gap between numbers, set [Dilation extraction].

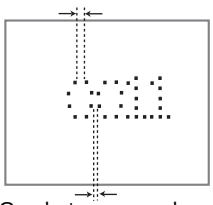
Dot gap



Gap between numbers

- If without exception the dot gap is larger than the gap between numbers, set [Even extraction].

Dot gap



Gap between numbers

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5 Setting Number of Dilations

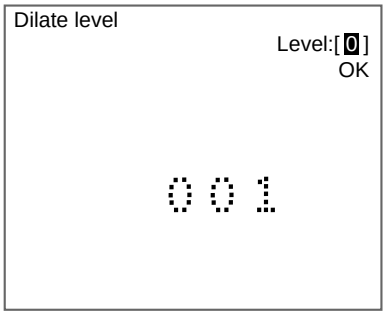
Set the number of dilations if [Dilate extraction] has been chosen to extract characters. Dilation is performed until the width between dots is eliminated, and then the extraction is performed.

CHECK! This setting is effective only if [Automatic] is set under [Measurement conditions/Extract method].

▶ [Lot-No. OCV1/Extract conditions/Dilate level]

1. Move the cursor to the level value and use the Left and Right Keys to change the value (0 to 9).

2. After the dot have joined, select [OK].



6 Setting Noise Removal Conditions

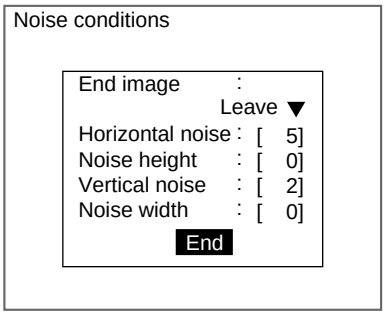
Set the conditions for ignoring noise when executing character extraction.

CHECK! This setting is effective only if [Automatic] is set under [Measurement conditions/Extract method].

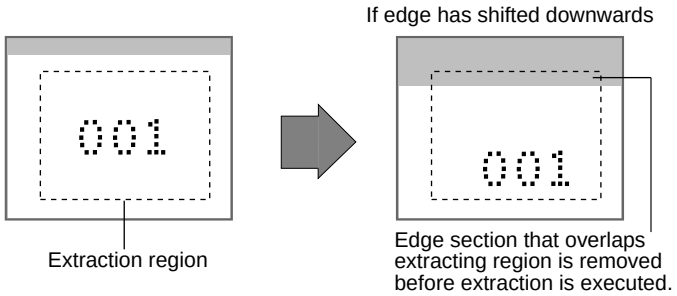
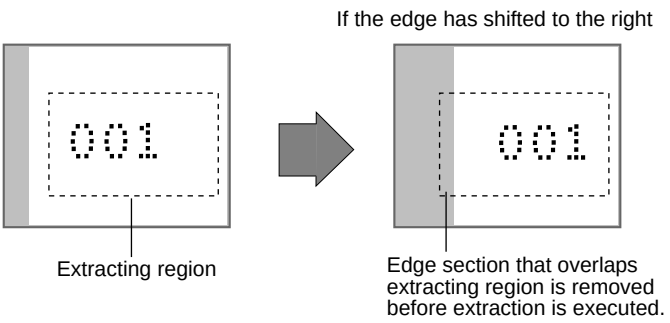
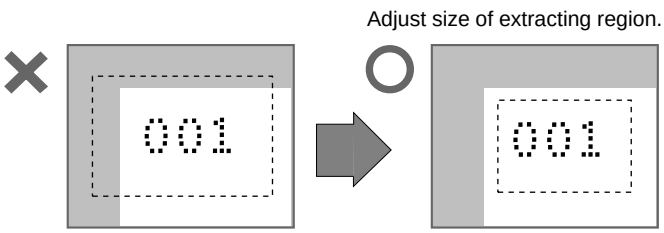
▶ [Lot-No. OCV1/Extract conditions/Noise conditions]

1. Set each item.

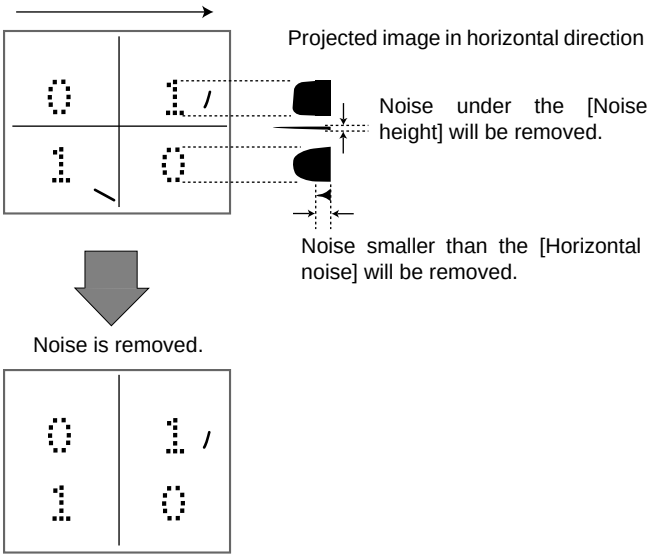
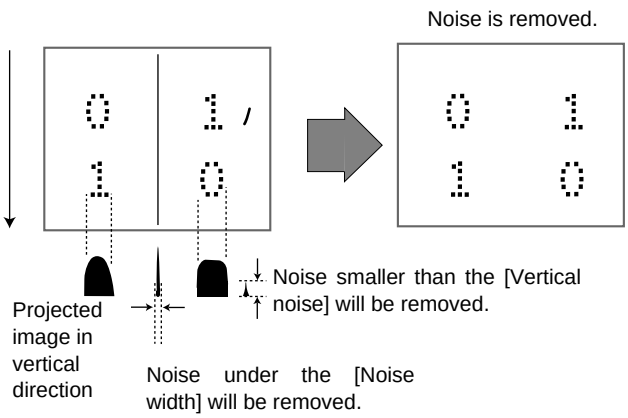
2. Select [End].



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Setting data	Selection	Details
End Images	Remain (default setting) Erase (Horizontal) Erase (Vertical)	Set whether to leave or remove the area adjacent to the extracting region. [Erase(Vertical)] must be selected if the object may move vertically.  [Erase(Horizontal)] must be selected if the object may move horizontally.  Only edges that overlap either vertically or horizontally can be removed. If the edges overlap both vertically and horizontally, the characters cannot be extracted correctly. If it is not certain in which direction the object may move, adjust the position and size of the extracting region so that only the characters to be extracted fall within the extracting region. 

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<table>
<tr><th>Setting data</th><th>Selection</th><th>Details</th></tr>
<tr><td>Horizontal noise</td><td>0 to 512
(default setting: 5)</td><td rowspan="2">To extract lines, a projected image in the horizontal direction must be created.
Set the size to be removed as noise from this projected image.

</td></tr>
<tr><td>Noise height</td><td>0 to 484
(default setting: 0)</td></tr>
<tr><td>Vertical noise</td><td>0 to 484
(default setting: 2)</td><td rowspan="2">To extract characters in an image after lines have been extracted, a projected image must be created in the vertical direction.
Set the size to be removed as noise from this projected image.

</td></tr>
<tr><td>Noise width</td><td>0 to 512
(default setting: 5)</td></tr>
</table>

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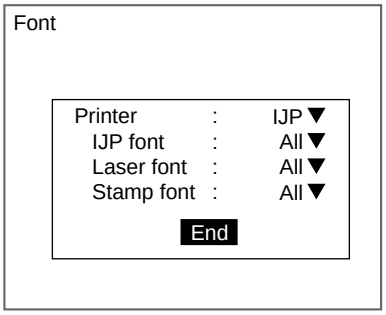
Selecting Fonts

Set the font for the lot numbers to be verified.
If the font is unknown, change [IJP font], [Laser font], and [Stamp font] settings to [All].

▶ [Lot-No. OCV1/Font]

1. Set each item.

2. Select [End].



Setting data	Selection
Printer	IJP (Ink jet printer) (default setting) Laser (laser printer) Stamp
IJP font	OFF (default setting) 5dot(Common), 5dot(Hitachi), 5dot(Marconi), 5dot(Domino), 5dot(Linx), 5dot(Willet), dot(Imaje), 5dot(KGK)*, 7dot(Common) 7dot(Hitachi), 7dot(Marconi), 7dot(Domino), 7dot(Linx), 7dot(Willet), 7dot(Imaje), 7dot(KGK)*, 7dot(EDM), 9-12dot, Over 14dot (* KGK: Kishu Giken Kogyo)
Laser font	All (default), Gothic, OCRA, OCRB, SEMI
Stamp font	All (default), Gothic, Ming-style, OCRA, OCRB

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Setting Measurement Conditions

Set the initial value and incrementing method for the lot numbers.

CHECK!

Set the data information correctly; this information serves as the basic for incrementing the lot numbers.

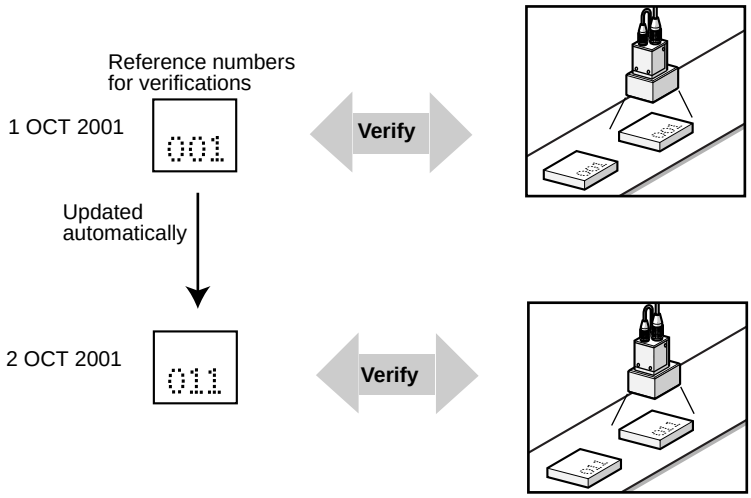
Setting Dates
SECTION 5 System Settings, “Setting the Calendar Date and Time (Date/Time)”

CHECK!

Set the initial date to be printed as the reference date.
The lot number will be calculated as the initial date plus the number of days that have elapsed since the initial date was set.

Reference date setting method p.16

Example: Reference date: 1 OCT 2001
Lot No. default: 001
Lot No. add method: Day
Lot No. add value: 10

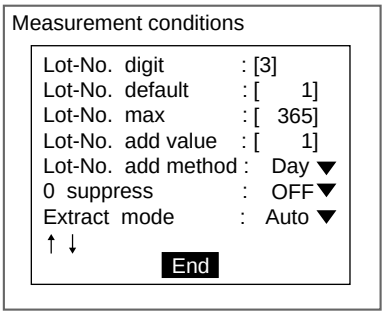


A value of 10 is added when 1 day has elapsed from the reference date.

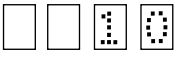
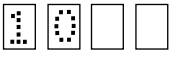
▶ [Lot-No. OCV1/Measurement conditions]

1. Set each item.

2. Select [End].



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Setting data	Selection	Details
Lot-No. digits	0 to 4 (default setting: 3)	Set the number of digits in the lot number. Set to a value at least as large as the number of digits in the maximum lot number. If a smaller value is set, it will be increased automatically to the number of digits in the maximum lot number.
Lot-No. default	0 to 9999 (default setting: 1)	Set the initial value of the lot number. The default will be set as the numbers printed on the reference date and then incremented according to the add method.
Lot-No. max.	0 to 9999 (default setting: 365)	Set the maximum lot number. The lot number will be reset to the default when the maximum value is exceeded and it will be incremented again.
Lot-No. add value	0 to 9999 (default setting: 1)	Set the value to be added to the lot number each cycle defined by the add method.
Lot-No. add method	Day (default setting) Week Month Year	Set the period at which to increment the lot number. Lot numbers will be calculated as follows based on the built-in calender. Day: The lot number will be incremented every day. Example: 1 OCT 2001 to 2 OCT 2001 Week: The lot number will be incremented every week. Example: 1 OCT 2001 to 8 OCT 2001 Month: The lot number will be incremented every month. (Days are ignored.) Example: 8 OCT 2001 to 1 NOV 2001 Year: The lot number will be incremented every year. (Months and days are ignored.) Example: 1 OCT 2001 to 1 JAN 2002
0 Suppress	OFF (default setting) ON	Set whether initial zeros are present or not when the lot number does not require all of the digits. Example: [Lot-No. digits] is 3, and lot number is 4: When “004” is printed: Select [ON]. When “4” is printed: Select [OFF].
Extract mode	Auto (default setting) Fixed	Set the mode to use to extract numbers. Auto: The number with the specified number of digits is automatically extracted from the inspection region.  Fixed: Inspected regions are drawn separately for each digit to extract numbers. This enables verifying the position of individual digits. 
Alignment	Right (default setting) Left	Positioning can be used only when fixed extraction and no 0 suppression are set. Set whether the numbers are left-aligned or right-aligned when the lot number does not require all of the digits. Example  Right  Left

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Setting data	Selection	Details
Output result	OFF (default setting) ON	Set whether or not to output on serial communications the first candidate lot number. Output Format: <unit number>, <1st candidate lot No.> Delimiter Example: If the first candidate lot number registered for Unit 1 is 123, the output is as follows: 1,123 Delimiter

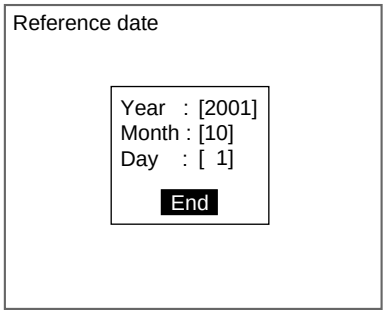
Setting the Reference Date

Set the reference date, which specifies the data the initial lot number is printed.
The lot number will be calculated as the initial date plus the number of days that have elapsed since the initial date was set.

▶ [Lot-No. OCV1/Reference date]

1. Set each item.

2. Select [End].



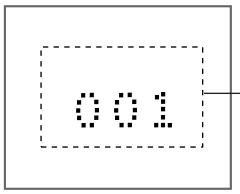
Setting data	Selection	Details
Year	2001 to 2099 (default setting: 2001)	Set the reference date.
Month	1 to 12 (default setting: 10)	
Day	1 to 31 (default setting: 1)	

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Setting Inspected Regions

Set the region in which numbers are to be extracted.
The setting method depends on the extract mode (automatic/fixed) set as a measurement condition.

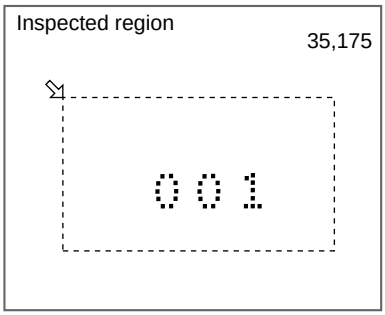
Automatic Extraction Mode



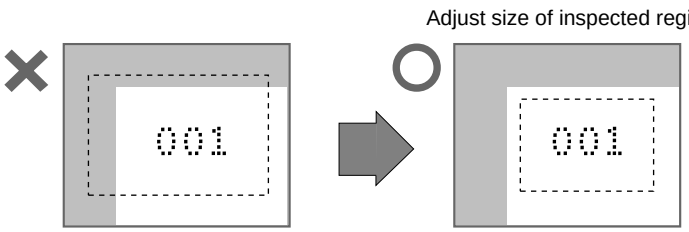
Inspected region
Set one inspected region.
The numbers will be automatically extracted from this region.
The following settings are used when extracting.
[Extract conditions/Extraction method]: p.7
[Extract conditions/Dilate level]: p.10
[Extract conditions/Noise conditions]: p.10

▶ [Lot-No. OCV1/Inspected region]

1. Draw the inspected region as a square block.
Specify the upper left and lower right coordinates.

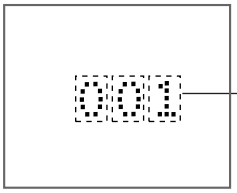


CHECK!
Draw the region so that only the target numbers fall within the region. Use End Image to remove anything other than the target numbers that overlap either vertically or horizontally on the inspected region.
p.10
If the edges overlap both vertically and horizontally, the numbers cannot be extracted correctly.
If the edges overlap in both directions, adjust the position and size of the inspected region so that only the numbers to be extracted fall within the inspected region.



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Fixed Extraction

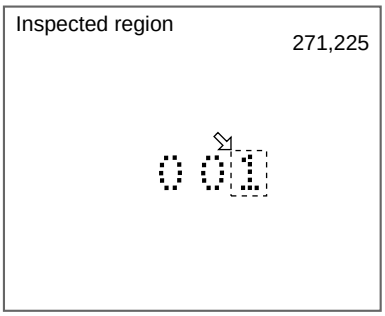


Inspected region
An inspected region is set for each digit. This enables verifying the position of individual digits.

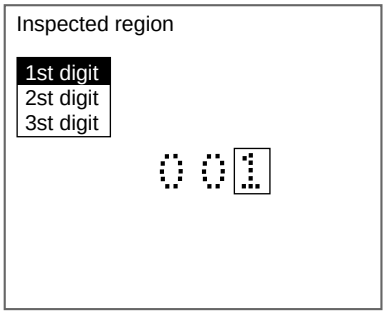
CHECK! Set the number of digits under [Measurement conditions/Lot-No. digits].
p.14

▶ [Lot-No. OCV1/Inspected region/1st digit]

1. Draw the inspected region for the first digit as a square block.
Specify the upper left and lower right coordinates.



When the lower right coordinates have been specified, the inspected region will be set and digit number selection screen will be displayed.



2. Draw inspected regions for the other digits in the same way as for the first.

CHECK! If the number of digits set for [Measurement conditions/Lot-No. digits] is changed, all of the inspected regions will be cleared. Repeat the settings from **1.**

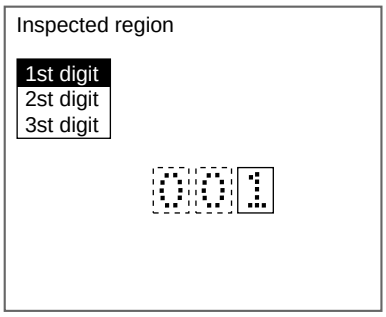
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■ Correcting Fixed Regions

▶ [Lot-No. OCV1/Inspected region/ st digit]

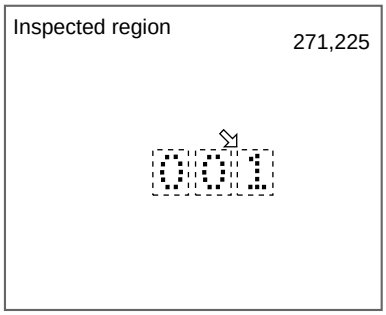
1. Select the digit for which the region is to be corrected.

The selected region will be displayed in solid lines.



An arrow cursor will be displayed at the upper left coordinates.

2. Change the region.



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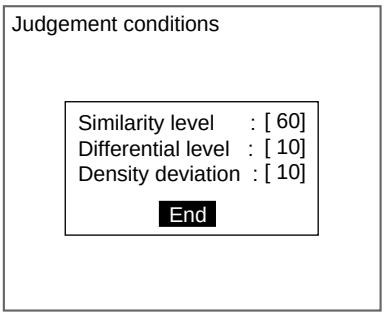
Setting judgement Conditions

Set the judgement conditions to determine if the first candidate matches a correct lot number. Also set whether to check for blank lot numbers.

▶ [Lot-No. OCV1/Judgement conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Similarity level	0 to 100 (default setting: 60)	Similarity level for OK result for 1st candidate. The judgement will be OK if this value is exceeded.
Diff. level	0 to 100 (default setting: 10)	Similarity level difference between 1st and 2nd candidates for OK result. The judgement will be OK if this value is exceeded.
Density deviation	0 to 127 (default setting: 10)	If fixed extraction and no zero suppression are used, then this value is used to determine if the fixed region is blank or not when the lot number does not require all of the digits. A blank is output if the density deviation is below this value. Set the value to 0 if the blank check is not to be performed.

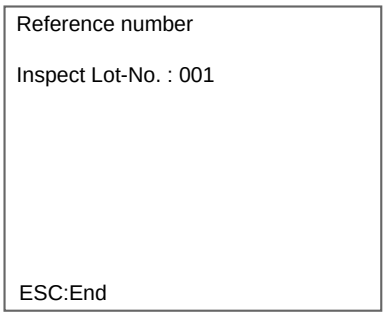
Checking the Lot Number

This function can be used to check the numbers that are being verified.

▶ [Lot-No. OCV1/Reference number]

1. Check the characters that have been set as the verification reference.

2. Press the ESC Key to exit.

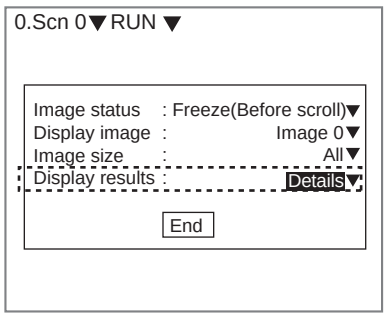


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Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].

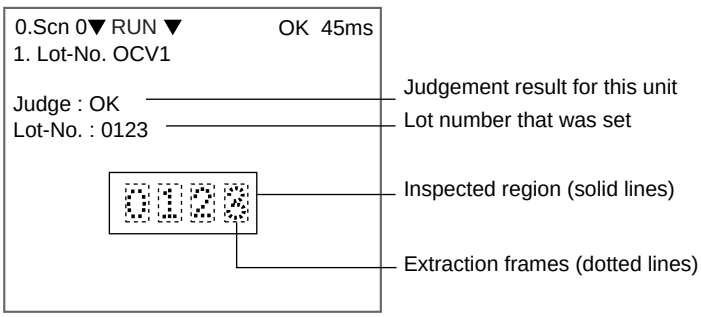


Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed. Use the SHIFT+Right or Left Keys to switch in order between the two screens.

(1) Inspected Regions

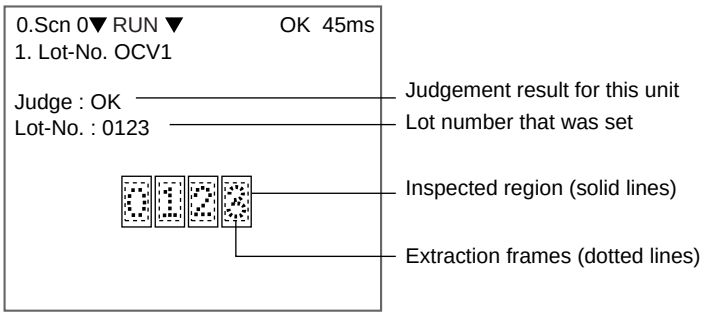
The judgement result for this unit, the set lot number, the inspected regions, and the extraction frame for each number will be displayed.

- Auto Extract Mode



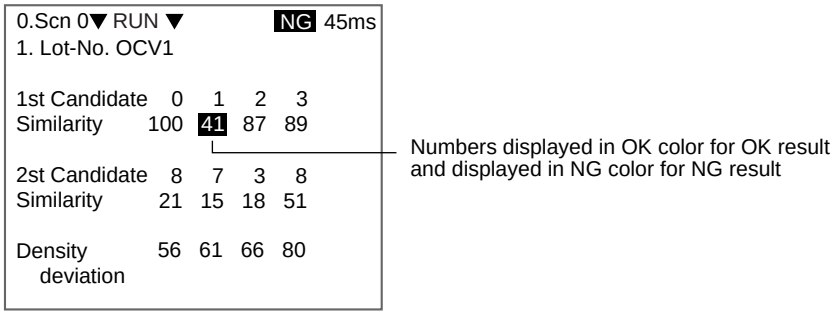
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• Fixed Extract Mode



(2) Measurement Values

The first candidate similarity, second candidate similarity, and density deviation are displayed in list form.



When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.

This section describes each item displayed in the submenu.

For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Unit judgement result (-2: Not measured -1: NG 0: OK)
The following measurement data is for N digit (1 to 4).		
Judgement	JG*	Judgement result (-2: Not measured -1: NG 0: OK)
Candidate 1	CF*	Candidate 1
Similarity 1	VF*	Similarity of 1st candidate
Candidate 2	CS*	Candidate 2
Similarity 2	VS*	Similarity of 2nd candidate

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Unit judgement result (-2: Not measured -1: NG 0: OK)
The following measurement data is for N digit (1 to4).	
5N-4	Judgement result (-2: Not measured -1: NG 0: OK)
5N-3	Candidate 1
5N-2	Similarity of 1st candidate
5N-1	Candidate 2
5N	Similarity of 2nd candidate

■ Setting Data

Data type	Details
32	Measurement image (0: Image 0 1: Image 1)
33	Character color (0: Black 1: White)
34	Rotation compensation (0: OFF 1: ON)
35	Inclination compensation (0: OFF 1: ON)
36	Shading level compensation (0 to 10)
37	Binary method (0: Manual 1: Auto)
38	Binary lower limit threshold (0 to 255)
39	Binary upper limit threshold (0 to 255)
40	Reverse binary (0: OFF 1: ON)
41	Extraction method (0: Gap search 1: Dilate extraction 2: Even extraction)
42	Perturbation (0: OFF 1: ON)
43	No. of dilations (0 to 9)
44	Extraction direction (0: From left 1: From right)
45	End image (0: Leave 1: Erase (horizontal) 2: Erase (vertical))
46	Horizontal noise (0 to 512)
47	Noise height (0 to 484)
48	Vertical noise (0 to 484)
49	Noise width (0 to 512)
50	Printer (0: IJP 1: Laser 2: Stamp)
51	IJP font (0: All 1: 5 dot (Common) 2: 5 dot (Hitachi) 3: 5 dot (Marconi) 4: 5 dot (Domino) 5: 5 dot (Linx) 6: 5 dot (Willet) 7: 5 dot (Imaje) 8: 5 dot (KGK) 9: 7 dot (Common) 10: 7 dot (Hitachi) 11: 7 dot (Marconi) 12: 7 dot (Domino) 13: 7 dot (Linx) 14: 7 dot (Willet) 15: 7 dot (Imaje) 16: 7 dot (KGK) 17: 7 dot (EDM) 18: 9 to 12 dot 19: Over 14 dot)
52	Laser font (0: All 1: Gothic 2: OCRA 3: OCRB 4: SEMI)

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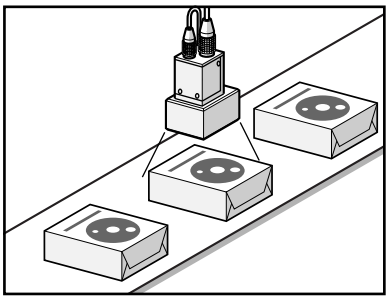
Data type	Details
53	Stamp font (0: All 1: Gothic 2: Ming-style 3: OCRA 4: OCRB)
60	Lot number digits (1 to 4)
61	Lot number default (0 to 9999)
62	Lot number maximum value (0 to 9999)
63	Lot number add value (0 to 9999)
64	Lot-No. add method (0: Day 1: Week 2: Month 3:Year)
65	0 suppress (0: OFF 1: ON)
66	Extraction mode (0: Auto 1: Fixed)
67	Position (0: Left-aligned 1: Right-aligned)
68	Output (0: No 1: Yes)
69	Day (1 to 31)
70	Month (1 to 12)
71	Year (2001 to 2099)
72	Similarity judgement condition (1 to 100)
73	Similarity difference judgement condition (1 to 100)
74	Density deviation judgement condition (1 to 127)
Setting data for auto extraction	
80	Upper left X coordinate (0 to 511)
81	Upper left Y coordinate (0 to 483)
82	Lower right X coordinate (0 to 511)
83	Lower right Y coordinate (0 to 483)
Preset data for fixed 1st digit	
84	Upper left X coordinate (0 to 511)
85	Upper left Y coordinate (0 to 483)
86	Lower right X coordinate (0 to 511)
87	Lower right Y coordinate (0 to 483)
Preset data for fixed 2nd digit	
88	Upper left X coordinate (0 to 511)
89	Upper left Y coordinate (0 to 483)
90	Lower right X coordinate (0 to 511)
91	Lower right Y coordinate (0 to 483)
Preset data for fixed 3rd digit	
92	Upper left X coordinate (0 to 511)
93	Upper left Y coordinate (0 to 483)
94	Lower right X coordinate (0 to 511)
95	Lower right Y coordinate (0 to 483)
Preset data for fixed 4th digit	
96	Upper left X coordinate (0 to 511)
97	Upper left Y coordinate (0 to 483)
98	Lower right X coordinate (0 to 511)
99	Lower right Y coordinate (0 to 483)

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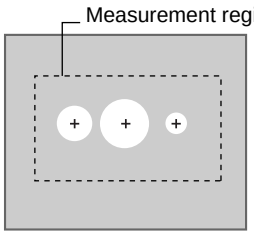
Labeling

The Labeling processing item counts how many labels there are in a measurement region and calculates the area and center of gravity for the specified label number. Images read by the Camera are converted to binary images and the white pixels are measured.

Example: Inspecting the Number of Labels

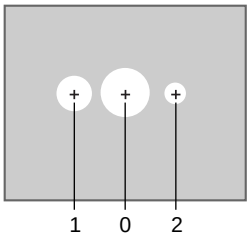


Images are converted to binary images so that the labels are white, and the areas and centers of gravity of the labels are calculated.



The labels that are extracted are sorted according to area or position of their center of gravity, and each label is assigned a number.

Example: Sorted in descending areas



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Operational Flow

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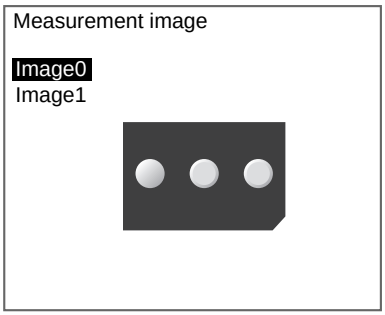
Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [Labeling/Measurement image]

1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.



Setting Binary Levels

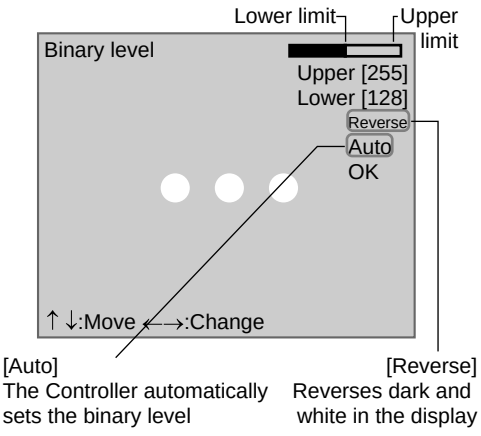
Set the level for converting 256-gradation images into binary images. The Controller performs measurement for the white pixels. Therefore, make the settings so that the label measurement areas are white.
In this explanation, 3 circles on a measurement object will be used as an example.

▶ [Labeling/Binary]

1. Move the cursor to the upper value and use the Left and Right Keys to adjust the value.

2. Use the same method to change the lower value.

3. Select [OK].



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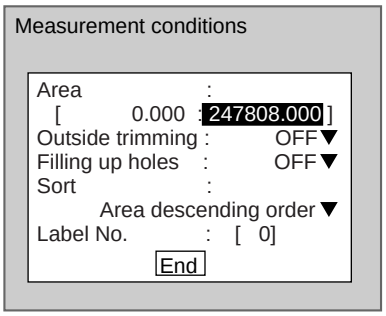
Setting Measurement Conditions

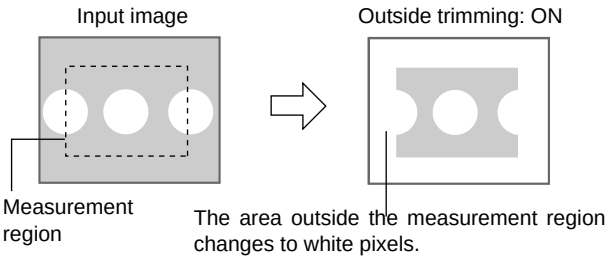
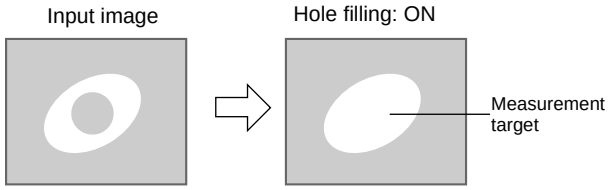
Set the [Area], [Sort], and [Label No.] as conditions for label measurement.
Change the other settings as well when necessary.

▶ [Labeling/Measurement conditions]

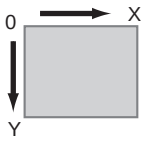
1. Set each item.

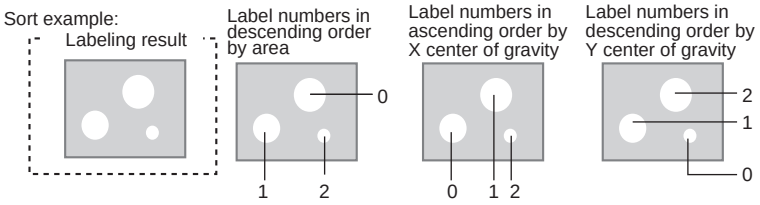
2. Select [End].



Setting data	Selection	Details
Area	0 to 9,999,999.999 (default setting: 0)	Set the range of areas to be judged as a label.
Outside trimming	ON OFF (default setting)	Select Outside trimming when there is a white-pixel area inside the measurement region that is not to be measured. If [ON] is selected, all pixels outside the measurement region will be measured as white pixels. 
Filling up holes	ON OFF (default setting)	Use the Filling up holes setting to specify how areas of black pixels contained inside donut-shaped areas of white pixels are processed. If selected, the black pixels will be processed as white pixels. 

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<table>
<tr><th>Setting data</th><th>Selection</th><th>Details</th></tr>
<tr><td>Sort</td><td colspan="2">Set the label number re-assignment conditions.
The upper left corner will be used as the origin when sorting by center of gravity X and Y.
The coordinates set using calibration are not affected by labeling.






When Position compensation is set, the sort is performed on center of gravity coordinates after position compensation.</td></tr>
<tr><td></td><td>Area descending order
(default setting)</td><td>Sorts in descending order by area</td></tr>
<tr><td></td><td>Area ascending</td><td>Sorts in ascending order by area.</td></tr>
<tr><td></td><td>X gravity descending</td><td>Sorts in descending order by center of gravity X.</td></tr>
<tr><td></td><td>X gravity ascending</td><td>Sorts in ascending order by center of gravity X.</td></tr>
<tr><td></td><td>Y gravity descending</td><td>Sorts in descending order by center of gravity Y.</td></tr>
<tr><td></td><td>Y gravity ascending</td><td>Sorts in ascending order by center of gravity Y.</td></tr>
<tr><td>Label No.</td><td>0 to 10,000
(default setting: 0)</td><td>Specify the label number for data output.
The number of measurable labels varies depending on the controller model.
 p.12</td></tr>
</table>

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Drawing Measurement Regions

When a measurement region is drawn, measurement is performed for the displayed image and the results are registered as the reference values (area and the position of center of gravity of the label number specified under Measurement conditions).

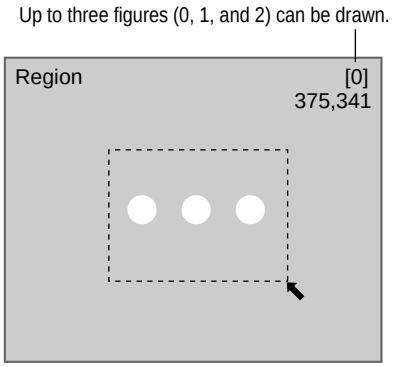
CHECK!

Regions can be created by combining up to 3 different figures. Regions with complicated shapes can be drawn and areas can be omitted from the measurement region by combining figures.

▶ [Labeling/Region/New/figure/drawing mode]

1. Draw a figure in the region to be measured.

SECTION 1 Basic Operating Procedures, “Drawing a Region”



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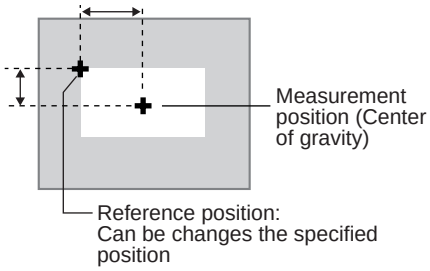
Re-registering Reference Values

This operation is performed when only the reference value is to be re-registered.
When a measurement region is drawn, the measurement is performed for the displayed image and the results are registered as the reference values. If the re-registering function explained here is used, only the reference values for the image currently displayed will be registered.
(The area and center of gravity of the specified label number is registered for the reference value.)

CHECK!

The reference position can be changed to enable the following function.

- Measuring Positions from a Specified Position
  Once the reference values have been obtained for the image currently displayed, the reference position is changed to an suitable point. Position inspection can be performed by calculating the difference between this reference position and the measurement position.



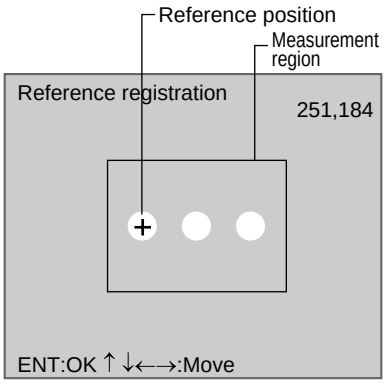
CHECK!

When the measurement region is changed, the reference value returns to the default setting.

▶ [Labeling/Reference registration]

1. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.



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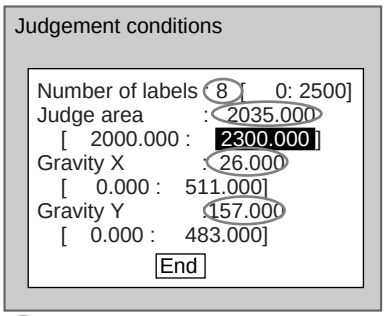
Setting Judgement Conditions

Set the ranges for the number of labels, area and center of gravity for an OK judgement.
Range for an OK judgement

▶ [Labeling/Judgement conditions]

1. Set each item.

2. Select [End].



: The measurement results for the displayed image.
Use these values as references in setting the upper and lower limits.

Setting data	Selection	Details
Number of labels	0 to 10,000*	Set the number of labels in measurement region.
Judge area	0 to 9,999,999.999	Area range of the specified label number
Gravity X	-9,999.999 to 9,999.999	Range of movement of the specified label number in the X direction
Gravity Y	-9,999.999 to 9,999.999	Range of movement of the specified label number in the Y direction

* The number of measurable labels varies depending on the controller model.

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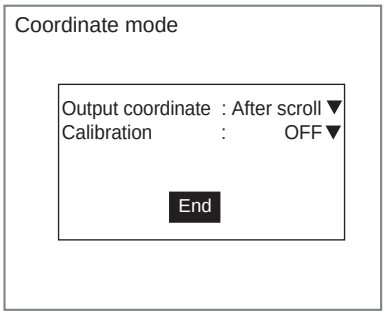
Setting the Coordinate Mode

Select the type of coordinate values.

CHECK!

If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [Labeling/Coordinate mode]



1. Set each item.

2. Select [End].

Settings Data

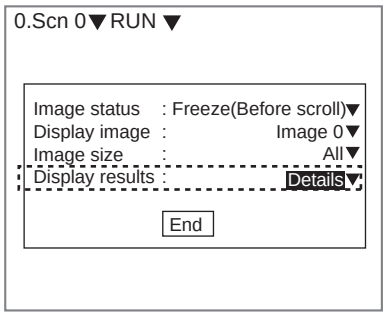
SECTION 7 Appendix, “Coordinate Handling Method”

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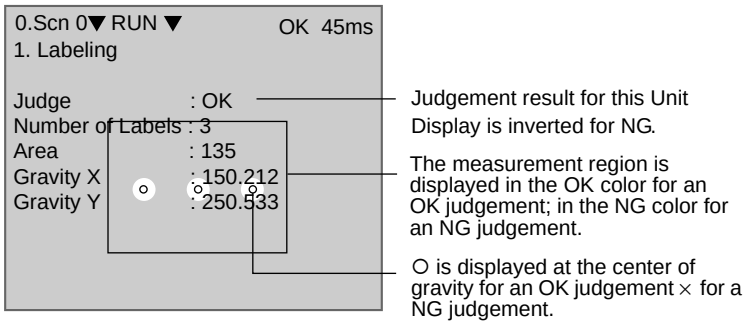
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Number of labels	L	Number of labels measured
Center of gravity	X	X coordinate of center of gravity for measurement result
Center of gravity	Y	Y coordinate of center of gravity for measurement result
Area	AR	Area for measurement result
Reference position	SX	X coordinate when measurement region drawn
Reference position	SY	Y coordinate when measurement region drawn
Reference area	SA	Area when measurement region drawn
Displacement	DX	Difference between measured and reference X coordinate
Displacement	DY	Difference between measured and reference Y coordinate
Difference area	DA	Difference between measured area and reference area

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Number of labels measured
2	X coordinate of center of gravity for measurement result
3	Y coordinate of center of gravity for measurement result
4	Area for measurement result
5	X coordinate when measurement region drawn
6	Y coordinate when measurement region drawn
7	Area when measurement region drawn
8	Difference between measured and reference X coordinate
9	Difference between measured and reference Y coordinate
10	Difference between measured area and reference area

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■ Setting Data

Data type	Details
31	Measurement image (0: Image 0 1: Image 1)
32	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF 2: After scroll, calibration ON 3: Before scroll, calibration ON)
33	Measurement region upper left X (0 to X_MAX) (See *1, *2)
34	Measurement region upper left Y (0 to Y_MAX) (See *1, *2)
35	Measurement region lower right X (0 to X_MAX) (See *1, *2.)
36	Measurement region lower right Y (0 to Y_MAX) (See *1, *2.)
37	Binary level upper limit (0 to 255)
38	Binary level lower limit (0 to 255)
39	Reverse binary level (0: Not reversed 1: Reversed)
40	Area upper limit (0 to 9,999,999.999)
41	Area lower limit (0 to 9,999,999.999)
42	Filling up holes (0: OFF 1: ON)
43	Sort (0:Area descending 1: Area ascending 2:X gravity descending 3: X gravity ascending 4:Y gravity descending 5: Y gravity ascending)
44	Outside trimming (0: OFF 1: ON)
45	Label number (0 to 9999)
46	No. of labels upper limit (0 to 10000)
47	No. of labels lower limit (0 to 10000)
48	Area upper limit (0 to 9,999,999.999)
49	Area lower limit (0 to 9,999,999.999)
50	Gravity X upper limit (-9,999.999 to 9,999.999)
51	Gravity X lower limit (-9,999.999 to 9,999.999)
52	Gravity Y upper limit (-9,999.999 to 9,999.999)
53	Gravity Y lower limit (-9,999.999 to 9,999.999)

*1: If these settings are changed, one rectangular region will be set and the previously drawn figures will be deleted.

*2: The range varies depending on the controller model.

Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

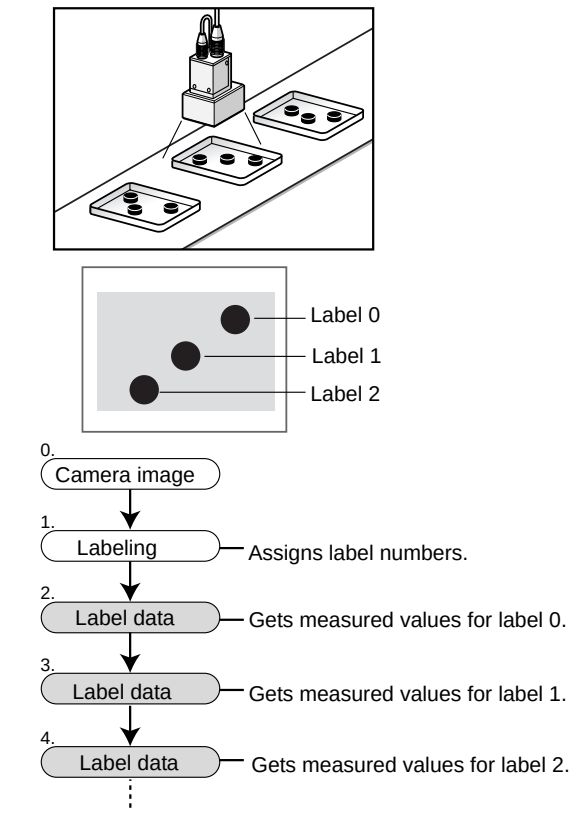
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Label Data

The Label Data processing item can be used to get the data for a specified label number from the measured values held by another unit.
The referenced processing item must be one of the following, all of which perform label processing.

- Labeling
- Fine matching
- EC Defect Inspection

Example: Getting the Position for Each Group



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Operational Flow

Selecting the Reference Unit Number 3

Selecting the Label Number 4

Setting Judgement Conditions 5

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- Submenus for Expressions 7
- External Reference Table 7

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Selecting the Reference Unit Number

Select the unit number of the processing item to be referenced.

The unit numbers for which the following processing items are set will be displayed as selections.

- Labeling
- Fine matching (Select a unit for which label area is set as the defect detection method.)
- EC Defect (Select a unit that is set for a labeling inspection region.)

CHECK!

Do not allow units for the following processing items to come between the label data unit and the unit that is being referenced.

Processing item	Affect
Inputting Camera Images	Calibration will not be properly performed for the measurement results of the Label Data processing item.
Switch camera	
Processing items for position compensation	The Label Data processing item will not be able to get the data from before scrolling.

▶ [Label data/Label unit]

1. Select the unit number of the labeling processing item from which to get the date.

2. Select [End].



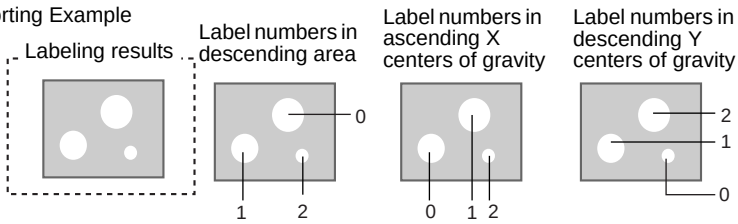
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Selecting the Label Number

Select the label number that is to be referenced.
When an EC Defect processing item is being referenced, select the inspection region number as the label number.

CHECK!

Label numbers are assigned during the labeling process according to the sort conditions.



▶ [Label data/Label No.]

1. Set the desired label no.

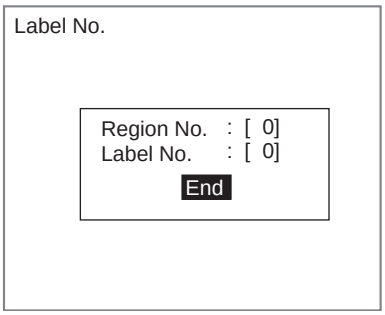
Example for when Labeling or Fine Matching is the reference unit



CHECK!

When the reference unit is EC Defect, a selection item will also be displayed for the [Region number].
Set the number of the inspection region for which [Labeling] has been set.

Example for when EC Defect is the reference unit



2. Select [End].

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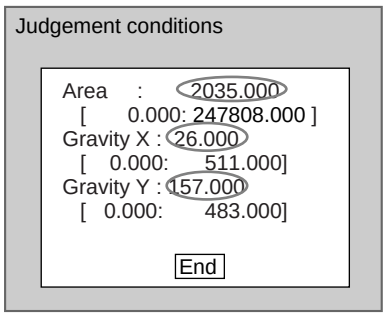
Setting Judgement Conditions

Set the judgement conditions for the label data that was obtained (area and center of gravity).
Range for an OK judgement

▶ [Label data/Judgement conditions]

1. Set each item.

2. Select [End].



: The measurement results for the displayed image.
Use these values as references in setting the upper and lower limits.

Setting data	Selection	Details
Area	0 to 9,999,999.999	Area range of the specified label number
Gravity X	-9,999.999 to 9,999.999	Range of movement of the specified label number in the X direction
Gravity Y	-9,999.999 to 9,999.999	Range of movement of the specified label number in the Y direction

Setting the Coordinate Mode

Select the type of coordinate values.

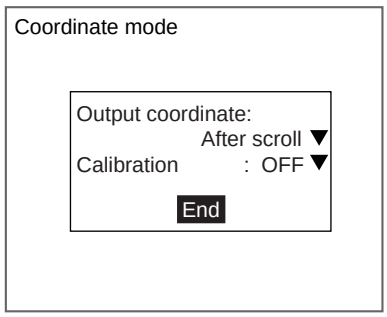
CHECK!

If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [Label data/Coordinate mode]

1. Set each item.

2. Select [End].



Settings Data

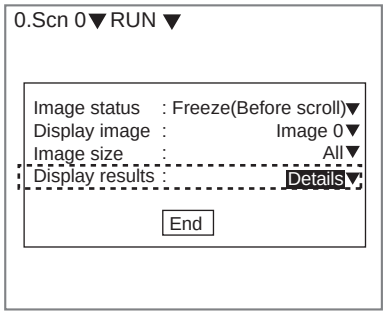
SECTION 7 Appendix, “Coordinate Handling Method”

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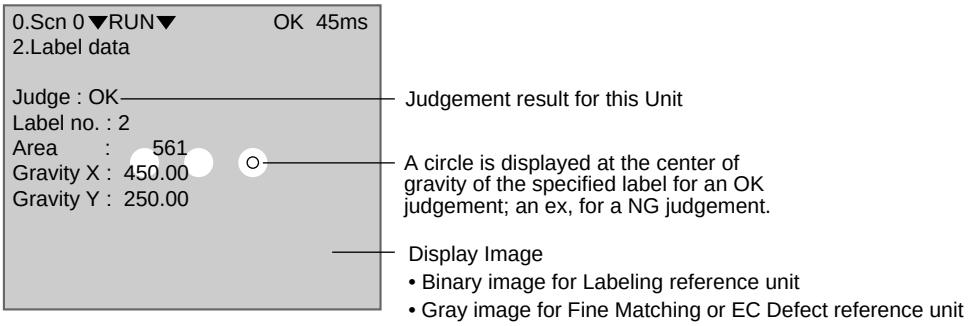
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed. This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Setting data	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Label Number	LN	Measured label number
Center of gravity	X	X coordinate of center of gravity for measurement result
Center of gravity	Y	Y coordinate of center of gravity for measurement result
Area	AR	Area for measurement result

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Measured label number
2	X coordinate of center of gravity for measurement result
3	Y coordinate of center of gravity for measurement result
4	Area for measurement result

■ Setting Data

Data type	Details
32	Label unit number (-1 to 9999)
33	Label number (0 to 9999) (See *1.)
34	Region number (0 to 7)
35	Gravity X upper limit (-9,999.999 to 9,999.999)
36	Gravity X lower limit (-9,999.999 to 9,999.999)
37	Gravity Y upper limit (-9,999.999 to 9,999.999)
38	Gravity Y lower limit (-9,999.999 to 9,999.999)
39	Area upper limit (0 to 9,999,999.999)
40	Area lower limit (0 to 9,999,999.999)
41	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF 2: After scroll, calibration ON 3: Before scroll, calibration ON)

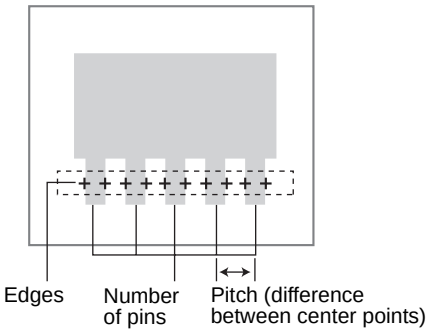
*1: The number of labels that can be measured varies with the processing item that refers to the data.

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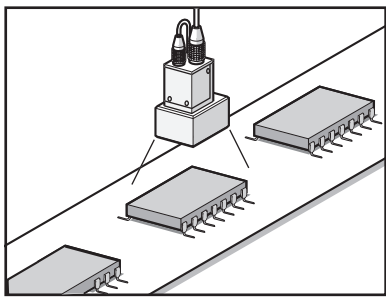
Edge Pitch

Use the Edge Pitch processing item to find edges through density variations. This can be done, for example, to obtain the number of pins, the widths between pins, or the pin pitch on ICs or connectors.

The number of pins can be obtained, along with the pitch and width.



Example: Inspection for the Number of IC Pins



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Operational Flow

Selecting Measurement Images 3

Set the edge detection conditions 3

Drawing Measurement Regions 4

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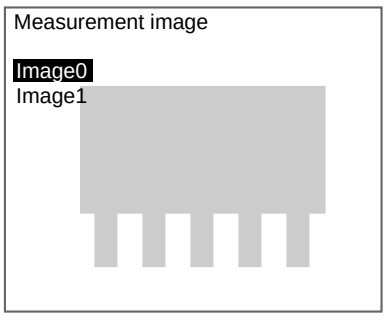
- Submenus for Expressions 9
- External Reference Table 10

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Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [Edge pitch/Measurement image]



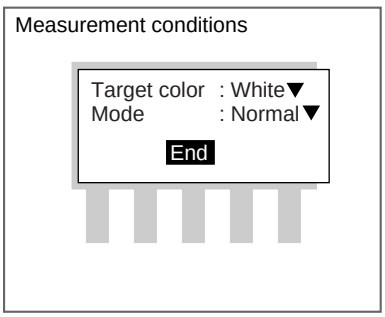
1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.

Set the edge detection conditions

Set the search conditions for edges.

▶ [Edge pitch/Measurement conditions]



1. Set each item.

2. Select [End].

Setting data	Selection	Details
Target color	White (default setting) Black	Select the color to be counted.
Mode	Normal (default setting)	Use when the pin width and pitch are 2 pixels or more.
	Fine	Use to stably detect the number of pins for smaller widths and pitches than for [Normal].

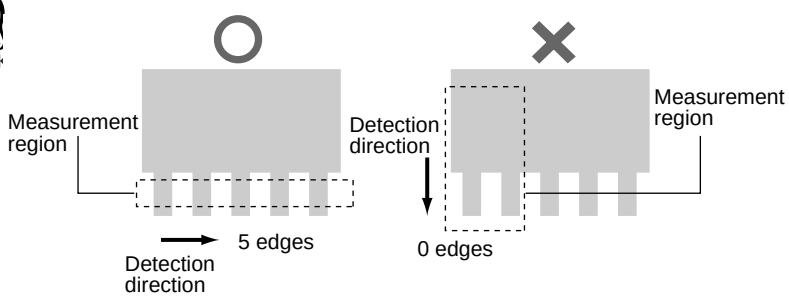
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Drawing Measurement Regions

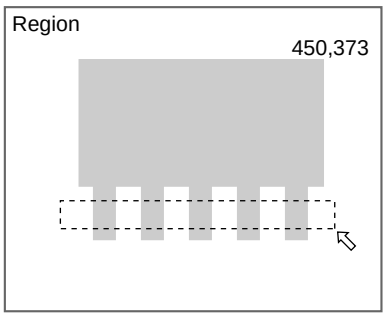
Draw a region to include all the edges to be detected.

CHECK

Edges are detected in the direction of the long side of the measurement region.



▶ [Edge pitch/Region]



1. Draw a box-shaped region.

Specify the upper left and lower right coordinates.

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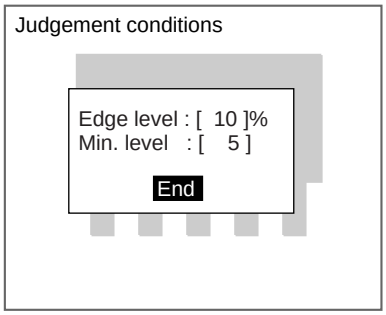
Setting Judgement Conditions

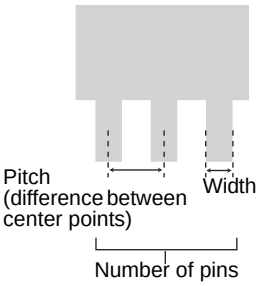
Set the ranges for an OK judgement.

▶ [Edge pitch/Judgement conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Number of pins	0 to 511	Set the ranges for an OK judgement. 
Range for average pitch	0 to 9999.999	
Range for average width	0 to 9999.999	

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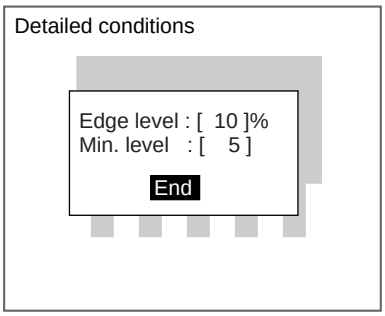
Changing Detailed Conditions

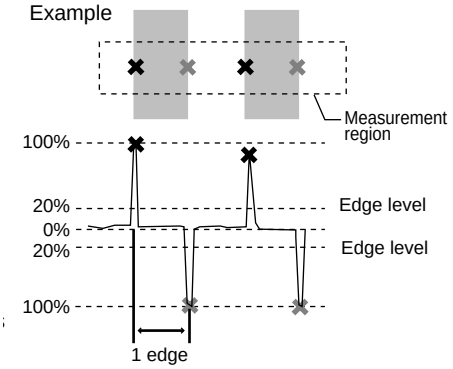
Change the detailed conditions when the measurement results are unstable. Normally, the method can be left on the default setting. After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

▶ [Edge pitch/Detailed conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Edge Level	0 to 100 (default setting: 50)	Set a density change level between 0 and 100 that will indicate the edge. If the measured number of objects is less than the actual number of objects, set the edge level (or the minimum level) to a smaller value. If the measured number of objects is greater than the actual number of objects, set the edge level (or the minimum level) to a larger value. Example 
Min. level	0 to 255 (default setting: 5)	To prevent incorrect detection due to noise. If the density variation is less than the minimum value, it will be considered to be noise.

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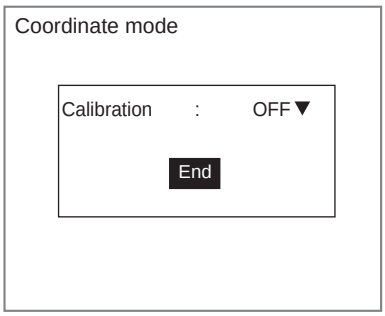
Setting the Coordinate Mode

Select the type of coordinate values.

CHECK!

If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [Edge pitch/Coordinate mode]



1. Set each item.

2. Select [End].

Settings Data

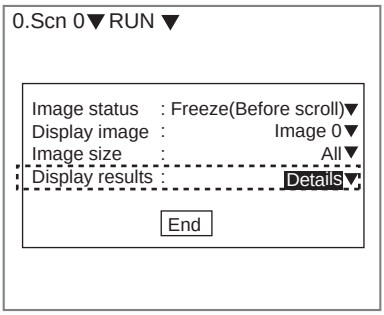
SECTION 7 Appendix, “Coordinate Handling Method”

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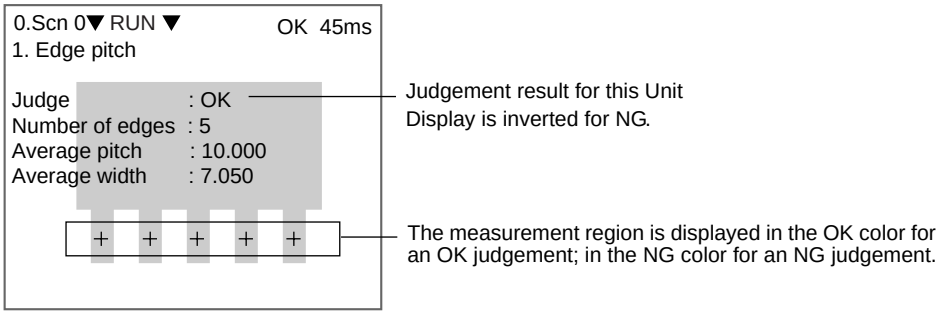
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Number of edges	N	Number of detected edges
Range for average pitch	P	Average detected edge pitch
Max. pitch	PH	Maximum detected edge pitch
Min. pitch	PL	Minimum detected edge pitch
Range for average width	W	Average detected edge width
Max. width	WH	Maximum detected edge width
Min. width	WL	Minimum detected edge width

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Number of detected edges
2	Average detected edge pitch
3	Maximum detected edge pitch
4	Minimum detected edge pitch
5	Average detected edge width
6	Maximum detected edge width
7	Minimum detected edge width

■ Setting Data

Data type	Details
31	Measurement image (0: Image 0 1: Image 1)
32	Coordinate mode (0: Calibration OFF 1: Calibration ON)
33	Number of edges upper limit (0 to 511)
34	Number of edges lower limit (0 to 511)
35	Pitch upper limit (0 to 9,999.999)
36	Pitch lower limit (0 to 9,999.999)
37	Width upper limit (0 to 9,999.999)
38	Width lower limit (0 to 9,999.999
39	Region upper left X (0 to X_MAX) (See *1.)
40	Region upper left Y (0 to Y_MAX) (See *1.)
41	Region lower right X (0 to X_MAX) (See *1.)
42	Region lower right Y (0 to Y_MAX) (See *1.)
43	Target color (0:White 1: Black)
44	Edge level (0 to 100)
45	Minimum level (0 to 255)
46	Mode (0:Normal 1: Fine)

*1 The range varies depending on the controller model.

Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

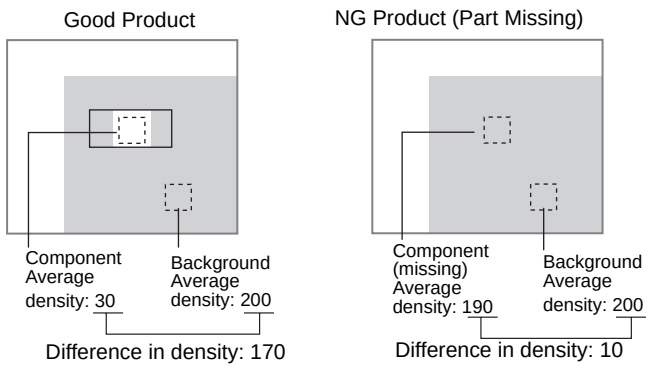
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Density Data

The Density Data processing item can be used to inspect for the presence of the measurement object. The Density Data processing item detects the density of each pixel (0 to 255) and calculates the density average and deviation to be used for inspection. Because the density deviations are compared, the effects on inspection of dark images can be reduced, e.g., when illumination deteriorates.

Example: Inspecting for the Presence of Electronic Components

Two measurement regions are set: One in the area where the electronic component is and one on the background. The difference between these regions is used to check for the presence of the component.



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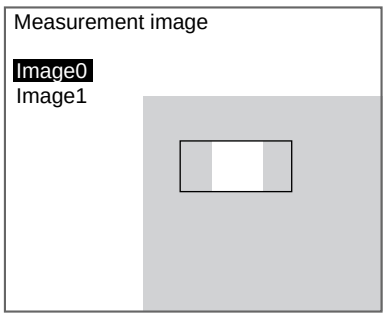
External Reference Table 7

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Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [Density data/Measurement image]



1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.

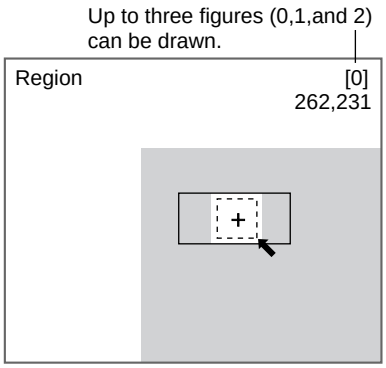
Drawing Measurement Regions

Draw the region for which the density is to be found.

CHECK!

Regions can be created by combining up to 3 different figures. Regions with complicated shapes can be drawn and areas can be omitted from the measurement region by combining figures.

▶ [Density data/Region/New/figure/drawing mode]



1. Draw a figure in the region to be measured.

SECTION 1 Basic Operating Procedures, “Drawing a Region”

When the figure is drawn, the measurement region will be displayed with a + cursor at the center of gravity.

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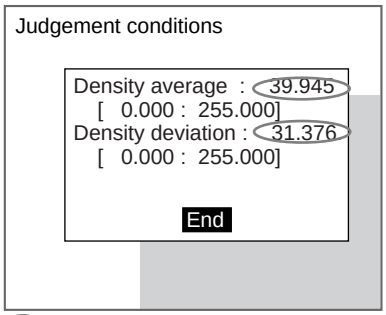
Setting judgement Conditions

Set the ranges for an OK judgement.

▶ [Density data/Judgement conditions]

1. Set each item.

2. Select [End].



: The measurement results for the displayed image.
Use these values as references in setting the upper and lower limits.

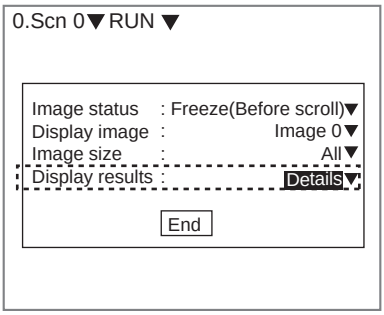
Setting data	Selection	Details
Density average	0.000 to 255.000	Average density range
Density deviation	0.000 to 127.000	Density deviation range

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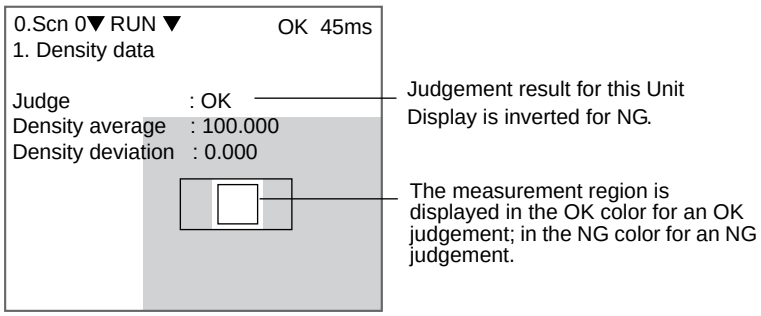
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Density average	AV	Average density of measurement result
Density deviation	DV	Density deviation of measurement result
Reference average	SA	Average density when measurement region drawn
Reference deviation	SD	Density deviation when measurement region drawn
Difference average	DA	Difference between the measured and reference average density
Difference deviation	DD	Difference between the measured and reference density deviation

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Average density of measurement result
2	Density deviation of measurement result
3	Average density when measurement region drawn
4	Density deviation when measurement region drawn
5	Difference between the measured and reference average density
6	Difference between the measured and reference density deviation

■ Setting Data

Data type	Details
31	Measurement image (0: Image 0 1: Image 1)
32	Density average upper limit (0 to 255.000)
33	Density average lower limit (0 to 255.000)
34	Density deviation upper limit (0 to 127.000)
35	Density deviation lower limit (0 to 127.000)
36	Region upper left X (0 to X_MAX) (See *1, *2)
37	Region upper left Y (0 to Y_MAX) (See *1, *2)
38	Region lower right X (0 to X_MAX) (See *1, *2.)
39	Region lower right Y (0 to Y_MAX) (See *1, *2.)

*1: If these settings are changed, one rectangular region will be set and the previously drawn figures will be deleted.

*2: The range varies depending on the controller model.

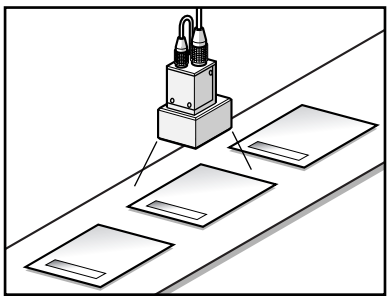
Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

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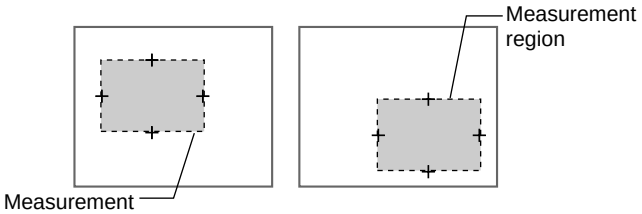
Area (Var. Box)

This processing item is used to check the size (area) and position (center of gravity) of a measurement object whose size or position changes.
Since the location of the object is determined using the four-side detected edges of the object, inspection is still possible even if the size or position of the object changes.

Example: Adhesive application Inspection



With the edges detected, the Controller can determine where the measurement object is. Even if the size and position of the measurement object changes, the Controller can move the measurement region appropriately.



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Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [Area(var. box)/Measurement image]



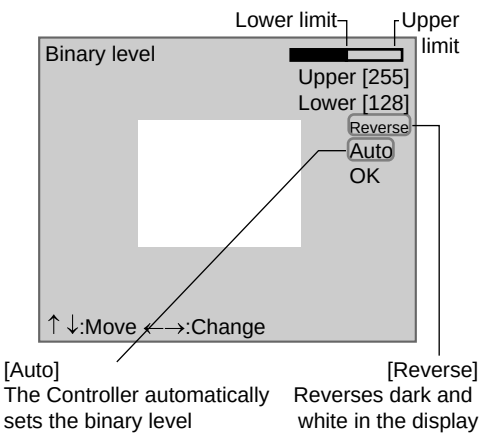
1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.

Setting Binary Levels

Set the level for converting 256-gradation images read by the Camera into binary images. Measurements are performed for the white pixels. Therefore, make the settings so that the measurement object is white. The binary level set here is used for all of the measurement regions.

▶ [Area(var. box)/Binary]



1. Move the cursor to the upper value and use the Left and Right Keys to adjust the value.

2. Use the same method to change the lower value.

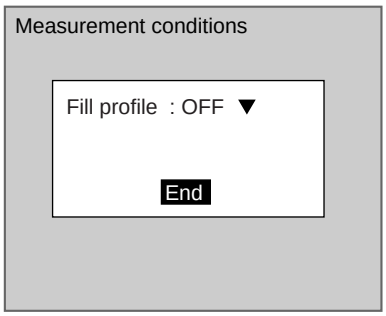
3. Select [OK].

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Setting Measurement Conditions

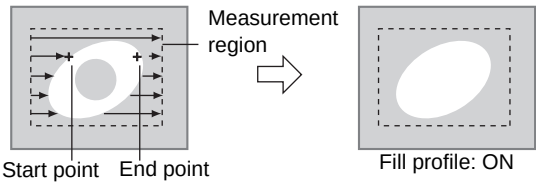
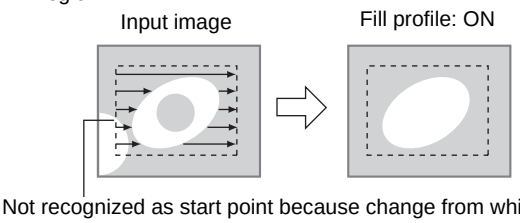
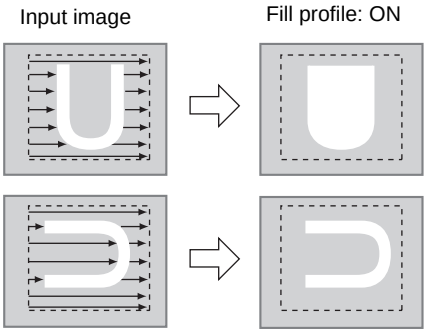
Set measurement conditions to measure the exterior of a measurement object or to make the binary levels track the brightness of the measurement image. The default for all settings is [OFF].

▶ [Area(var. box)/Measurement conditions]



1. Select [ON] or [OFF].

2. Select [End].

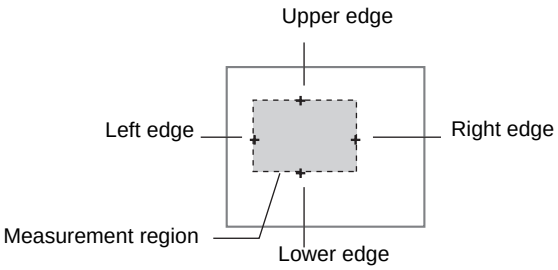
Setting data	Selection	Details
Fill Profile Function	ON OFF (default setting)	Set the fill profile function to [ON] when the exterior of the measurement object is being measured. Turn [ON] the [Fill profile] function to measure the whole area between the start point (black pixels to white) and the end point (white pixels to black) in the measurement region as white pixels.  • When a White-pixel Section Encroaches on the Measurement Region  Not recognized as start point because change from white to black. • Measuring Open-form Measurement Objects The measurement result changes depending on the orientation of the measurement object. 

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Set the measurement region

Find the edges in the density image, and set the inner area enclosed by the edge as the measurement region. Specify the upper, lower, left, and right edges of the measurement object.

If even one of the edges cannot be located, the judgement result will be NG.



When one of the edges is selected, the settings for the conditions for the selected edge will be displayed. In this example, the settings for [Left edge] will be explained. Make adjustments as necessary when setting conditions for [Upper edge], [Lower edge], and [Right edge].

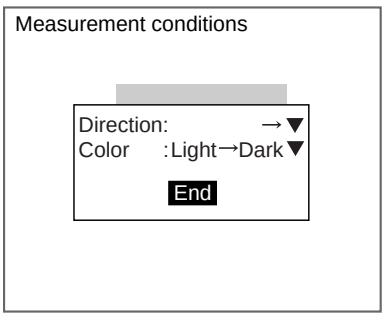
1 Set the edge detection conditions.

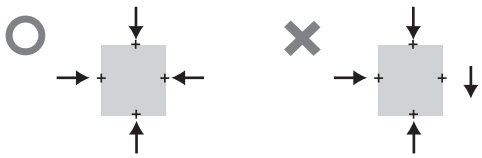
Set the direction for edge detection and the density changes.

▶ [Area(var. box)/Left edge/Measurement conditions]

1. Set each item.

2. Select [End].

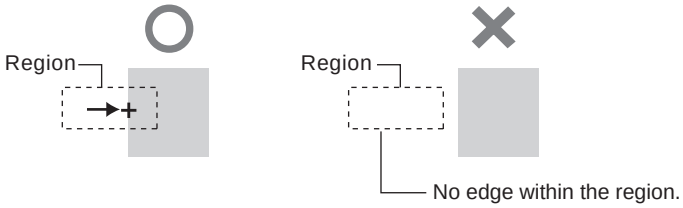


Setting data	Selection	Details
Direction	↑ , ↓ , ← , →	Set the direction to detect the edge. Set a combination of upper, lower, right, and left edge detection directions that surround the area to be measured. Example: 
Color	Light →Dark Dark →Light	Set the density change to be considered as edges.

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2 Drawing the Edge Detection Region

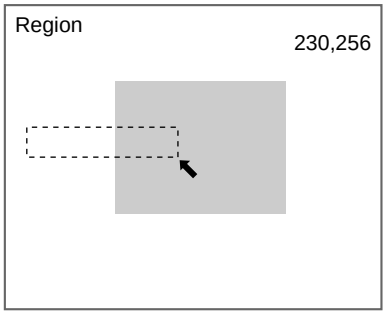
Draw a region to include the edge for detection.



▶ [Area(var. box)/Left edge/Region]

1. Draw a box-shaped region.

Specify the upper left and lower right coordinates.

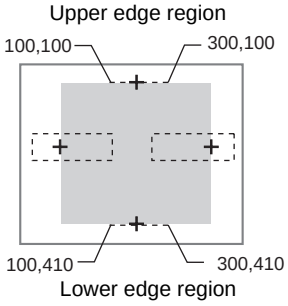


CHECK!

Use the following procedure to fix the measurement region

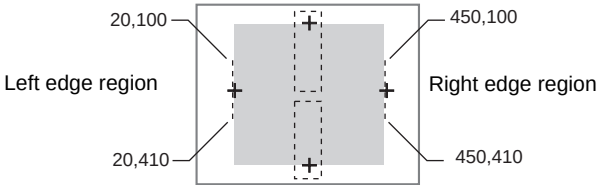
- Measurement Objects with Variable Widths Only

  Draw the edge detection region so that the measurement region Y coordinates will remain the same for both the upper and lower edges. Draw the edge detection region so that the measurement region Y coordinates will remain the same for both the upper and lower edges.



- Measurement Objects with Variable Heights Only

  Draw the edge detection region so that the measurement region X coordinates will remain the same for both the left and right edges. Draw the edge detection region so that the measurement region Y coordinates will remain the same for both the left and right edges.



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3 Changing Detailed Conditions as Required

Change the detailed conditions when the measurement results are unstable.

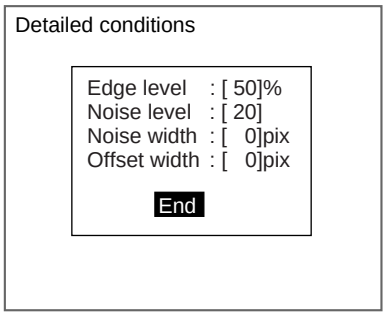
Change and set [Edge level], [Noise level], [Noise width], and [Offset width] as required. Normally, the method can be left on the default setting.

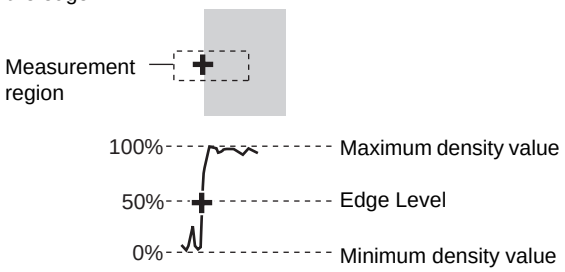
After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

▶ [Area(var. box)/Left edge/Detailed conditions]

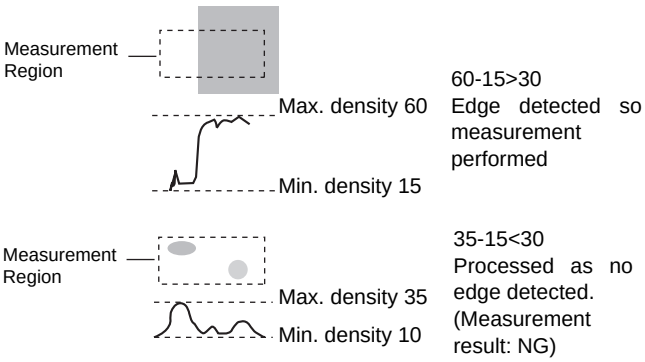
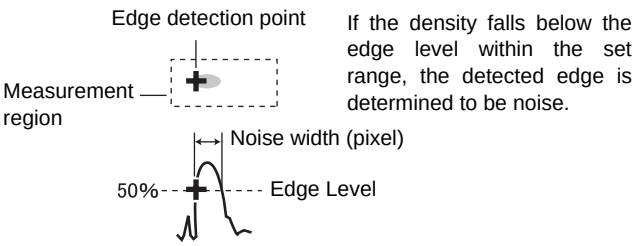
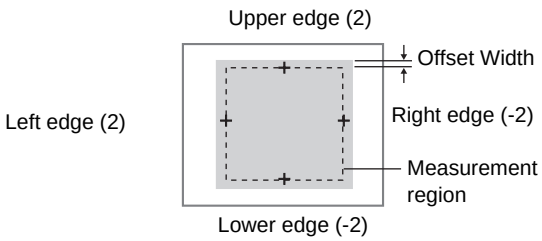
1. Set each item.

2. Select [End].



Setting data	Selection	Details
Edge Level	0 to 100 (default setting: 50)	Set a density change level between 0 and 100 that will indicate the edge. 

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Setting data	Selection	Details
Noise Level	0 to 255 (default setting: 20)	Noise level used to make judgement if edges are present or not. The maximum density and minimum density within the edge detection area is calculated and if the difference between the two values is less than the noise level, then the Controller determines that there is no edge. If noise is causing incorrect detection, make this value higher. (Within the edge detection region) Max. density - min. density < noise level →no edge →NG measurement result Max. density - min. density ≥ noise level →Edge →Used for measurement Example: When [Noise level] is set to 30 
Noise Width	0 to 255 (default setting: 0)	Set the width of objects that are to be judged as noise. If the density distribution from the position where the edge was first detected falls to below the edge level within the noise width range, the detected point is judged as noise. If noise is causing incorrect detection, make this value higher. Example: 
Offset Width	-1,023 to 1,023 (default setting: 0)	Set the adjustment width (in pixel units) for the detected edge position. Example: To Measure from 2 Pixel-widths Inside the Edge Detection Point 

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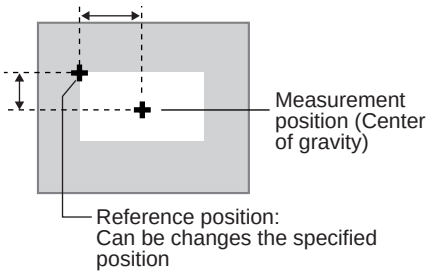
Registering Reference Positions

When detecting differences from an acceptable product, reference values must be registered. Place the acceptable product in the correct position and register the reference values. The area and center of gravity are registered for the reference values.

CHECK!

The reference position can be changed to enable the following function.

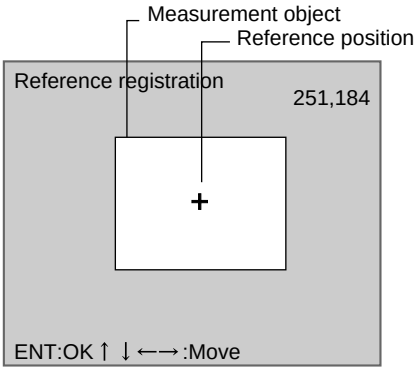
- Measuring Positions from a Specified Position
  Once the reference values have been obtained for the image currently displayed, the reference position is changed to an suitable point. Position inspection can be performed by calculating the difference between this reference position and the measurement position.



CHECK!

When the measurement region is changed, the reference value returns to the default setting.

▶ [Area(var. box)/Reference registration]



1. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.

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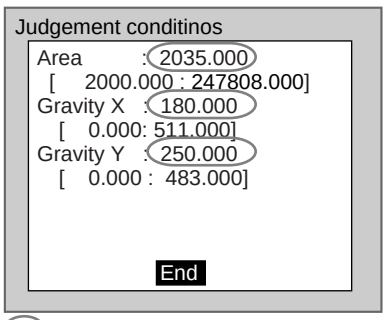
Setting Judgement Conditions

Make settings for the area and center of gravity.
Range for an OK judgement

▶ [Area(var. box)/Judgement conditions]

1. Set each item.

2. Select [End].



: The measurement results for the displayed image.
Use these values as references in setting the upper and lower limits.

Setting data	Selection	Details
Area	0 to 9,999,999.999	Set the area range for an OK judgement.
Gravity X	-9,999.999 to 9,999.999	Set the range of movement of the measurement object in the X direction for an OK judgement.
Gravity Y	-9,999.999 to 9,999.999	Set the range of movement of the measurement object in the Y direction for an OK judgement.

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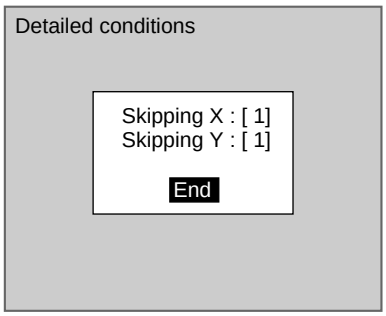
Changing Pixel Skipping (Changing Detailed Conditions)

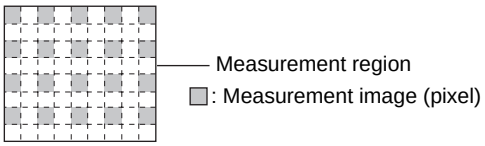
To shorten measurement processing time, change the number of pixels to be skipped.
The greater the skipping setting, the shorter the processing time. However, the accuracy of the measurement will decrease.
After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

▶ [Area(var. box)/Detailed conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Skipping X	1 to 15 (default setting: 1)	Set how many pixels to skip in the measurement region during measurement.The default setting is 1, which means that all of the measurement region will be measured. Example: Skipping X and Skipping Y are set to 2: 
Skipping Y		

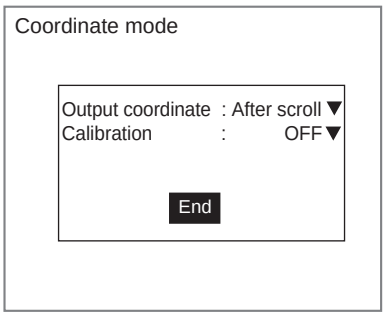
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Setting the Coordinate Mode

Select the type of coordinate values.

CHECK! If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [Area(var. box)/Left edge/Detailed conditions]



1. Set each item.

2. Select [End].

Settings Data

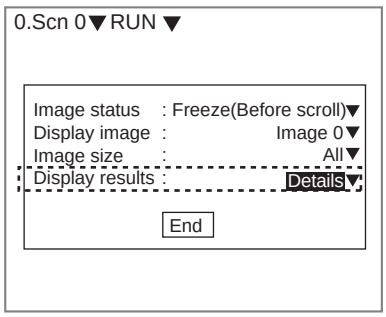
SECTION 7 Appendix, “Coordinate Handling Method”

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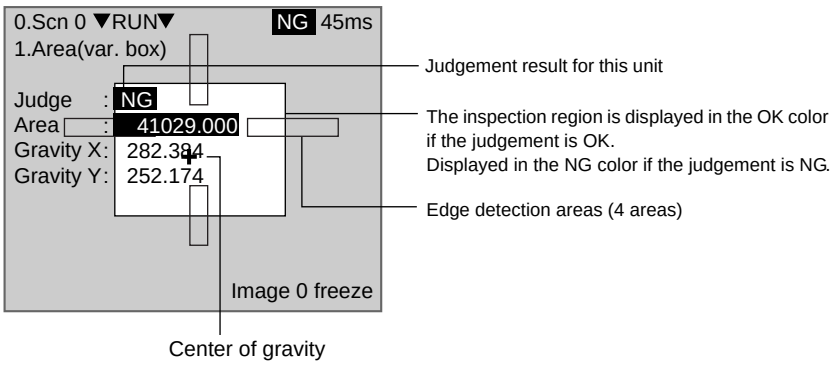
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Setting data	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Measurement region	X1	Upper left X coordinate of measurement region
Measurement region	Y1	Upper left Y coordinate of measurement region
Measurement region	X2	Lower right X coordinate of measurement region
Measurement region	Y2	Lower right Y coordinate of measurement region
Center of gravity	X	X coordinate of center of gravity for measurement result
Center of gravity	Y	Y coordinate of center of gravity for measurement result
Area	AR	Area for measurement result
Reversed area	RA	Difference between area measurement value and area for measurement result
Reference X	SX	X coordinate when measurement region drawn
Reference Y	SY	Y coordinate when measurement region drawn
Reference area	SA	Area when measurement region drawn
Displacement	DX	Difference between measured and reference X coordinate
Displacement	DY	Difference between measured and reference Y coordinate
Difference area	DA	Difference between measured area and reference area

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Upper left X coordinate of measurement region
2	Upper left Y coordinate of measurement region
3	Lower right X coordinate of measurement region
4	Lower right Y coordinate of measurement region
5	X coordinate of center of gravity for measurement result
6	Y coordinate of center of gravity for measurement result

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Data type	Details
7	Area for measurement result
8	Difference between area measurement value and area for measurement result
9	X coordinate when measurement region drawn
10	Y coordinate when measurement region drawn
11	Area when measurement region drawn
12	Difference between measured and reference X coordinate
13	Difference between measured and reference Y coordinate
14	Difference between measured area and reference area

■ Setting Data

Data type	Details
31	Measurement image (0: Image 0 1: Image 1)
32	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF 2: After scroll, calibration ON 3: Before scroll, calibration ON)
33	X upper limit (-9,999.999 to 9,999.999)
34	X lower limit (-9,999.999 to 9,999.999)
35	Y upper limit (-9,999.999 to 9,999.999)
36	Y lower limit (-9,999.999 to 9,999.999)
37	Area upper limit (-9999999.999 to 9,999,999.999)
38	Area lower limit (-9,999,999.999 to 9,999,999.999)
39	Binary level upper limit (0 to 255)
40	Binary level lower limit (0 to 255)
41	Reverse binary level (0: Not reversed 1: Reversed)
42	Skipping X (1 to 15)
43	Skipping Y (1 to 15)
44	Fill profile (0: OFF 1: ON)
45	Edge detection direction (left edge: 0: ↑ 1: ↓ 2: → 3: ←)
46	Edge color (Left edge 0: Light →dark 1: Dark →light)
47	Edge level (left edge: 0 to 100)
48	Noise level (left edge, 0 to 255)
49	Noise width (left edge, 0 to 255)
50	Offset width (left edge, -1023 to 1023)
51	Edge detection direction (upper edge, 0: ↑ 1: ↓ 2: → 3: ←)
52	Edge color (upper edge, 0: Light →Dark 1: Dark →Light)
53	Edge level (upper edge, 0 to 100)
54	Noise level (upper edge, 0 to 255)
55	Noise width (upper edge, 0 to 255)
56	Offset width (upper edge, -1023 to 1023)
57	Edge detection direction (right edge, 0: ↑ 1: ↓ 2: → 3: ←)
58	Edge color (right edge, 0: Light →Dark 1: Dark →Light)
59	Edge level (right edge, 0 to 100)
60	Noise level (right edge, 0 to 255)
61	Noise width (right edge, 0 to 255)
62	Offset width (right edge, -1023 to 1023)

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Data type	Details
63	Edge detection direction (lower edge, 0: ↑ 1: ↓ 2: → 3: ←)
64	Edge color (left edge, 0: Light →Dark 1: Dark →Light)
65	Edge level (lower edge, 0 to 100)
66	Noise level (lower edge, 0 to 255)
67	Noise width (lower edge, 0 to 255)
68	Offset width (lower edge, -1023 to 1023)
69	Region upper left X (left edge) (0 to X_MAX) (See *1.)
70	Region upper left Y (left edge) (0 to Y_MAX) (See *1.)
71	Region lower right X (left edge) (0 to X_MAX) (See *1.)
72	Region lower right Y (left edge) (0 to Y_MAX) (See *1.)
73	Region upper left X (upper edge) (0 to X_MAX) (See *1.)
74	Region upper left Y (upper edge) (0 to Y_MAX) (See *1.)
75	Region lower right X (upper edge) (0 to X_MAX) (See *1.)
76	Region lower right Y (upper edge) (0 to Y_MAX) (See *1.)
77	Region upper left X (right edge) (0 to X_MAX) (See *1.)
78	Region upper left Y (right edge) (0 to Y_MAX) (See *1.)
79	Region lower right X (right edge) (0 to X_MAX) (See *1.)
80	Region lower right Y (right edge) (0 to Y_MAX) (See *1.)
81	Region upper left X (lower edge) (0 to X_MAX) (See *1.)
82	Region upper left Y (lower edge) (0 to Y_MAX) (See *1.)
83	Region lower right X (lower edge) (0 to X_MAX) (See *1.)
84	Region lower right Y (lower edge) (0 to Y_MAX) (See *1.)
85	Reference position X (0 to X_MAX)
86	Reference position Y (0 to Y_MAX)

*1: The range varies depending on the controller model.

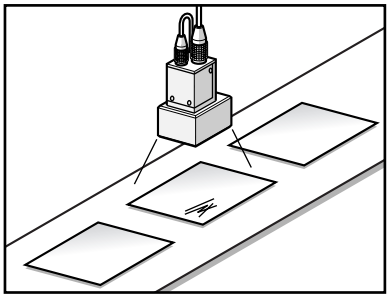
Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

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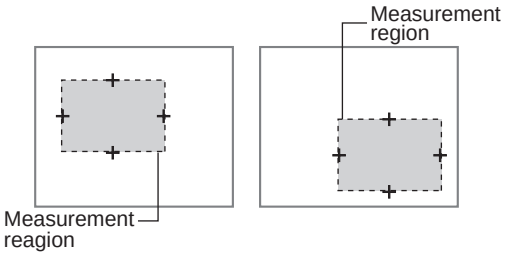
Defect (Variable Box)

This processing item is used for external inspections for defects or dirt on unbuttoned measurement objects and defects or burrs on parts, whose sizes or positions change.
Since the location of the object is determined using the four-side detected edges of the object, inspection is still possible even if the size or position of the object changes.

Example: Checking for Stains on Sheets



With the edges detected, the Controller can determine where the measurement object is. Even if the size and position of the measurement object changes, the Controller can move the measurement region appropriately.



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Operational Flow

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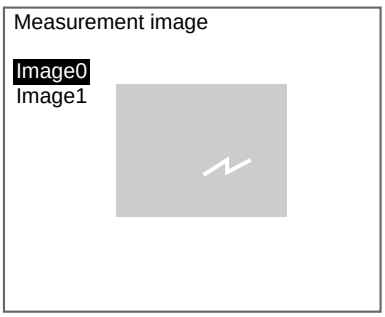
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Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [Defect (var. box)/Measurement image]



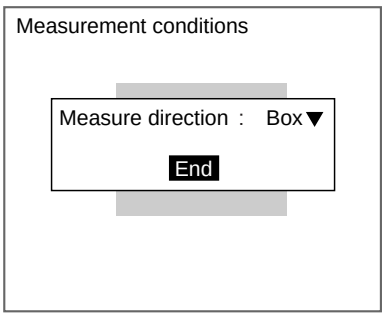
1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.

Setting Measurement Conditions

First, the upper, lower, left, and right edges of the measurement object are located. The area within the edges becomes the measurement region.
This section describes how to set the conditions to be used for calculating density changes in measurement regions.

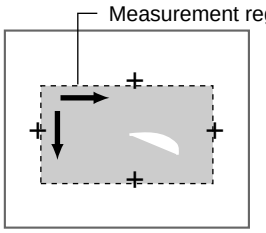
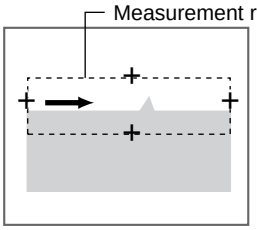
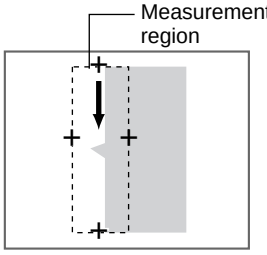
▶ [Defect (var. box)/Measurement conditions]



1. Set the desired measure direction.

2. Select [End].

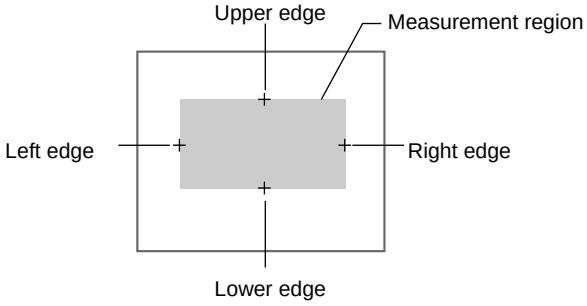
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Setting data	Details
2-dimensional	Select to detect the defects for the whole measurement region. (Calculates the variation in density in the X direction and Y direction.) 
X line	Select to detect defects or burrs in the upper or lower section of the measurement region. p.6 (Calculates the variation in density in the X direction.) 
Y line	Select to detect defects or burrs in the right or left section of the measurement region. p.6 (Calculates the variation in density in the Y direction.) 

Set the measurement region

Find the edges in the density image, and set the inner area enclosed by the edge as the measurement region. Specify the upper, lower, left, and right edges of the measurement object.

If even one of the edges cannot be located, the judgement result will be NG.



When one of the edges is selected, the settings for the conditions for the selected edge will be displayed. In this example, the settings for [Left edge] will be explained. Make adjustments as necessary when setting conditions for [Upper edge], [Lower edge], and [Right edge].

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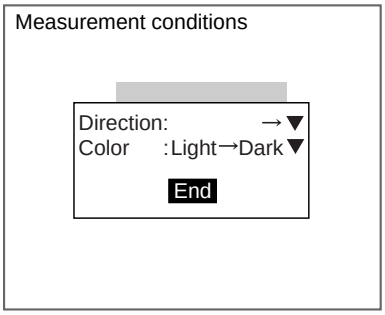
1 Set the edge detection conditions.

Set the direction for edge detection and the density changes.

▶ [Defect (var. box)/Left edge/Measurement conditions]

1. Set each item.

2. Select [End].

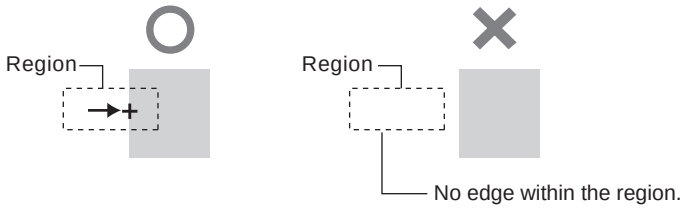


Setting data	Selection	Details
Direction	↑ , ↓, ←, →	Set the direction to detect the edge. Set a combination of upper, lower, right, and left edge detection directions that surround the area to be measured. Example: 
Color	Light →Dark Dark →Light	Set the density change to be considered as edges.

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2 Drawing the Edge Detection Region

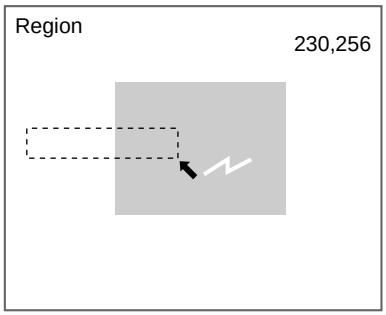
Draw a region to include the edge for detection.



▶ [Defect (var. box)/Left edge/Region]

1. Draw a box-shaped region.

Specify the upper left and lower right coordinates.

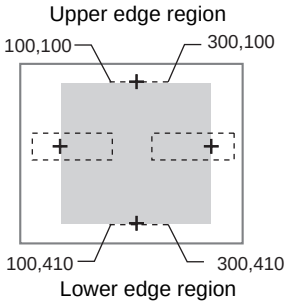


CHECK!

Use the following procedure to fix the measurement region

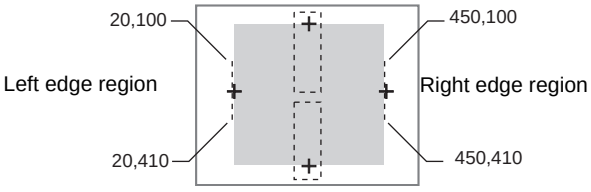
- Measurement Objects with Variable Widths Only

  Draw the edge detection region so that the measurement region Y coordinates will remain the same for both the upper and lower edges. Draw the edge detection region so that the measurement region Y coordinates will remain the same for both the upper and lower edges.



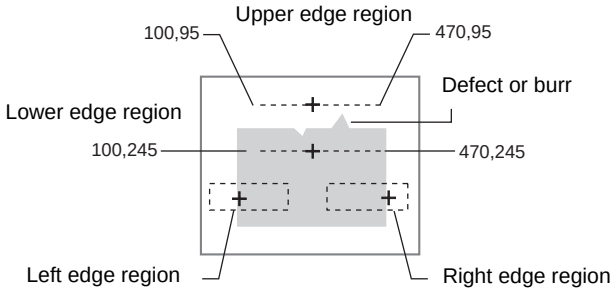
- Measurement Objects with Variable Heights Only

  Draw the edge detection region so that the measurement region X coordinates will remain the same for both the left and right edges. Draw the edge detection region so that the measurement region Y coordinates will remain the same for both the left and right edges.

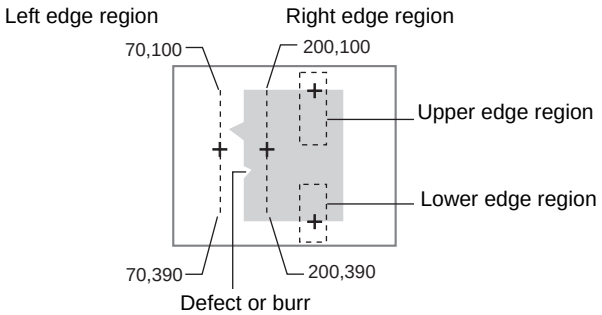


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- To measure defects and burrs in the upper section of measurement regions with variable widths only:
  Draw the edge detection region so that the measurement region Y coordinates will remain the same for both the upper and lower edges.
  The upper and lower edges will always have these edge points.
  * Specify [X line] under [Measurement conditions/Measurement direction].



- To measure defects and burrs in the left section of measurement regions with variable heights only:
  Draw the edge detection region so that the measurement region X coordinates will remain the same for both the left and right edges.
  The left and right edges will always have these edge points.
  * Specify [Y line] under [Measurement conditions/Measurement direction].



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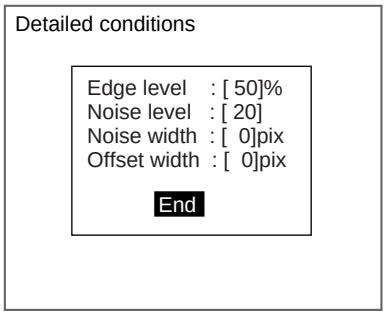
3 Changing Detailed Conditions as Required

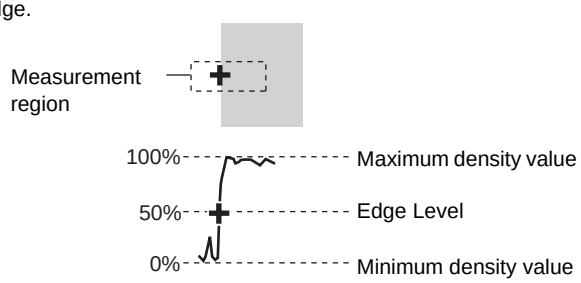
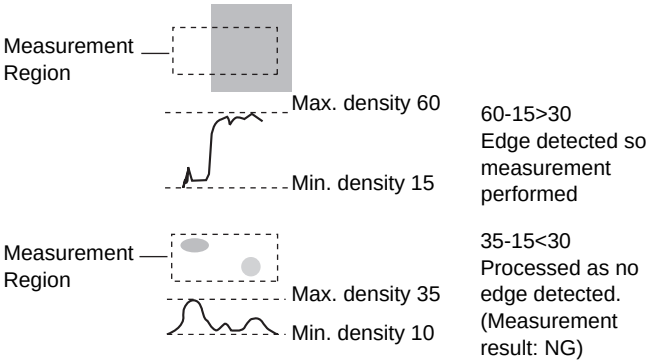
Change the detailed conditions when the measurement results are unstable.
Normally, the method can be left on the default setting.
After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

▶ [Defect (var. box)/Left edge/Detailed conditions]

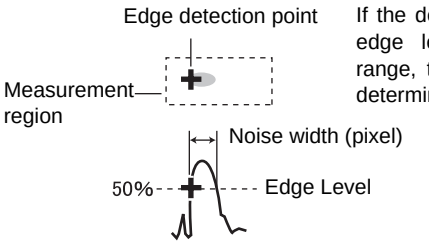
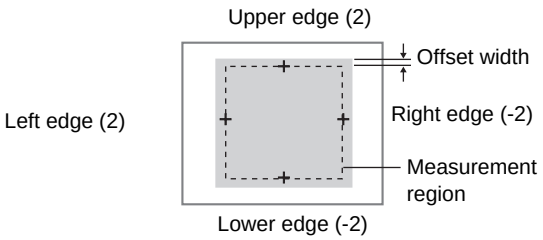
1. Set each item.

2. Select [End].



Setting data	Selection	Details
Edge Level	0 to 100 (default setting: 50)	Set a density change level between 0 and 100 that will indicate the edge. 
Noise Level	0 to 255 (default setting: 20)	Noise level used to make judgement if edges are present or not. The maximum density and minimum density within the edge detection area is calculated and if the difference between the two values is less than the noise level, then the Controller determines that there is no edge. If noise is causing incorrect detection, make this value higher. (Within the edge detection region) Max. density - min. density < noise level →no edge →NG measurement result Max. density - min. density ≥ noise level →Edge →Used for measurement Example: When [Noise level] is set to 30 

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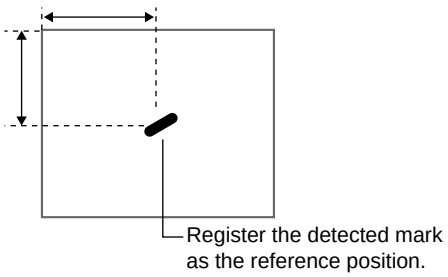
Setting data	Selection	Details
Noise Width	0 to 255 (default setting: 0)	Set the width of objects that are to be judged as noise. If the density distribution from the position where the edge was first detected falls to below the edge level within the noise width range, the detected point is judged as noise. If noise is causing incorrect detection, make this value higher. Example:  If the density falls below the edge level within the set range, the detected edge is determined to be noise.
Offset Width	-1,023 to 1,023 (default setting: 0)	Set the adjustment width (in pixel units) for the detected edge position. Example: To Measure from 2 Pixel-widths Inside the Edge Detection Point 

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Registering Reference Positions

Register reference positions here to detect position displacement. Positions can be inspected if the difference between the reference position and the measurement position is obtained from a calculation.
(The following reference values must be registered: The X and Y coordinates of the position found as a defect)

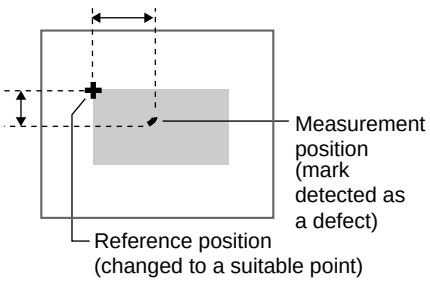
Example: Inspecting Whether or Not the Measurement Object Is Always in the Same Position
Display a measurement object in the correct position, detect a mark, and register that position as the reference position.



CHECK!

The reference position can be changed to enable the following function.

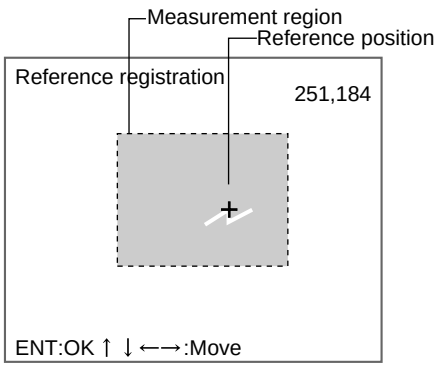
- Inspecting Positions from a Specified Point
  Once the reference values (area and center of gravity) have been obtained for the image currently displayed, the reference position is changed to an suitable point. Position inspection can be performed by calculating the difference between this reference position and the measurement position.



▶ [Defect (var. box)/Reference registration]

1. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.



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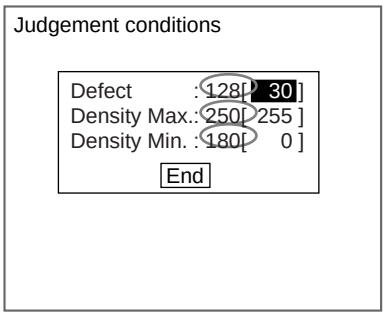
Setting judgement Conditions

Set the conditions for determining defects.
Set a deviation for an OK judgement.
Measure several samples and set the judgement conditions while referring to the measurement results.

▶ [Defect (var. box)/Judgement conditions]

1. Set each item.

2. Select [End].



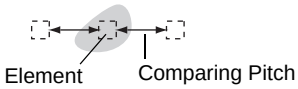
: The measurement results for the displayed image.
Use these values as reference in setting the conditions.

Setting data	Selection	Details
Defect	0 to 255	Set the upper limit for an OK judgement. (The lower limit is fixed at “0”.) When [Defect level] is set to 30, the judgement will be OK if the measured value is between 0 and 30.
Density Max.	0 to 255	Set the upper limit for the density.
Density Min.	0 to 255	Set the lower limit for the density.

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Changing Detection Conditions (Changing Detailed Conditions)

To shorten measurement processing time, change the conditions for detecting defects.
When a measurement region is drawn, rectangular areas called elements are created automatically. The average densities in these elements are calculated and compared to the average densities of surrounding elements as the elements are moved across the measurement region. The differences in the average densities of the elements are called the defect values. The defect values for all elements are calculated, and if the largest defect value is equal to or greater than the judgement condition, a defect will be detected for the measurement region.

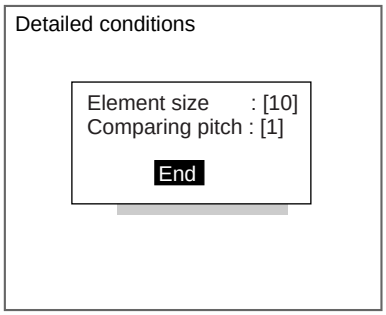


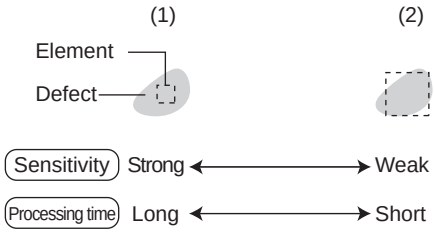
The greater [Element size] and [Comparing pitch], the shorter the processing time. However, the accuracy of the measurement will decrease.
Once the element size or comparing pitch setting has been changed, perform measurements to check that they can be performed correctly.

▶ [Defect (var. box)/Detailed conditions]

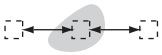
1. Set each item.

2. Select [End].



Setting data	Selection	Details
Element size	4 to 80 (default setting: 10)	Determine the element size according to the size of the defect to be detected. Setting a smaller element size increases detection sensitivity. Setting a larger element size decreases detection sensitivity. Example:  If density that is not part of the defect is included in the calculations as shown in (2), the differences with areas that are not part of the defect will be reduced. In other words, the more the background is included in the element, the weaker the sensitivity will be.

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Setting data	Selection	Details
Comparing pitch	1 to 6 (default setting: 1)	Determine the comparing pitch based on the size of the defects and the size of the elements. The larger the comparing pitch, the shorter the processing time will be. • If the element size is larger than the defect size: Set a smaller comparing pitch. To find line-shaped defects, set it to about 1 or 2.  • If the defect size is larger than the element size: Set a somewhat larger comparing pitch. If the comparing pitch is too small, comparisons will be made for elements on the edges of defects, reducing the defect value. 

Setting the Coordinate Mode

Select the type of coordinate values.

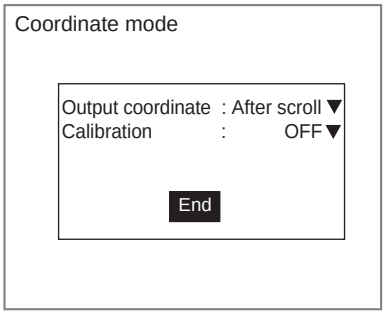
CHECK!

If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [Defect (var. box)/Detailed conditions]

1. Set each item.

2. Select [End].



Settings Data

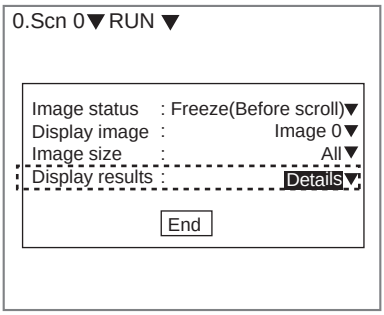
SECTION 7 Appendix, “Coordinate Handling Method”

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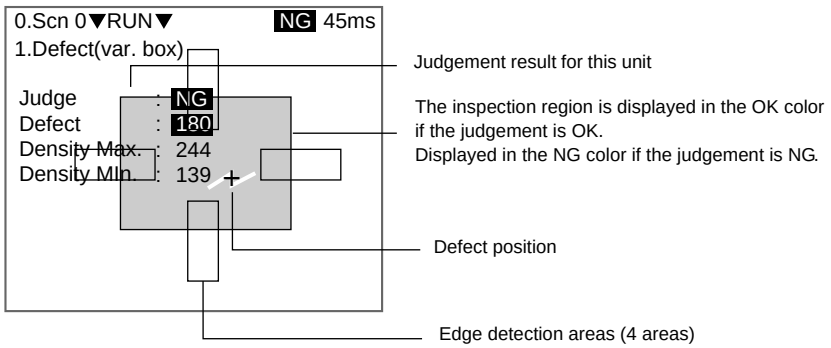
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Measurement region	X1	Upper left X coordinate of measurement region
Measurement region	Y1	Upper left Y coordinate of measurement region
Measurement region	X2	Lower right X coordinate of measurement region
Measurement region	Y2	Lower right Y coordinate of measurement region
Defect position	X	X coordinate of defect position measured
Defect position	Y	Y coordinate of defect position measured
Defect	F	Defect level measured
Max. density	GA	Maximum density in the measurement region
Min. density	GI	Minimum density in the measurement region
Reference position	SX	X coordinate when measurement region drawn
Reference position	SY	Y coordinate when measurement region drawn
Displacement	DX	Difference between measured and reference X coordinate
Displacement	DY	Difference between measured and reference Y coordinate

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Upper left X coordinate of measurement region
2	Upper left Y coordinate of measurement region
3	Lower right X coordinate of measurement region
4	Lower right Y coordinate of measurement region
5	X coordinate of defect position measured
6	Y coordinate of defect position measured
7	Defect level measured
8	Maximum density in the measurement region
9	Minimum density in the measurement region
10	X coordinate when measurement region drawn
11	Y coordinate when measurement region drawn
12	Difference between measured and reference X coordinate
13	Difference between measured and reference Y coordinate

■ Setting Data

Data type	Details
31	Measurement image (0: Image 0 1: Image 1)
32	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF 2: After scroll, calibration ON 3: Before scroll, calibration ON)
33	Defect level (0 to 255)
34	Density upper limit (0 to 255)
35	Density lower limit (0 to 255)
36	Element size (4 to 80)
37	Comparing pitch (1 to 6)
38	Measurement direction (0: X line 1: Y line 2: Box)
39	Edge detection direction (left edge, 0: ↑ 1: ↓ 2: → 3: ←)
40	Edge color (Left edge, 0: Light →dark 1: Dark →light)
41	Edge level (left edge, 0 to 100)
42	Noise level (left edge, 0 to 255)
43	Noise width (left edge, 0 to 255)
44	Offset width (left edge, -1023 to 1023)
45	Edge detection direction (upper edge, 0: ↑ 1: ↓ 2: → 3: ←)

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Data type	Details
46	Edge color (upper edge, 0: Light →Dark 1: Dark →Light)
47	Edge level (upper edge, 0 to 100)
48	Noise level (upper edge, 0 to 255)
49	Noise width (upper edge, 0 to 255)
50	Offset width (upper edge, -1023 to 1023)
51	Edge detection direction (right edge, 0: ↑ 1: ↓ 2: → 3: ←)
52	Edge color (right edge, 0: Light →Dark 1: Dark →Light)
53	Edge level (right edge, 0 to 100)
54	Noise level (right edge, 0 to 255)
55	Noise width (right edge, 0 to 255)
56	Offset width (right edge, -1023 to 1023)
57	Edge detection direction (lower edge, 0: ↑ 1: ↓ 2: → 3: ←)
58	Edge color (left edge, 0: Light →Dark 1: Dark →Light)
59	Edge level (lower edge, 0 to 100)
60	Noise level (lower edge, 0 to 255)
61	Noise width (lower edge, 0 to 255)
62	Offset width (lower edge, -1023 to 1023)
63	Region upper left X (left edge) (0 to X_MAX) (See *1.)
64	Region upper left Y (left edge) (0 to Y_MAX) (See *1.)
65	Region lower right X (left edge) (0 to X_MAX) (See *1.)
66	Region lower right Y (left edge) (0 to Y_MAX) (See *1.)
67	Region upper left X (upper edge) (0 to X_MAX) (See *1.)
68	Region upper left Y (upper edge) (0 to Y_MAX) (See *1.)
69	Region lower right X (upper edge) (0 to X_MAX) (See *1.)
70	Region lower right Y (upper edge) (0 to Y_MAX) (See *1.)
71	Region upper left X (right edge) (0 to X_MAX) (See *1.)
72	Region upper left Y (right edge) (0 to Y_MAX) (See *1.)
73	Region lower right X (right edge) (0 to X_MAX) (See *1.)
74	Region lower right Y (right edge) (0 to Y_MAX) (See *1.)
75	Region upper left X (lower edge) (0 to X_MAX) (See *1.)
76	Region upper left Y (lower edge) (0 to Y_MAX) (See *1.)
77	Region lower right X (lower edge) (0 to X_MAX) (See *1.)
78	Region lower right Y (lower edge) (0 to Y_MAX) (See *1.)
79	Reference position X (0 to X_MAX)
80	Reference position Y (0 to Y_MAX)

*1: The range varies depending on the controller model.

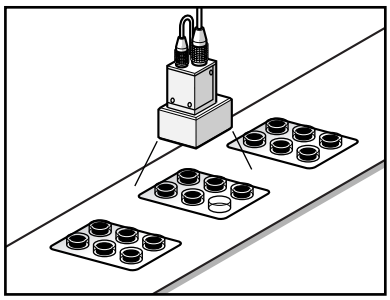
Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

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Gravity and Area

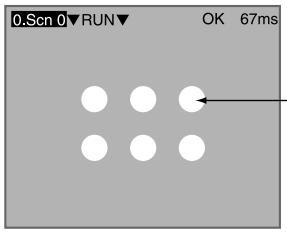
The 256-gradation images read by the Camera are converted into binary black-and-white images and measurement is performed on the white pixels.
The size (area) and position (center of gravity) of the measurement object can be detected.

Example: Detecting the Presence of Tablets



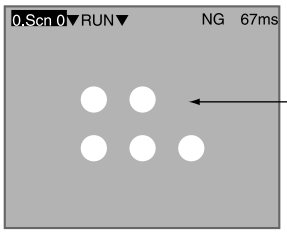
The image is converted into binary.

OK workpiece



The image is converted into binary so that the tablet is displayed in white.

NG workpiece



Loss of a tablet is detected because the area of white pixels is insufficient.

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Operational Flow

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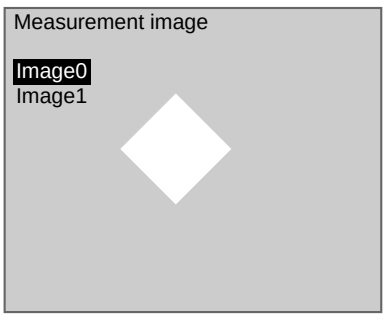
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Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [Gravity and area/Measurement image]



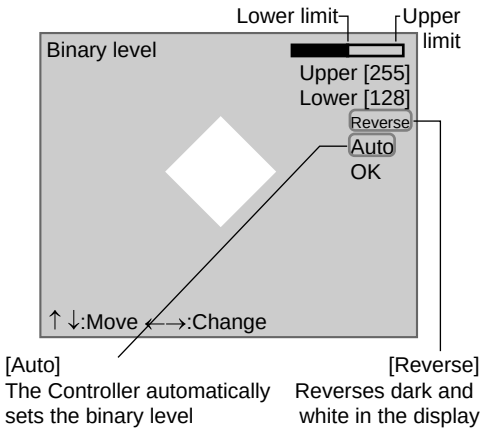
1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.

Setting Binary Levels

Set the level for converting 256-gradation images read by the Camera into binary images. Measurements are performed for the white pixels. Therefore, make the settings so that the measurement object is white. The binary level set here is used for all of the measurement regions.

▶ [Gravity and area/Binary]



1. Move the cursor to the upper value and use the Left and Right Keys to adjust the value.

2. Use the same method to change the lower value.

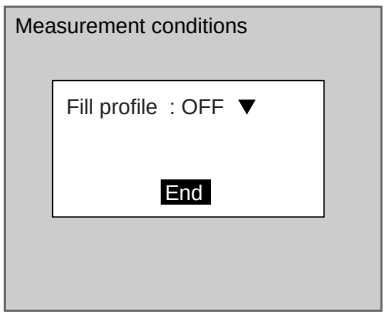
3. Select [OK].

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Setting Measurement Conditions

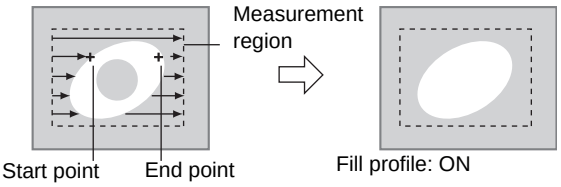
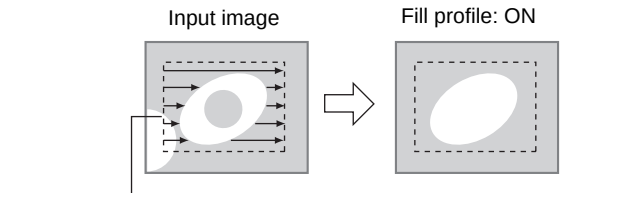
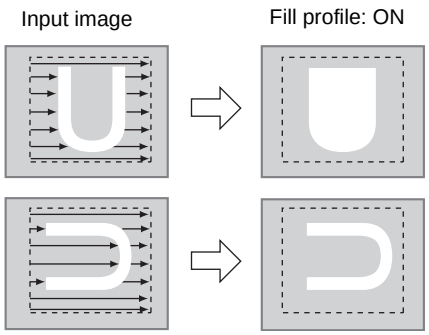
Set measurement conditions to measure the exterior of a measurement object or to make the binary levels track the brightness of the measurement image. The default for all settings is OFF.

▶ [Gravity and area/Measurement conditions]



1. Select [ON] or [OFF].

2. Select [End].

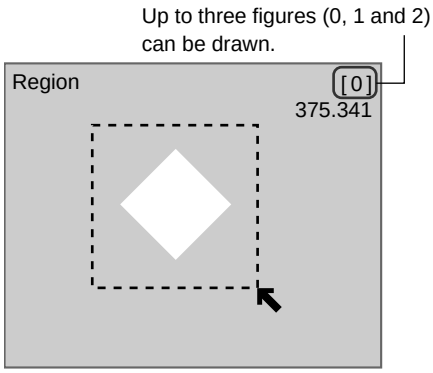
Setting data	Selection	Details
Fill Profile Function	ON OFF (default setting)	Set the fill profile function to [ON] when the exterior of the measurement object is being measured. Turn [ON] the [Fill profile] function to measure the whole area between the start point (black pixels to white) and the end point (white pixels to black) in the measurement region as white pixels.  • When a White-pixel Section Encroaches on the Measurement Region  • Measuring Open-form Measurement Objects The measurement result changes depending on the orientation of the measurement object. 

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Drawing Measurement Regions

When a measurement region is drawn, measurement is performed for the displayed image and the results are registered as the reference values (area and center of gravity).

▶ [Gravity and area/Region/New/figure/drawing mode]



1. Draw a figure in the region to be measured.

SECTION 1 Basic Operating Procedures, “Drawing a Region”

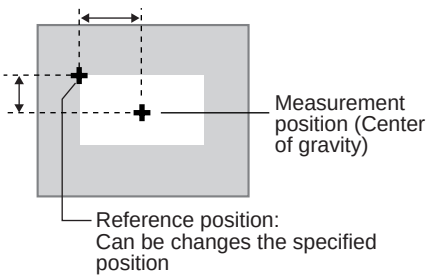
Re-registering Reference Values

This operation is performed when only the reference value is to be re-registered.
When a measurement region is drawn, the measurement is performed for the displayed image and the results are registered as the reference values. If the re-registering function explained here is used, only the reference values for the image currently displayed will be registered.
The area and center of gravity are registered for the reference values.

CHECK!

The reference position can be changed to enable the following function.

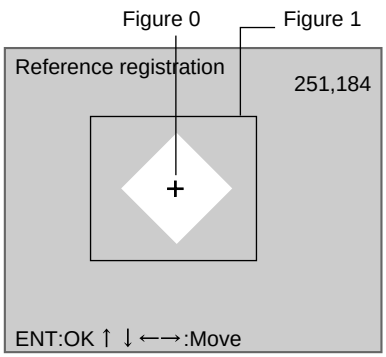
- Measuring Positions from a Specified Position
  Once the reference values have been obtained for the image currently displayed, the reference position is changed to an suitable point. Position inspection can be performed by calculating the difference between this reference position and the measurement position.



CHECK!

When the measurement region is changed, the reference value returns to the default setting.

▶ [Gravity and area/Reference registration]



1. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.

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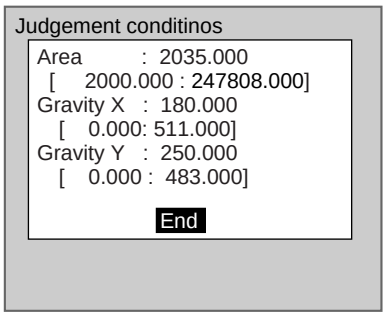
Setting Judgement Conditions

Make settings for the area and center of gravity.
Range for an OK judgement

▶ [Gravity and area/Judgement conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Area	0 to 9,999,999.999	Set the area range for an OK judgement.
Gravity X Gravity Y	-9,999.999 to 9,999.999	Range of movement of the measurement object in the X and Y directions.

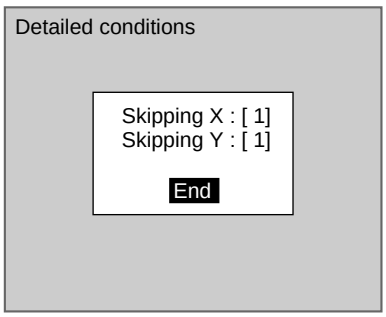
Changing Pixel Skipping (Changing Detailed Conditions)

To shorten measurement processing time, change the number of pixels to be skipped.
The greater the skipping setting, the shorter the processing time. However, the accuracy of the measurement will decrease.
After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

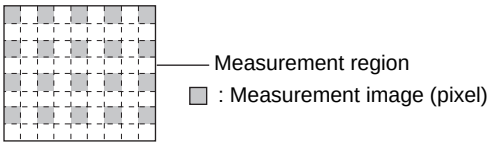
▶ [Gravity and area/Detailed conditions]

1. Set the number of pixels to skip.

2. Select [End].



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Setting data	Selection	Details
Skipping X	1 to 15 (default setting: 1)	Set how many pixels to skip in the measurement region during measurement. The default setting is 1, which means that all of the measurement region will be measured. Example: Skipping X and Skipping Y are set to 2: 
Skipping Y		

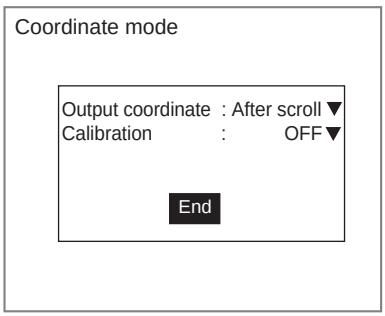
Setting the Coordinate Mode

Select the type of coordinate values.

CHECK!

If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [Gravity and area/Coordinate mode]



1. Set each item.

2. Select [End].

Settings Data

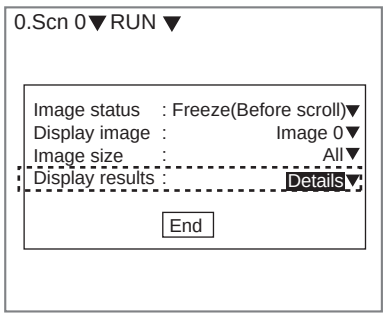
SECTION 7 Appendix, “Coordinate Handling Method”

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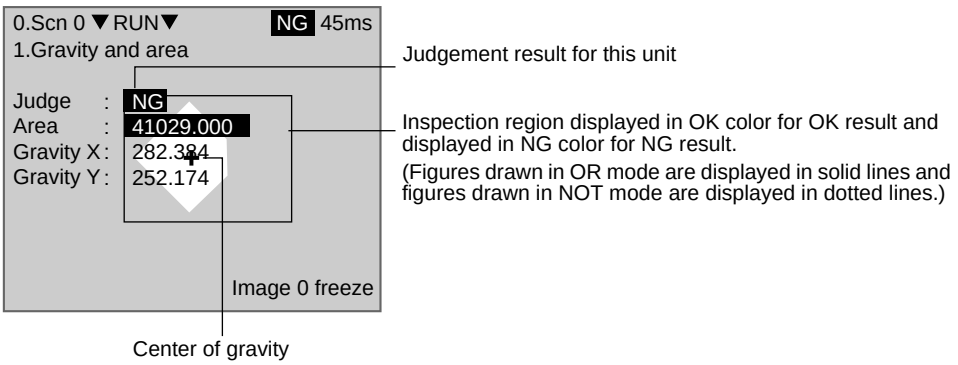
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Setting data	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Center of gravity	X	X coordinate of center of gravity for measurement result
Center of gravity	Y	Y coordinate of center of gravity for measurement result
Area	AR	Area for measurement result
Reversed area	RA	Difference between area measurement value and area for measurement result
Reference position	SX	X coordinate when measurement region drawn
Reference position	SY	Y coordinate when measurement region drawn
Reference area	SA	Area when measurement region drawn
Displacement	DX	Difference between measured and reference X coordinate
Displacement	DY	Difference between measured and reference Y coordinate
Difference area	DA	Difference between measured area and reference area

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	X coordinate of center of gravity for measurement result
2	Y coordinate of center of gravity for measurement result
3	Area for measurement result
4	Difference between area measurement value and area for measurement result
5	X coordinate when measurement region drawn
6	Y coordinate when measurement region drawn
7	Area when measurement region drawn

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Data type	Details
8	Difference between measured and reference X coordinate
9	Difference between measured and reference Y coordinate
10	Difference between measured area and reference area

■ Setting Data

Data type	Details
31	Measurement image (0: Image 0 1: Image 1)
32	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF 2: After scroll, calibration ON 3: Before scroll, calibration ON)
33	X upper limit (-9,999.999 to 9,999.999)
34	X lower limit (-9,999.999 to 9,999.999)
35	Y upper limit (-9,999.999 to 9,999.999)
36	Y lower limit (-9,999.999 to 9,999.999)
37	Area upper limit (-9999999.999 to 9,999,999.999)
38	Area lower limit (-9,999,999.999 to 9,999,999.999)
39	Region upper left X (0 to X_MAX) (See *1.)
40	Region upper left Y (0 to Y_MAX) (See *1.)
41	Region lower right X (0 to X_MAX) (See *1.)
42	Region lower right Y (0 to Y_MAX) (See *1.)
43	Binary level upper limit (0 to 255)
44	Binary level lower limit (0 to 255)
45	Reverse binary level (0: Not reversed 1: Reversed)
46	Skipping X (1 to 15)
47	Skipping Y (1 to 15)
48	Fill profile (0: OFF 1: ON)
49	Reference position X (0 to X_MAX) (See *1)
50	Reference position Y (0 to Y_MAX) (See *1)

*1: The range varies depending on the controller model.

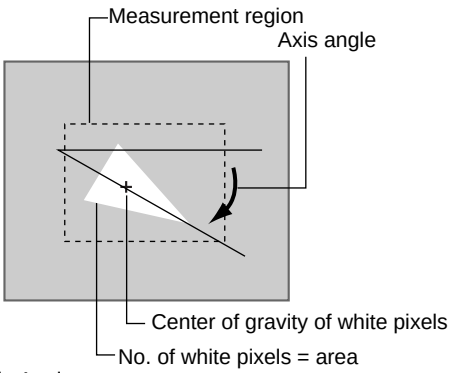
Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

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Gravity and Axis

The 256-gradation images read by the Camera are converted into binary black-and-white images and measurement is performed on the white pixels.
The size (area), position (center of gravity), and orientation (angle) of the measurement object can be detected.

The image is converted into binary.



Axis Angle

The axis angle is the angle of the major axis of an ellipse that is diagrammatically equivalent to the area occupied by the white pixels.

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Operational Flow

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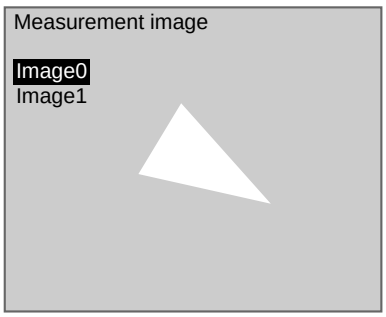
- Submenus for Expressions 8
- External Reference Table 8

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Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [Gravity and axis/Measurement image]



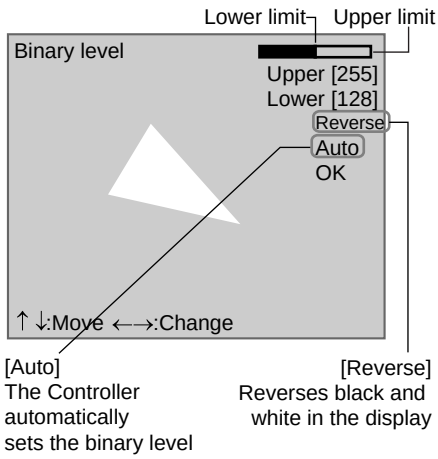
1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.

Setting Binary Levels

Set the level for converting 256-gradation images read by the Camera into binary images.Measurements are performed for the white pixels. Therefore, make the settings so that the measurement object is white. The binary level set here is used for all of the measurement regions.

▶ [Gravity and axis/Binary]



1. Move the cursor to the upper value and use the Left and Right Keys to adjust the value.

2. Use the same method to change the lower value.

3. Select [OK].

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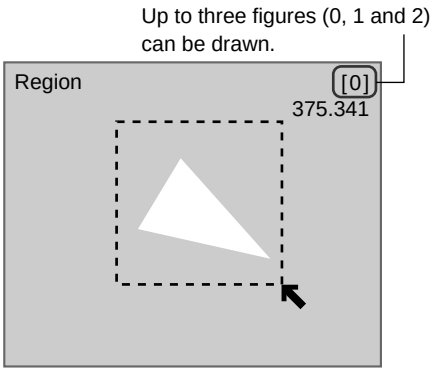
Drawing Measurement Regions

When a measurement region is drawn, measurement is performed for the displayed image and the results are registered as the reference values (area, center of gravity, and axis).

▶ [Gravity and axis/Region/New/figure/drawing mode]

1. Draw a figure in the region to be measured.

SECTION 1 Basic Operating Procedures, “Drawing a Region”



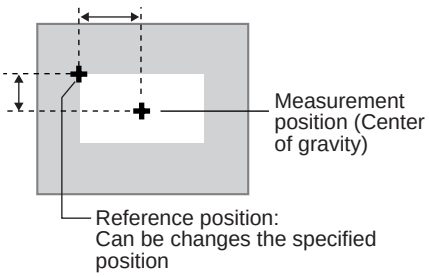
Re-registering Reference Values

This operation is performed when only the reference value is to be re-registered.
When a measurement region is drawn, the measurement is performed for the displayed image and the results are registered as the reference values. If the re-registering function explained here is used, only the reference values for the image currently displayed will be registered.
The area, center of gravity, and axis are registered for the reference values.

CHECK!

The reference position can be changed to enable the following function.

- Measuring Positions from a Specified Position
  Once the reference values have been obtained for the image currently displayed, the reference position is changed to an suitable point. Position inspection can be performed by calculating the difference between this reference position and the measurement position.



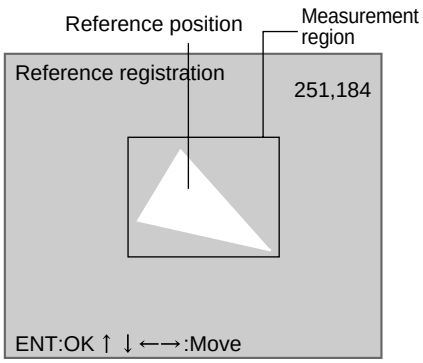
CHECK!

When the measurement region is changed, the reference value returns to the default setting.

▶ [Gravity and axis/Reference registration]

1. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.



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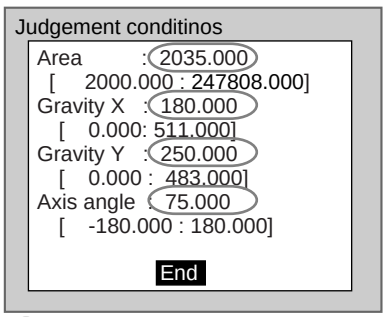
Setting Judgement Conditions

Make settings for the area, center of gravity, and axis angle.
Range for an OK judgement

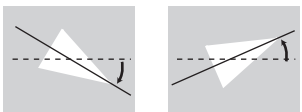
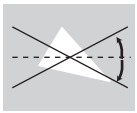
▶ [Gravity and axis/Judgement conditions]

1. Set each item.

2. Select [End].



○ : The measurement results for the displayed image.
Use these values as references in setting the upper and lower limits.

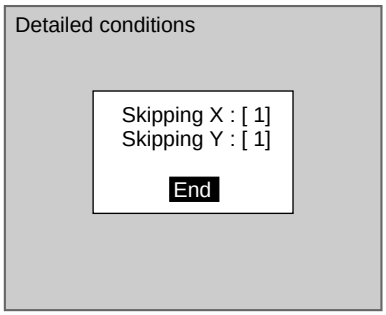
Setting data	Selection	Details
Area	0 to 9,999,999.999	Set the area range for an OK judgement.
Gravity X	-9,999.999 to 9,999.999	Set the range of movement of the measurement object in the X direction for an OK judgement.
Gravity Y	-9,999.999 to 9,999.999	Set the range of movement of the measurement object in the Y direction for an OK judgement.
Axis angle	-180.000 to 180.000	Set the axis angle for an OK judgement. Output in the measurement value of -90,000 to 90,000 Example: Measurement value for axis angle 10.000 -10.000   If this range is to be judged OK, set to [-10.000: 10.000].

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Changing Pixel Skipping (Changing Detailed Conditions)

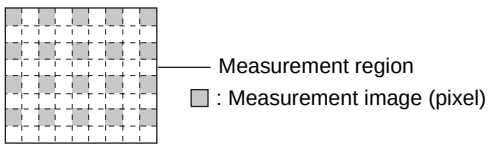
To shorten measurement processing time, change the number of pixels to be skipped.
The greater the skipping setting, the shorter the processing time. However, the accuracy of the measurement will decrease.
After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

▶ [Gravity and axis/Detailed conditions]



1. Set each item.

2. Select [End].

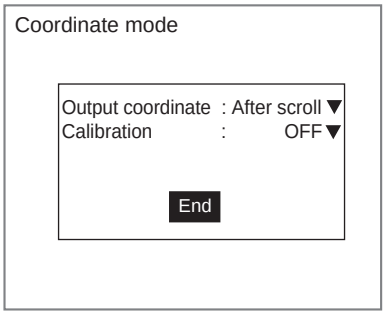
Setting data	Selection	Details
Skipping X	1 to 15 (default setting: 1)	Set how many pixels to skip in the measurement region during measurement. The default setting is 1, which means that all of the measurement region will be measured. Example: Skipping X and Skipping Y are set to 2: 
Skipping Y		

Setting the Coordinate Mode

Select the type of coordinate values.

CHECK!
If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [Gravity and axis/Coordinate mode]



1. Set each item.

2. Select [End].

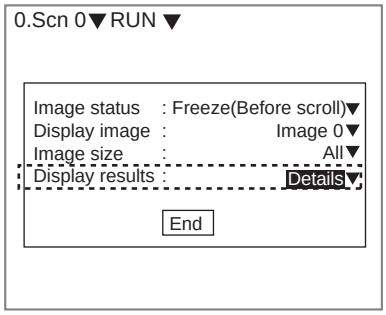
Settings Data
SECTION 7 Appendix, “Coordinate Handling Method”

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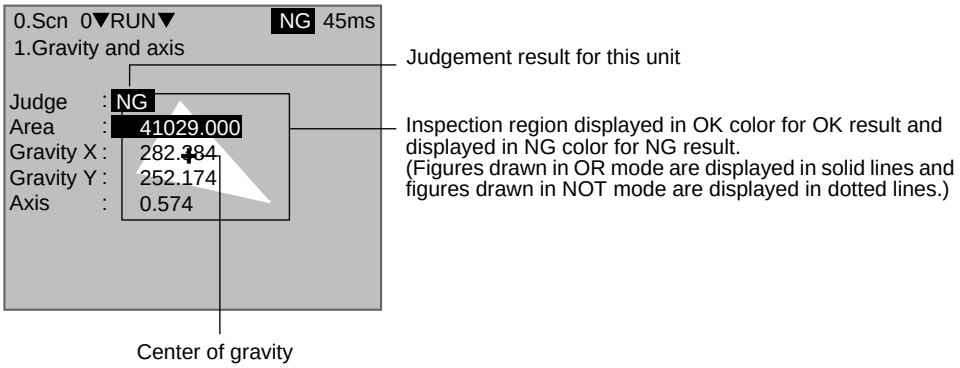
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Setting data	String	Details
Judgement result	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Center of gravity	X	X coordinate of center of gravity for measurement result
Center of gravity	Y	Y coordinate of center of gravity for measurement result
Axis angle	TH	Axis angle for measurement result.
Area	AR	Area for measurement result
Reversed area	RA	Difference between area measurement value and area for measurement result
Reference position	SX	X coordinate when measurement region drawn
Reference position	SY	Y coordinate when measurement region drawn
Reference axis	ST	Axis angle when measurement region drawn
Reference area	SA	Area when measurement region drawn
Displacement	DX	Difference between measured and reference X coordinate
Displacement	DY	Difference between measured and reference Y coordinate
Axis displacement	DT	Difference between the measured and reference axis angle
Difference area	DA	Difference between measured area and reference area

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	X coordinate of center of gravity for measurement result
2	Y coordinate of center of gravity for measurement result
3	Axis angle for measurement result.
4	Area for measurement result

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Data type	Details
5	Difference between area measurement value and area for measurement result
6	X coordinate when measurement region drawn
7	Y coordinate when measurement region drawn
8	Axis angle when measurement region drawn
9	Area when measurement region drawn
10	Difference between measured and reference X coordinate
11	Difference between measured and reference Y coordinate
12	Difference between the measured and reference axis angle
13	Difference between measured area and reference area

■ Setting Data

Data type	Details
31	Measurement image (0: Image 0 1: Image 1)
32	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF 2: After scroll, calibration ON 3: Before scroll, calibration ON)
33	X upper limit (-9,999.999 to 9,999.999)
34	X lower limit (-9,999.999 to 9,999.999)
35	Y upper limit (-9,999.999 to 9,999.999)
36	Y lower limit (-9,999.999 to 9,999.999)
37	Area upper limit (-9999999.999 to 9,999,999.999)
38	Area lower limit (-9,999,999.999 to 9,999,999.999)
39	Region upper left X (0 to X_MAX) (See *1.)
40	Region upper left Y (0 to Y_MAX) (See *1.)
41	Region lower right X (0 to X_MAX) (See *1.)
42	Region lower right Y (0 to Y_MAX) (See *1.)
43	Binary level upper limit (0 to 255)
44	Binary level lower limit (0 to 255)
45	Reverse binary level (0: Not reversed 1: Reversed)
46	Skipping X (1 to 15)
47	Skipping Y (1 to 15)
48	Axis angle upper limit (-180.000 to 180.00)
49	Axis angle lower limit (-180.000 to 180.00)
50	Reference position X (0 to X_MAX) (See *1)
51	Reference position Y (0 to Y_MAX) (See *1)

*1: The range varies depending on the controller model.

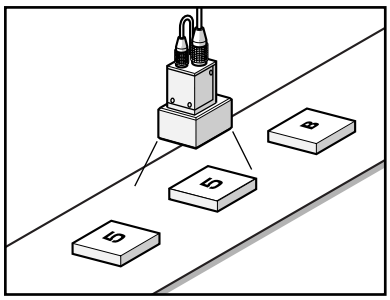
Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

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OCR for 1 character

This processing item is used to recognize a single alphanumeric character or symbol.
Standards characters do not need to be registered because the shape characteristics of various character fonts are registered in the internal dictionary.

Example: Recognition of Printed Characters



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Operational Flow

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Setting Measurement Conditions 3

Drawing Measurement Regions 4

Setting judgement Conditions 5

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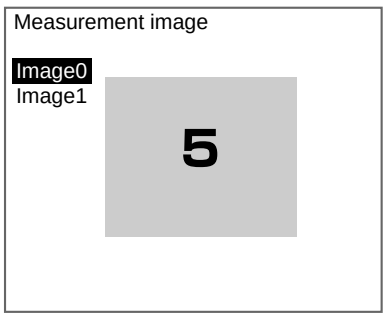
- Submenus for Expressions 7
- External Reference Table 8

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Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [OCR for 1 chara/Measurement image]



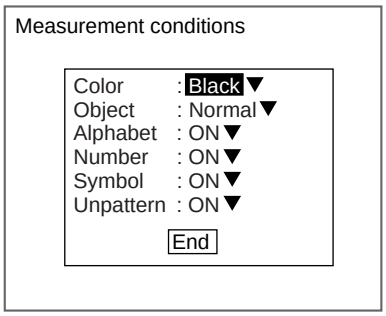
1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.

Setting Measurement Conditions

Set the conditions to be used for recognition of characters.

▶ [OCR for 1 chara/Measurement conditions]



1. Set each item.

2. Select [End].

Setting data	Selection	Details
Color	Black (default setting) White	Select whether the font color will be white or black compared to the background.
Object	Normal (default setting) Dot	Set the character print type.
Alphabet	ON (default setting) OFF	Select whether to recognize alphabets A to Z.
Number	ON (default setting) OFF	Select whether to recognize numbers 0 to 9.
Symbol	ON (default setting) OFF	Select whether to recognize codes ":" and "/".
Unpattern	ON (default setting) OFF	Select whether to recognize non-patterns. If this item is set to ON, the density deviation judgement condition must be set.

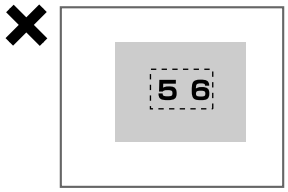
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Drawing Measurement Regions

Set the area where the target character is printed as the measurement region.

CHECK!

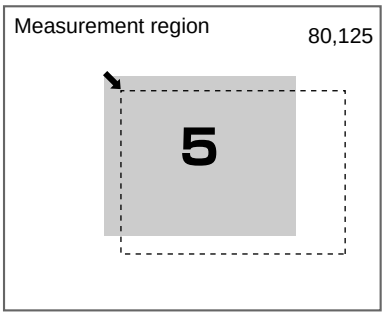
Draw the region so that only the target character falls within the region. If two or more characters are present inside the region, measurement cannot be performed correctly.



▶ [OCR for 1 chara/Measurement region]

1. Draw a box-shaped region.

Specify the upper left and lower right coordinates.

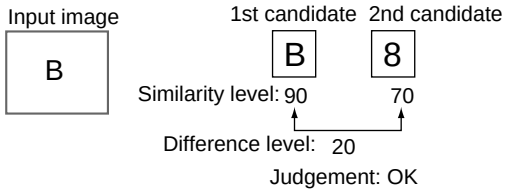


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Setting judgement Conditions

Set the conditions for judging the 1st candidate character or unbuttoned areas.
From the dictionary, the controller chooses the first candidate that is the most similar in characteristics to the character image inside the measurement region, and the second candidate that is the second most similar, and indicates how much they are similar. The similarity difference is the difference in similarity between the 1st and 2nd.

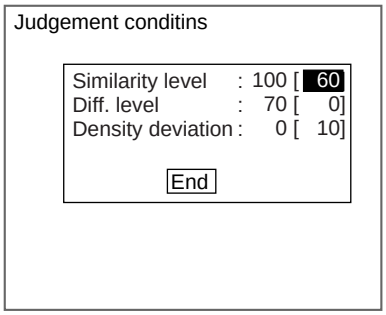
Example: When [Similarity level] is set to 85 and [Diff. Level] is set to 10:



▶ [OCR for 1 chara/Judgement conditions]

1. Set each item.

2. Select [End].



The value before [ ] is the measurement results for the displayed image. Use these values as references in setting the upper and lower limits.

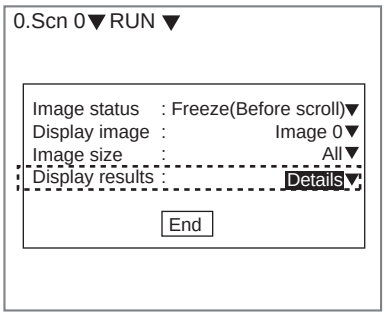
Setting data	Selection	Details
Similarity level	0 to 100 (default setting: 60)	Similarity level for OK result for 1st candidate. The judgement will be OK if this value is exceeded.
Diff. level	0 to 100 (default setting: 10)	Similarity level difference between 1st and 2nd candidates for OK result. The judgement will be OK if this value is exceeded.
Density deviation	0 to 100 (default setting: 60)	Set the density deviation for the measurement region for an OK judgement. This function is effective only if [Unpattern] under [Measurement conditions] is set to [ON]. The character is judged to be an unbuttoned area if the density deviation is below the specified value.

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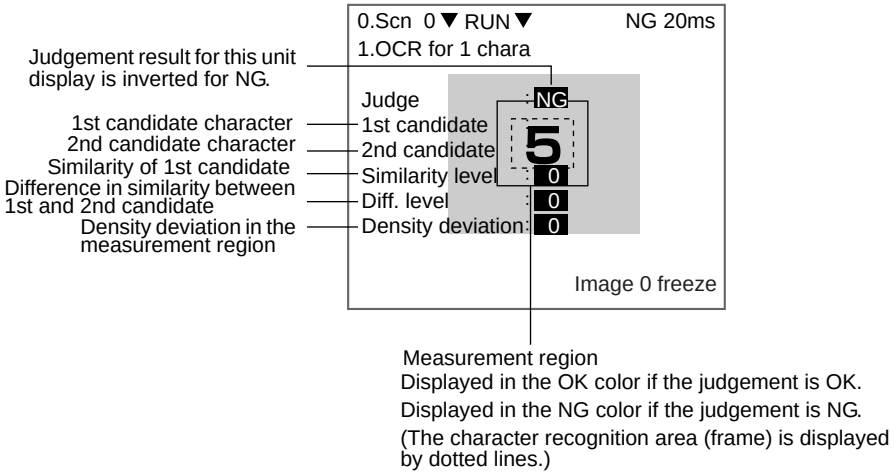
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed.



CHECK!

When a result output processing item is used to output OCR for 1 character results, the character codes for the recognized characters are output to external devices. In the case of an unbuttoned area, a character code "_ (underbar)" will be output.

SECTION 7 Appendix, "Character Codes"

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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Setting data	String	Details
Judge	JG	Judgement result (-2: Not measured -1: NG 0: OK)
1st candidate	C1	Character code for 1st candidate
2nd candidate	C2	Character code for 2nd candidate
Similarity level	SM	Similarity of 1st candidate
Diff. level	DS	Similarity of 1st candidate - similarity of 2nd candidate
Density deviation	DV	Density deviation in the measurement region

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Character code for 1st candidate
2	Character code for 2nd candidate
3	Similarity of 1st candidate
4	Similarity of 1st candidate - similarity of 2nd candidate
5	Density deviation in the measurement region

■ Setting Data

Data type	Details
31	Measurement image (0: Image 0 1: Image 1)
32	Region upper left X (0 to X_MAX) (See *1.)
33	Region upper left Y (0 to Y_MAX) (See *1.)
34	Region lower right X (0 to X_MAX) (See *1.)
35	Region lower right Y (0 to Y_MAX) (See *1.)
36	Character color (0: Black 1: White)
37	Subject (0: Normal 1: Dot character)
38	Alphabet (0: OFF 1: ON)
39	Numeric (0: OFF 1: ON)
40	Symbol (0:OFF 1: ON)
41	Unpattern area (0:OFF 1: ON)
42	Similarity level (0 to 100)
43	Differential level (0 to 100)
44	Density deviation·(0 to 127)

*1: The range varies depending on the controller model.

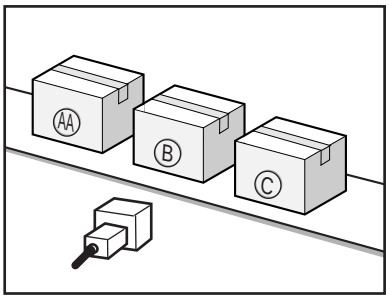
Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

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Classification

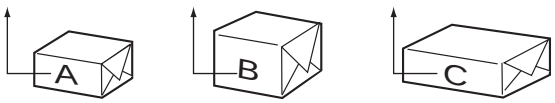
With the Classification processing item, products are classified or differentiated between when there are many types of products being handled on the same production line.

Example: The number of the most similar model is output.

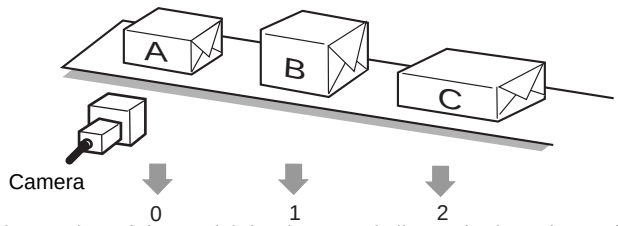


Sections that will serve as classification references are registered as models beforehand.

Registered to “0” Registered to “1” Registered to “2”



The number of the model that is most similar to the input image is output. If this data is retrieved by an external device, the products can be classified at the next stage of the process. (If there is no model that matches the image, the output will be NG (-1).)



The number of the model that is most similar to the input image is output.

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Operational Flow

Selecting Measurement Images 3

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Setting Judgement Conditions 6

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When you want to obtain measurement results externally 10

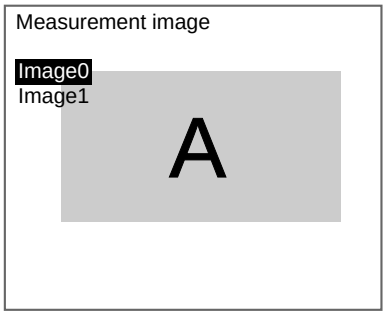
- Submenus for Expressions 10
- External Reference Table 11

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Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [Classification#/Measurement image]



1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.

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Registering the Model

A section that will serve as the classification reference is registered as the model.
Up to 36 versions of a model can be registered with index numbers 0 to 35.
When the model has variations in printing quality or shape, register multiple models to the same index number. Up to 5 models can be registered to the same index number.
When a model is registered, the center position of the model is registered as the search coordinates.

CHECK!

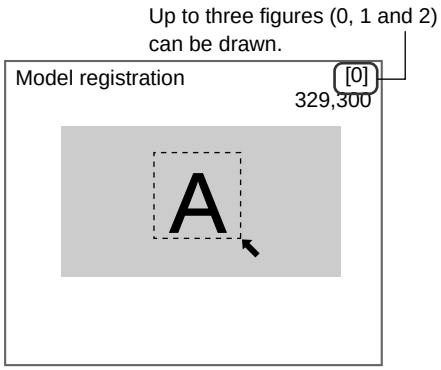
When multiple models are registered to the same index number, the Controller automatically creates auxiliary models between the models that are registered.
If the auxiliary models are added to the registered models when searches are performed, stable searches are possible even if there are variations between the registered models. Select whether or not to use auxiliary models in searches under Detailed settings.

Auxiliary model
p.8

▶ [Classification#/Model registration/Index (No.)/Registration/New/figure/drawing mode]

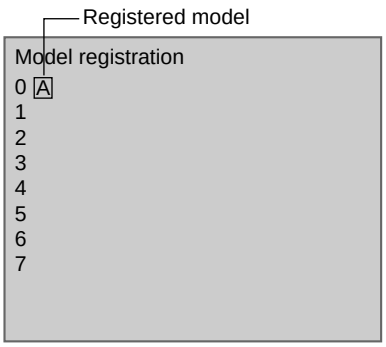
1. Draw the region to be registered as the model with the selected figure.

SECTION 1 Basic Operating Procedures, “Drawing a Region”



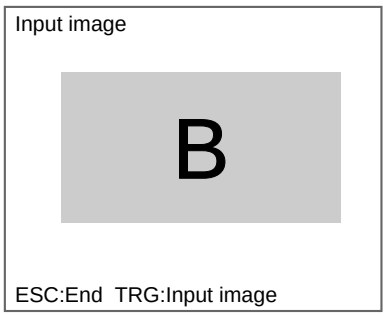
Use this operation to register models.
The registered model is displayed as a thumbnail.

2. To register the next model, change the measurement object and press the SHIFT+ESC Keys.



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The Input Image Screen will be displayed.



3. Press the TRIG Key to refresh the image.

4. Press the ESC Key.

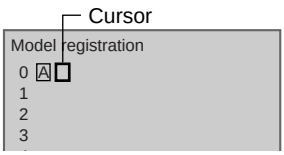
The display returns to the [Index (No.)] screen.

5. Repeat the above steps to register further models.

SHIFT+Up/Down Keys: Switches the index number.

CHECK!

To add models to the same index number, use the Right Key to move the cursor.



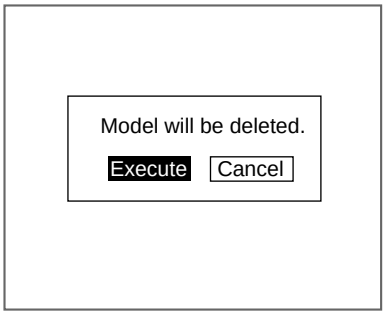
6. When all models have been registered, press the ESC Key.

Deleting Models

Use this operation to delete registered models.

▶ [Classification#/Model registration/Model/Delete]

1. Select [Execute].



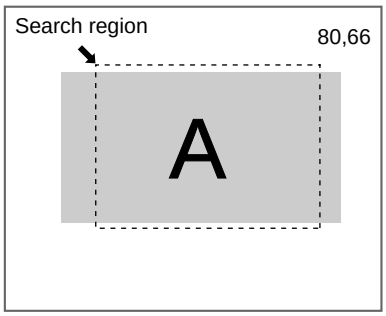
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Setting the Search Region

Set the region in which the model is to be searched for. It is possible to perform a search for the entire input image, but the processing time can be shortened and the accuracy can be increased by setting limits on the search region.

▶ [Classification#/Search region]

1. Draw a rectangular search region.
Specify the upper left and lower right coordinates.



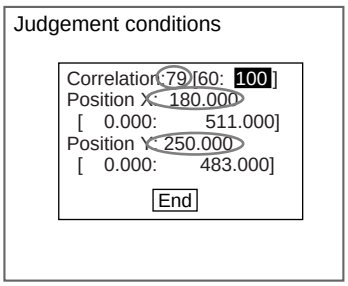
Setting Judgement Conditions

Set the judgement conditions for the correlation with the model and for the position (X, Y) where the object was detected.

▶ [Classification#/Judgement conditions]

1. Set each item.

2. Select [End].



: The measurement results for the displayed image
Use these values as references in setting the upper and lower limits.

Setting data	Selection	Details
Correlation	0 to 100	Set the correlation lower limit. The judgement will be OK if the measured value is upper than this.
Position X	-9,999.999 to 9,999.999	Set the range of movement in the X direction for an OK judgement.
Position Y	-9,999.999 to 9,999.999	Set the range of movement in the Y direction for an OK judgement.

Search
SECTION 7 Appendix, “Terminology”

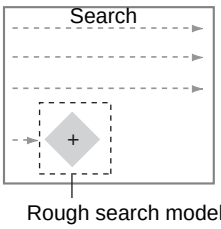
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Changing Detailed Conditions

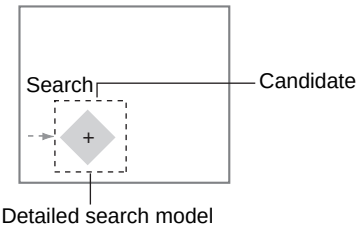
The search settings can be changed here. Change the conditions if the measurement results are unstable or if high-speed processing is required. Normally, the method can be left on the default setting. After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

The Controller performs the following 2-stage processing internally.

1. Rough search
   The rough search model is used to search every item in the measurement region.



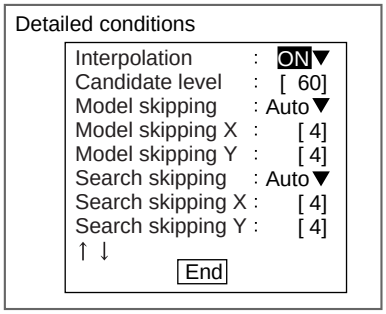
2. Detailed search
   Uses the detailed search model to re-measure the images surrounding the candidate point.



▶ [Classification#/Detailed conditions]

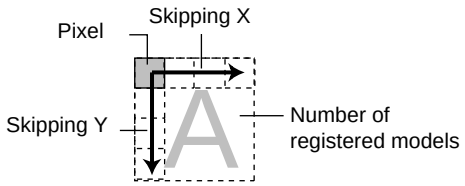
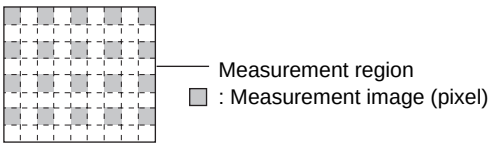
1. Set each item.

2. Select [End].



Setting data	Selection	Details
Interpolation Mode	When 2 or more models are registered to in the same index, set whether or not to search using an auxiliary model.	
	ON (default setting)	The registered models and auxiliary models will be used in searches. The measurement will be more stable. Processing time, however, will be longer.
	OFF	The searches will be performed with registered models only.
Candidate level	0 to 100 (default setting: 60)	Set the level to be used to search the model during rough search. Reduce the correlation level if the model searches are unstable.

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Setting data	Selection	Details
Model skipping Detailed model skipping	Set the number of pixels to be skipped for the search model (i.e. the number of pixels to be skipped from the registered models). [Model skipping] is used to set pixel skipping conditions for rough search models, and [Detailed model skipping] is used to set for detailed search models. The setting range is the same.  	
	Auto (default setting)	The controller sets the appropriate numbers (X, Y) of pixels to be skipped. The specified values will be displayed for model skipping X, Y (or detailed model skipping X, Y).
	Fixed	Specify the desired number of pixels to be skipped. The specified values will be reflected for model skipping X, Y (or detailed model skipping X, Y).
Model skipping X Detailed model skipping X	1 to 15	Set the number of pixels to be skipped in X direction.
Model skipping Y Detailed model skipping Y	1 to 15	Set the number of pixels to be skipped in Y direction.
Search skipping	Set the number of pixels to be skipped for rough search. The number of pixels to be skipped in the measurement region must be set. Example: When Skipping X: 2 and Skipping Y: 2  	
	Auto (default setting)	The controller sets the appropriate numbers (X, Y) of pixels to be skipped The specified values will be displayed for search skipping X, Y.
	Fixed	Specify the desired number of pixels to be skipped. The specified values will be reflected for search skipping X, Y.
Search skipping X	1 to 15	Set the number of pixels to be skipped in X direction.
Search skipping Y	1 to 15	Set the number of pixels to be skipped in Y direction.

Auxiliary model

Auxiliary models are models created between the registered models.

Auxiliary models are automatically created by the Controller when multiple models have been registered to the same index number.

Number of registered models	Number of auxiliary models	Total number of models (See note.)
2	1	3
3	3	6
4	6	10
5	10	15

* Number of modes when [Interpolation Mode] is set to [ON]

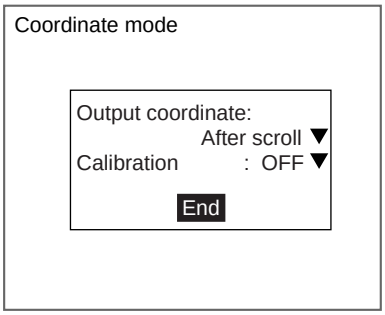
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Setting the Coordinate Mode

Select the type of coordinate values.

CHECK! If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [Classification#/Coordinate mode]



1. Set each item.

2. Select [End].

Settings Data

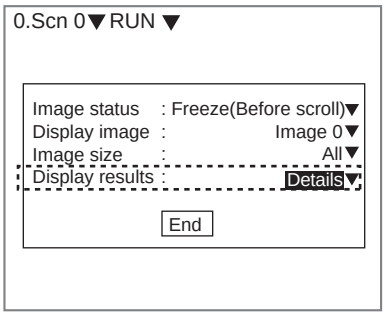
SECTION 7 Appendix, “Coordinate Handling Method”

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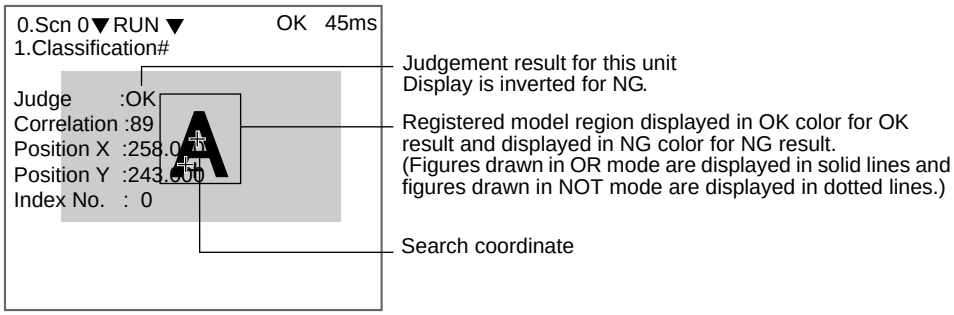
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed.



When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.

This section describes each item displayed in the submenu.

For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Unit judgement result (-2: Not measured -1: NG 0: OK)
Position X	X	X coordinate of position where model found
Position Y	Y	Y coordinate of position where model found
Correlation	CR	Correlation value with model
Index No.	IN	Number of model with highest correlation

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Unit judgement result (-2: Not measured -1: NG 0: OK)
1	X coordinate of position where model found
2	Y coordinate of position where model found
3	Correlation value with model
4	Number of model with highest correlation

■ Setting Data

Data type	Details
31	Measurement image (0: Image 0 1: Image 1)
32	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF 2: After scroll, calibration ON 3: Before scroll, calibration ON)
33	X coordinate judgement upper limit (-9,999.999 to 9,999.999)
34	X coordinate judgement lower limit (-9,999.999 to 9,999.999)
35	Y coordinate judgement upper limit (-9,999.999 to 9,999.999)
36	Y coordinate judgement lower limit (-9,999.999 to 9,999.999)
37	Correlation judgement upper limit (0 to 100)
38	Correlation judgement lower limit (0 to 100)
39	Search region upper left X (0 to X_MAX) (See *1.)
40	Search region upper left Y (0 to Y_MAX) (See *1.)
41	Search region lower right X (0 to X_MAX) (See *1.)
42	Search region lower right Y (0 to Y_MAX) (See *1.)
43	Interpolation (0: OFF 1: ON)
44	Candidate level (0 to 99)
45	Rough model skipping setting (0: Auto 1: Fixed)
46	Rough model skipping X (1 to 15)
47	Rough model skipping Y (1 to 15)
48	Rough search skipping setting (0: Auto 1: Fixed)
49	Rough search skipping X (1 to 15)
50	Rough search skipping Y (1 to 15)
51	Detailed model skipping setting (0: Auto 1: Fixed)
52	Detailed model skipping X (1 to 15)
53	Detailed model skipping Y (1 to 15)
54	Maximum candidate points for rough search (1 to 128)
56	Model registration area upper left X coordinate (0 to X_MAX) (See *1.)

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Data type	Details
57	Model registration area upper left Y coordinate (0 to Y_MAX) (See *1.)
58	Model registration area lower right X coordinate (0 to X_MAX) (See *1.)
59	Model registration area lower right Y coordinate (0 to Y_MAX) (See *1.)
60	Index number (0 to 35)
61	Model number (0 to 4)

*1 The range varies depending on the controller model.

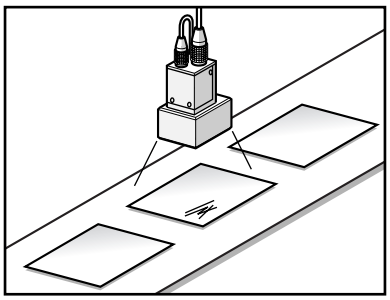
Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

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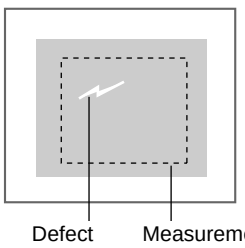
Defect

The Density Defect processing item is used to inspect measurement objects using differences in density (brightness) in the measurement region.
This processing item is suitable for external inspections for defects or dirt on unbuttoned measurement objects and defects or burrs on parts.

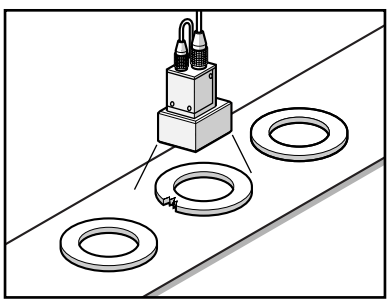
Example: Checking for Stains on Sheets



Defect found using density changes within measurement region.



Example 2: Inspecting for Defects or Burrs in O Rings



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Operational Flow

Selecting Measurement Images 3

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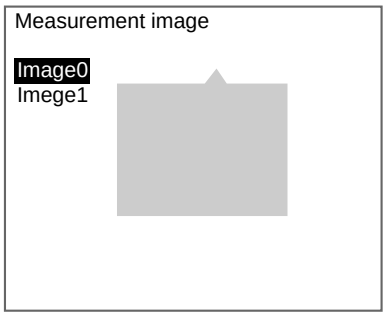
- Submenus for Expressions 10
- External Reference Table 10

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Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [Defect/Measurement image]



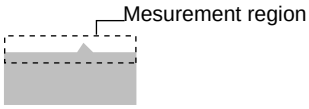
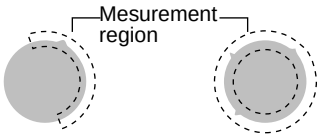
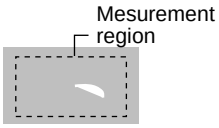
1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.

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Drawing Measurement Regions

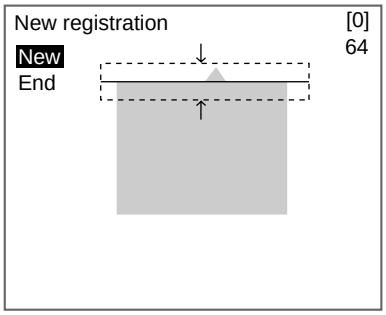
For the shape of the measurement region, select line, circumference, arc or region.
Do not include areas with marks and patterns in the measurement region. It will not be possible to distinguish them from surface detects, and measurement will not be performed properly.

Figure	Details
Line	Select to detect chipping or burrs on the measurement object. Only one line can be drawn. 
Circumference, Arc	Select to detect chipping or burrs on the circular measurement object. Only one circumference or arc can be drawn. 
Region	Select to detect the defects on the whole measurement object. Up to three figures (box, ellipse, circle, circumference) can be drawn. 

CHECK!
Position detection can be also performed using algorithms for detecting defects.
When a measurement region is drawn, measurement is performed for the displayed image and the results are registered as the reference values (X and Y coordinates of the position where the defect was found). This position becomes the reference position, so be sure to place the measurement object in the correct position before drawing the measurement region.

▶ [Defect/Region/figure/New]

1. Draw a figure in the region to be measured.



CHECK!
Up to 3 figures can be drawn to create a region if [Defect (region)] has been selected.
SECTION 1 Basic Operating Procedures, “Drawing a Region”

2. Select [End].

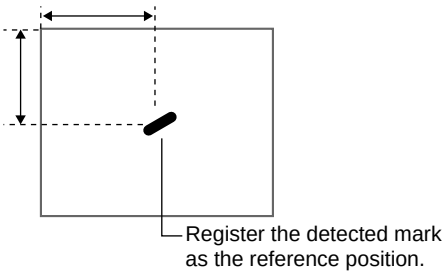
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Registering Reference Positions

Position detection can be also performed using algorithms for detecting defects.
Register the reference values when performing position detection.
(The following reference values must be registered: The X and Y coordinates of the position found as a defect)

Example: Inspecting Whether or Not the Measurement Object Is Always in the Same Position

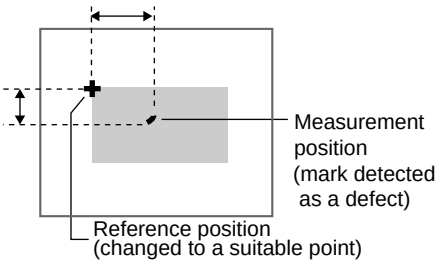
Display a measurement object in the correct position, detect a mark, and register that position as the reference position.



CHECK!

The reference position can be changed to enable the following function.

- Inspecting Positions from a Specified Point
  Once the reference values (area and center of gravity) have been obtained for the image currently displayed, the reference position is changed to an suitable point. Position inspection can be performed by calculating the difference between this reference position and the measurement position.

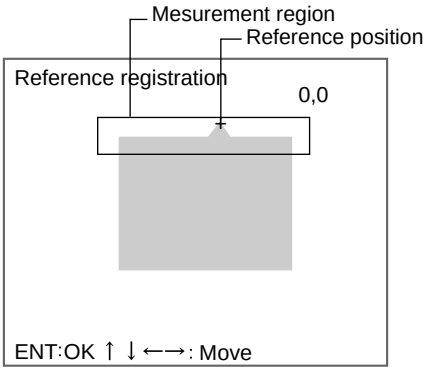


▶ [Defect/Reference registration]

1. A cursor will appear at the position of the defect.

2. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

3. Press the ENT Key.



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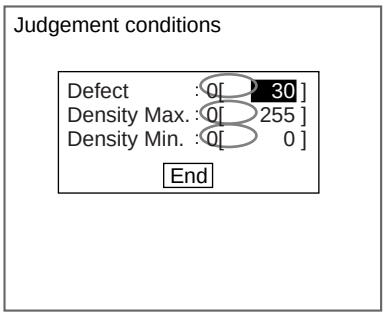
Setting judgement Conditions

Set the conditions for determining defects.
Set a deviation for an OK judgement.
Measure several samples and set the judgement conditions while referring to the measurement results.

▶ [Defect/Judgement conditions]

1. Set each item.

2. Select [End].



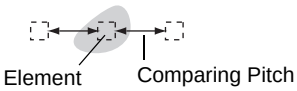
: The measurement results for the displayed image
Use these values as references in setting the upper and lower limits.

Setting data	Selection	Details
Defect	0 to 255	Set the upper limit for an OK judgement. (The lower limit is fixed at “0”.) When [Defect level] is set to 30, the judgement will be OK if the measured value is between 0 and 30.
Density Max.	0 to 255	Set the density upper limit.
Density Min.	0 to 255	Set the density lower limit.

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Changing Detection Conditions (Changing Detailed Conditions)

To shorten measurement processing time, change the conditions for detecting defects.
When a measurement region is drawn, rectangular areas called elements are created automatically. The average densities in these elements are calculated and compared to the average densities of surrounding elements as the elements are moved across the measurement region. The differences in the average densities of the elements are called the defect values. The defect values for all elements are calculated, and if the largest defect value is equal to or greater than the judgement condition, a defect will be detected for the measurement region.

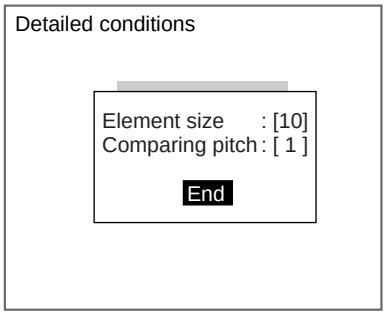


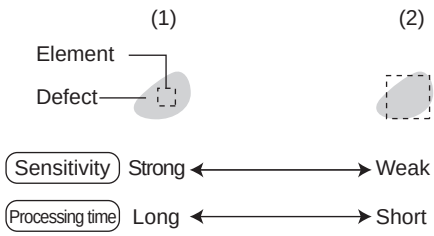
The greater [Element size] and [Comparing pitch], the shorter the processing time. However, the accuracy of the measurement will decrease.
Once the element size or comparing pitch setting has been changed, perform measurements to check that they can be performed correctly.

▶ [Defect/Detailed conditions]

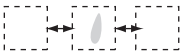
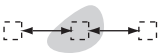
1. Set each item.

2. Select [End].



Setting data	Selection	Details
Element size	4 to 80 (default setting: 10)	Determine the element size according to the size of the defect to be detected. Setting a smaller element size increases detection sensitivity. Setting a larger element size decreases detection sensitivity. Example:  If density that is not part of the defect is included in the calculations as shown in (2), the differences with areas that are not part of the defect will be reduced. In other words, the more the background is included in the element, the weaker the sensitivity will be.

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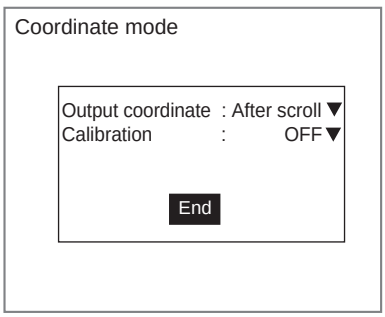
Setting data	Selection	Details
Comparing pitch	1 to 6 (default setting: 1)	Determine the comparing pitch based on the size of the defects and the size of the elements. The larger the comparing pitch, the shorter the processing time will be. If the element size is larger than the defect size: Set a smaller comparing pitch. To find line-shaped defects, set it to about 1 or 2.  If the defect size is larger than the element size: Set a somewhat larger comparing pitch. If the comparing pitch is too small, comparisons will be made for elements on the edges of defects, reducing the defect value. 

Setting the Coordinate Mode

Select the type of coordinate values.

CHECK! If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [Defect/Coordinate mode]



1. Set each item.

2. Select [End].

Settings Data

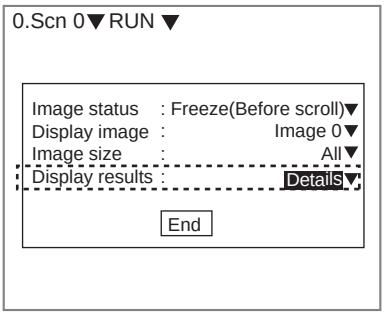
SECTION 7 Appendix, “Coordinate Handling Method”

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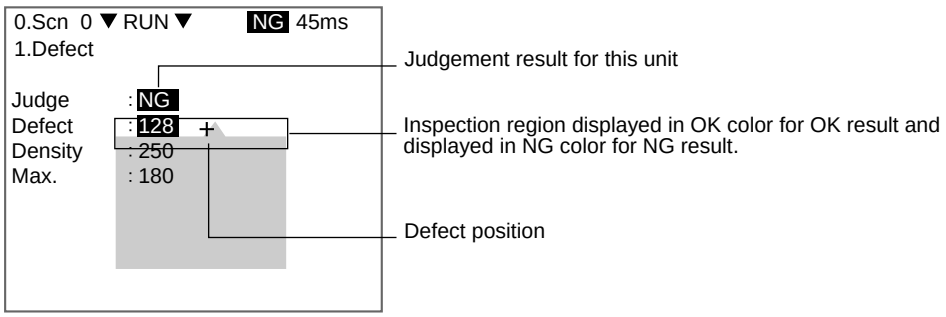
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Defect	F	Defect level measured
Max. density	GA	Maximum density in the measurement region
Min. density	GI	Minimum density in the measurement region
Defect position	X	X coordinate of defect position measured
Defect position	Y	Y coordinate of defect position measured
Reference position	SX	X coordinate of reference position
Reference position	SY	Y coordinate of reference position
Displacement	DX	Difference between measured and reference X coordinate
Displacement	DY	Difference between measured and reference Y coordinate

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Defect level measured
2	Maximum density in the measurement region
3	Minimum density in the measurement region
4	X coordinate of defect position measured
5	Y coordinate of defect position measured
6	X coordinate of reference position
7	Y coordinate of reference position
8	Difference between measured and reference X coordinate
9	Difference between measured and reference Y coordinate

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■ Setting Data

Data type	Details
31	Measurement image (0: Image 0 1: Image 1)
32	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF 2: After scroll, calibration ON 3: Before scroll, calibration ON)
33	Defect judgement value (0 to 255)
34	Density judgement upper limit (0 to 255)
35	Density judgement lower limit (0 to 255)
36	Element size (4 to 80)
37	Comparing pitch (1 to 6)
The following setting data is for the [Defect (region)].	
38	Region upper left X (0 to X_MAX) (See *1.)
39	Region upper left Y (0 to Y_MAX) (See *1.)
40	Region lower right X (0 to X_MAX) (See *1.)
41	Region lower right Y (0 to Y_MAX) (See *1.)
The following setting data is for the [Defect (line)].	
42	Start X (0 to X_MAX) (See *1.)
43	Start Y (0 to Y_MAX) (See *1.)
44	End X (0 to X_MAX) (See *1.)
45	End Y (0 to Y_MAX) (See *1.)
46	Width (1 to 64)
The following setting data is for the [Defect (circum)].	
47	Center X (0 to X_MAX) (See *1.)
48	Center Y (0 to Y_MAX) (See *1.)
49	Radius (1 to R_MAX) (See *1, *2.)
50	Width (1 to 64)
The following setting data is for the [Defect (arc)].	
51	Center X (0 to X_MAX) (See *1.)
52	Center Y (0 to Y_MAX) (See *1.)
53	Radius (1 to R_MAX) (See *1, *2.)
54	Width (1 to 64)
55	Start angle (-180.00 to 180.00)
56	End angle (-180.00 to 180.00)
The following settings data is for all measurements.	
57	Reference position X (0 to X_MAX) (See *1)
58	Reference position Y (0 to Y_MAX) (See *1)

*1: The range varies depending on the controller model.

Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483
1 to R_MAX	1 to 1024	1 to 512

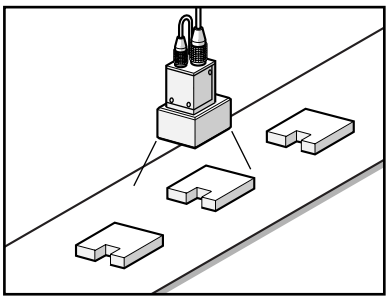
*2: Sometimes excessively small or large values cannot be set depending on the specified coordinate of the circle center or element size.

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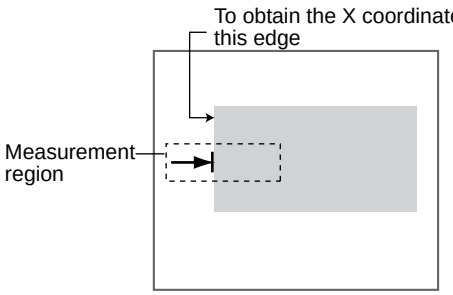
Edge Position_1

The Edge Position processing item uses the density (brightness) in the measurement region to find the position of the measurement object.
Use this processing item to find the edge coordinates or width of the measurement object.

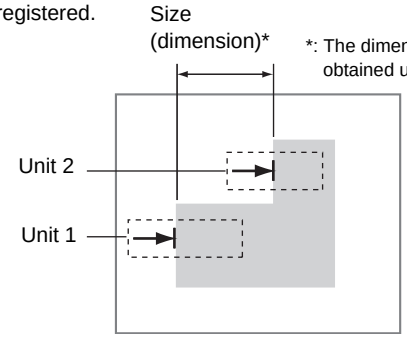
Example: Finding the size of a molded product.



The edge is found using density changes in the measurement region.



The size (dimensions) of the edge can also be obtained if multiple regions are registered.



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Operational Flow

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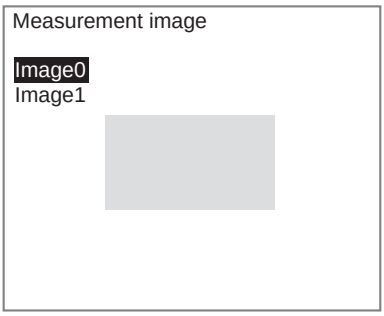
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Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [Edge position_1/Measurement image]



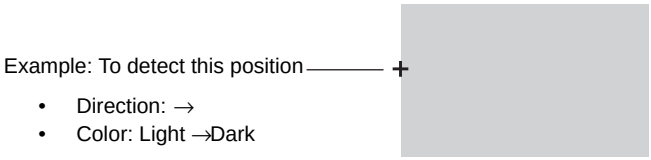
1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.

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Setting Edge Detection Conditions

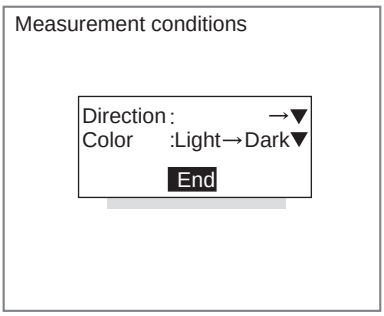
Set the direction for edge detection and the density changes.



▶ [Edge position_1/Measurement conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Direction	→ ← ↑ ↓	Select the edge detection direction.
Color	Light to Dark Dark to Light	Select the density change.

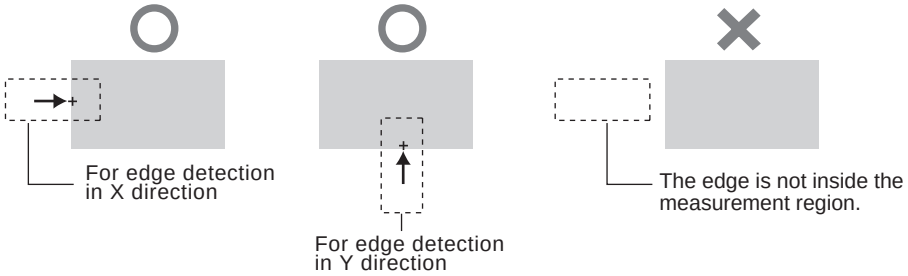
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Drawing Measurement Regions

Draw a measurement region to include all the edges for detection.
When a measurement region is drawn, measurement is performed for the displayed image and the result is registered as the reference value (edge position).

CHECK!

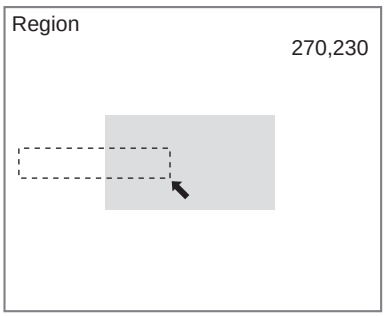
If the edge is not in the measurement region, measurement will not be possible. Make a region of a size and position that allows for movement of the range of the measurement object.



▶ [Edge position_1/Region]

1. Draw a box-shaped region.

Specify the upper left and lower right coordinates.



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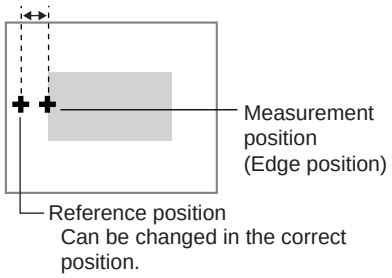
Re-registering Reference Values

This operation is performed when only the reference value is to be re-registered.
When a measurement region is drawn, the measurement is performed for the displayed image and the results are registered as the reference values. If the re-registering function explained here is used, only the reference values for the image currently displayed will be registered. (Edge position is registered for the reference value).

CHECK!

The reference position can be changed to enable the following function.

- Measuring Positions from a Specified Position
  Once the reference values have been obtained for the image currently displayed, the reference position is changed to an suitable point. Position inspection can be performed by calculating the difference between this reference position and the measurement position.



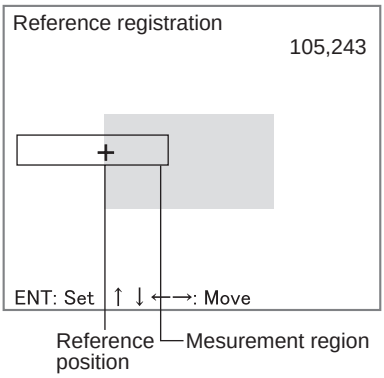
CHECK!

When the measurement region is changed, the reference value returns to the default setting.

▶ [Edge position_1/Reference registration]

1. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.



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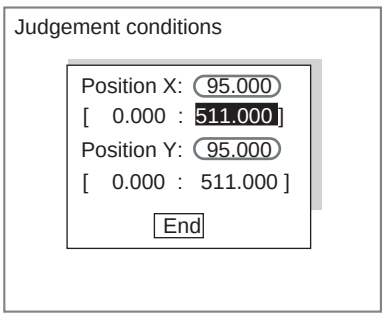
Setting Judgement Conditions

Set the position ranges for an OK judgement.

▶ [Edge position_1/Judgement conditions]

1. Set each item.

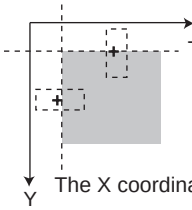
2. Select [End].



: Measurement result for the displayed image.
Use as a reference for setting conditions.

Setting data	Selection	Details
Position X	-9999.999 to 9999.999	Set the range of movement in the X direction for an OK judgement.
Position Y	-9999.999 to 9999.999	Set the range of movement in the Y direction for an OK judgement.

CHECK! Position X and Position Y will change depending on the settings under [Measurement/Direction].



The Y coordinate is set when [↑] and [↓] are selected.

The X coordinate is set when [←] and [→] are selected.

* The origin and coordinate system vary with the calibration setting.

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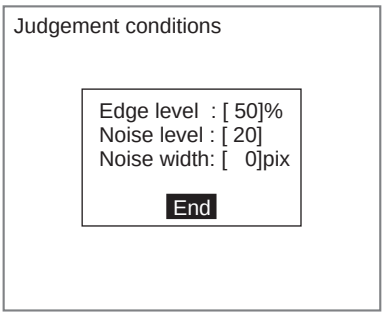
Changing Detailed Conditions

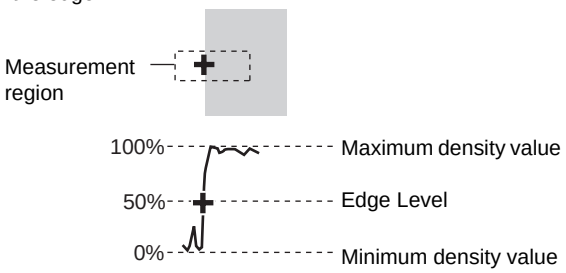
Change the detailed conditions when the measurement results are unstable. Normally, the method can be left on the default setting. After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

▶ [Edge position_1/Detailed conditions]

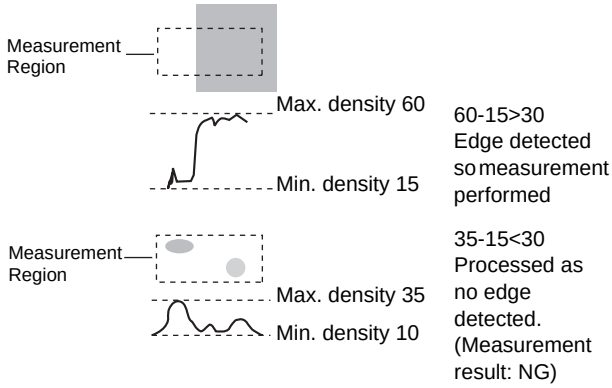
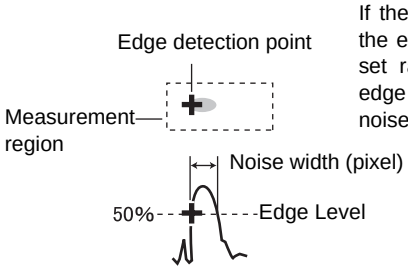
1. Set each item.

2. Select [End].



Setting data	Selection	Details
Edge Level	0 to 100 (default setting: 50)	Set a density change level between 0 and 100 that will indicate the edge. 

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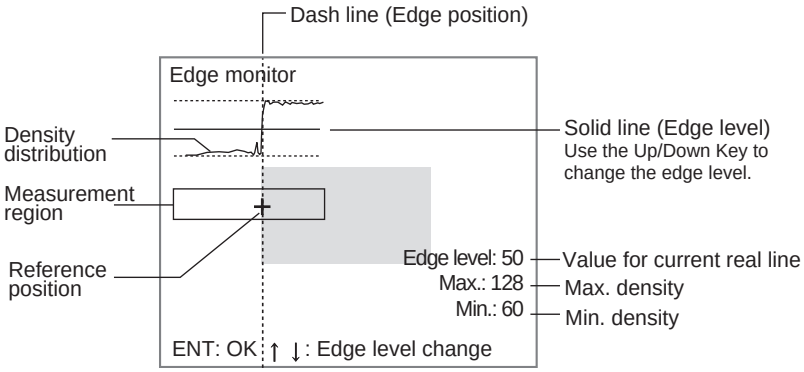
Setting data	Selection	Details
Noise Level	0 to 255 (default setting: 20)	Noise level used to make judgement if edges are present or not. The maximum density and minimum density within the edge detection area is calculated and if the difference between the two values is less than the noise level, then the Controller determines that there is no edge. If noise is causing incorrect detection, make this value higher. (Within the edge detection region) Max. density - min. density < noise level →no edge →NG measurement result Max. density - min. density ≥ noise level →Edge →Used for measurement Example: When [Noise level] is set to 30 
Noise Width	0 to 255 (default setting: 0)	Set the width of objects that are to be judged as noise. If the density distribution from the position where the edge was first detected falls to below the edge level within the noise width range, the detected point is judged as noise.If noise is causing incorrect detection, make this value higher.  If the density falls below the edge level within the set range, the detected edge is determined to be noise.

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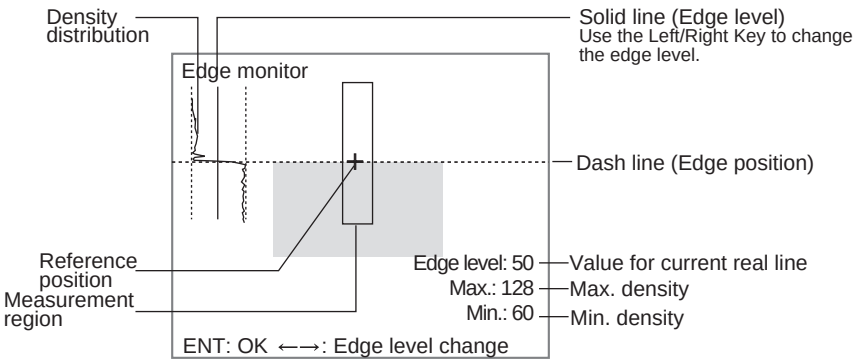
Checking the Density Distribution Near the Edge

The density distribution and edge level within the measurement region can be checked on the screen.
The edge level can also be set while monitoring density distribution.
After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

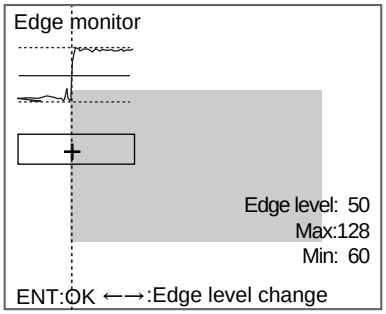
- When edge detection directions is Left or Right:



- When edge detection directions is Up or Down:



▶ [Edge position_1/Edge monitor]



- To check density distribution and edge level
  Check the density distribution near the edge and press the ESC key to exit.
- To change the edge level
  Use the Up/Down/Left/Right Keys to move the cursor and press the ENT Key.

CHECK! The edge level can also be set in [Detailed conditions]. (The setting that has been specified the last will become effective.)
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Setting the Coordinate Mode

Select the type of coordinate values.

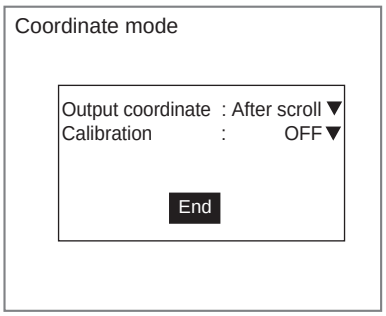
CHECK!

If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [Edge position_1/Coordinate mode]

1. Set each item.

2. Select [End].



Settings Data

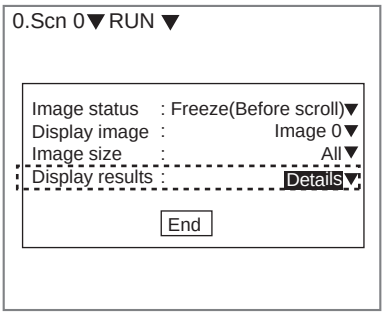
SECTION 7 Appendix, “Coordinate Handling Method”

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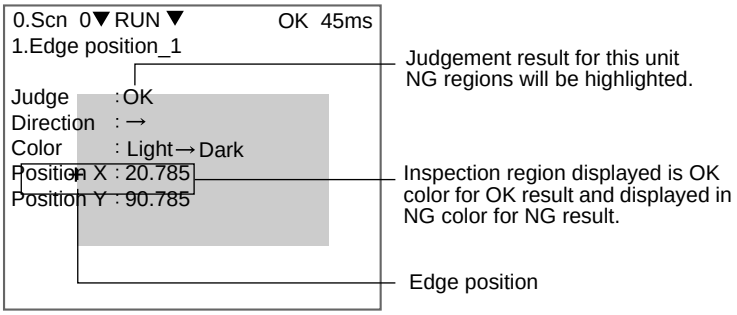
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Edge position	X	X coordinate of measured edge position
Edge position	Y	Y coordinate of measured edge position
Reference position	SX	X coordinate of reference position
Reference position	SY	Y coordinate of reference position
Displacement	DX	Difference between measured and reference X coordinate
Displacement	DY	Difference between measured and reference Y coordinate

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	X coordinate of measured edge position
2	Y coordinate of measured edge position
3	X coordinate of reference position
4	Y coordinate of reference position
5	Difference between measured and reference X coordinate
6	Difference between measured and reference Y coordinate

■ Setting Data

Data type	Details
31	Measurement image (0: Image 0 1: Image 1)
32	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF 2: After scroll, calibration ON 3: Before scroll, calibration ON)
33	X upper limit (-9,999.999 to 9,999.999)
34	X lower limit (-9,999.999 to 9,999.999)
35	Y upper limit (-9,999.999 to 9,999.999)
36	Y lower limit (-9,999.999 to 9,999.999)
37	Region upper left X (0 to X_MAX) (See *1.)
38	Region upper left Y (0 to Y_MAX) (See *1.)
39	Region lower right X (0 to X_MAX) (See *1.)
40	Region lower right Y (0 to Y_MAX) (See *1.)
41	Edge detection direction (0: ↑ 1: ↓ 2: →3: ←)
42	Edge color (0: Light →Dark, 1: Dark →Light)
43	Edge level (0 to 100)
44	Noise level (0 to 255)
45	Noise width (0 to 255)
46	Reference position X (0 to X_MAX) (See *1)
47	Reference position Y (0 to Y_MAX) (See *1)

*1: The range varies depending on the controller model.

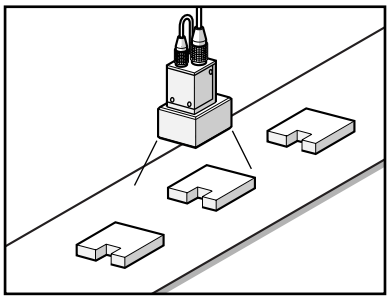
Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

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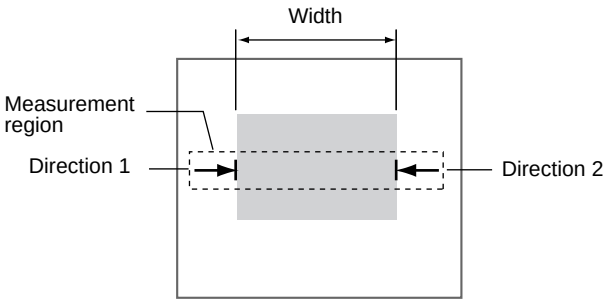
Edge Width

The Edge Width processing item uses the density (brightness) in the measurement region to find the width of the measurement object.

Example: Finding the size of a molded product.



Two edges where the density changes are found inside the measurement region, and the distance between the two edges is considered to be the width of the object.



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Operational Flow

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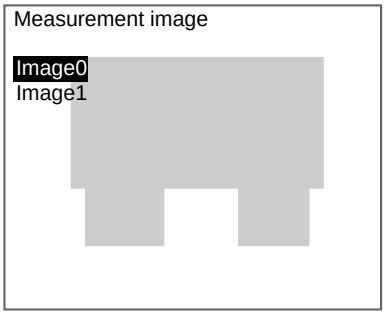
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Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [Edge width/Measurement image]



1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

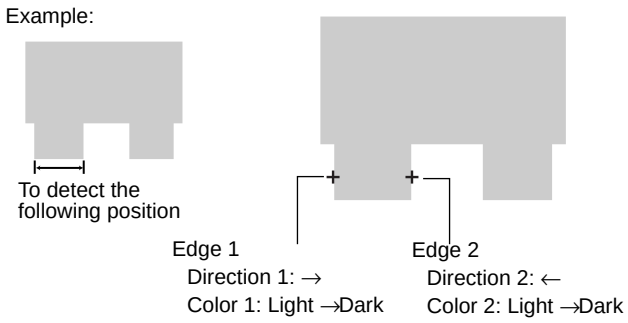
2. Press the ENT Key.

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Setting Edge Detection Conditions

[Edge width] detects two edges where the density changes inside a region to find the width of the object.

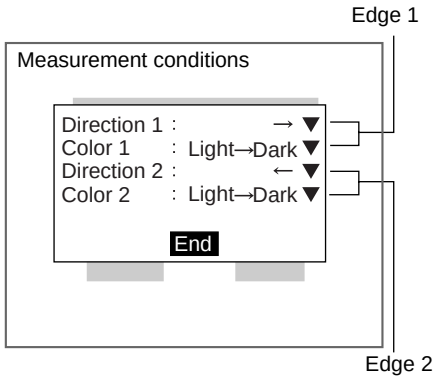
Set the direction for edge detection and the density changes.

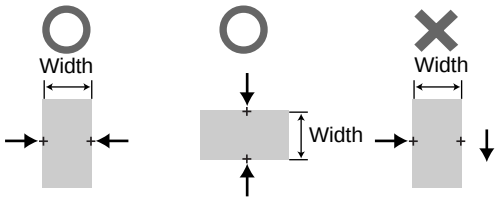


▶ [Edge width/Measurement conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Direction☐	→ ←, ↑ , ↓	Select the edge detection direction.
Color☐	Light to Dark Dark to Light	Select the density change. Set the directions for the edge 1 and edge 2 so that the width to be set is enclosed. 

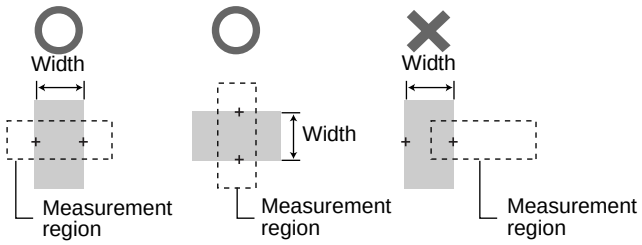
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Drawing Measurement Regions

Draw a measurement region to include all the edges for detection.
When a measurement region is drawn, measurement is performed for the displayed image and the result is registered as the reference value (two edge positions, edge width).

CHECK!

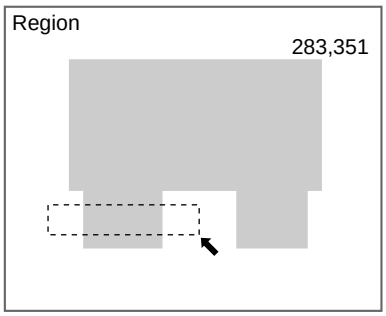
If the 2 edges are not in the measurement region, measurement will not be possible. Make a region of a size and position that allows for movement of the range of the measurement object.



▶ [Edge width/Region]

1. Draw a box-shaped region.

Specify the upper left and lower right coordinates.



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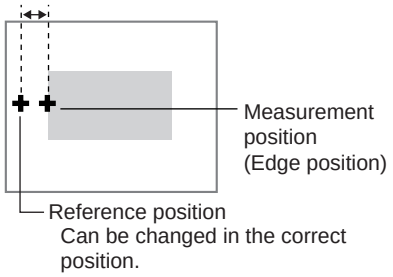
Re-registering Reference Values

This operation is performed when only the reference value is to be re-registered.
When a measurement region is drawn, the measurement is performed for the displayed image and the results are registered as the reference values. If the re-registering function explained here is used, only the reference values for the image currently displayed will be registered.
(Items to be registered as the reference value: Two edge positions (edge 1, edge 2), edge width)

CHECK!

The reference position can be changed to enable the following function.

- Measuring Positions from a Specified Position
  Once the reference values have been obtained for the image currently displayed, the reference position is changed to an suitable point. Position inspection can be performed by calculating the difference between this reference position and the measurement position.



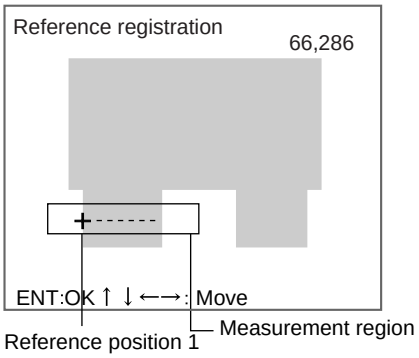
CHECK!

When the measurement region is changed, the reference value returns to the default setting.

▶ [Edge width/Reference registration]

1. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

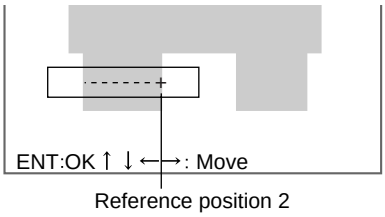
2. Press the ENT Key.



A cursor will appear at the position of edge 2.

3. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

4. Press the ENT Key.



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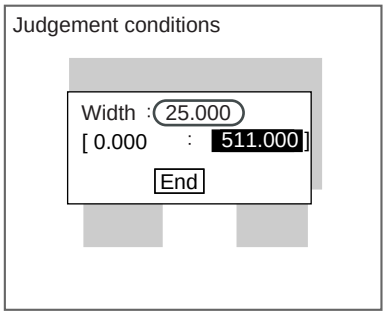
Setting Judgement Conditions

Set the width range for an OK judgement.

▶ [Edge width/Judgement conditions]

1. Set each item.

2. Select [End].



: The measurement results for the displayed image.
Use these values as references in setting the upper and lower limits.

Setting data	Selection	Details
Width	0 to 9999.999	Set the width range for an OK judgement.

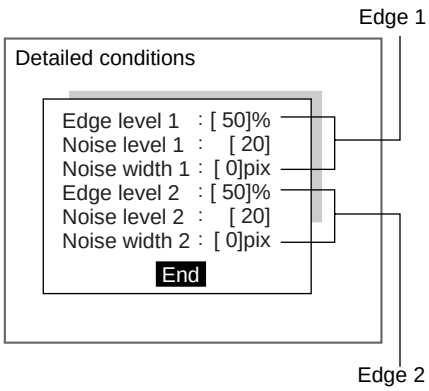
Changing Detailed Conditions

Change the detailed conditions when the measurement results are unstable. Normally, the method can be left on the default setting. After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

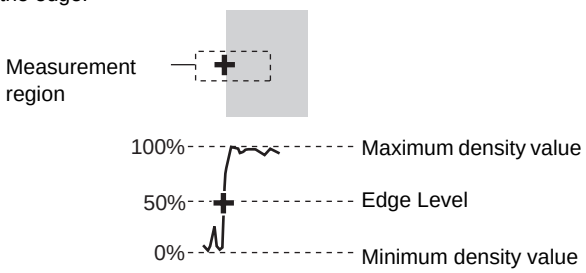
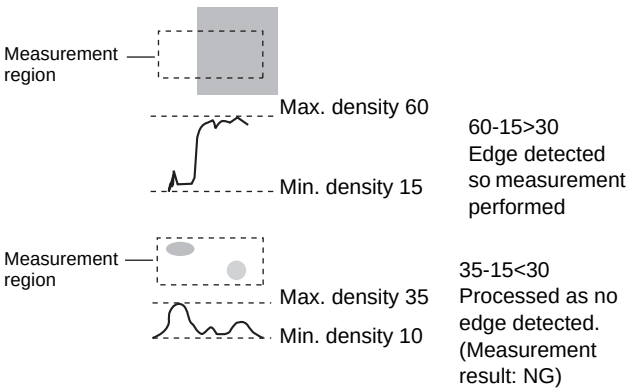
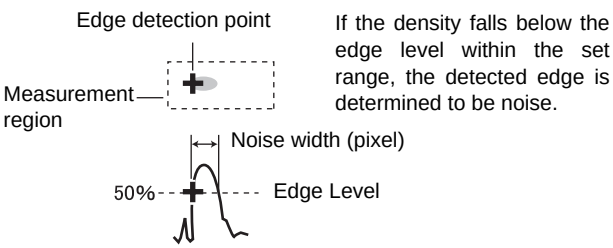
▶ [Edge width/Detailed conditions]

1. Set each item.

2. Select [End].



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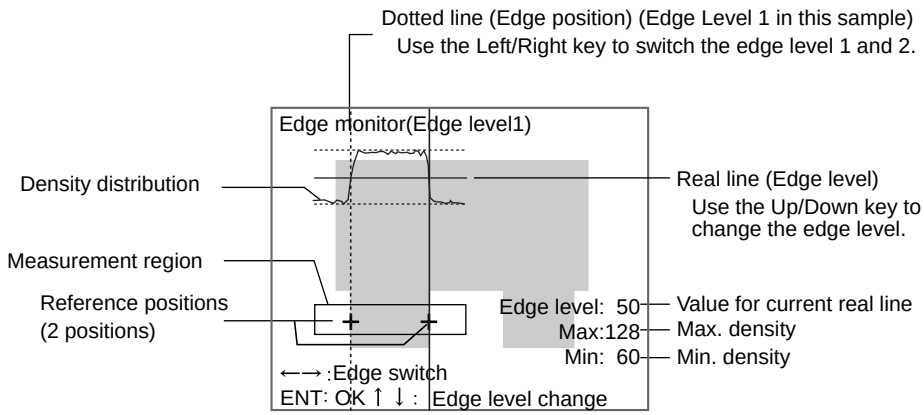
Setting data	Selection	Details
Edge Level☐	0 to 100 (default setting: 50)	Set a density change level between 0 and 100 that will indicate the edge. 
Noise Level☐	0 to 255 (default setting: 20)	Noise level used to make judgement if edges are present or not. The maximum density and minimum density within the edge detection area is calculated and if the difference between the two values is less than the noise level, then the Controller determines that there is no edge. If noise is causing incorrect detection, make this value higher. Example: When [Noise level] is set to 30 
Noise Width☐	0 to 255 (default setting: 0)	Set the width of objects that are to be judged as noise. If the density distribution from the position where the edge was first detected falls to below the edge level within the noise width range, the detected point is judged as noise.If noise is causing incorrect detection, make this value higher. 

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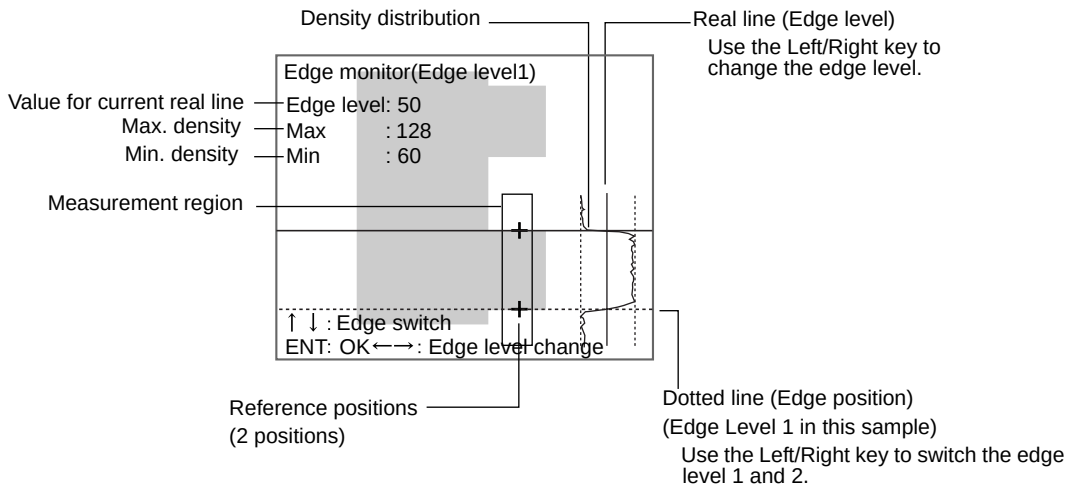
Checking the Density Distribution Near the Edge

The density distribution and edge level within the measurement region can be checked on the screen.
The edge level can also be set while monitoring density distribution.
After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

- When edge detection directions is Left or Right:



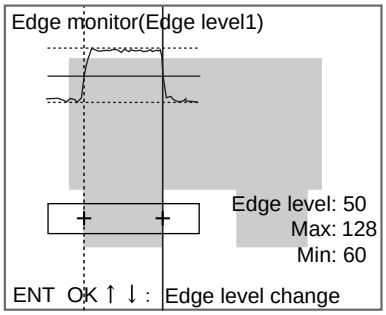
- When edge detection directions is Up or Down:



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▶ [Edge width/Edge monitor]

- To check density distribution and edge level
  Check the density distribution near the edge and press the ESC key to exit.
- To change the edge level
  Use the Up/Down/Left/Right Keys to move the cursor and press the ENT Key.



CHECK! The edge level can also be set in [Detailed conditions]. (The setting that has been specified the last will become effective.)
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Setting the Coordinate Mode

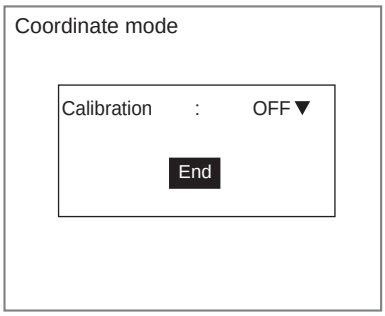
Select the type of coordinate values.

CHECK! If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [Edge width/Coordinate mode]

1. Set each item.

2. Select [End].



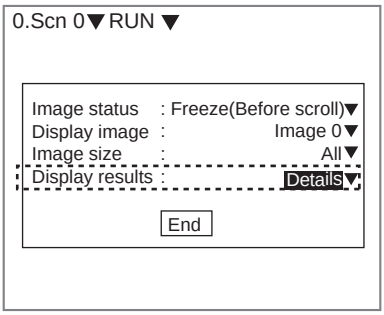
Settings Data
SECTION 7 Appendix, “Coordinate Handling Method”

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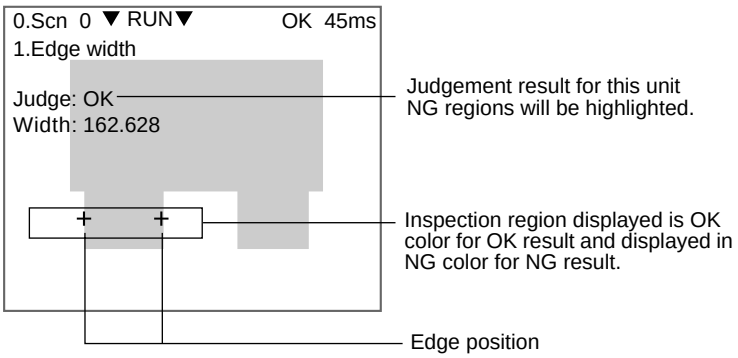
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Width	WD	Edge width for measurement result
Reference width	SW	Edge width when measurement region drawn
Displacement	DW	Difference between measured and reference edge widths

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Edge width for measurement result
2	Edge width when measurement region drawn
3	Difference between measured and reference edge widths

■ Setting Data

Data type	Details
31	Measurement image (0: Image 0 1: Image 1)
32	Coordinate mode (0: Calibration OFF 1: Calibration ON)
33	Edge width upper limit (0 to 9,999.999)
34	Edge width lower limit (0 to 9,999.999)
35	Edge 1 detection direction (0: ↑ 1: ↓ 2: →3: ←)
36	Edge 1 color (0: Light →dark 1: Dark →light)
37	Edge 1 level (0 to 100)
38	Edge 1 noise level (0 to 255)
39	Edge 1 noise width (0 to 255)
40	Edge 2 detection direction (0: ↑ 1: ↓ 2: →3: ←)
41	Edge 2 color (0: Light →dark 1: Dark →light)
42	Edge 2 level (0 to 100)
43	Edge 2 noise level (0 to 255)
44	Edge 2 noise width (0 to 255)
45	Region upper left X (0 to X_MAX) (See *1.)
46	Region upper left Y (0 to Y_MAX) (See *1.)
47	Region lower right X (0 to X_MAX) (See *1.)
48	Region lower right Y (0 to Y_MAX) (See *1.)
49	Reference position X1 (0 to X_MAX) (See *1)
50	Reference position Y1 (0 to Y_MAX) (See *1)
51	Reference position X2 (0 to X_MAX) (See *1)
52	Reference position Y2 (0 to Y_MAX) (See *1)

*1: The range varies depending on the controller model.

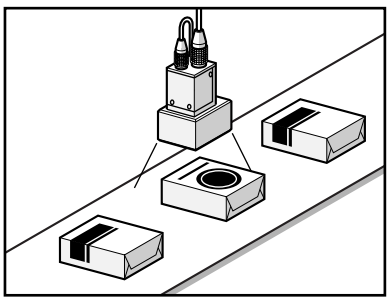
Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

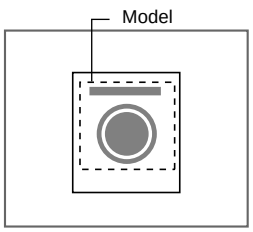
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Gray Search

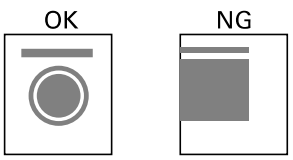
The Precise Search processing item is used to distinguish between measurement object shapes or positions.
The part of the input image that most corresponds to the special characteristics of the measurement image (model) is found and the correlation (degree of similarity) and position are detected.

Example: Detecting for Mixed Varieties of Packaging





When Judgement (Correlation) is 70:



Correlation: 80 Correlation: 20

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Operational Flow

Selecting Measurement Images 3

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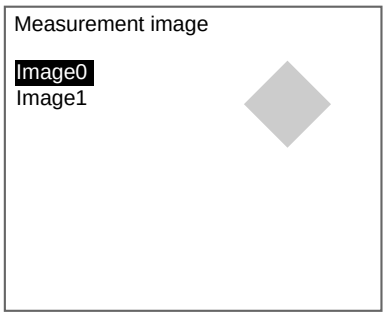
Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [Gray search/Measurement image]

1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.



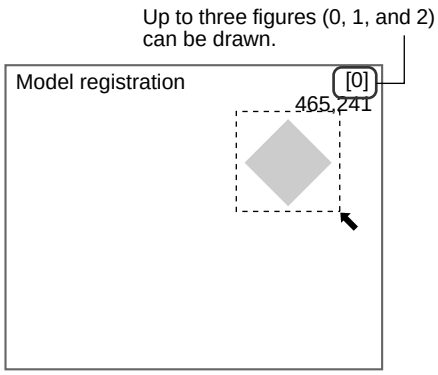
Registering the Model

The area of the image to be inspected is registered as a model.
When a model is registered, the center position of the model is registered as the search coordinates. (When several figures have been combined in the drawing, the center coordinates of circumscribing rectangle becomes the search coordinates.)

▶ [Gray search/Model registration]

1. Draw the region to be registered as the model with the selected figure.

SECTION 1 Basic Operating Procedures, “Drawing a Region”



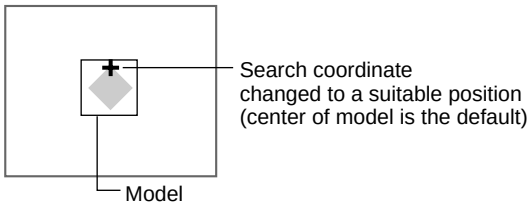
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Changing the Search Coordinates

Use this function to change the search coordinates only.
When a model is registered, the center position of the model is registered as the search coordinates. This function can be used to register a point other than the center of the model as the search coordinates.

CHECK!

The search coordinates are used for the point output as the measurement value. The search coordinates can be changed to an appropriate position.
Changing the Point Output as the Measurement Value

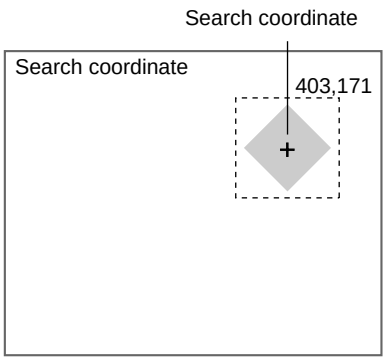


If the model is re-registered, the search coordinates are changed to the center position of the new model.

▶ [Gray search/Search coordinate]

1. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.



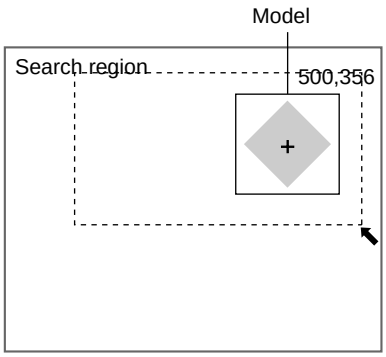
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Setting the Search Region

Set the region in which the model is to be searched for.
It is possible to perform a search for the entire input image, but the processing time can be shortened and the accuracy can be increased by setting limits on the search region.

▶ [Gray search/Search region]

1. Draw a rectangular search region.
Specify the upper left and lower right coordinates.



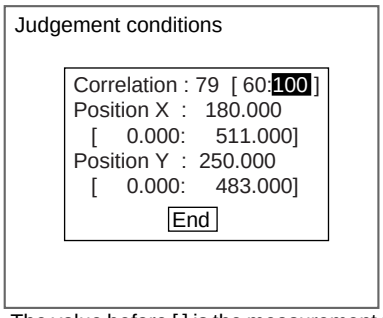
Setting Judgement Conditions

Set the judgement conditions for the correlation with the model and for the position (X, Y) where the object was detected.

▶ [Gray search/Judgement conditions]

1. Set each item.

2. Select [End].



The value before [ ] is the measurement results for the displayed image. Use these values as references in setting the upper and lower limits.

Setting data	Selection	Details
Correlation	0 to 100	Set the correlation lower limit. The judgement will be OK if the measured value is upper than this.
Position X	-9,999.999 to 9,999.999	Set the range of movement in the X direction for an OK judgement.
Position Y	-9,999.999 to 9,999.999	Set the range of movement in the Y direction for an OK judgement.

Search
SECTION 7 Appendix, “Search”

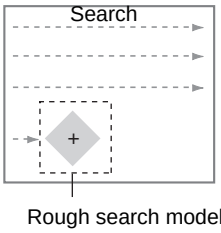
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Changing Detailed Conditions

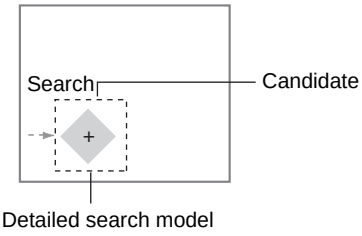
The search settings can be changed here. Change the conditions if the measurement results are unstable or if high-speed processing is required. Normally, the method can be left on the default setting. After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

The Controller performs the following 2-stage processing internally.

1. Rough search
   Uses the rough search model to search every item in the measurement region and detect candidate points.



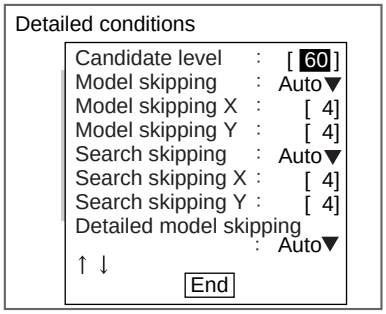
2. Detailed search
   Uses the detailed search model to re-measure the images surrounding the candidate point.



▶ [Gray search/Detailed conditions]

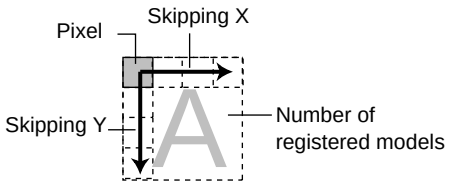
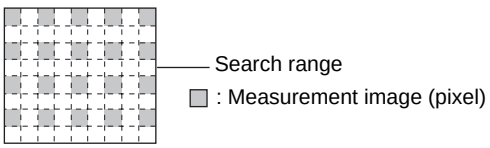
1. Set each item.

2. Select [End].



Setting data	Selection	Details
Candidate level	0 to 100 (default setting: 60)	Set the level to be used to search the model during rough search. Reduce the correlation level if the model searches are unstable.

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<table>
<tr><th>Setting data</th><th>Selection</th><th>Details</th></tr>
<tr><td>Model skipping
Detailed model skipping</td><td colspan="2">Set the number of pixels to be skipped for the search model (i.e. the number of pixels to be skipped from the registered models). [Model skipping] is used to set pixel skipping conditions for rough search models, and [Detailed model skipping] is used to set for detailed search models. The setting range is the same.
Example: When Skipping X: 2 and Skipping Y: 2

</td></tr>
<tr><td></td><td>Auto (default setting)</td><td>The controller sets the appropriate numbers (X, Y) of pixels to be skipped. The specified values will be displayed for model skipping X, Y (or detailed model skipping X, Y).</td></tr>
<tr><td></td><td>Fixed</td><td>Specify the desired number of pixels to be skipped. The specified values will be reflected for model skipping X, Y (or detailed model skipping X, Y).</td></tr>
<tr><td>Model skipping X
Detailed model skipping X</td><td>1 to 15</td><td>Set the number of pixels to be skipped in X direction.
The changes made to the number of pixels to be skipped will be effective for the models that will be registered next time. They will not be effective for the models that have already been registered.</td></tr>
<tr><td>Model skipping Y
Detailed model skipping Y</td><td>1 to 15</td><td>Set the number of pixels to be skipped in Y direction.
The changes made to the number of pixels to be skipped will be effective for the models that will be registered next time. They will not be effective for the models that have already been registered.</td></tr>
<tr><td>Search skipping</td><td colspan="2">Set the number of pixels to be skipped for rough search.
The number of pixels to be skipped in the measurement region must be set.
Example: When Skipping X: 2 and Skipping Y: 2

</td></tr>
<tr><td></td><td>Auto (default setting)</td><td>The controller sets the appropriate numbers (X, Y) of pixels to be skipped
The specified values will be displayed for search skipping X, Y.</td></tr>
<tr><td></td><td>Fixed</td><td>Specify the desired number of pixels to be skipped. The specified values will be reflected for search skipping X, Y.</td></tr>
<tr><td>Search skipping X</td><td>1 to 15</td><td>Set the number of pixels to be skipped in X direction.</td></tr>
<tr><td>Search skipping Y</td><td>1 to 15</td><td>Set the number of pixels to be skipped in Y direction.</td></tr>
</table>

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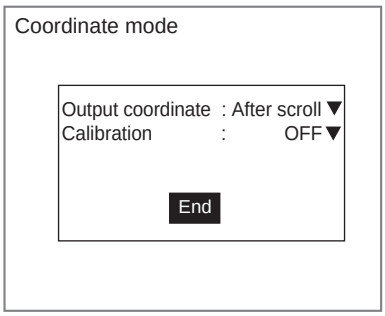
Setting the Coordinate Mode

Select the type of coordinate values.

CHECK!

If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [Gray search/Coordinate mode]



1. Set each item.

2. Select [End].

Settings Data

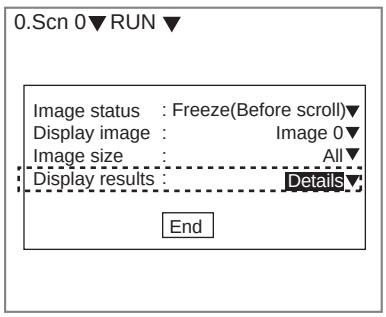
SECTION 7 Appendix, “Coordinate Handling Method”

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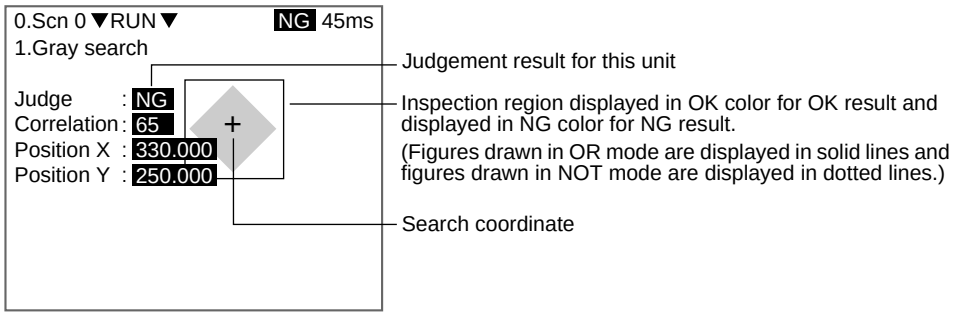
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Search position	X	X coordinate of position where model found
Search position	Y	Y coordinate of position where model found
Correlation value	CR	Correlation value with model
Reference position	SX	X coordinate when model registered
Reference position	SY	Y coordinate when model registered
Displacement	DX	Difference between measured and reference X coordinate
Displacement	DY	Difference between measured and reference Y coordinate

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	X coordinate of position where model found
2	Y coordinate of position where model found
3	Correlation value with model
4	X coordinate when model registered
5	Y coordinate when model registered
6	Difference between measured and reference X coordinate
7	Difference between measured and reference Y coordinate

Gray Search
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■ Setting Data

Data type	Details
31	Measurement image (0: Image 0 1: Image 1)
32	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF 2: After scroll, calibration ON 3: Before scroll, calibration ON)
33	X upper limit (-9,999.999 to 9,999.999)
34	X lower limit (-9,999.999 to 9,999.999)
35	Y upper limit (-9,999.999 to 9,999.999)
36	Y lower limit (-9,999.999 to 9,999.999)
37	Correlation upper limit (0 to 100)
38	Correlation lower limit (0 to 100)
39	Search region upper left X (0 to X_MAX) (See *1.)
40	Search region upper left Y (0 to Y_MAX) (See *1.)
41	Search region lower right X (0 to X_MAX) (See *1.)
42	Search region lower right Y (0 to Y_MAX) (See *1.)
43	Model registration area upper left X (0 to X_MAX) (See *1.)
44	Model registration area upper left Y (0 to Y_MAX) (See *1.)
45	Model registration area lower right X (0 to X_MAX) (See *1.)
46	Model registration area lower right Y (0 to Y_MAX) (See *1.)
47	Model reference position lower right X coordinate (0 to X_MAX) (See *1.)
48	Model reference position lower right Y coordinate (0 to Y_MAX) (See *1.)
49	Candidate level (0 to 100)
50	Model skipping setting (0: Auto 1: Fixed)
51	Model skipping X (1 to 15)
52	Model skipping Y (1 to 15)
53	Search skipping setting (0: Auto 1: Fixed)
54	Search skipping X (1 to 15)
55	Search skipping Y (1 to 15)
56	Detailed model skipping setting (0: Auto 1: Fixed)
57	Detailed model skipping X (1 to 15)
58	Detailed model skipping Y (1 to 15)

*1: The range varies depending on the controller model.

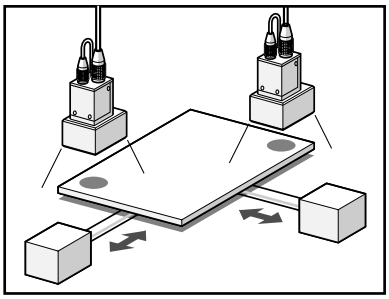
Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

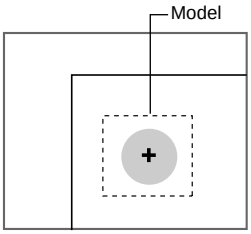
Gray Search
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Precise Search

The Precise Search processing item is used to distinguish between measurement object shapes or positions.
The part of the input image that most corresponds to the special characteristics of the measurement image (model) is found and the correlation (degree of similarity) and position are detected.Since the position can be found in sub-pixel units (smaller than pixels), measurement can be performed with high position accuracy. Processing time, however, will be longer.

Example: Positioning of fiducial mark on PCB





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Operational Flow

Selecting Measurement Images 3

Registering the Model 3

Changing the Search Coordinates 4

Setting the Search Region 5

Setting Judgement Conditions 5

Changing Detailed Conditions 6

Referencing Models 8

Setting the Coordinate Mode 8

Checking the Measurement Image 9

When you want to obtain measurement results externally 10

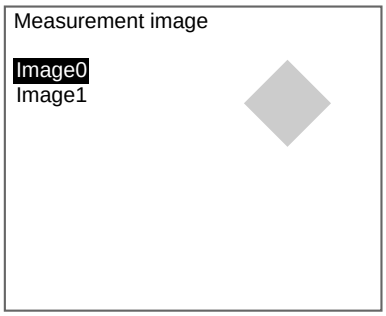
- Submenus for Expressions 10
- External Reference Table 10

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Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [Precise search/Measurement image]



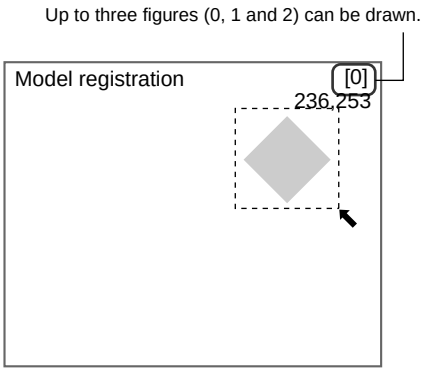
1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.

Registering the Model

The area of the image to be inspected is registered as a model.
When a model is registered, the center position of the model is registered as the search coordinates. (When several figures have been combined in the drawing, the center coordinates of circumscribing rectangle becomes the search coordinates.)

▶ [Precise search/Model registration/New/figure/drawing mode]



1. Draw the region to be registered as the model with the selected figure.

SECTION 1 Basic Operating Procedures, “Drawing a Region”

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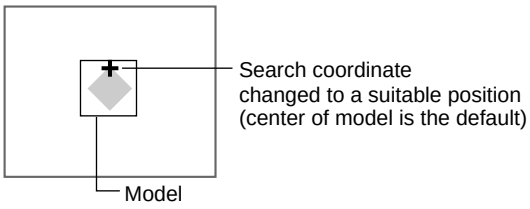
Changing the Search Coordinates

Use this function to change the search coordinates only.
When a model is registered, the center position of the model is registered as the search coordinates. This function can be used to register a point other than the center of the model as the search coordinates.

CHECK!

The search coordinates are used for the point output as the measurement value. The search coordinates can be changed to an appropriate position.

- Changing the Point Output as the Measurement Value

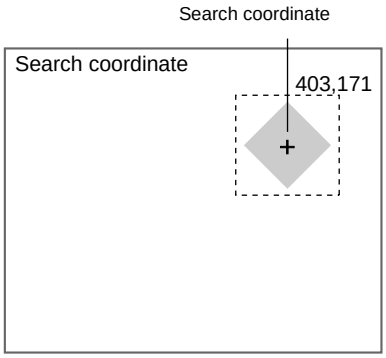


If the model is re-registered, the search coordinates are changed to the center position of the new model.

▶ [Precise search/Search coordinate]

1. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.



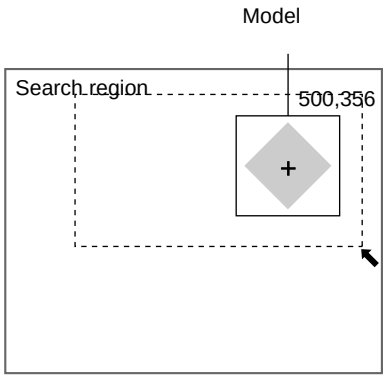
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Setting the Search Region

Set the region in which the model is to be searched for.
It is possible to perform a search for the entire input image, but the processing time can be shortened and the accuracy can be increased by setting limits on the search region.

▶ [Precise search/Search region]

1. Draw a rectangular search region.
Specify the upper left and lower right coordinates.



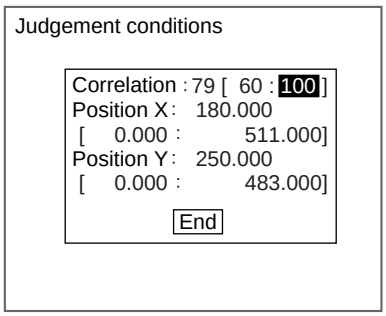
Setting Judgement Conditions

Set the judgement conditions for the correlation with the model and for the position (X, Y) where the object was detected.

▶ [Precise search/Judgement conditions]

1. Set each item.

2. Select [End].



The value before [ ] is the measurement results for the displayed image. Use these values as references in setting the upper and lower limits.

Setting data	Selection	Details
Correlation	0 to 100	Set the correlation lower limit. The judgement will be OK if the measured value is upper than this.
Position X	-9,999.999 to 9,999.999	Set the range of movement in the X direction for an OK judgement.
Position Y	-9,999.999 to 9,999.999	Set the range of movement in the Y direction for an OK judgement.

Search
SECTION 7 Appendix. “Search“

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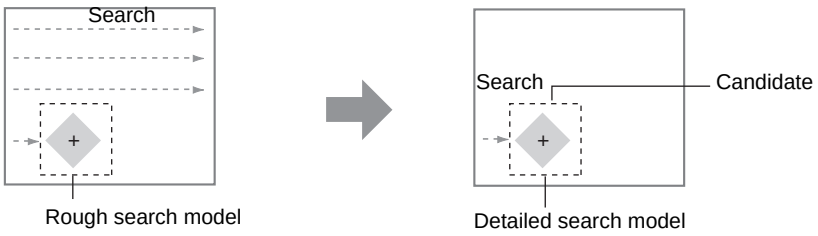
Changing Detailed Conditions

The search settings can be changed here. Change the conditions if the measurement results are unstable or if high-speed processing is required. Normally, the method can be left on the default setting. After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

The Controller performs the following 2-stage processing internally.

1. Rough search
   Uses the rough search model to search every item in the measurement region and detect candidate points.

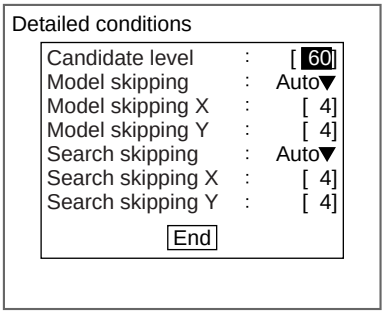
2. Detailed search
   Uses the detailed search model to re-measure the images surrounding the candidate point.



▶ [Precise search/Detailed conditions]

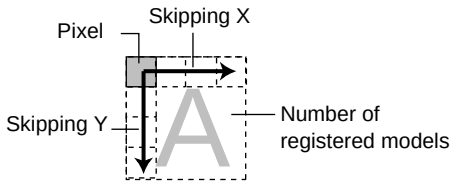
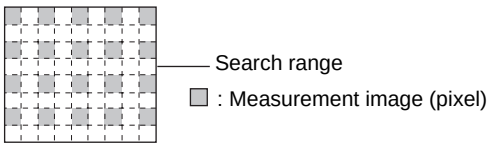
1. Set each item.

2. Select [End].



Setting data	Selection	Details
Candidate level	0 to 100 (default setting: 60)	Set the level to be used to search the model during rough search. Reduce the correlation level if the model searches are unstable.

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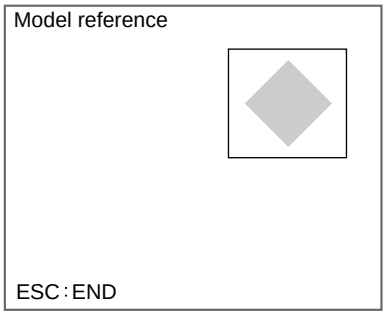
Setting data	Selection	Details
Model skipping	Set the number of pixels to be skipped for the rough search model (i.e. the number of pixels to be skipped from the registered models). Example: Skipping X and Skipping Y are set to 2:  	
	Auto (default setting)	The controller sets the appropriate numbers (X, Y) of pixels to be skipped. The specified values will be displayed for model skipping X, Y.
	Fixed	Specify the desired number of pixels to be skipped. The specified values will be reflected for model skipping X, Y.
Model skipping X	1 to 15	Set the number of pixels to be skipped in X direction. The changes made to the number of pixels to be skipped will be effective for the models that will be registered next time. They will not be effective for the models that have already been registered.
Model skipping Y	1 to 15	Set the number of pixels to be skipped in Y direction. The changes made to the number of pixels to be skipped will be effective for the models that will be registered next time. They will not be effective for the models that have already been registered.
Search skipping	Set the number of pixels to be skipped for rough search. The number of pixels to be skipped in the measurement region must be set. Example: When Skipping X: 2 and Skipping Y: 2  	
	Auto (default setting)	The controller sets the appropriate numbers (X, Y) of pixels to be skipped The specified values will be displayed for search skipping X, Y.
	Fixed	Specify the desired number of pixels to be skipped. The specified values will be reflected for search skipping X, Y.
Search skipping X	1 to 15	Set the number of pixels to be skipped in X direction.
Search skipping Y	1 to 15	Set the number of pixels to be skipped in Y direction.

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Referencing Models

Models can be displayed on screen to check what kind of images are registered as models.

▶ [Precise search/Model reference]



1. Referencing Models

2. Press the ESC Key to exit.

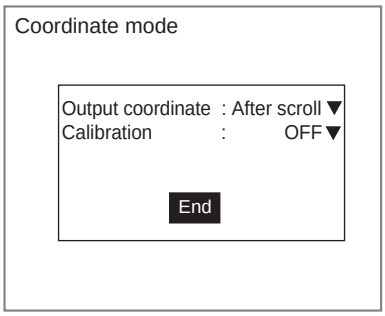
Setting the Coordinate Mode

Select the type of coordinate values.

CHECK!

If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [Precise search/Coordinate mode]



1. Set each item.

2. Select [End].

Settings Data

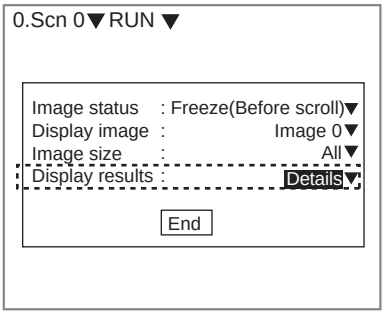
SECTION 7 Appendix, “Coordinate Handling Method”

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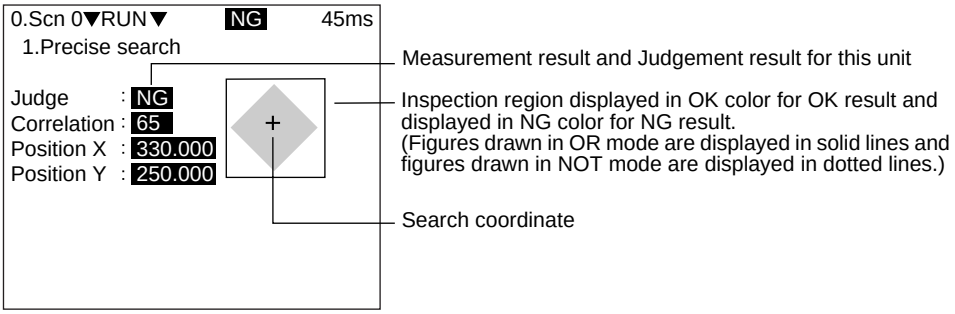
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Search position	X	X coordinate of position where model found
Search position	Y	Y coordinate of position where model found
Correlation value	CR	Correlation value with model
Reference position	SX	X coordinate when model registered
Reference position	SY	Y coordinate when model registered
Displacement	DX	Difference between measured and reference X coordinate
Displacement	DY	Difference between measured and reference Y coordinate

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	X coordinate of position where model found
2	Y coordinate of position where model found
3	Correlation value with model
4	X coordinate when model registered
5	Y coordinate when model registered
6	Difference between measured and reference X coordinate
7	Difference between measured and reference Y coordinate

Precise Search
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■ Setting Data

Data type	Details
31	Measurement image (0: Image 0 1: Image 1)
32	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF 2: After scroll, calibration ON 3: Before scroll, calibration ON)
33	X upper limit (-9,999.999 to 9,999.999)
34	X lower limit (-9,999.999 to 9,999.999)
35	Y upper limit (-9,999.999 to 9,999.999)
36	Y lower limit (-9,999.999 to 9,999.999)
37	Correlation upper limit (0 to 100)
38	Correlation lower limit (0 to 100)
39	Search region upper left X (0 to X_MAX) (See *1.)
40	Search region upper left Y (0 to Y_MAX) (See *1.)
41	Search region lower right X (0 to X_MAX) (See *1.)
42	Search region lower right Y (0 to Y_MAX) (See *1.)
43	Model registration area upper left X (0 to X_MAX) (See *1.)
44	Model registration area upper left Y (0 to Y_MAX) (See *1.)
45	Model registration area lower right X (0 to X_MAX) (See *1.)
46	Model registration area lower right Y (0 to Y_MAX) (See *1.)
47	Model reference position lower right X coordinate (0 to X_MAX) (See *1.)
48	Model reference position lower right Y coordinate (0 to Y_MAX) (See *1.)
49	Candidate level (0 to 100)
50	Model skipping setting (0: Auto 1: Fixed)
51	Model skipping X (1 to 15)
52	Model skipping Y (1 to 15)
53	Search skipping setting (0: Auto 1: Fixed)
54	Search skipping X (1 to 15)
55	Search skipping Y (1 to 15)

*1: The range varies depending on the controller model.

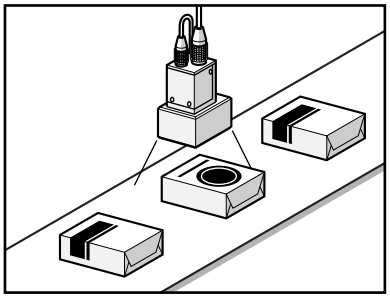
Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

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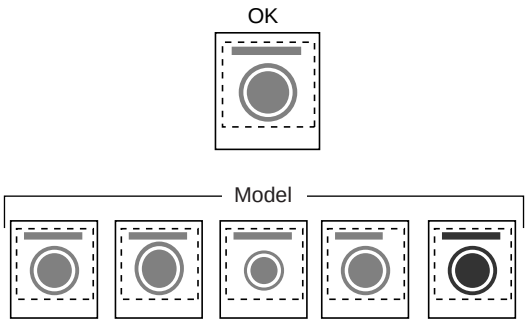
Flexible Search

The Flexible Search processing item is used to recognize measurement objects that have variation in printing quality or shape as well as detecting their position.
Two or more characteristics (models) of the measurement object need to be registered in advance. The part of the input image that most corresponds to the registered images (models) is found, and the correlation (degree of similarity) and position are detected.

Example: Detecting for Mixed Varieties of Packaging



This controller allows registration of two or more models according to variations in printing quality and shape.



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Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [Flexible search/Measurement image]



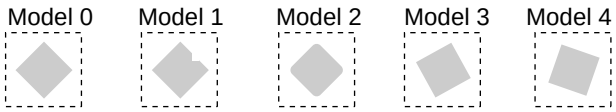
1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.

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Registering the Model

The area of the image to be inspected is registered as a model. Five kinds of models (0 to 4) can be registered and there are no restrictions on the size of the models.
If there are variations in printing quality and shape, register two or more models.



When a model is registered, the center position of the model is registered as the search coordinates. (When several figures have been combined in the drawing, the center coordinates of circumscribing rectangle becomes the search coordinates.)

CHECK!

When two or more models are registered, the Controller automatically creates auxiliary models between the models that are registered.
If the auxiliary models are added to the registered models when searches are performed, stable searches are possible even if there are variations between the registered models. Select whether or not to use auxiliary models in searches under Detailed settings.

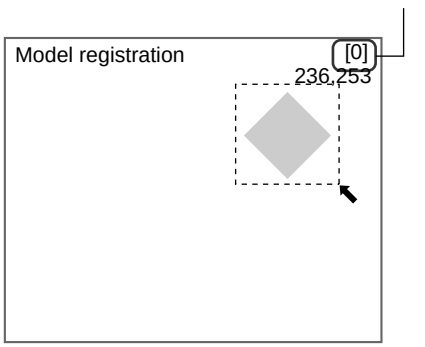
Auxiliary model
p.7

▶ [Flexible search/Model registration/No./Registration/New/figure/drawing mode]

1. Draw the region to be registered as the model with the selected figure.

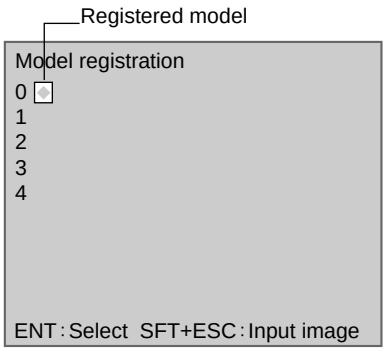
SECTION 1 Basic Operating Procedures, “Drawing a Region”

Up to three figures (0, 1 and 2) can be drawn.



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The setting for model 0 will be registered.
The registered model is displayed as a thumbnail.



2. Repeat these procedures to register further models.

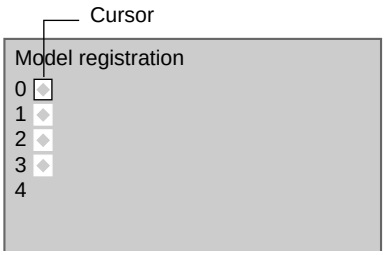
CHECK! To update the image, press the SHIFT+ESC Keys in the model registration screen. The image input screen will appear, so press the TRIG Key to display the latest camera image.

3. When all models have been registered, press the ESC Key.

Clearing or Overwriting the Registered Models

▶ [Flexible search/Model registration]

1. Among the thumbnails, select the model to be deleted or overwritten, and press the ENT Key.



The selections will be displayed.



2. Select either [Register] or [Delete] and press the ENT Key.

[Correct]: The model registration screen will appear, so register the model.
[Clear]: The selected figure will be cleared.

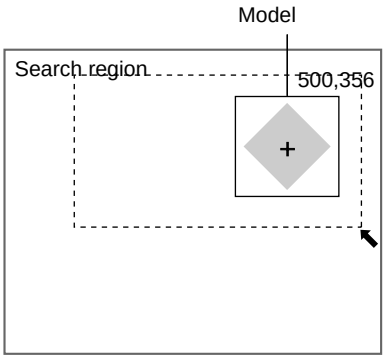
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Setting the Search Region

Set the region in which the model is to be searched for.
It is possible to perform a search for the entire input image, but the processing time can be shortened and the accuracy can be increased by setting limits on the search region.

▶ [Flexible search/Search region]

1. Draw a rectangular search region.
Specify the upper left and lower right coordinates.



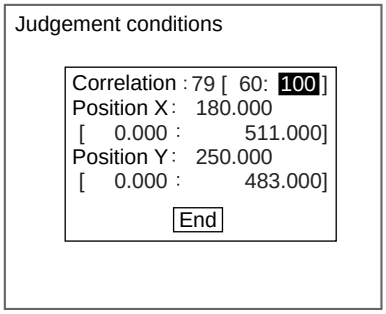
Setting Judgement Conditions

Set the judgement conditions for the correlation with the model and for the position (X, Y) where the object was detected.

▶ [Flexible search/Judgement conditions]

1. Set each item.

2. Select [End].



The value before [ ] is the measurement results for the displayed image. Use these values as references in setting the upper and lower limits.

Setting data	Selection	Details
Correlation	0 to 100	Set the correlation range for an OK judgement.
Position X	-9,999.999 to 9,999.999	Set the range of movement in the X direction for an OK judgement.
Position Y	-9,999.999 to 9,999.999	Set the range of movement in the Y direction for an OK judgement.

Search
SECTION 7 Appendix, "Search"

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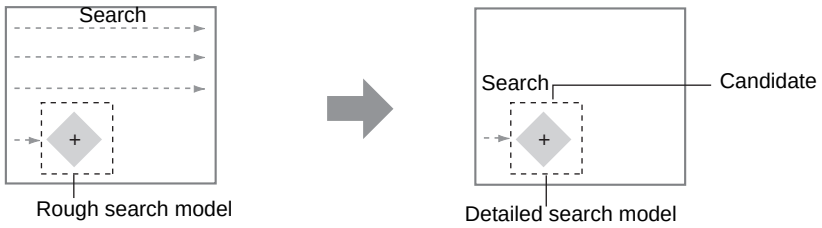
Changing Detailed Conditions

The search settings can be changed here. Change the conditions if the measurement results are unstable or if high-speed processing is required. Normally, the method can be left on the default setting. After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

The Controller performs the following 2-stage processing internally.

1. Rough search
   The rough search model is used to search every item in the measurement region.

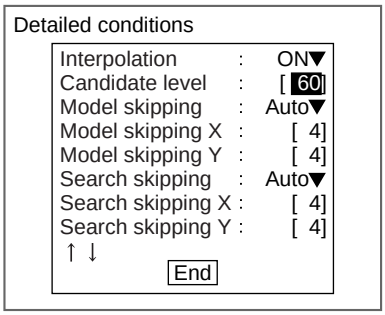
2. Detailed search
   Uses the detailed search model to re-measure the images surrounding the candidate point.

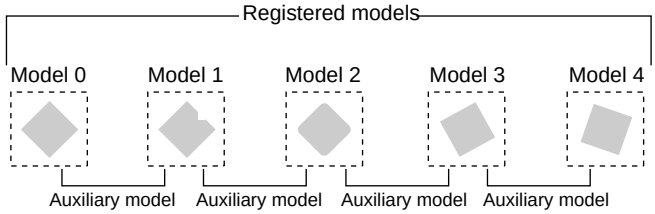


▶ [Flexible search/Detailed conditions]

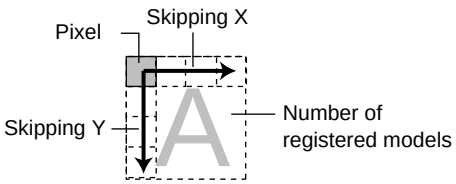
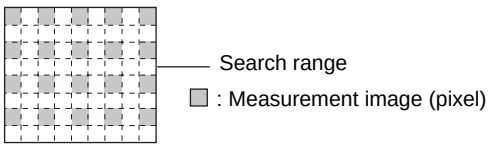
1. Set each item.

2. Select [End].



Setting data	Selection	Details
Auxiliary model	Select whether or not to use auxiliary models for searching. Auxiliary models are models created between the registered models. Auxiliary models are automatically created by the Controller when multiple models have been registered.  		
	ON (default setting)	The registered models and auxiliary models will be used in searches. The measurement will be more stable. Processing time, however, will be longer.
	OFF	The searches will be performed with registered models only.

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Setting data	Selection	Details
Candidate level	0 to 100 (default setting: 60)	Set the level to be used to search the model during rough search. Reduce the correlation level if the model searches are unstable.
Model skipping Detailed model skipping	Set the number of pixels to be skipped for the search model (i.e. the number of pixels to be skipped from the registered models). [Model skipping] is used to set pixel skipping conditions for rough search models, and [Detailed model skipping] is used to set for detailed search models. The setting range is the same. Example: When Skipping X: 2 and Skipping Y: 2  	
	Auto (default setting)	The controller sets the appropriate numbers (X, Y) of pixels to be skipped. The specified values will be displayed for model skipping X, Y (or detailed model skipping X, Y).
	Fixed	Specify the desired number of pixels to be skipped. The specified values will be reflected for model skipping X, Y (or detailed model skipping X, Y).
Model skipping X Detailed model skipping X	1 to 15	Set the number of pixels to be skipped in X direction. The changes made to the number of pixels to be skipped will be effective for the models that will be registered next time. They will not be effective for the models that have already been registered.
Model skipping Y Detailed model skipping Y	1 to 15	Set the number of pixels to be skipped in Y direction. The changes made to the number of pixels to be skipped will be effective for the models that will be registered next time. They will not be effective for the models that have already been registered.
Search skipping	Set the number of pixels to be skipped for rough search. The number of pixels to be skipped in the measurement region must be set. Example: When Skipping X: 2 and Skipping Y: 2  	
	Auto (default setting)	The controller sets the appropriate numbers (X, Y) of pixels to be skipped The specified values will be displayed for search skipping X, Y.
	Fixed	Specify the desired number of pixels to be skipped. The specified values will be reflected for search skipping X, Y.
Search skipping X	1 to 15	Set the number of pixels to be skipped in X direction.
Search skipping Y	1 to 15	Set the number of pixels to be skipped in Y direction.

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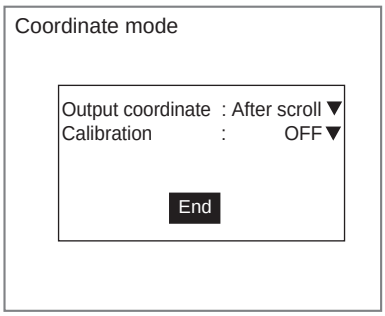
Setting the Coordinate Mode

Select the type of coordinate values.

CHECK!

If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [Flexible search/Coordinate mode]



1. Set each item.

2. Select [End].

Settings Data

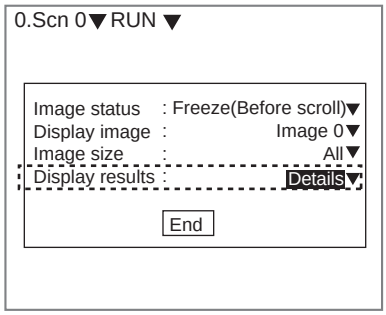
SECTION 7 Appendix, “Coordinate Handling Method”

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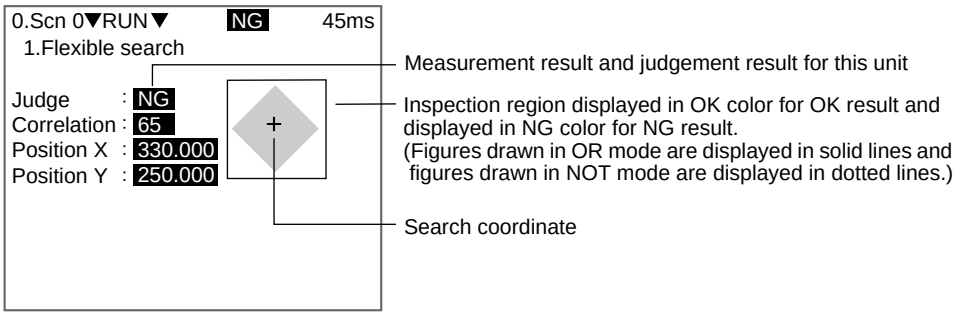
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Search position	X	X coordinate of position where model found
Search position	Y	Y coordinate of position where model found
Correlation value	CR	Correlation value with model
Reference position	SX	X coordinate when model registered
Reference position	SY	Y coordinate when model registered
Displacement	DX	Difference between measured and reference X coordinate
Displacement	DY	Difference between measured and reference Y coordinate

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	X coordinate of position where model found
2	Y coordinate of position where model found
3	Correlation value with model
4	X coordinate when model registered
5	Y coordinate when model registered
6	Difference between measured and reference X coordinate
7	Difference between measured and reference Y coordinate

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■ Setting Data

Data type	Details
31	Measurement image (0: Image 0 1: Image 1)
32	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF 2: After scroll, calibration ON 3: Before scroll, calibration ON)
33	X upper limit (-9,999.999 to 9,999.999)
34	X lower limit (-9,999.999 to 9,999.999)
35	Y upper limit (-9,999.999 to 9,999.999)
36	Y lower limit (-9,999.999 to 9,999.999)
37	Correlation upper limit (0 to 100)
38	Correlation lower limit (0 to 100)
39	Search region upper left X (0 to X_MAX) (See *1.)
40	Search region upper left Y (0 to Y_MAX) (See *1.)
41	Search region lower right X (0 to X_MAX) (See *1.)
42	Search region lower right Y (0 to Y_MAX) (See *1.)
43	Interpolation (0: OFF 1: ON)
44	Candidate level (0 to 100)
45	Model skipping setting (0: Auto 1: Fixed)
46	Model skipping X (1 to 15)
47	Model skipping Y (1 to 15)
48	Search skipping setting (0: Auto 1: Fixed)
49	Search skipping X (1 to 15)
50	Search skipping Y (1 to 15)
51	Detailed model skipping setting (0: Auto 1: Fixed)
52	Detailed model skipping X (1 to 15)
53	Detailed model skipping Y (1 to 15)

*1: The range varies depending on the controller model.

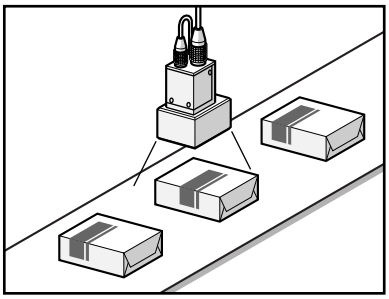
Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

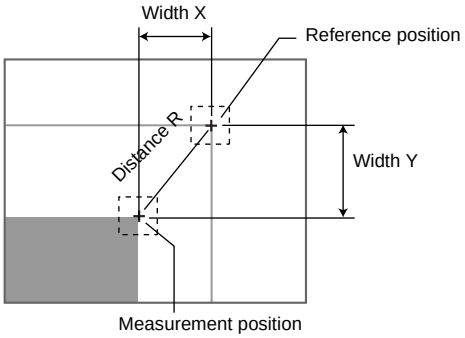
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Relative Search

The Relative search processing item is used to check whether mark or hole position on the object is correct.
Two image patterns (one near the reference position, the other near the inspection position) need to be registered as models. The part of the input image that most corresponds to the registered images (models) is found and the correlation (degree of similarity) and the relative search of the two output points are obtained.

Example: Inspection of Label Position





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- External Reference Table 13

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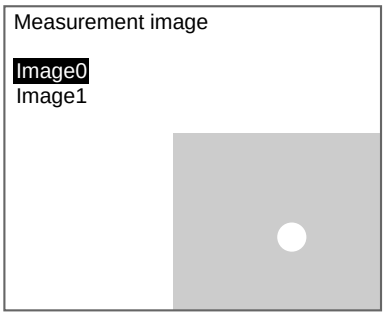
Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [Relative search/Measurement image]

1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

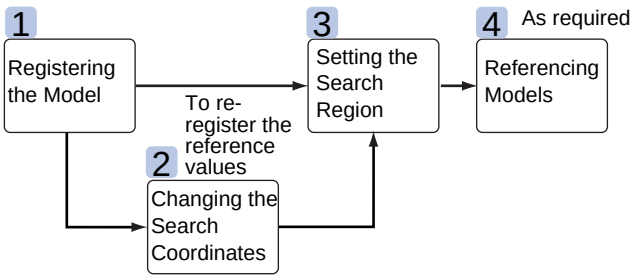
2. Press the ENT Key.



Setting Inspection Conditions

Set the measurement conditions for the inspection and reference positions.

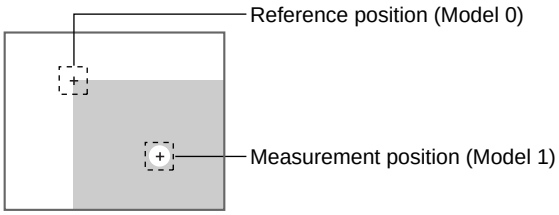
■ Operational Flow



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1 Registering the Model

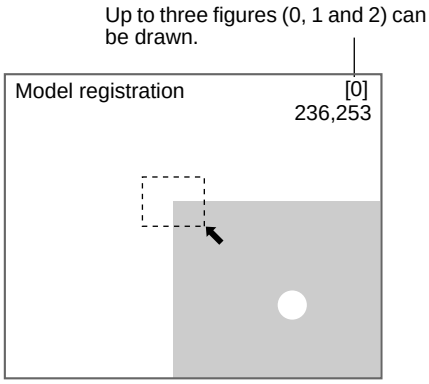
Register the inspection positions to models 0 and 1.
When a model is registered, the center position of the model is registered as the search coordinates. (When several figures have been combined in the drawing, the center coordinates of circumscribing rectangle becomes the search coordinates.)



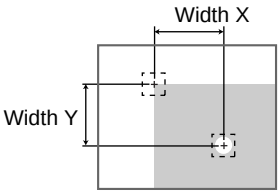
▶ [Relative search/Model ☐ setting/New/figure/drawing mode]

1. Draw the region to be registered as the model with the selected figure.

SECTION 1 Basic Operating Procedures, “Drawing a Region”



CHECK! Either the reference or inspection position can be registered to models 0 and 1. However, whether to register the reference or inspection position must be decided depending on whether the width is to be output in a positive or negative value. The coordinates vary with the calibration setting.



The width can be calculated by the following formual:
Model 1 - Model 0.

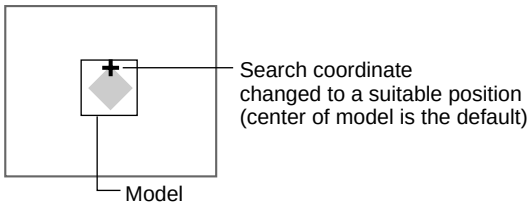
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2 Changing the Search Coordinates

Use this function to change the search coordinates only.
When a model is registered, the center position of the model is registered as the search coordinates. This function can be used to register a point other than the center of the model as the search coordinates.

CHECK!

The search coordinates are used for the point output as the measurement value. The search coordinates can be changed to an appropriate position.
Changing the Point Output as the Measurement Value

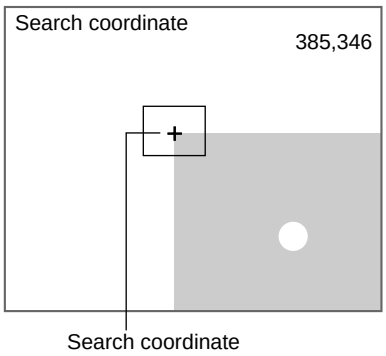


If the model is re-registered, the search coordinates are changed to the center position of the new model.

▶ [Relative search/Model ☐ setting/Search coordinate]

1. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.



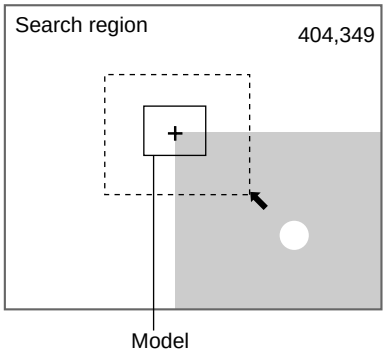
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3 Setting the Search Region

Set the region in which the model is to be searched for.
It is possible to perform a search for the entire input image, but the processing time can be shortened and the accuracy can be increased by setting limits on the search region.

▶ [Relative search/Model ☐ setting/Search region]

1. Draw a rectangular search region.
Specify the upper left and lower right coordinates.



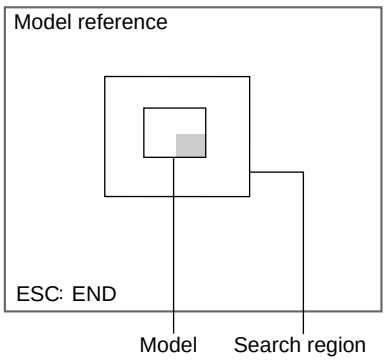
4 Referencing Models

Models can be displayed on screen to check what kind of images are registered as models.

▶ [Relative search/Model ☐ setting/Model reference]

1. Referencing Models

2. Press the ESC Key to exit.



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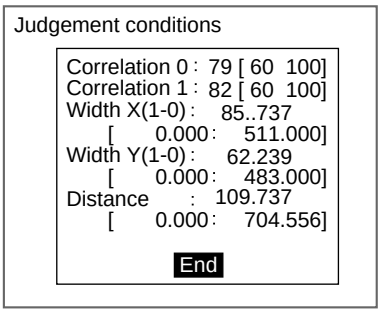
Setting Judgement Conditions

Set the judgement conditions for the correlation with the model and for the position (X, Y) where the object was detected.

▶ [Relative search/Judgement conditions]

1. Set each item.

2. Select [End].

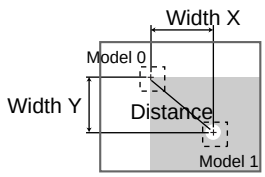


The value before [ ] is the measurement results for the displayed image. Use these values as references in setting the upper and lower limits.

Setting data	Selection	Details
Correlation 0	0 to 100	Set the correlation range for model 0 for an OK judgement.
Correlation 1	0 to 100	Set the correlation range for model 1 for an OK judgement.
Width X (1-0)	-9999.999 to 9999.999	Set the width in the X direction (Model 1 - Model 0) for an OK judgement.
Width Y (1-0)	-9999.999 to 9999.999	Set the width in the Y direction (Model 1 - Model 0) for an OK judgement.
Distance	0 to 9999.999	Set the distance between Model 0 and Model 1 for an OK judgement.

CHECK!

Width X, Width Y, Distance



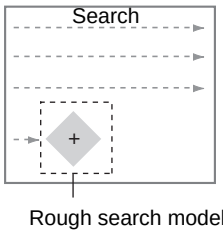
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Changing Detailed Conditions

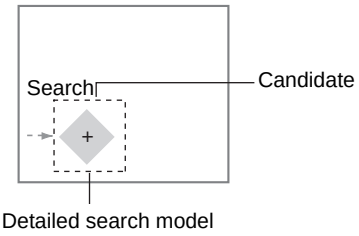
The search settings can be changed here. Change the conditions if the measurement results are unstable or if high-speed processing is required. Normally, the method can be left on the default setting. After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

The Controller performs the following 2-stage processing internally.

1. Rough search
   The rough search model is used to search every item in the measurement region.



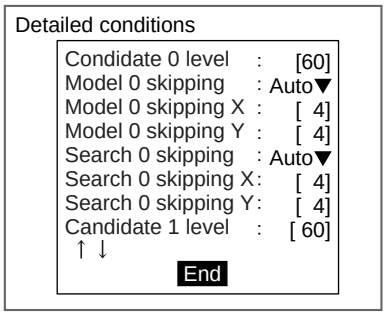
2. Detailed search
   Uses the detailed search model to re-measure the images surrounding the candidate point.



▶ [Relative search/Detailed conditions]

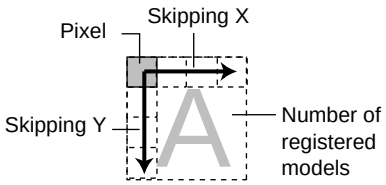
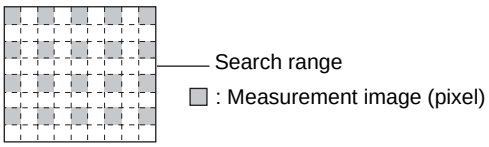
1. Set each item.

2. Select [End].



Setting data	Selection	Details
Candidate ☐ level	0 to 100 (default setting: 60)	Set the level to be used to search the model during rough search. Reduce the correlation level if the model searches are unstable.

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Setting data	Selection	Details
Model☐skipping	Set the number of pixels to be skipped for the search model (i.e. the number of pixels to be skipped from the registered models). [Model skipping] is used to set pixel skipping conditions for rough search models, and [Detailed model skipping] is used to set for detailed search models. The setting range is the same. Example: When Skipping X: 2 and Skipping Y: 2  		
	Auto (default setting)	The controller sets the appropriate numbers (X, Y) of pixels to be skipped. The specified values will be displayed for model skipping X, Y.
	Fixed	Specify the desired number of pixels to be skipped. The specified values will be reflected for model skipping X, Y.
Model☐ skipping X	1 to 15	Set the number of pixels to be skipped in X direction. The changes made to the number of pixels to be skipped will be effective for the models that will be registered next time. They will not be effective for the models that have already been registered.
Model☐ skipping Y	1 to 15	Set the number of pixels to be skipped in Y direction. The changes made to the number of pixels to be skipped will be effective for the models that will be registered next time. They will not be effective for the models that have already been registered.
Search☐ skipping	Set the number of pixels to be skipped for rough search. The number of pixels to be skipped in the measurement region must be set. Example: When Skipping X: 2 and Skipping Y: 2  	
	Auto (default setting)	The controller sets the appropriate numbers (X, Y) of pixels to be skipped The specified values will be displayed for search skipping X, Y.
	Fixed	Specify the desired number of pixels to be skipped. The specified values will be reflected for search skipping X, Y.
Search☐ skipping X	1 to 15	Set the number of pixels to be skipped in X direction.
Search☐ skipping Y	1 to 15	Set the number of pixels to be skipped in Y direction.

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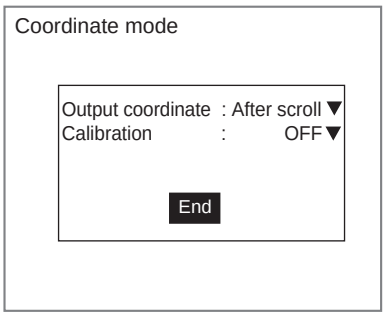
Setting the Coordinate Mode

Select the type of coordinate values.

CHECK!

If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [Relative search/Coordinate mode]



1. Set each item.

2. Select [End].

Settings Data

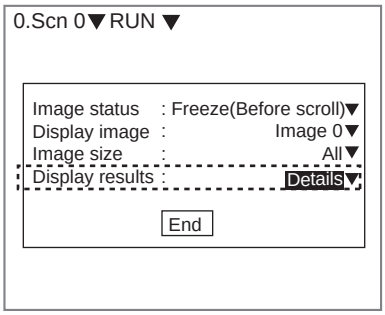
SECTION 7 Appendix, “Coordinate Handling Method”

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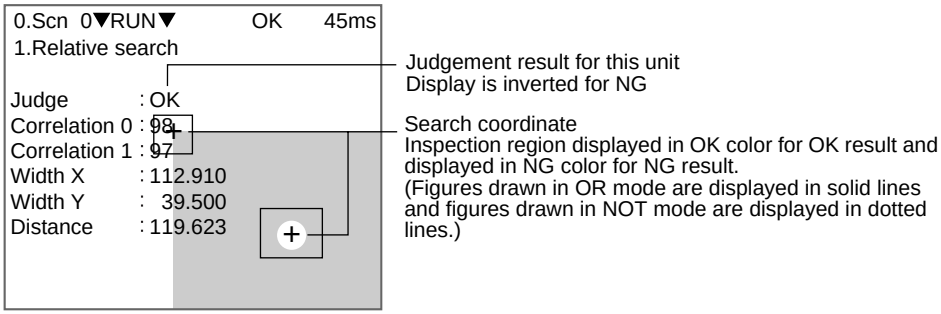
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Setting data	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Width X	X	Difference in X coordinate of position where model found (model 1 - model 0)
Width Y	Y	Difference in Y coordinate of position where model found (model 1 - model 0)
Distance	D	Distance of position where model found
Correlation 0	C0	Correlation with model 0
Correlation 1	C1	Correlation with model 1
Reference width X	SX	Difference in X coordinate of position where model registered (model 1 - model 0)
Reference width Y	SY	Difference in Y coordinate of position where model registered (model 1 - model 0)
Reference distance	SD	Distance of position where model registered
Displacement width X	DX	Difference between width X and reference width X
Displacement width Y	DY	Difference between width Y and reference width Y
Displacement distance	DD	Difference between distance and reference distance

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Difference in X coordinate of position where model found (model 1 - model 0)
2	Difference in Y coordinate of position where model found (model 1 - model 0)
3	Distance of position where model found
4	Correlation with model 0
5	Correlation with model 1
6	Difference in X coordinate of position where model registered (model 1 - model 0)
7	Difference in Y coordinate of position where model registered (model 1 - model 0)
8	Distance of position where model registered
9	Difference between width X and reference width X
10	Difference between width Y and reference width Y
11	Difference between distance and reference distance

■ Setting Data

Data type	Details
31	Measurement image (0: Image 0 1: Image 1)
32	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF 2: After scroll, calibration ON 3: Before scroll, calibration ON)
33	Width X upper limit (-9,999.999 to 9,999.999)
34	Width X lower limit (-9,999.999 to 9,999.999)
35	Width Y upper limit (-9,999.999 to 9,999.999)
36	Width Y lower limit (-9,999.999 to 9,999.999)
37	Distance upper limit (0 to 9,999.999)
38	Distance lower limit (0 to 9,999.999)
39	Correlation 0 upper limit (0 to 100)
40	Correlation 0 lower limit (0 to 100)
41	Search region 0 upper left X (0 to X_MAX) (See *1.)
42	Search region 0 upper left Y (0 to Y_MAX) (See *1.)
43	Search region 0 lower right X (0 to X_MAX) (See *1.)
44	Search region 0 lower right Y (0 to Y_MAX) (See *1.)
45	Model 0 registration area upper left X coordinate (0 to X_MAX) (See *1.)
46	Model 0 registration area upper left Y coordinate (0 to Y_MAX) (See *1.)
47	Model 0 registration area lower right X coordinate (0 to X_MAX) (See *1.)

Relative Search
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Data type	Details
48	Model 0 registration area lower right Y coordinate (0 to Y_MAX) (See *1.)
49	Model 0 reference position X (0 to X_MAX) (See *1.)
50	Model 0 reference position Y (0 to Y_MAX) (See *1.)
51	Candidate 0 level (0 to 100)
52	Model 0 skipping setting (0: Auto, 1: Fixed)
53	Model 0 skipping X (1 to 15)
54	Model 0 skipping Y (1 to 15)
55	Search 0 skipping setting (0: Auto, 1: Fixed)
56	Search 0 skipping X (1 to 15)
57	Search 0 skipping Y (1 to 15)
58	Correlation 1 upper limit (0 to 100)
59	Correlation 1 lower limit (0 to 100)
60	Search region 1 upper left X (0 to X_MAX) (See *1.)
61	Search region 1 upper left Y (0 to Y_MAX) (See *1.)
62	Search region 1 lower right X (0 to X_MAX) (See *1.)
63	Search region 1 lower right Y (0 to Y_MAX) (See *1.)
64	Model 1 registration area upper left X coordinate (0 to X_MAX) (See *1.)
65	Model 1 registration area upper left Y coordinate (0 to Y_MAX) (See *1.)
66	Model 1 registration area lower right X coordinate (0 to X_MAX) (See *1.)
67	Model 1 registration area lower right Y coordinate (0 to Y_MAX) (See *1.)
68	Model 1 reference position X (0 to X_MAX) (See *1.)
69	Model 1 reference position Y (0 to Y_MAX) (See *1.)
70	Candidate 1 level (0 to 100)
71	Model 1 skipping setting (0: Auto, 1: Fixed)
72	Model 1 skipping X (1 to 15)
73	Model 1 skipping Y (1 to 15)
74	Search 1 skipping setting (0: Auto, 1: Fixed)
75	Search 1 skipping X (1 to 15)
76	Search 1 skipping Y (1 to 15)

*1 The range varies depending on the controller model.

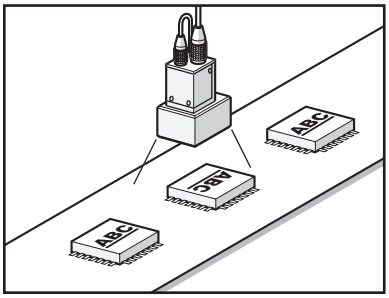
Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

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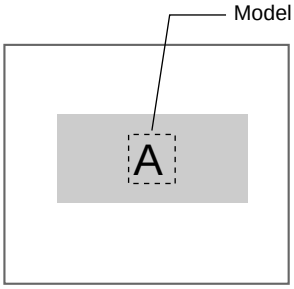
Rotation Search

The Rotation Search processing item is used to detect the angle of inclination and the position of the measurement object.

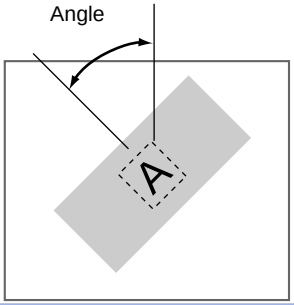
Example: Recognition of the position and angle of parts.



Register a reference image pattern as the model.



The Controller detects the angle of inclination of the input image compared to the reference image (model).



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Operational Flow

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Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [Rotation search/Measurement image]



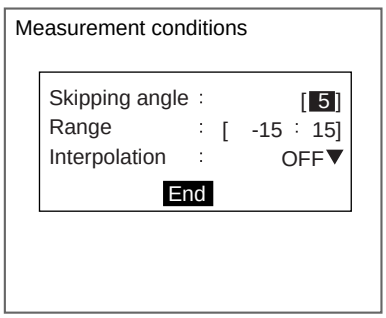
1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.

Setting Measurement Conditions

Set the search conditions.
A search is performed using a model that rotates in skipping angle increments within the rotation range.

▶ [Rotation search/Measurement conditions]



1. Set each item.

2. Select [End].

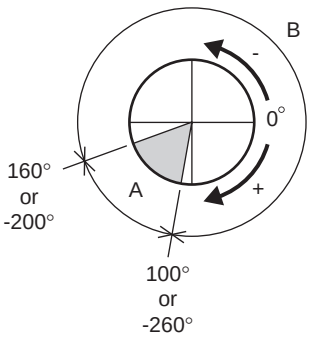
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Setting data	Selection	Details
Skipping angle	1 to 99 (default setting: 5)	Set the angle at which the image is to be rotated at a time. The smaller the angle, the more precise the search. Processing time, however, will be longer. Example: Skipping angle: 15° , Rotation range: -45° to 45° Searches while rotating the image by 15° at a time, starting from -45° to 45° .
Rotation range	-360° to 360° (Default: -15× to 15×)	Set the range within which the image is to be rotated. The range must be set by specifying two values (angles). Two values between -360° and 360° can be set. The value on the right, however, must be higher than the value on the left.
Angle interpolation	Set the unit of the angle to be found.	
	OFF (default setting)	Finds the angle in units of skipping angle.
	ON	Finds the angle (value of up to the third decimal digit) based on the correlation value obtained in units of skipping angle. Processing time, however, will be longer.

CHECK!

Rotation range

Example: When setting the following range A (coordinate system: left handed)



Angle: [-260: -200] ○ OK
[100: 160] ○ OK
(Give the same result.)

[100: -200] × The value on the right is smaller.

[-200: 100] × Setting within the B range.

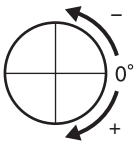
CHECK!

Coordinates and Rotation Angle Direction

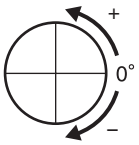
Depending on whether a right-hand or left-hand coordinate system has been set, the rotation angle direction changes. Check the coordinate system setting before making rotation search settings.

- When [Calibration] of [Rotation Search/Coordinate mode] is set to [OFF]:
  Left-hand coordinate system
- When [Calibration] of [Rotation Search/Coordinate mode] is set to [ON]:
  The coordinate system that has been set in [Calibration]

Left-handed system



Right-handed system



Coordinate system checking and changing method
SECTION 2, 1.1 Inputting Camera Images, “Calibration”

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Registering the Model

The area of the image to be inspected is registered as a model.
When a model is registered, the center position of the model is registered as the search coordinates. (When several figures have been combined in the drawing, the center coordinates of circumscribing rectangle becomes the search coordinates.)

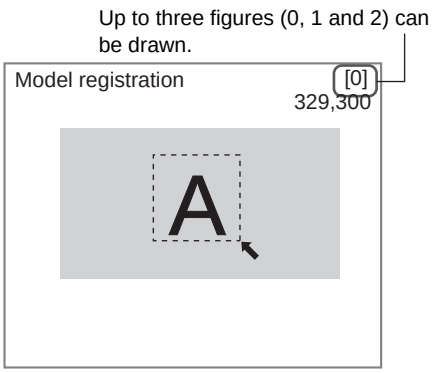
CHECK!

Models can be created by combining up to 3 different figures. Regions with difficult shapes can be drawn and sections not to be measured can be left out of the region by combining different figures.

▶ [Rotation search/Model registration/New/figure/drawing mode]

1. Draw the region to be registered as the model with the selected figure.

SECTION 1 Basic Operating Procedures, “Drawing a Region”



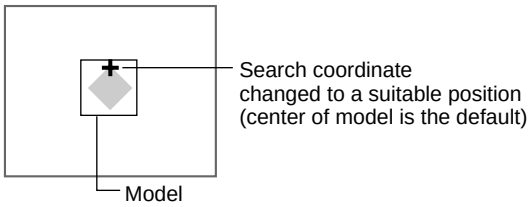
Changing the Search Coordinates

Use this function to change the search coordinates only.
When a model is registered, the center position of the model is registered as the search coordinates. This function can be used to register a point other than the center of the model as the search coordinates.

CHECK!

The search coordinates are used for the point output as the measurement value. The search coordinates can be changed to an appropriate position.

- Changing the Point Output as the Measurement Value



If the model is re-registered, the search coordinates are changed to the center position of the new model.

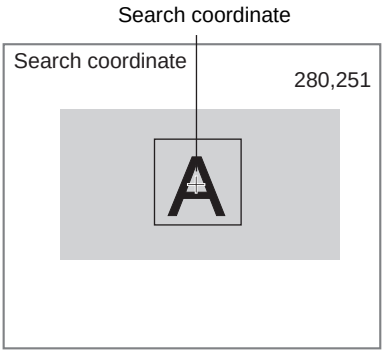
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▶ [Rotation search/Search coordinate]

A cursor will appear in the center position.

1. To change the position, use the Up/Down and Right/Left Keys to move the cursor.

2. Press the ENT Key.



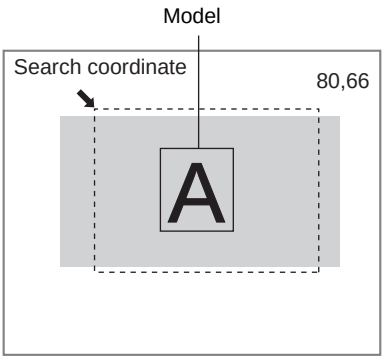
Setting the Search Region

Set the region in which the model is to be searched for.
It is possible to perform a search for the entire input image, but the processing time can be shortened and the accuracy can be increased by setting limits on the search region.

▶ [Rotation search/Search region]

1. Draw a rectangular search region.

Specify the upper left and lower right coordinates.



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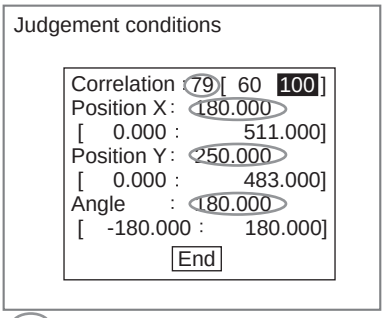
Setting Judgement Conditions

Set the judgement conditions for the correlation with the model and for the position (X, Y) where the object was detected.
Range for an OK judgement

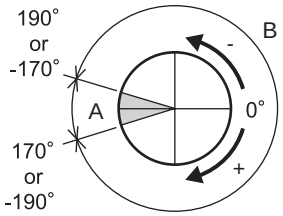
▶ [Rotation search/Judgement conditions]

1. Set each item.

2. Select [End].



: The measurement results for the displayed image.
Use these values as references in setting the upper and lower limits.

Setting data	Selection	Details
Correlation	0 to 100	Set the range for an OK judgement.
Position X	-9,999.999 to 9,999.999	Set the range of movement in the X direction for an OK judgement.
Position Y	-9,999.999 to 9,999.999	Set the range of movement in the Y direction for an OK judgement.
Angle	-360.000 to 360.000	Angle range for measurement object. Output in the range of -180.000 to 180.000. Two values between -360° and 360° can be set. The value on the right, however, must be higher than the value on the left. Example: When setting the following range A (coordinate system: left-hand)  Angle: [190 : 170] ○ OK [-190 : -170] ○ OK (Give the same result.) [170 : -170] × The value on the right is smaller. [-170 : -170] × Setting within the B range. The measurement value is output between -180° and 180°, so a measurement value of 190° becomes -170°.

Search
SECTION 7 Appendix, "Search"

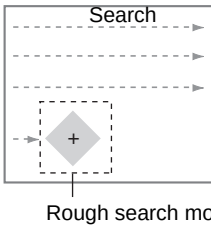
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Changing Detailed Conditions

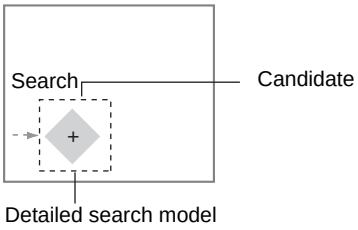
The search settings can be changed here. Change the conditions if the measurement results are unstable or if high-speed processing is required. Normally, the method can be left on the default setting. After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

The Controller performs the following 2-stage processing internally.

1. Rough search
   The rough search model is used to search every item in the measurement region.



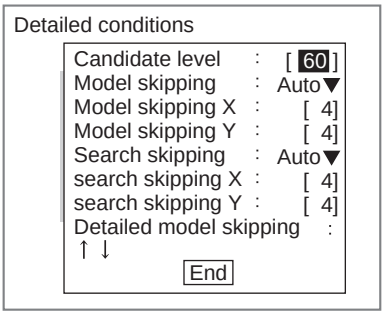
2. Detailed search
   Uses the detailed search model to re-measure the images surrounding the candidate point.



▶ [Rotation search/Detailed conditions]

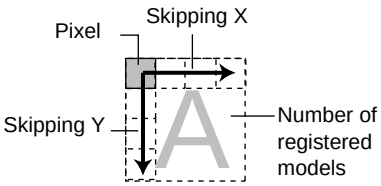
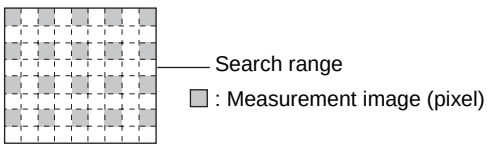
1. Set each item.

2. Select [End].



Setting data	Selection	Details
Candidate level	0 to 100 (default setting: 60)	Set the level to be used to search the model during rough search. Reduce the correlation level if the model searches are unstable.

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<table>
<tr><th>Setting data</th><th>Selection</th><th>Details</th></tr>
<tr><td rowspan="3">Model skipping
Detailed model skipping</td><td colspan="2">Set the number of pixels to be skipped for the search model (i.e. the number of pixels to be skipped from the registered models). [Model skipping] is used to set pixel skipping conditions for rough search models, and [Detailed model skipping] is used to set for detailed search models. The setting range is the same.
Example: When Skipping X: 2 and Skipping Y: 2

</td></tr>
<tr><td>Auto (default setting)</td><td>The controller sets the appropriate numbers (X, Y) of pixels to be skipped. The specified values will be displayed for model skipping X, Y (or detailed model skipping X, Y).</td></tr>
<tr><td>Fixed</td><td>Specify the desired number of pixels to be skipped. The specified values will be reflected for model skipping X, Y (or detailed model skipping X, Y).</td></tr>
<tr><td>Model skipping X
Detailed model skipping X</td><td>1 to 15</td><td>Set the number of pixels to be skipped in X direction.
The changes made to the number of pixels to be skipped will be effective for the models that will be registered next time. They will not be effective for the models that have already been registered.</td></tr>
<tr><td>Model skipping Y
Detailed model skipping Y</td><td>1 to 15</td><td>Set the number of pixels to be skipped in Y direction.
The changes made to the number of pixels to be skipped will be effective for the models that will be registered next time. They will not be effective for the models that have already been registered.</td></tr>
<tr><td rowspan="3">Search skipping</td><td colspan="2">Set the number of pixels to be skipped for rough search.
The number of pixels to be skipped in the measurement region must be set.
Example: When Skipping X: 2 and Skipping Y: 2

</td></tr>
<tr><td>Auto (default setting)</td><td>The controller sets the appropriate numbers (X, Y) of pixels to be skipped
The specified values will be displayed for search skipping X, Y.</td></tr>
<tr><td>Fixed</td><td>Specify the desired number of pixels to be skipped. The specified values will be reflected for search skipping X, Y.</td></tr>
<tr><td>Search skipping X</td><td>1 to 15</td><td>Set the number of pixels to be skipped in X direction.</td></tr>
<tr><td>Search skipping Y</td><td>1 to 15</td><td>Set the number of pixels to be skipped in Y direction.</td></tr>
</table>

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Setting the Coordinate Mode

Select the type of coordinate values.

CHECK!

If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

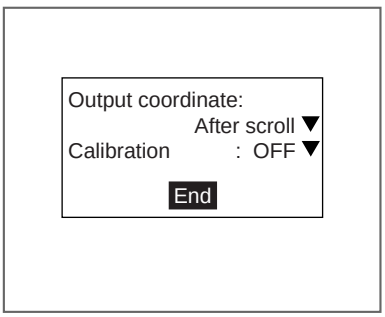
▶ [Rotation search/Coordinate mode]

1. Set each item.

2. Select [End].

Settings Data

SECTION 7 Appendix, “Coordinate Handling Method”

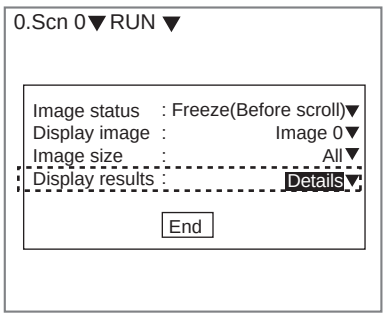


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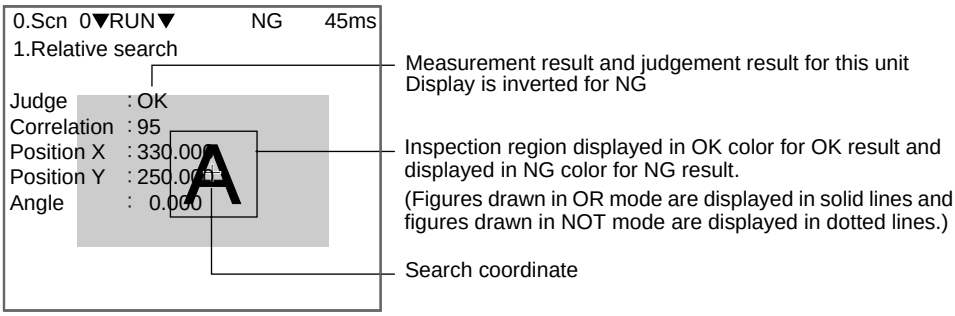
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Setting data	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Measured X	X	X coordinate of position where model found
Measured Y	Y	Y coordinate of position where model found
Measurement angle	TH	Angle of position where model found
Correlation value	CR	Correlation value with model
Reference X	SX	X coordinate when model registered
Reference Y	SY	Y coordinate when model registered
Reference angle	ST	Angle when model registered
Displacement X	DX	Difference between measured and reference X coordinate
Displacement Y	DY	Difference between measured and reference Y coordinate
Angle displacement	DT	Difference between the measured and reference angles

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	X coordinate of position where model found
2	Y coordinate of position where model found
3	Angle of position where model found
4	Correlation value with model
5	X coordinate when model registered
6	Y coordinate when model registered
7	Angle when model registered
8	Difference between measured and reference X coordinate
9	Difference between measured and reference Y coordinate
10	Difference between the measured and reference angles

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■ Setting Data

Data type	Details
31	Measurement image (0: Image 0 1: Image 1)
32	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF 2: After scroll, calibration ON 3: Before scroll, calibration ON)
33	X upper limit (-9,999.999 to 9,999.999)
34	X lower limit (-9,999.999 to 9,999.999)
35	Y upper limit (-9,999.999 to 9,999.999)
36	Y lower limit (-9,999.999 to 9,999.999)
37	Correlation upper limit (0 to 100)
38	Correlation lower limit (0 to 100)
39	Angle upper limit (-360.00 to 360.00)
40	Angle lower limit (-360.00 to 360.00)
41	Search region upper left X (0 to X_MAX) (See *1.)
42	Search region upper left Y (0 to Y_MAX) (See *1.)
43	Search region lower right X (0 to X_MAX) (See *1.)
44	Search region lower right Y (0 to Y_MAX) (See *1.)
45	Model registration area upper left X coordinate (0 to X_MAX) (See *1.)
46	Model registration area upper left Y coordinate (0 to Y_MAX) (See *1.)
47	Model registration area lower right X coordinate (0 to X_MAX) (See *1.)
48	Model registration area lower right Y coordinate (0 to Y_MAX) (See *1.)
49	Model reference position lower right X (0 to X_MAX) (See *1.)
50	Model reference position Y (0 to Y_MAX) (See *1.)
51	Skipping angle (1 to 99)
52	Rotation range upper limit (-360 to 360)
53	Rotation range lower limit (-360 to 360)
54	Angle compensation (0: OFF 1: ON)
55	Candidate level (0 to 100)
56	Model skipping setting (0: Auto 1: Fixed)
57	Model skipping X (1 to 15)
58	Model skipping Y (1 to 15)
59	Search skipping setting (0: Auto 1: Fixed)
60	Search skipping X (1 to 15)
61	Search skipping Y (1 to 15)
62	Detailed model skipping setting (0: Auto 1: Fixed)
63	Detailed model skipping X (1 to 15)
64	Detailed model skipping Y (1 to 15)

*1: The range varies depending on the controller model.

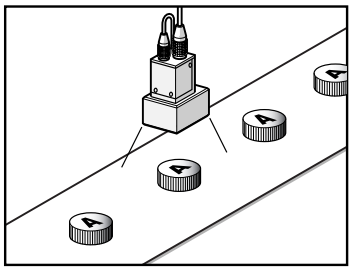
Range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

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Circle Angle

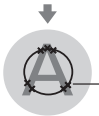
The Circle angle processing item is used to detect the angle of inclination of a circular measurement object.

Example: External Inspection While Correcting Gap Inclination

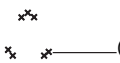




A circle is drawn in the area that shows characteristics of the reference image, to detect points that show such characteristics and set registration conditions for the detected points.



Points that show characteristics of the reference image and are present on the circumference are detected in pixel units according to the conditions set on the controller, to register them as reference positions.



(Characteristic points of reference position)

Reference image



Input image



Characteristic points of the reference image are compared to those of the input image, to obtain the rotation angle.



CHECK!

To use this item effectively, the center of the object needs to be at a fixed position. Before performing this item, make sure that the center of the object is at a fixed position by using a position correction processing item.

p.2

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Operational Flow

Selecting Measurement Images 3

Setting Inspection Conditions 3

Drawing a Circle to Detect Characteristics (Setting a Region) 4

Changing Detailed Conditions 5

Checking the Measurement Image 8

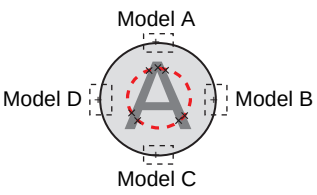
When you want to obtain measurement results externally 9

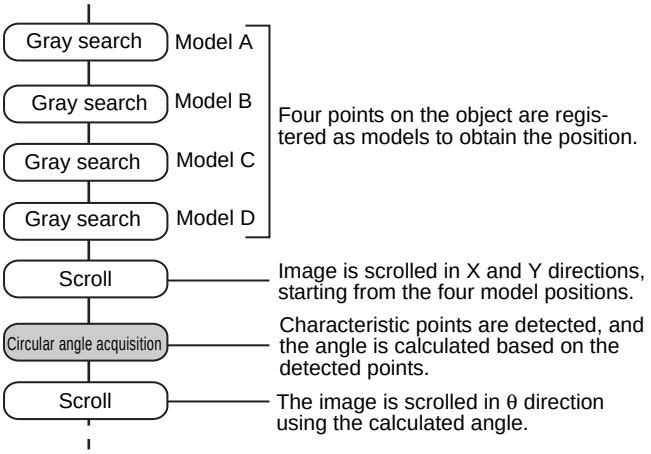
Submenus for Expressions 9

External Reference Table 9

CHECK!

For this item, the center of the object needs to be at a fixed position. Before performing this item, make sure that the center of the object is at a fixed position by using a position correction processing item.





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Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [Circle angle/Measurement image]

1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.



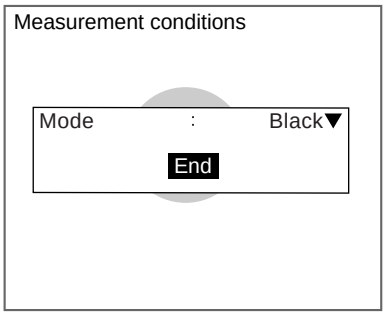
Setting Inspection Conditions

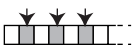
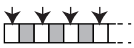
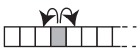
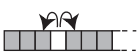
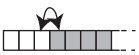
Select the degree of the characteristic feature to use for comparison.

▶ [Circle angle/Measurement conditions]

1. Select the mode.

2. Select [End].



Selection	Details	
Black (default setting)	Uses the low density (black) points.	
White	Uses the high density (white) points.	
Black	Compares the density with surrounding pixels and uses the point with the largest difference (where the density decreases suddenly).	
White	Compares the density with surrounding pixels and uses the point with the largest difference (where the density increases suddenly).	
Edge	Compares the density with surrounding pixels and uses the point with the largest difference (where the density decreases/increases suddenly).	

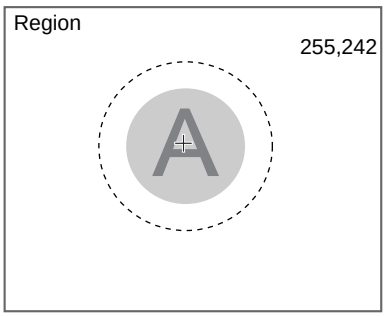
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Drawing a Circle to Detect Characteristics (Setting a Region)

Draw a circle to detect characteristics.

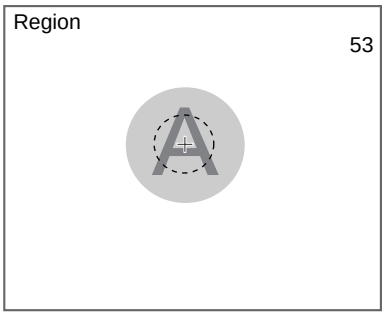
▶ [Circle angle/Region]

1. Move the cursor to the center of the characteristic area, and press the ENT Key.

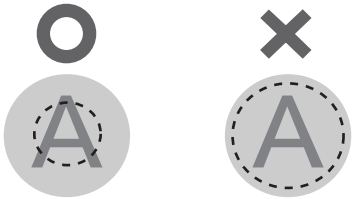


The center position will be set.

2. Use the Up/Down and Right/Left Keys to change the radius of the circle, and press the ENT Key.



The circle must be drawn so that the characteristic area is located on the circumference.



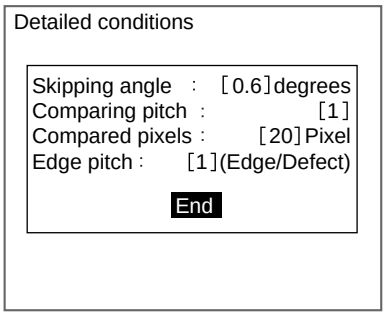
After drawing, the characteristic points detected by using the default value will be displayed in red.

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Changing Detailed Conditions

This section describes how to change the registration or comparison conditions for the points to be detected. Change the conditions if the measurement results are unstable or if high-speed processing is required. Normally, these conditions can be left on the default settings. After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

▶ [Circle angle/Detailed conditions]



1. Set each item.

2. Select [End].

Setting data	Selection	Details	
Skipping angle	0.4 to 2.0 (default setting: 1.0)	Set the angle to skip between point extractions. The density of all points on the circumference corresponding to the skipping angle will be measured. The most suitable value for the radius of the circle that was drawn will be set automatically. The larger the setting, the fewer points will be extracted. This will increase processing speed, but decrease detection and rotation accuracy.	
Comparing Pitch	1 to 9 (default setting: 1)	Select the number of registered detection points on the input image that are to be compared to the reference image. The larger the setting, the larger the detection interval. This will increase processing speed, but decrease detection accuracy.	
Compared Pixels	1 to 99 (default setting: 20)	Set how many points (pixels) out of the characteristic feature detected using the mode set under Measurement conditions will be registered for comparison. The smaller the setting, the fewer points will be compared. This will increase processing speed, but decrease detection accuracy. If two or more points of the same conditions exist, all of them will be registered even if the set number of points has been reached.	
		Black	Set points in order from the lowest density until the set number of points is reached.
		White	Set points in order from the highest density until the set number of points is reached.
		Black	Registers points in order, starting from the one with the highest density difference against the surrounding pixels (i.e. the one where the density decreases suddenly), until the set number of points is reached.
		White	Registers points in order, starting from the one with the highest density difference against the surrounding pixels (i.e. the one where the density increases suddenly), until the set number of points is reached.
		Edge	Registers points in order, starting from the one with the highest density difference against the surrounding pixels (i.e. the one where the density increases/decreases suddenly), until the set number of points is reached.

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Setting data	Selection	Details
Edge Pitch	1to 9 (default setting: 1)	Set the pitch to obtain the density difference. The edge pitch setting is enabled only when [Black defect], [White defect], or [Edge] are selected as the mode under [Measurement conditions]. Example: When [Black defect] is selected for [Mode] and 2 for [Edge pitch]  Compares the density with a point two pixels away.
Number of Circles	1 to 2 (default setting: 1)	Set the number of circles for detecting the rotation positioning tag. (1 or 2 (1*)) The number of circles that can be drawn on the Model Registration Screen will be limited to the number set here. If the number is set to 2, the detection accuracy will increase but processing will take longer.

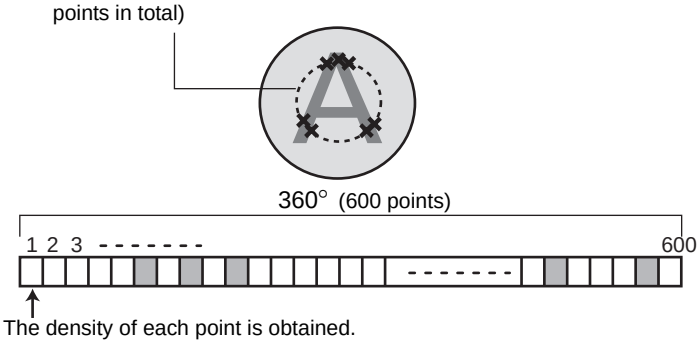
CHECK!

If the skipping angle has been changed, it cannot return to the automatically set values even if the model is re-registered. To automatically set the most suitable value for the radius after the skipping angle has been changed, clear the settings first and then re-register the model.

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Skipping angle

- Example: When the skipping angle is set to 0.6°
  Points are detected at every 0.6 degree on the circumference (in pixel units). (600 points in total)

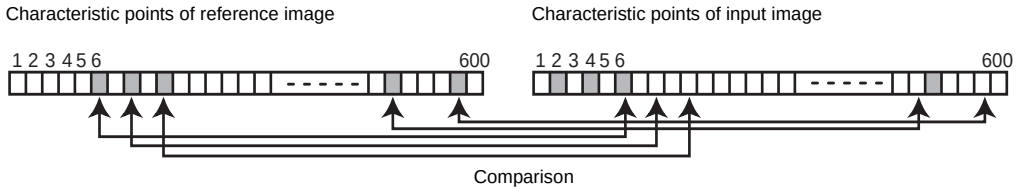


Comparing pitch

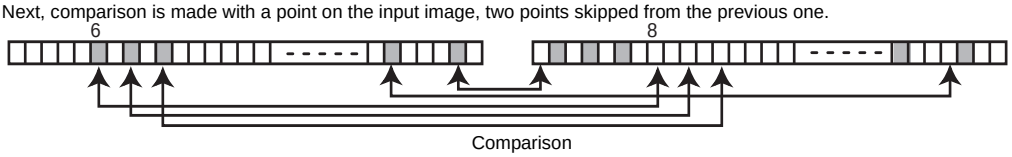
- Example: When the mode is set to black, the skipping angle is set to 0.6° , and pitch is set to 2.



1. Comparison is performed, starting from the youngest characteristic point No. (black) of the reference image.



2. Next, comparison is made with a point on the input image, two points skipped from the previous one.

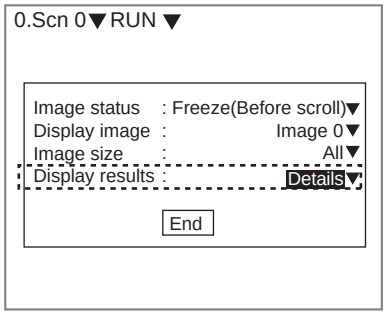


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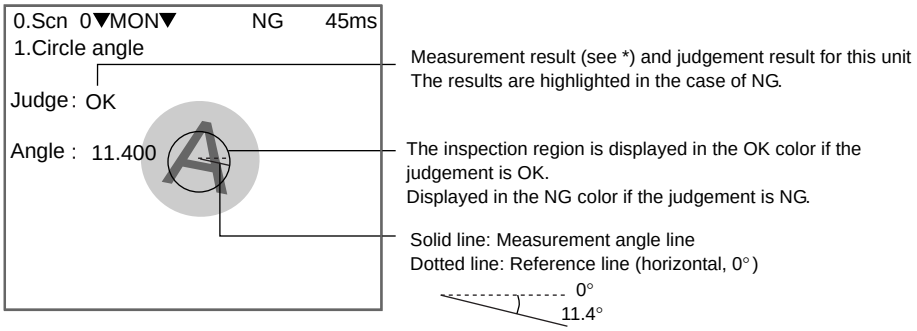
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.

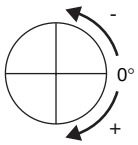
Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed.



* The measurement value is displayed in the range of -180° to +180°.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed. This section describes each item displayed in the submenu.

For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Setting data	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Center position X	X	X coordinate of center of circle for measurement result
Center position Y	Y	Y coordinate of center of circle for measurement result
Rotation angle	TH	Angle for measurement result
Reference X	SX	X coordinate of center of circle when measurement region drawn
Reference Y	SY	Y coordinate of center of circle when measurement region drawn
Reference angle	ST	Angle when measurement region drawn

*1: Since this processing item performs measurement at the same position every time, the center position X will be the reference position SX and the center position Y will be the reference position SY.

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	X coordinate of center of circle for measurement result
2	Y coordinate of center of circle for measurement result
3	Angle for measurement result
4	X coordinate of center of circle when measurement region drawn
5	Y coordinate of center of circle when measurement region drawn
6	Angle when measurement region drawn

*1: Since this processing item performs measurement at the same position every time, the center position X will be the reference position SX and the center position Y will be the reference position SY.

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■ Setting Data

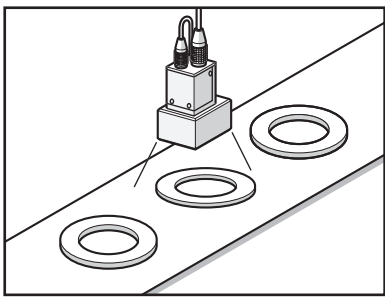
Data type	Details
32	Measurement image (0: Image 0 1: Image 1)
33	Mode (0: Black 1: White 2: Black defect 3: White defect 4: Edge)
34	Skipping angle (0.4 to 2.0)
35	Skipping angle (1 to 9)
36	Necessary number of elements (1 to 99)
37	Edge pitch (1 to 9)

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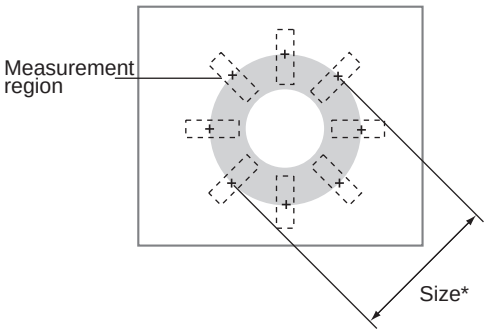
T-Edge Position

The Edge Position processing item uses the density (brightness) in the measurement region to find the position of the measurement object.
Use this processing item to find the edge coordinates or width of the measurement object.

Example: Checking the circular shape of O rings



The edge is found using density changes in the measurement region. Since the measurement region can also be drawn diagonally, it is possible to detect edges of circular and inclined objects. The size (dimensions) of the edge can also be obtained if multiple regions are registered.



* Size is caluculated in "Caluculation"

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Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [T-Edge position/Measurement image]

1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.

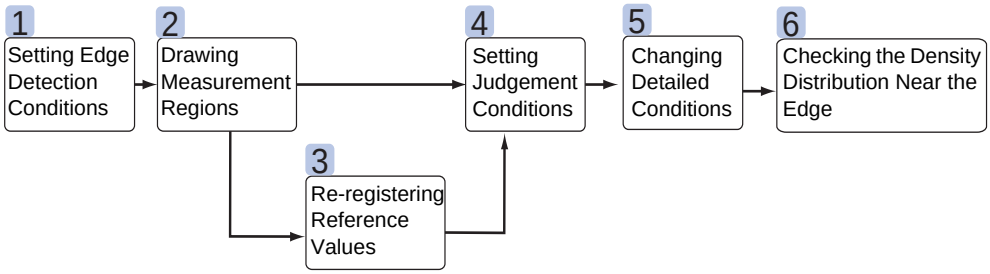


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Set the measurement region

Up to 8 regions can be set.

■ Operational Flow



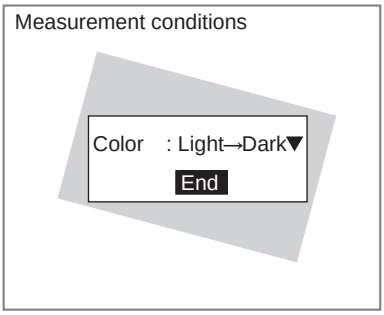
1 Setting Edge Detection Conditions

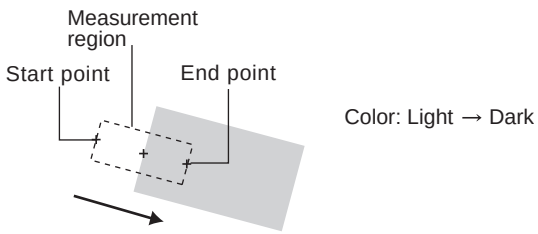
Set density change as explained below.

▶ [T-Edge position/Select region/Region (No.)/Measurement conditions]

1. Select the edge detection conditions.

2. Select [End].



Setting data	Selection	Details
Color	Light to Dark Dark to Light	Select the density change. Measurement is performed within the measurement region, starting from the start point to the end point, to detect edges. The density change direction that is the same as this must be selected. Example: 

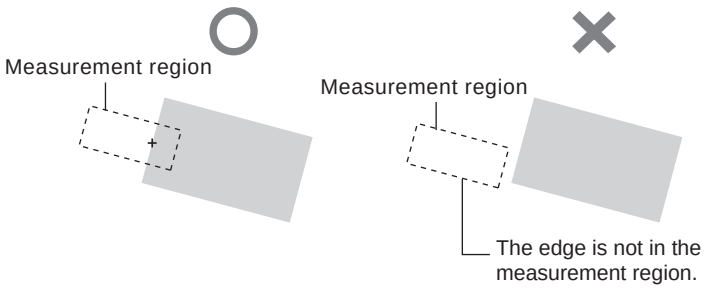
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2 Drawing Measurement Regions

Draw a measurement region to include all the edges for detection. Measurement will be performed, starting from the start point of the specified region to the endpoint.
When a measurement region is drawn, measurement is performed for the displayed image and the result is registered as the reference value (edge position).

CHECK!

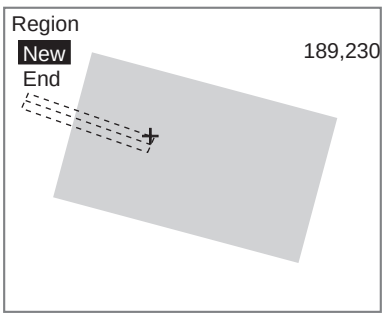
If the edge is not in the measurement region, measurement will not be possible. Make a region of a size and position that allows for movement of the range of the measurement object.



▶ [T-Edge position/Select region/Region (No.)/Region /New]

1. Draw a figure in the region to be measured.
Specify the start point, endpoint and region width.

2. Select [End].



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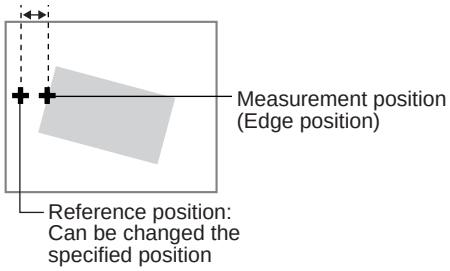
3 Re-registering Reference Values

This operation is performed when only the reference value is to be re-registered.
When a measurement region is drawn, the measurement is performed for the displayed image and the results are registered as the reference values. If the re-registering function explained here is used, only the reference values for the image currently displayed will be registered.
(Edge position is registered for the reference value).

CHECK!

The reference position can be changed to enable the following function.

- Measuring Positions from a Specified Position
  Once the reference values have been obtained for the image currently displayed, the reference position is changed to an suitable point. Position inspection can be performed by calculating the difference between this reference position and the measurement position.



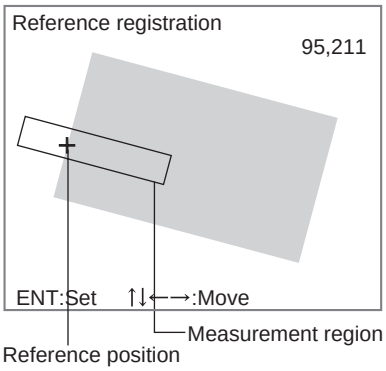
CHECK!

When the measurement region is changed, the reference value returns to the default setting.

▶ [T-Edge position/Select region/Region (No.)/Reference registration]

1. To change the position, use the Up/Down and Right/Left Keys to move the cross cursor.

2. Press the ENT Key.



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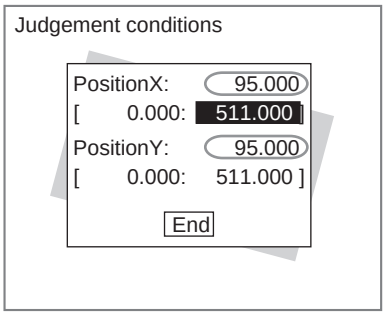
4 Setting Judgement Conditions

Set the position ranges for an OK judgement.

▶ [T-Edge position/Select region/Region (No.)/Judgement conditions]

1. Set each item.

2. Select [End].



: Measurement results for the displayed image
Use these values as a reference for setting upper and lower limits.

Setting data	Selection	Details
Position X	-9999.999 to 9999.999	Set the range of movement in the X direction for an OK judgement.
Position Y	-9999.999 to 9999.999	Set the range of movement in the Y direction for an OK judgement.

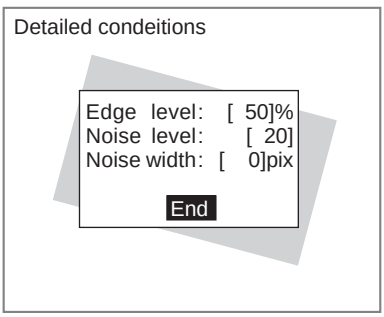
5 Changing Detailed Conditions

Change the detailed conditions when the measurement results are unstable. Normally, the method can be left on the default setting. After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

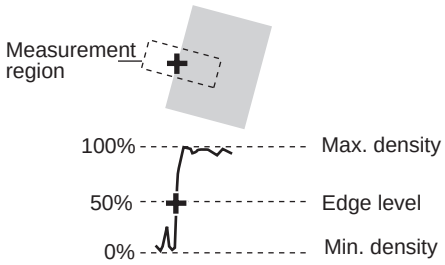
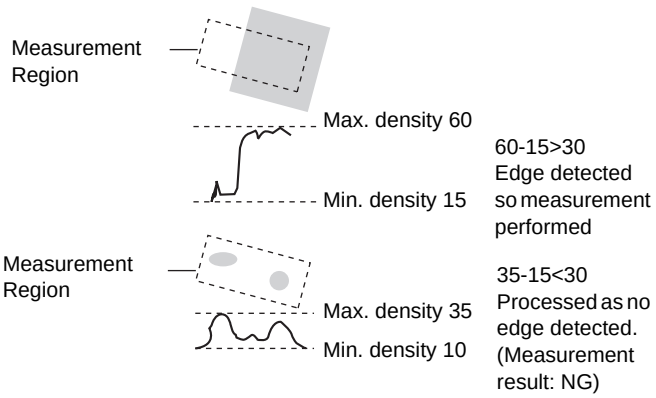
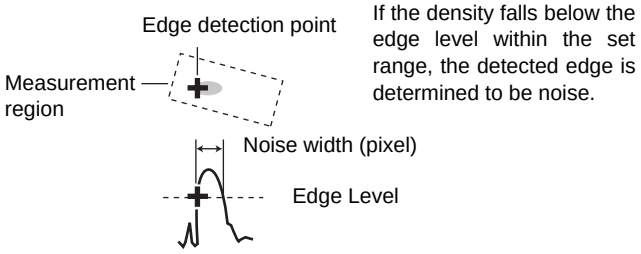
▶ [T-Edge position/Select region/Region (No.)/Detailed conditions]

1. Set each item.

2. Select [End].



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Setting data	Selection	Details
Edge Level	0 to 100 (default setting: 50)	Set a density change level between 0 and 100 that will indicate the edge. 
Noise Level	0 to 255 (default setting: 20)	Noise level used to make judgement if edges are present or not. The maximum density and minimum density within the edge detection area is calculated and if the difference between the two values is less than the noise level, then the Controller determines that there is no edge. If noise is causing incorrect detection, make this value higher. (Within the edge detection region) Max. density - min. density < noise level →no edge →NG measurement result Max. density - min. density ≥ noise level →Edge →Used for measurement Example: When [Noise level] is set to 30 
Noise Width	0 to 255 (default setting: 0)	Set the width of objects that are to be judged as noise. If the density distribution from the position where the edge was first detected falls to below the edge level within the noise width range, the detected point is judged as noise.If noise is causing incorrect detection, make this value higher. 

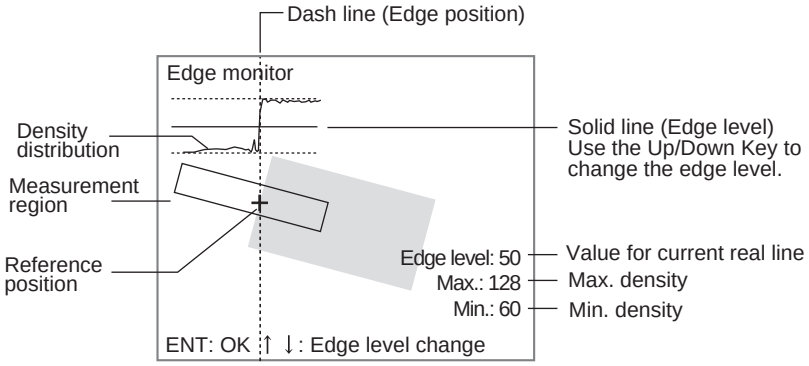
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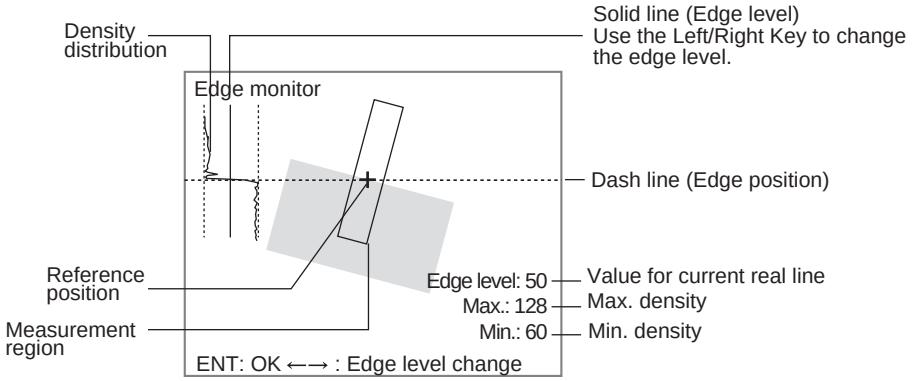
6 Checking the Density Distribution Near the Edge

The density distribution and edge level within the measurement region can be checked on the screen.

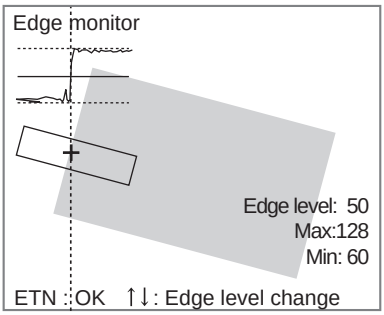
The edge level can also be set while monitoring density distribution.

After changing the settings, perform an object measurement to check that measurement can still be performed correctly.





▶ [T-Edge position/Select region/Region (No.)/Check edge]



- To check density distribution and edge level
  Check the density distribution near the edge and press the ESC key to exit.

- To change the edge level
  Use the Up/Down/Left/Right Keys to move the cursor and press the ENT Key.

CHECK! The edge level can also be set in [Detailed conditions]. (The setting that has been specified the last will become effective.)

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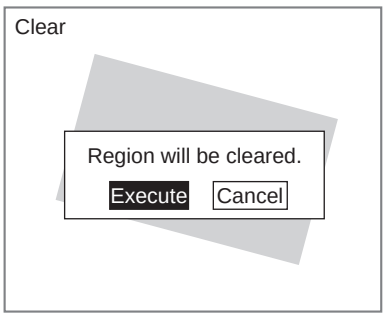
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Clearing the Set Regions

The clear operation is performed separately for each region.

▶ [T-Edge position/Select region/Region (No.)/Clear]

1. Select [Execute].



Setting the Coordinate Mode

Select the type of coordinate values.

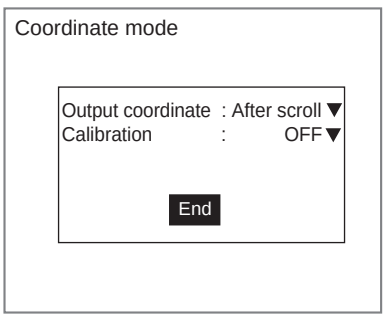
CHECK!

If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [T-Edge position/Coordinate mode]

1. Set each item.

2. Select [End].



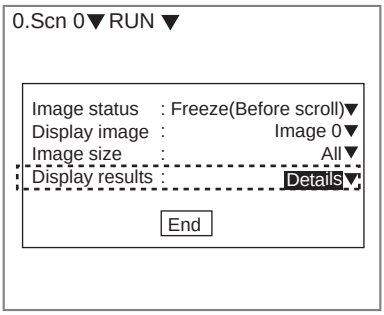
Settings Data

SECTION 7 Appendix, “Coordinate Handling Method”

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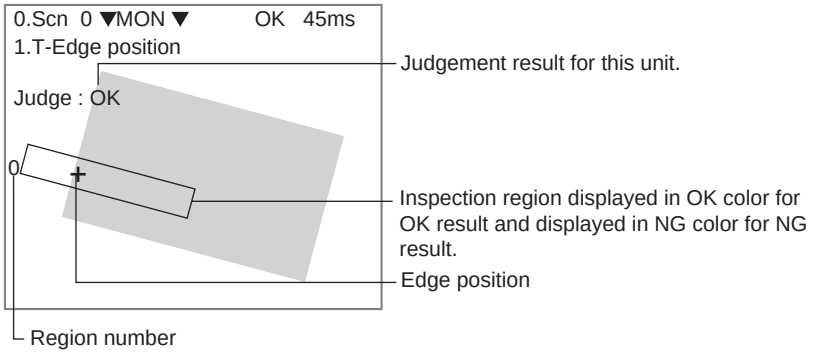
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.
Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



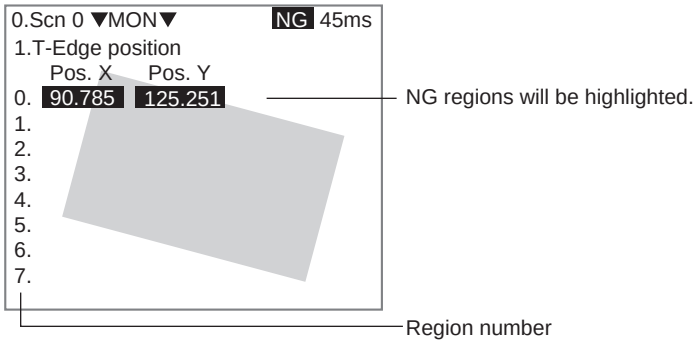
Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed. Use the SHIFT+Right or Left Keys to switch in order between the two screens.

(1) Judgement Result



(2) List of Positions

A list of edge positions for each region will be displayed.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Unit judgement result (-2: Not measured -1: NG 0: OK)
The following measurement data is for Region N (0 to 7).		
Judgement	R**JG	Judgement result (-2: Not measured -1: NG 0: OK)
Edge position	R**X	Edge position X
Edge position	R**Y	Edge position Y
Reference position	R**SX	Reference X
Reference position	R**SY	Reference Y

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement Data

Data No.	Details
0	Unit judgement result (-2: Not measured -1: NG 0: OK)
The following measurement data is for Region N (0 to 7).	
5N+1	Judgement result (-2: Not measured -1: NG 0: OK)
5N+2	Edge position X
5N+3	Edge position Y
5N+4	Reference X
5N+5	Reference Y

■ Setting Data

Data No.	Details
50	Measurement image (0: Image 0 1: Image 1)
51	Coordinate mode (0: After scroll calibration OFF 1: Before scroll calibration OFF 2: After scroll calibration ON 3: Before scroll calibration ON)
The following measurement data is for Region N (0 to 7).	
15N+52	Edge color (0: Light →Dark, 1: Dark →Light)
15N+53	X upper limit (-9,999.999 to 9,999.999)
15N+54	X lower limit (-9,999.999 to 9,999.999)
15N+55	Y upper limit (-9,999.999 to 9,999.999)
15N+56	Y lower limit (-9,999.999 to 9,999.999)
15N+57	Edge level (0 to 100)
15N+58	Noise level (0 to 255)
15N+59	Noise width (0 to 255)
15N+60	Region upper left X (0 to X_MAX) (See *1.)
15N+61	Region upper left Y (0 to Y_MAX) (See *1.)
15N+62	Region lower right X (0 to X_MAX) (See *1.)
15N+63	Region lower right Y (0 to Y_MAX) (See *1.)
15N+64	Region width (1 to 64)
15N+65	Reference position X (0 to X_MAX) (See *1.)
15N+66	Reference position Y (0 to Y_MAX) (See *1.)

*1: The setting range varies depending on the controller model.

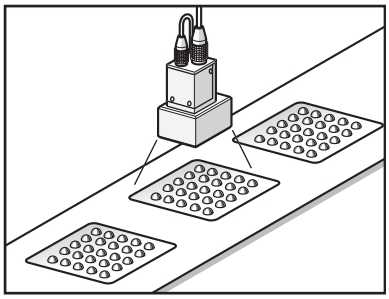
Setting range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

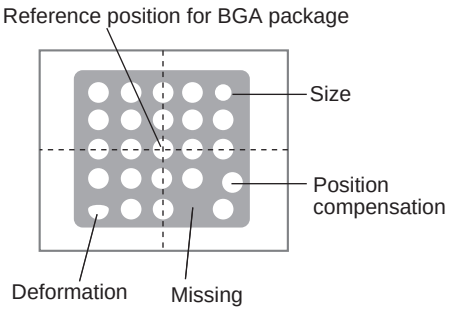
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BGA Inspection

BGA inspection is used for BGA package positioning and external inspection.
It inspects the package position, the number of balls*, ball position, size and deformation.

Example: Positioning of PGA package





* The number of measurable balls varies depending on the controller model.

For F500: Max. 10000
For the other controllers: Max. 2500

CHECK!

Stable BGA inspection can be performed if BGA packages are exposed to low-angle illumination.

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Operational Flow

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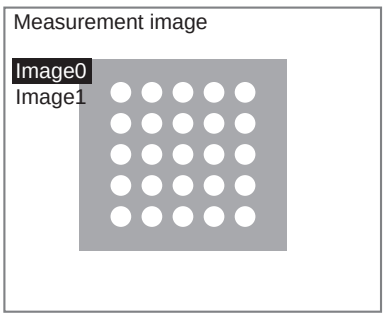
Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

▶ [BGA/Measurement image]

1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Press the ENT Key.



Setting Binary Levels

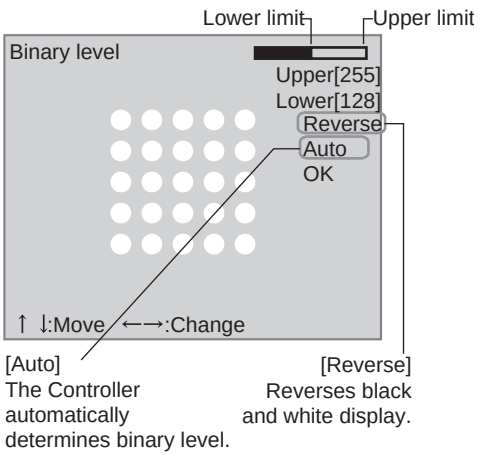
Set the level for converting 256-gradation images into binary images. Measurements are performed for the white pixels. Therefore, make the settings so that all the balls are white.

▶ [BGA/Binary]

1. Move the cursor to the upper value and use the Left and Right Keys to adjust the value.

2. Use the same method to change the lower value.

3. Select [OK].

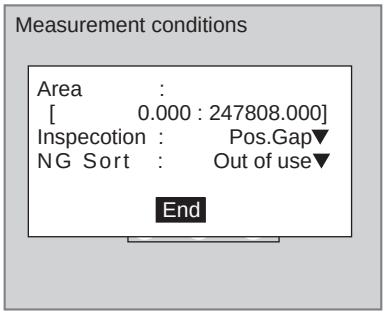


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Setting Measurement Conditions

Set [Area], [Inspection] and [Sort] for ball measurement.
Set these detailed conditions as required.

▶ [BGA/Measurement conditions]



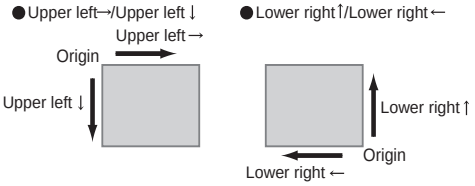
1. Set each item.

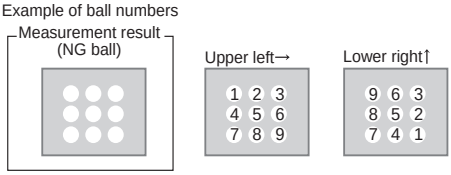
2. Select [End].

Setting data	Selection	Details
Area	0 to 9,999,999.999 (default setting: 0)	Set the area to be judged as a ball.
Inspection	Select the items to be measured.	
	Fast	Checks the number of balls.
	Pos.Gap (default setting)	Inspects the number of balls, ball position, size and deformation.
	Precise	Inspects the number of balls, ball position, size and deformation in units of sub pixels. This method requires longer measurement time.
NG Sort	Select the ball number re-assignment direction for the balls for which NG judgement was made.	
	OFF (default setting)	Ball numbers are not re-assigned.
	Left Up →	Re-assigns ball numbers, starting from the package's upper left position (with priority given to X-coordinate).
	Left Down ↓	Re-assigns ball numbers, starting from the package's upper left position (with priority given to Y-coordinate).
	Right Down ←	Re-assigns ball numbers, starting from the package's lower right position (with priority given to X-coordinate).
	Right Up ↑	Re-assigns ball numbers, starting from the package's lower right position (with priority given to Y-coordinate).

CHECK!

The origin to be used for [NG Sort] is given below for each sorting method. It does not correspond to the origin of the coordinate system set for calibration.





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Drawing Measurement Regions

This section describes how to set the region to be measured.

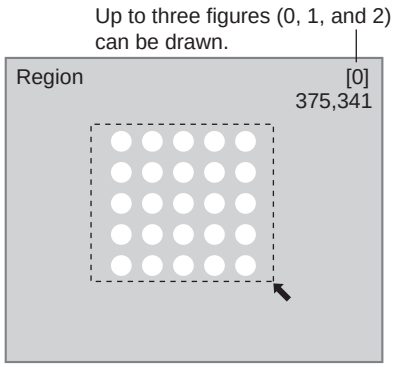
CHECK!

Regions can be created by combining up to 3 different figures. Regions with complicated shapes can be drawn and areas can be omitted from the measurement region by combining figures.

▶ [BGA/Region/New/figure/drawing mode]

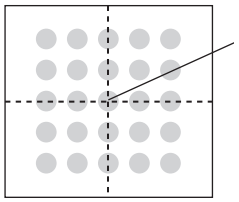
1. Draw a figure in the region to be measured.

SECTION 1 Basic Operating Procedures, "Drawing a Region"



Registering Reference Values

This section describes how to set the package's reference position.

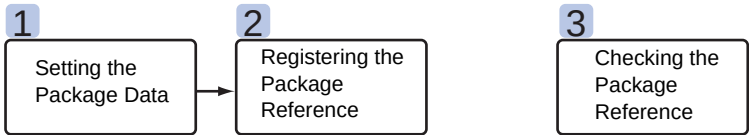


CHECK!

If you want to set the reference position using actual dimensions, calibration must be set.

Refer to SECTION 2, 1.1 Inputting Camera Images

■ Operational Flow



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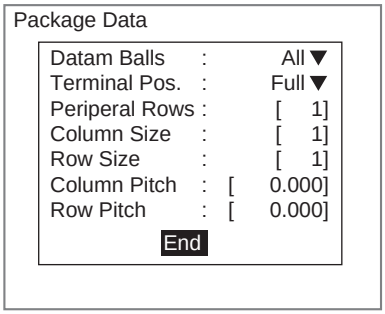
1 Setting the Package Data

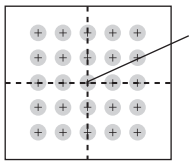
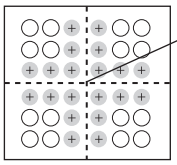
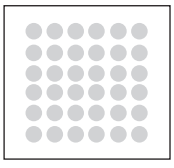
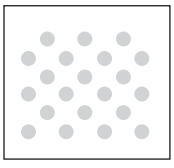
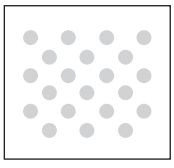
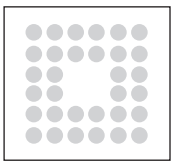
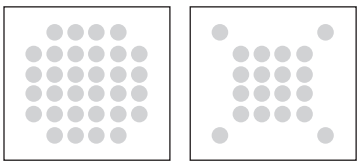
This section describes how to set the package reference position finding method.

▶ [BGA/Reference registration/Package Data]

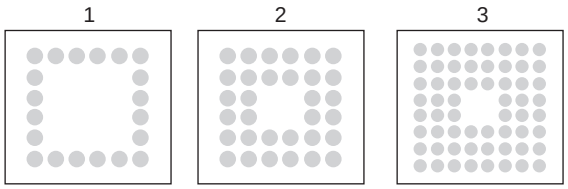
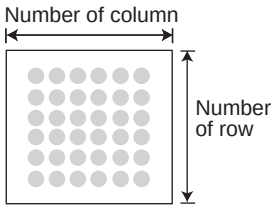
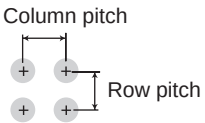
1. Set each item.

2. Select [End].



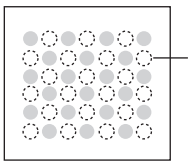
Setting data	Selection	Details
Datum Balls	All (default setting)	Finds the reference position using the center positions of all the measured balls.  Package's reference position The center of two lines crossing at right angles obtained by the least-squares method is set as the reference position.
	Oppose	Among all the measured balls, only the center positions of the opposed balls are used to find the reference position. Select this method when you want to reduce the reference position measurement time.  Package's reference position The cross point of two lines linking the centers among the balls opposing each edge is set as the reference position.
Terminal Pos.	Full (default setting) Staggered 1 Staggered 2 Peripheral Other	Select the arrangement of the balls to be measured. Full  Staggered 2  Staggered 2  Peripheral  Other (arrangements other than the above four) 

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Setting data	Selection	Details
Peripheral Rows	1 (default setting) 2 3	This setting must be made if [Peripheral] is selected for [Terminal Pos.]. Set the number of balls present on the peripheral of the package. (1*) The settable number varies depending on the controller model. p.17 
Column Size Row Size	-	Set the maximum number of balls for package's column and row directions. (1*) The settable number varies depending on the controller model. p.17  In the example on the left, “6” must be set for both “Column Size” and “Row Size”
Column Pitch Row Pitch	0 to 9999.999 (default setting: 0)	Set the ball pitch. This setting is not necessary if [Other] has been selected for [Terminal Pos.]. The pitch measured by [Reference registration]/[Registration] will be reflected. p.8 

CHECK!

When [Staggered] is selected for [Terminal Pos.]



[Column Size], [Row Size], [Column Pitch] and [Row Pitch] must be set assuming that there are balls in the spaces among the balls as shown on the left.

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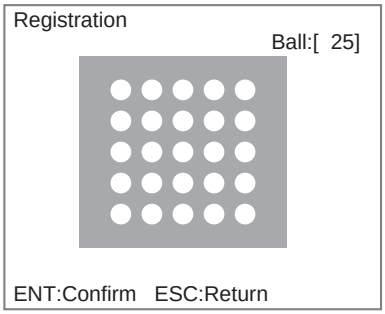
2 Registering the Package Reference

1 This section describes how to register the reference position set at step 1.
Display a good package on the monitor.

▶ [BGA/Reference registration/Registration]

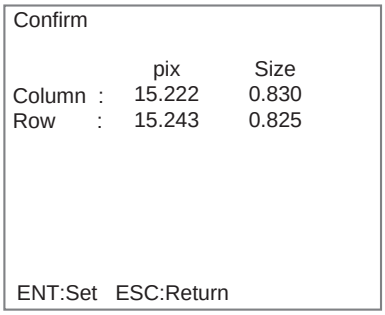
1. Place the good package at the correct position.

2. Press the ENT Key.



The data confirmation window will be displayed.

3. Press the ENT Key.



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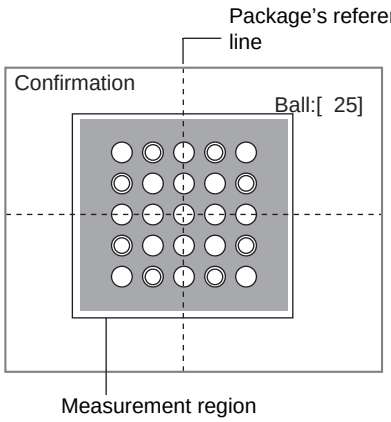
Checking the Package Reference

The registration information for the reference position can be displayed on the monitor.

▶ [BGA/Reference registration/Confirmation]

1. Check the package reference.

2. Press the ENT Key to exit.



○: Indicates a ball (opposed balls are indicated by ◎).

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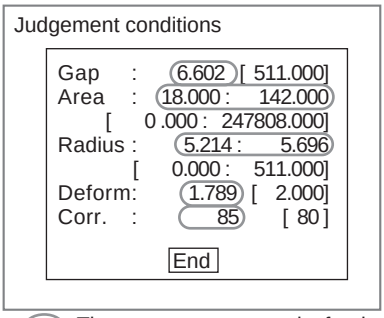
Setting Judgement Conditions

This section describes how to set judgement conditions, such as displacement (gap) from the reference position, ball area and size.
The range for OK judgement must be set for each item.

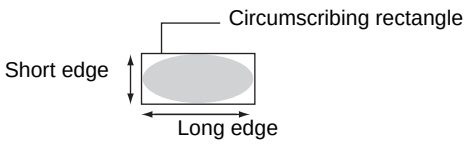
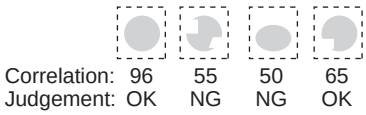
▶ [BGA/Judgement conditions]

1. Set each item.

2. Select [End].



: The measurement results for the displayed image
Use these values as references in setting the upper and lower limits.

Setting data	Selection	Details
Gap	0 to 9999.999	Set the upper limit for the deviation in straight distance from the reference position.
Area	0 to 9,999,999.999	Set the acceptable ball area range.
Diameter	0 to 9,999.999	Set the acceptable ball diameter range.
Deformation	1.000 to 9,999.999	Set the upper limit for the acceptable ball deformation rate (long, short edges). 
Correlation value	0 to 100	Set the correlation lower limit. Example: When “60” is set 

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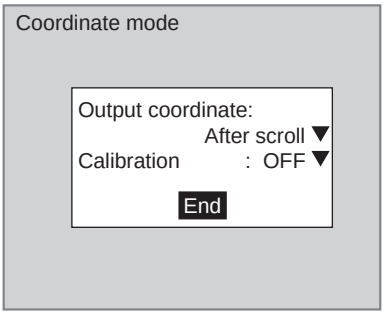
Setting the Coordinate Mode

Select the type of coordinate values.

CHECK!

If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

▶ [BGA/Coordinate mode]



1. Set each item.

2. Select [End].

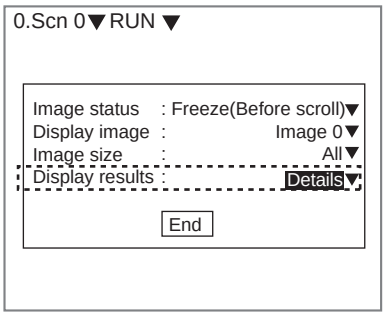
Settings Data

SECTION 7 Appendix, “Coordinate Handling Method”

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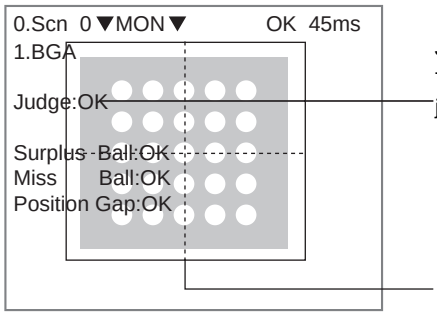
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.
Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed. Use the SHIFT+Right or Left Keys to switch in order between the two screens.

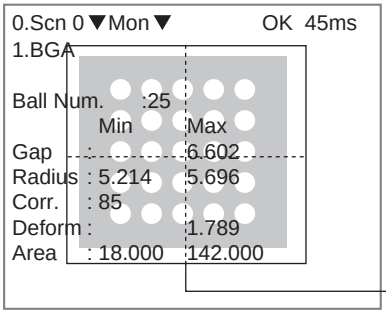
(1) Judgement Result



Judgement result for this unit
The measurement result is highlighted in the case of NG judgement.

Solid line: Measurement region
Dash line: Package's reference line

(2) Measurement items

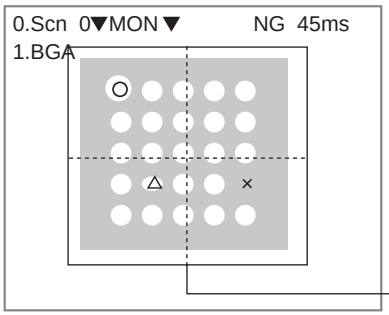


The measurement result is highlighted in the case of NG judgement.

Solid line: Measurement region
Dash line: Package's reference line

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(3) NG results

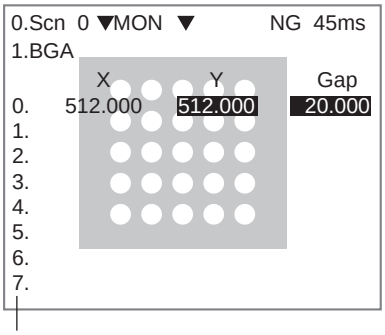


The nature of NG is shown on each NG ball using the following symbols.
Deformation: △
Ball present: ◎
Ball not present: ×
Diameter: ○
Gap: □
Area: +
Correlation: ▽

Solid line: Measurement region
Dash line: Package's reference line

(4) NG detailed results 1

Measurement results are displayed for up to 32 NG balls.
If there are 33 or more NG balls, the results will be displayed for the top 32 NG balls sorted according to the specified sort conditions.
(NG numbers indicate the numbers set for [Measurement conditions/NG Sort].



The results which are not acceptable (i.e. NG) will be highlighted.

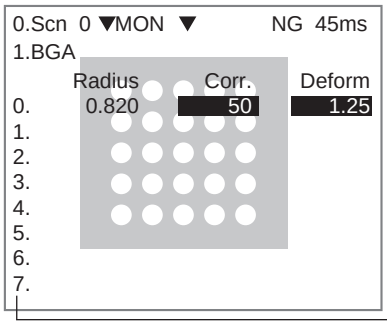
NG number (0 to 31)
The results for NG numbers 8 to 31 are displayed after the windows (4) to (6).

CHECK!

NG number
NG results are displayed for NG numbers 0 to 15 if the font size is set to [Small] for [System/ Conditions].

(5) NG detailed results 2

Measurement results are displayed for up to 32 NG balls.



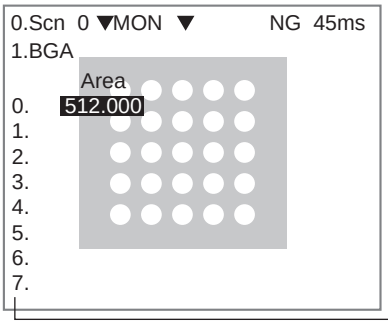
The results which are not acceptable (i.e. NG) will be highlighted.

NG number (0 to 31)
The results for NG numbers 8 to 31 are displayed after the windows (4) to (6).

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(6) NG detailed results 3

Measurement results are displayed for up to 32 NG balls.



The results which are not acceptable (i.e. NG) will be highlighted.

NG number (0 to 31)
The results for NG numbers 8 to 31 are displayed after the windows (4) to (6).

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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Unit judgement result (-2: Not measured -1: NG 0: OK)
NG count	NN	Number of measured NG balls
NG information	NI	NG causes * (0: OK 1: Ball present 2: Ball not present 4: Gap 8: Diameter 16: Correlation 32: Deformation 64: Area)
Ball count	BN	Number of balls
Maximum displacement (gap)	DH	Maximum straight distance between measurement and reference positions
Max. diameter	RH	Maximum ball diameter
Min. diameter	RL	Minimum ball diameter
Min. correlation	CR	Minimum ball correlation value
Max. deformation	AS	Maximum ball deformation
Max. area	AH	Maximum ball area
Min. area	AL	Minimum ball area
Reference X	SX	X coordinate of package's reference position
Reference Y	SY	Y coordinate of package's reference position
Reference axis	ST	Package's axis angle
Data for NG numbers (0 to 31) is shown below.		
NG information	B**JG	NG causes * (0: OK 1: Ball present 2: Ball not present 4: Gap, 8: Diameter 16: Correlation 32: Deformation 64: Area)
Measured X	B**X	X coordinate of measured position
Measured Y	B**Y	Y coordinate of measured position
Reference X	B**SX	X coordinate of reference position
Reference Y	B**SY	Y coordinate of reference position
Displacement	B**D	Straight distance between measurement and reference positions
Ball diameter	B**R	Diameter
Correlation value	B**CR	Correlation value
Deformation	B**AS	Deformation
Area	B**AR	Area

*: If two or more causes exist for NG judgement, the sum of the NG information number of each cause will be output.

Example: If [Corr.] and [Deform] are the causes, "48" will be output. (16 (Corr.) + 32 (Deform))

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement Data

Data type	Details
0	Unit judgement result (-2: Not measured -1: NG 0: OK)
1	Number of measured NG balls
2	NG causes * (0: OK 1: Ball present 2: Ball not present 4: Gap 8: Diameter 16: Correlation 32: Deformation 64: Area)
3	Number of balls
4	Maximum straight distance between measurement and reference positions
5	Maximum ball diameter
6	Minimum ball diameter
7	Minimum ball correlation value
8	Maximum ball deformation
9	Maximum ball area
10	Minimum ball area
11	X coordinate of package's reference position
12	Y coordinate of package's reference position
13	Package's axis angle
Data for NG numbers (0 to 31) is shown below.	
10N+14	NG causes * (0: OK 1: Ball present 2: Ball not present 4: Gap 8: Diameter 16: Correlation 32: Deformation 64: Area)
10N+15	X coordinate of measured position
10N+16	Y coordinate of measured position
10N+17	X coordinate of reference position
10N+18	Y coordinate of reference position
10N+19	Straight distance between measurement and reference positions
10N+20	Diameter
10N+21	Correlation value
10N+22	Deformation
10N+23	Area

*: If two or more causes exist for NG judgement, the sum of the NG information number of each cause will be output.

Example: If [Corr.] and [Deform] are the causes, "48" will be output. (16 (Corr.) + 32 (Deform))

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■ Setting Data

Data type	Details
340	Measurement image (0: Image 0 1: Image 1)
341	Coordinate mode (0: After scroll calibration OFF 1: Before scroll calibration OFF 2: After scroll calibration ON 3: Before scroll calibration ON)
342	Measurement region upper left X (0 to X_MAX) (See *1.)
343	Measurement region upper left Y (0 to Y_MAX) (See *1.)
344	Measurement region lower right X (0 to X_MAX) (See *1.)
345	Measurement region lower right Y (0 to Y_MAX) (See *1.)
346	Binary level upper limit (0 to 255)
347	Binary level lower limit (0 to 255)
348	Reverse binary level (0: Not reversed 1: Reversed)
349	Area judgement upper limit
350	Area judgement lower limit
351	Inspection method (0: Fast 1: Pos.Gap 2: Precise)
352	NG Sort (0: Out of use, 1: Left Up →, 2: Left Down ↓, 3: Right Down ←, 4: Right Up ↑)
353	Datum Balls (0: All 1: Oppose)
354	Terminal Pos. (0: Full 1: Staggered 1 2: Staggered 2 3: Peripheral 4: Other)
355	Peripheral Rows (1 to P_MAX) (See *1.)
356	Row Size (1 to N_MAX) (See *1.)
357	Column Size (1 to N_MAX) (See *1.)
358	Row Pitch (0 to 9,999.999)
359	Column Pitch (0 to 9,999.999)
360	Ball count (1 to 10000)
361	Displacement tolerance upper limit (0 to 9,999.999)
362	Ball diameter upper limit (0 to 9,999.999)
363	Ball diameter lower limit (0 to 9,999.999)
364	Deformation upper limit (1,000 to 9,999.999)
365	Correlation lower limit (0 to 100)
366	Area upper limit (0 to 9,999,999.999)
367	Area lower limit (0 to 9,999,999.999)

*1: The setting range varies depending on the controller model.

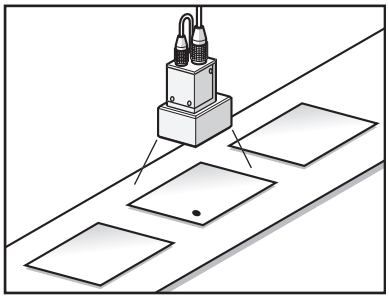
Setting range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483
1 to P_MAX	1 to 49	1 to 24
1 to N_MAX	1 to 100	1 to 50

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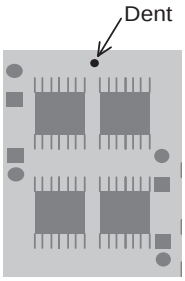
EC Circle Defect Inspection

This inspection performs accurate detection of circular defects, such as dents on a complicated background.
Stable inspection can be performed even if low-contrast scratches are present or the background changes.

Example: Detection of dents on metal plate



Inspection can be performed without the influence of hairline scratches on metal surface and uneven illumination.



Edge Code (EC)
SECTION 7 Appendix, “Terminology”

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Operational Flow

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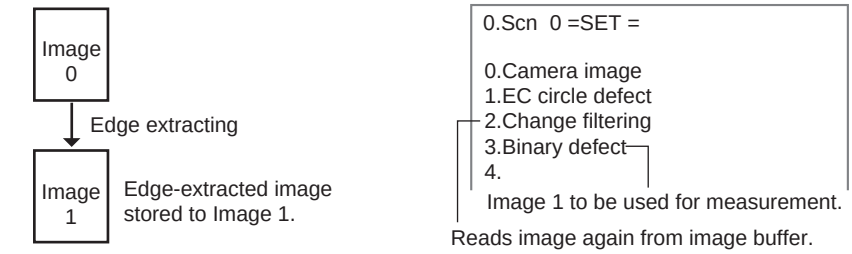
Selecting Measurement Images

This section describes how to select an image stored at either [Image 0] or [Image 1] as the image for measurement.

CHECK!

The edges are extracted for the image number selected here and this image is then stored at the other image number. Set [Change filtering] as the next processing item to use this image for measurement for units after the unit for which [EC circle defect] was set. Then store the image stored in the image buffer to Image 0 or Image 1.

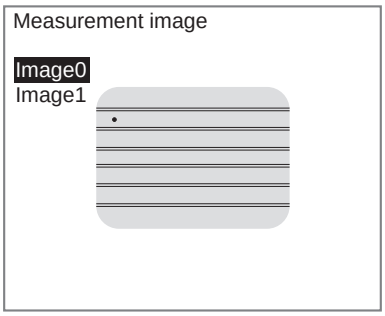
Example: When Image 0 Is Selected as Measurement Image



▶ [EC circle defect/Measurement image]

1. Select which image will be used for measurement, the image stored at [Image 0] or the image stored at [Image 1].

2. Select [ON] or [OFF].



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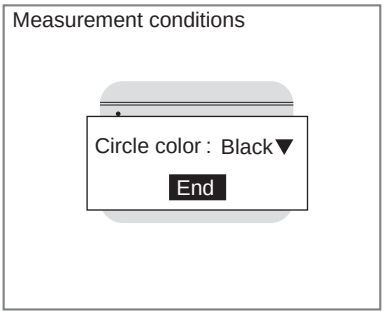
Selecting Circle Color

This section describes how to set the color of circular defects to be inspected.

▶ [EC circle defect/Measurement conditions]

1. Select the circle color.

2. Select [End].



Setting item	Selection	Details
Circle color	Black (default setting) White Both	Select whether the circle color will be white or black compared to the background. Select [Both] if the circle color is not fixed to either black or white.

Setting Inspected Regions

This section describes how to set the region within which circular defects matching the specified conditions are to be detected.

CHECK!

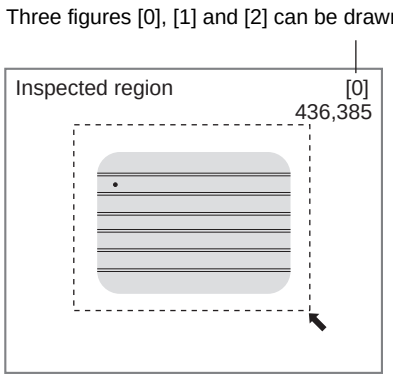
When edges are extracted, the pixels at the edges of the screen cannot be processed accurately.
Thus, make sure the outer edges of the screen are not included in the region when setting it.
In particular, when performing position displacement compensation, adjust so that the scrolled image or the measurement range will not overlap with this region. Furthermore, if the number of lines to be read has been set in the case of F160-S2 camera, there are restrictions on the setting range.

SECTION 2, 1.1 Inputting Camera Images, “Filtering”

▶ [EC circle detection/Inspected region/New/figure/drawing mode]

1. Draw a figure in the region to be inspected.

SECTION 1 Basic Operating Procedures, “Drawing a Region”



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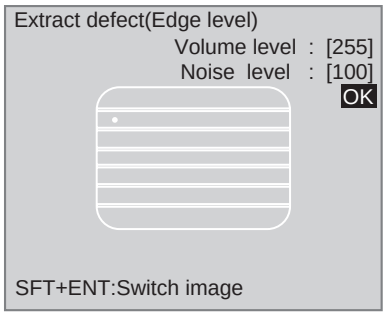
Extracting Circular Defects

[EC circle defect] performs measurement for edge images.
Monitor the displayed image and adjust so that the edges of circular defects to be detected can be seen clearly.

▶ [EC circle defect/Extract defect]

1. Adjust each level so that the edges of circular defects to be detected can be seen clearly.

2. If circular defects cannot be extracted successfully, press the [SHIFT]+[ENT] keys to switch to another window.

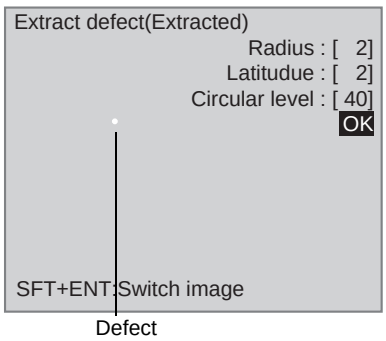


The [Extracted] window will appear.

3. Change the detection conditions for circles to be detected.

4. Select [ENT].

The changes will be reflected when [ENT] is selected in either the [Edge Level] or [Extracted] window.



Edge Level image

Setting item	Selection	Details
Volume level	10 to 255 (default setting: 255)	Set the density upper limit for the edges to be detected. The maximum level (255) will be used for the edges whose density exceeds the upper limit. Edges whose density is below this limit and above [Noise level] will be normalized for density levels 0 to 255.
Noise Level	10 to 255 (default setting: 100)	Set the noise cut level. Edges below this noise level will be removed as noise.

Settings Data

SECTION 7 Appendix, “EC (Edge Code) Image Measurement”

Extracted image

Setting item	Selection	Details
Radius	1 to 99 (default setting: 5)	Set the radius of circular defects to be removed. (In units of pixels)
Tolerance	1 to 64 (default setting: 2)	Set the radius tolerance for the circular defects to be removed. (In units of pixels)
Value	1 to 100 (default setting: 50)	Set the roundness lower limit for the circular defects to be removed. If the circle is chipped, the roundness is lower. Circles below this value will not be detected as circular defects.

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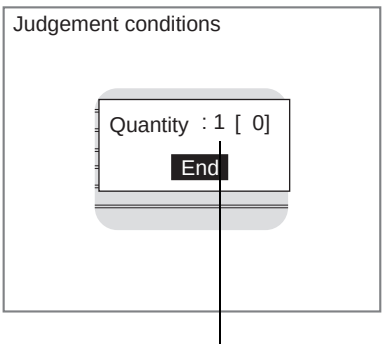
Setting judgement Conditions

Set the conditions for an OK judgement.

▶ [EC circle defect/Judgement conditions]

1. Set the number of circles for an OK judgement.

2. Select [End].



Measurement results for the displayed image (Use them as reference when setting conditions.)

Setting item	Selection	Details
Quantity	0 to 64	Set the upper limit of the accepted circular defect quantity.

Setting the Coordinate Mode

Select the type of coordinate values.

CHECK!

If the [Coordinate mode] is changed after the judgement conditions have been set, the measurement results will change also.
Change the judgement conditions to enable correct measurement.

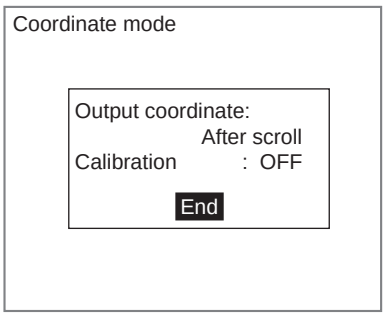
▶ [EC circle defect/Coordinate mode]

1. Set each item.

2. Select [End].

Settings Data

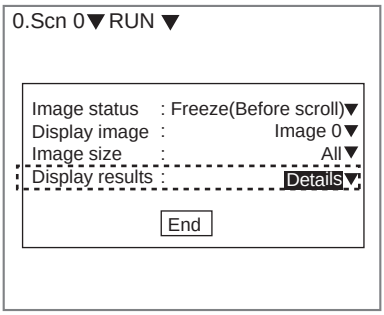
SECTION 7 Appendix, “Coordinate Handling Method”



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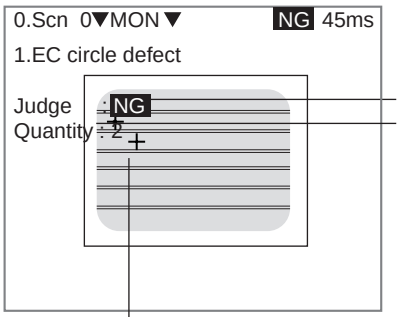
Checking the Measurement Image

Detailed measurement values can be displayed on the screen in Monitor and Run modes. These values are useful when adjusting measurement conditions.
Press the SHIFT+ESC Keys on the Run Screen to access the following screen and change [Display results] to [Details].



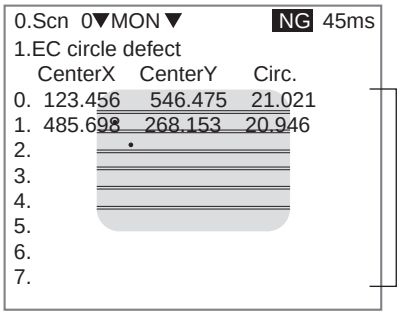
Use the Up or Down Key to change to the unit for which [Label data] is set and the following detailed screens will be displayed. Use the SHIFT+Right or Left Keys to switch in order between the two screens.

(1) Judgement Result



Judgement result for this unit (Example: When [Quantity] judgement condition is set to “0”)
Number of detected circular defects
Defect position (indicated by a + cursor (NG color))

(2) Circle Information (Center Position and Roundness)



Detailed information is displayed for the circles detected as defects.
(The relationship between numbers and circular defects can be found by Center X and Center Y.)

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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Unit judgement result (-2: Not measured -1: NG 0: OK)
Quantity	CN	Number of circular defects
Measurement data for quantity (0 to 63) is given below.		
Center	CX**	X coordinate of center position of circular defect
Center	CY**	Y coordinate of center position of circular defect
Value	CV**	Roundness of circular defect

Understanding the Menu

Each measurement item shows the region number when there are multiple measurement regions for a processing item.

■ Measurement Data

Data type	Details
0	Unit judgement result (-2: Not measured -1: NG 0: OK)
1	Number of circular defects
Measurement data for quantity N (0 to 63) is given below.	
3N+2	X coordinate of center position of circular defect
3N+3	Y coordinate of center position of circular defect
3N+4	Roundness of circular defect

■ Setting Data

Data type	Details
210	Measurement image (0: Image 0 1: Image 1)

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Data type	Details
211	Coordinate mode (0: After scroll, calibration OFF 1: Before scroll, calibration OFF 2: After scroll, calibration ON 3: Before scroll, calibration ON)
212	Noise level (10 to 255)
213	Volume level (10 to 255)
214	Inspected region upper left X (0 to X_MAX) (See *1.)
215	Inspected region upper left Y (0 to Y_MAX) (See *1.)
216	Inspected region lower right X (0 to X_MAX) (See *1.)
217	Inspected region lower right Y (0 to Y_MAX) (See *1.)
218	Circle color (0: Black 1: White 2: Both)
219	Radius (1 or 99)
220	Tolerance (1 to 64)
221	Roundness (1 to 100)
222	Quantity judgement value (0 to 64)

*1: The setting range varies depending on the controller model.

Setting range	For F500	For the other controllers
0 to X_MAX	0 to 1023	0 to 511
0 to Y_MAX	0 to 1023	0 to 483

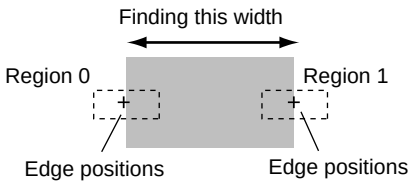
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Calculation

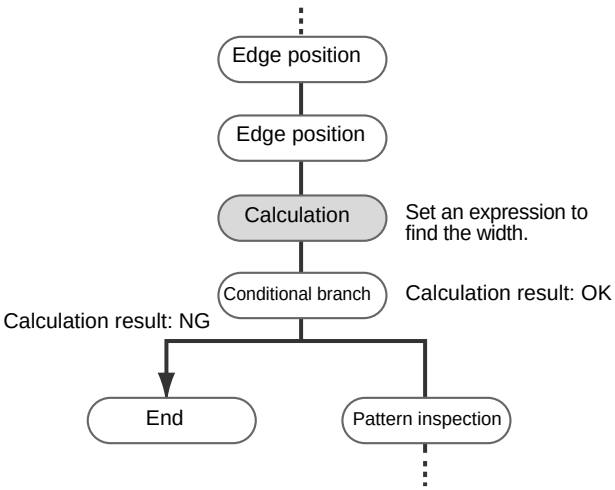
The Calculation processing item is used to perform calculations using the results and measurement values for the processing items registered to the units.

Example: Finding the Width of a Measurement Object

Two edge positions are found beforehand. An expression for calculating the difference between the two edge positions is set and this expression is used to find the width.



If combined with conditional branching, the inspection conditions can be changed based on the calculation result.



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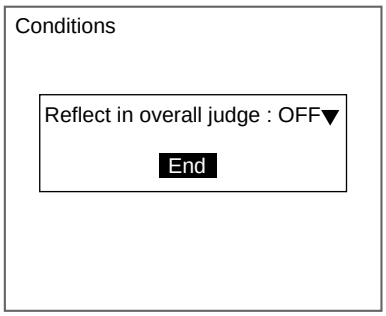
Selecting Reflection in Overall Judgement

For each unit, 8 expressions (0 to 7) can be set.Select whether to reflect the calculation results on unit judgement.

▶ [Calculation/Conditions]

1. Change the setting.

2. Select [End].



Selection	Details
OFF (default setting)	Calculation results are not reflected on unit judgement. Unit judgement is always OK even if calculation results have NG.
ON	Calculation results are reflected on unit judgement. Unit judgement is also NG if calculation results have NG.

Example: Expression 0: OK
Expression 1: OK
Expression 2: NG

When [OFF] is selected
Unit judgement: OK

When [ON] is selected
Unit judgement: NG

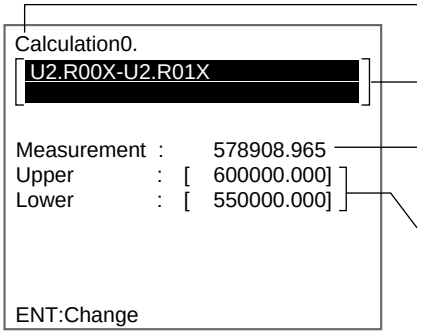
CHECK! To reflect the calculation result on the overall judgement that is output to the parallel interface OR signal, select [ON]. The overall judgement is also displayed on the Monitor and Measurement Screens.



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Setting Expressions

For each unit, 8 expressions (0 to 7) can be set.



Calculation number
Calculation 0 to 7

Expression

Measurement result for the set expression
Refer to this when setting judgement conditions.

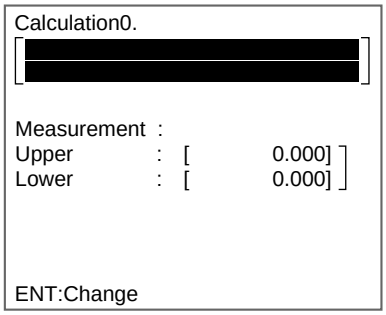
Judgement conditions
Set the judgement conditions for the expression.
Set the OK range (-9,999,999.999 to 9,999,999.999).

CHECK! It is possible to select whether each calculation result is to be reflected in the overall result.
p.3

CHECK! Select the result output processing items for results output if the calculation result needs to be output to an external device. The calculation result is not output to an external device.
SECTION 2, 6. Result Output Items

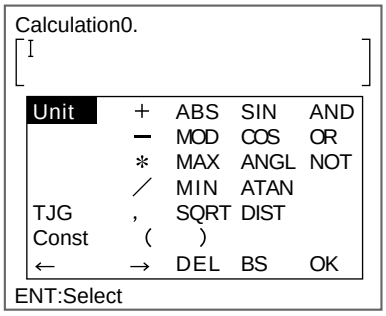
▶ [Calculation/No.(to which the expression is to be set)]

1. Place the cursor in the square brackets for the expression and press the ENT Key.



The setting items will be displayed.
List of Items p.6

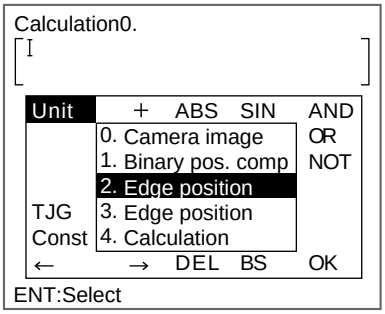
2. Select the items to be set. (This explanation will be based on the selection of unit.)



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The units set to the scene currently displayed will be displayed.

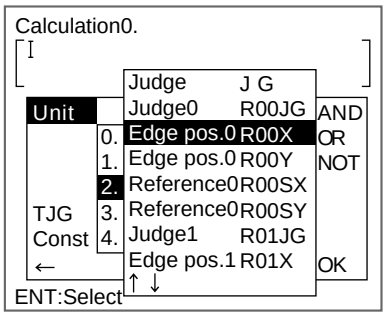
3. Select the unit to be set.



A submenu will be displayed.
The submenu will depend on the unit that was selected. For details, refer to “Submenus for Expressions for the processing item registered for the selected unit.

SECTION 2 Processing items Setting Procedure

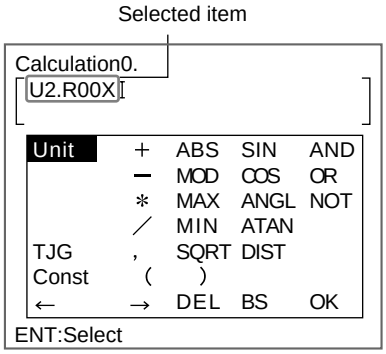
4. Select the desired item from the submenu.



The selected item will be set to the expression.

5. Repeat this operation to create the expression.

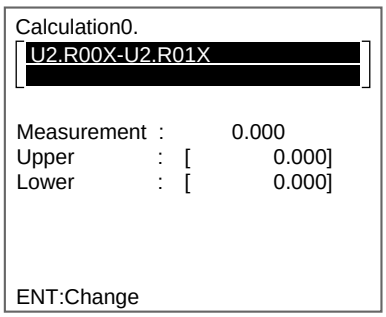
6. Once the expression has been set, select [OK].



The expression will be set.

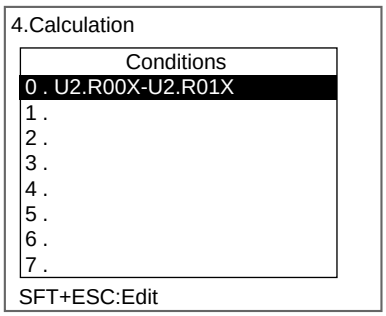
7. Set the upper and lower judgement limits.

8. Press the ESC Key.



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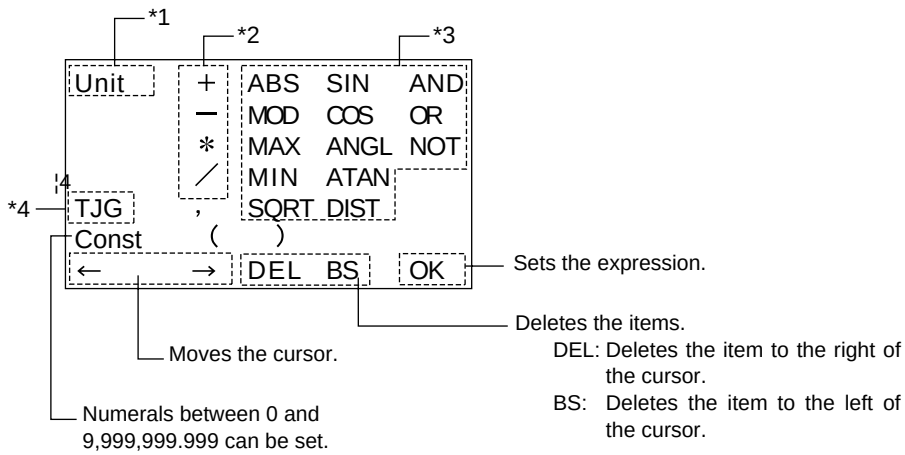
The settings will be registered.
Press the SHIFT+ESC Keys in this screen to copy or clear the expression.



9. Repeat these procedures to set the expressions.

10. Once the expressions have been set, press the ESC Key.

- List of Items



*1 Unit

Calculations can be performed using the measurement results for the units set to the scene currently displayed.

If this item is selected, the unit numbers and processing item names will be displayed. Select the unit number and then select the measurement item to be used in the calculation from the submenu that is displayed.

CHECK! The submenus differ depending on the selected unit. For details, refer to “Submenus for Expressions for the processing item registered for the selected unit.

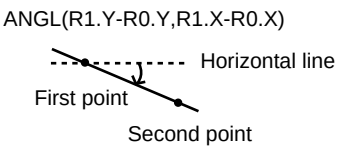
SECTION 2 Processing items Setting Procedure

*2 Arithmetic Operators

Operators	Meaning
+	Addition
-	Subtraction
*	Multiplication
/	Real number division

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*3 Function

Function	Details
ABS	Calculates the absolute value. ABS (argument)
MOD	Calculates the remainder when a number is divided by an ordinal number. MOD (dividend, ordinal number) When multiplication and division are performed and real numbers are used, the real numbers are rounded off to the nearest integer. The result is the remainder from the division of the integer. Example: MOD (13, 4) = 1 (Remainder when 13 is divided by 4.) MOD (25.68, 6.99) = 5 (Remainder when 26 is divided by 7.)
MAX	Gives the larger of two arguments. MAX (argument 1, argument 2)
MIN	Gives the smaller of two arguments. MIN (argument 1, argument 2)
SQRT	Calculates the square root. If the argument is negative, the calculation result will be 0. The judgement result will be NG. SQRT (argument)
SIN	Calculates the sine. The result will be in the range -1 to 1. The angle in the expression is specified in degrees. SIN (expression)
COS	Calculates the cosine. The result will be in the range -1 to 1. The angle in the expression is specified in degrees. COS (expression)
ANGL	Calculates the angle between a straight line joining two points, such as the center of gravity or the center of a model. Also calculates the angle to the horizontal line. The result will be in the range -180 to 180. ANGL (Y component, X component) 
ATAN	Calculates the arc tangent for the Y component/X component. The result is given as a radian of -p to p. ATAN (Y component, X component) Example: Set the following to calculate the angle between a straight line joining the center of gravity for region 0 and the center of gravity for region 1 and a horizontal line. ATAN (R1.Y-R0.Y,R1.X-R0.X) If both arguments are 0, the calculation result will also be 0 and the judgement will be NG.
DIST	Calculates the distance between two points, such as the center of gravity and the center of the model. DIST (X coordinate of first point, Y coordinate of first point, X coordinate of second point, Y coordinate of second point) Example: Set the following to calculate the distance between the center of gravity for region 0 and the center of gravity for region 1. DIST (R0.X,R0.Y,R1.X,R1.Y) The following calculation is internally performed. $\sqrt{(R1.X-R0.X)^2+(R1.Y-R0.Y)^2}$

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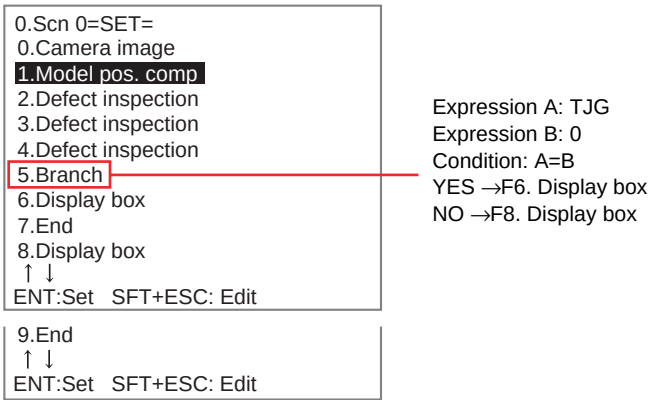
Function	Details
AND	Calculates the LOGICAL AND. If one of the arguments is 0, the calculation result will be 0. Other arguments will give -1. AND (argument 1, argument 2)
OR	Calculates the LOGICAL OR. If both arguments are 0, the calculation result will be 0. Other arguments will give -1. OR (argument 1, argument 2)
NOT	Calculates the LOGICAL NOT. If the argument is 0, the calculation result will be -1. Otherwise it will be 0. NOT (argument)

*4 Cumulative judgement result

The overall judgement result for the units set earlier than the unit for which the expression is set will be obtained.

This function can be used when you want to branch measurement procedure according to the measurement results.

Example: Branching measurement procedure according to the overall judgement results for units 0 to 4



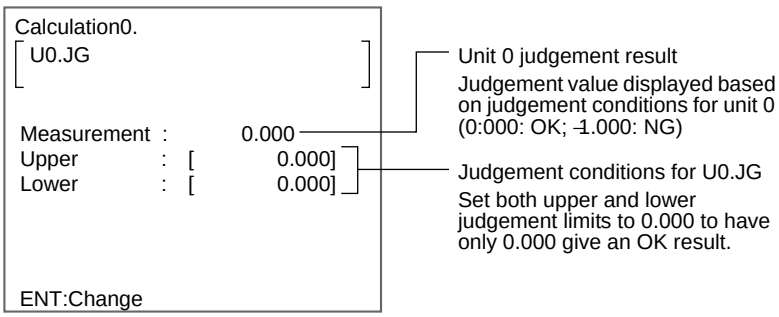
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■ Judgement JG

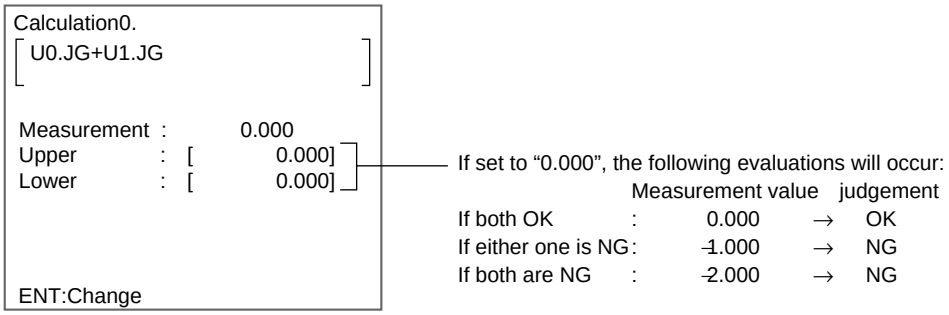
When unit judgement results are used in expressions, the following two-stage judgement is performed.

(1) Judgement based on judgement conditions set for each unit As a result, “0.000” (OK) or “-1.000” (NG) is output to the measurement result.
(2) Judgement of the measurement result from 1 based on the upper and lower judgement limits for that screen

Example 1: Calculation Using Judgement Result for Unit 0



Example 2: Calculation Using Judgement Results for Unit 0 and Unit 1

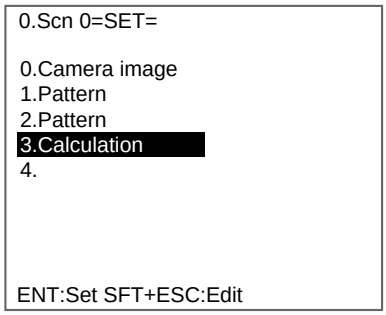


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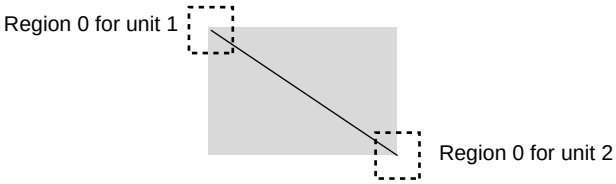
■ Calculations Using Other Expression Values

The expression values set in a calculation unit can be used for other calculations. The calculation result for the expression being used will be D00 to D07 and the judgement result for the expression will be J01 to J07.

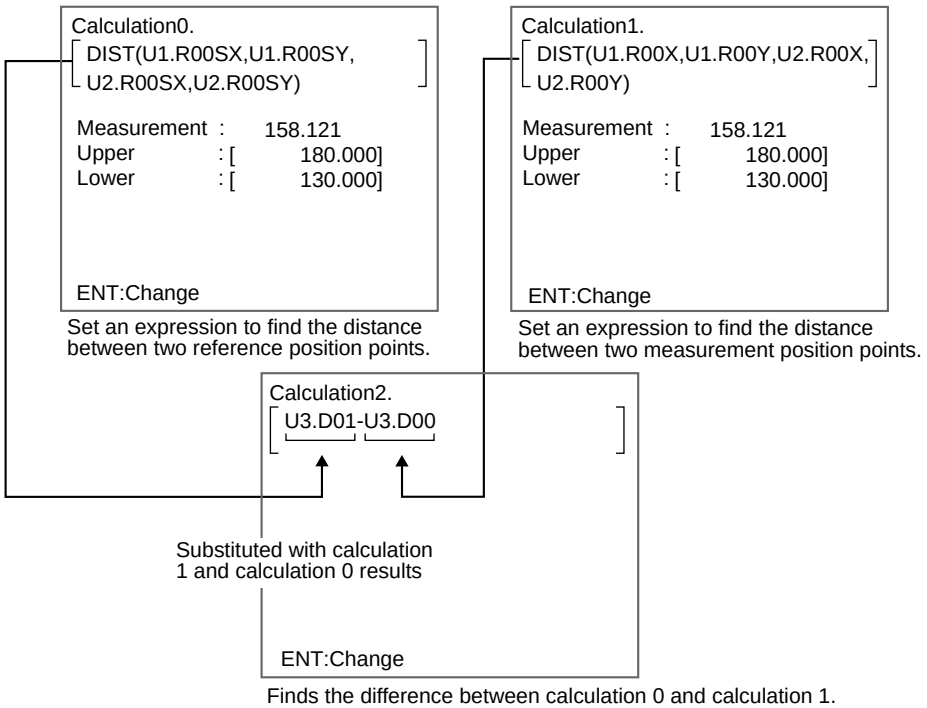
The settings for the expression are shown in the following diagram.



Example 1: Finding the reference position distance and measurement result distance using pattern inspection and outputting the difference



The settings for the expression are shown in the following diagram.



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CHECK!

Expressions are calculated in the order shown in the following diagram.
When using the calculation results from another expression, set the calculation number to a value larger than the number of the calculation for which the results are being used. If a smaller number is set, the result of a previous calculation will be inserted instead of the results of the latest calculation.

Calculation order

Calculation 0
↓
Calculation 1
↓
⋮
↓
Calculation 7

To find the distance between the 2 measurement region points in example 1 and then add 120.25 to that value.

Calculation0.
DIST(U1.R00X,U1.R00Y,U2.R00X,
U2.R00Y)
Measurement : 158.121
Upper : [180.000]
Lower : [130.000]

Find the distance between 2 points.

Calculation1.
U3.D00+120.25
Measurement : 158.121
Upper : [180.000]
Lower : [130.000]

Add 120.25 to the result for calculation 0.

If the expression was set in the reverse order

Calculation0.
U3.D01+120.25
Measurement : 158.121
Upper : [180.000]
Lower : [130.000]

Calculation 0 would be calculated before calculation 1 and the previous calculation result for U3.D01 would be used.

Calculation1.
DIST(U1.R00X,U1.R00Y,U2.R00X,
U2.R00Y)
Measurement : 158.121
Upper : [180.000]
Lower : [130.000]

Example 2: Counting the number of measurements

Calculation0.
U3.D00+1
Measurement : 0.000
Upper : [0.000]
Lower : [0.000]

ENT:Change

CHECK!

U3.D00 will return to “0” if the measurement value is cleared or the power is turned OFF so the count of the number of measurements will also be reset.

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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For the expression setting method, refer to p.4.

Measurement item	String	Details
judgement	JG	judgement result (-2: Not measured -1: NG 0: OK)
Data 0	DO0	Result of expression set to calculation 0
Data 1	DO1	Result of expression set to calculation 1
Data 2	DO2	Result of expression set to calculation 2
Data 3	DO3	Result of expression set to calculation 3
Data 4	DO4	Result of expression set to calculation 4
Data 5	DO5	Result of expression set to calculation 5
Data 6	DO6	Result of expression set to calculation 6
Data 7	DO7	Result of expression set to calculation 7
Judgement 0	J00	Judgement result for expression set to calculation 0 (-1: NG 0: OK)
Judgement 1	J01	Judgement result for expression set to calculation 1 (-1: NG 0: OK)
Judgement 2	J02	Judgement result for expression set to calculation 2 (-1: NG 0: OK)
Judgement 3	J03	Judgement result for expression set to calculation 3 (-1: NG 0: OK)
Judgement 4	J04	Judgement result for expression set to calculation 4 (-1: NG 0: OK)
Judgement 5	J05	Judgement result for expression set to calculation 5 (-1: NG 0: OK)
Judgement 6	J06	Judgement result for expression set to calculation 6 (-1: NG 0: OK)
Judgement 7	J07	Judgement result for expression set to calculation 7 (-1: NG 0: OK)

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement Data

Data type	Details
0	judgement result (-2: Not measured -1: NG 0: OK)
1	Result of expression set to calculation 0
2	Result of expression set to calculation 1
3	Result of expression set to calculation 2
4	Result of expression set to calculation 3
5	Result of expression set to calculation 4
6	Result of expression set to calculation 5
7	Result of expression set to calculation 6
8	Result of expression set to calculation 7
9	Judgement result for expression set to calculation 0 (-1: NG 0: OK)
10	Judgement result for expression set to calculation 1 (-1: NG 0: OK)
11	Judgement result for expression set to calculation 2 (-1: NG 0: OK)
12	Judgement result for expression set to calculation 3 (-1: NG 0: OK)
13	Judgement result for expression set to calculation 4 (-1: NG 0: OK)
14	Judgement result for expression set to calculation 5 (-1: NG 0: OK)
15	Judgement result for expression set to calculation 6 (-1: NG 0: OK)
16	Judgement result for expression set to calculation 7 (-1: NG 0: OK)

■ Setting Data

Data type	Details
17	Judgement lower limit for calculation 0 (-9,999,999.999 to 9,999,999.999)
18	Judgement upper limit for calculation 0 (-9,999,999.999 to 9,999,999.999)
19	Judgement lower limit for calculation 1 (-9,999,999.999 to 9,999,999.999)
20	Judgement upper limit for calculation 1 (-9,999,999.999 to 9,999,999.999)
21	Judgement lower limit for calculation 2 (-9,999,999.999 to 9,999,999.999)
22	Judgement upper limit for calculation 2 (-9,999,999.999 to 9,999,999.999)
23	Judgement lower limit for calculation 3 (-9,999,999.999 to 9,999,999.999)
24	Judgement upper limit for calculation 3 (-9,999,999.999 to 9,999,999.999)
25	Judgement lower limit for calculation 4 (-9,999,999.999 to 9,999,999.999)
26	Judgement upper limit for calculation 4 (-9,999,999.999 to 9,999,999.999)
27	Judgement lower limit for calculation 5 (-9,999,999.999 to 9,999,999.999)
28	Judgement upper limit for calculation 5 (-9,999,999.999 to 9,999,999.999)
29	Judgement lower limit for calculation 6 (-9,999,999.999 to 9,999,999.999)
30	Judgement upper limit for calculation 6 (-9,999,999.999 to 9,999,999.999)
31	Judgement lower limit for calculation 7 (-9,999,999.999 to 9,999,999.999)

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Data type	Details
32	Judgement upper limit for calculation 7 (-9,999,999.999 to 9,999,999.999)
33	Expression set to calculation 0
34	Expression set to calculation 1
35	Expression set to calculation 2
36	Expression set to calculation 3
37	Expression set to calculation 4
38	Expression set to calculation 5
39	Expression set to calculation 6
40	Expression set to calculation 7
41	Reflect to overall judgement (0: ON 1: OFF)

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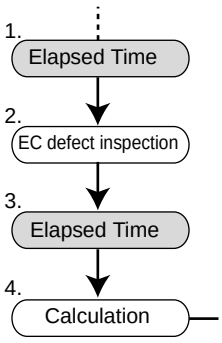
Elapsed Time

The Elapsed Time processing item finds the amount of time (in ms) that has passed since the measurement trigger was input.

No other conditions need to be set when this processing item is added to the flowchart.

Example 1: Finding the Processing Time for A Particular Unit

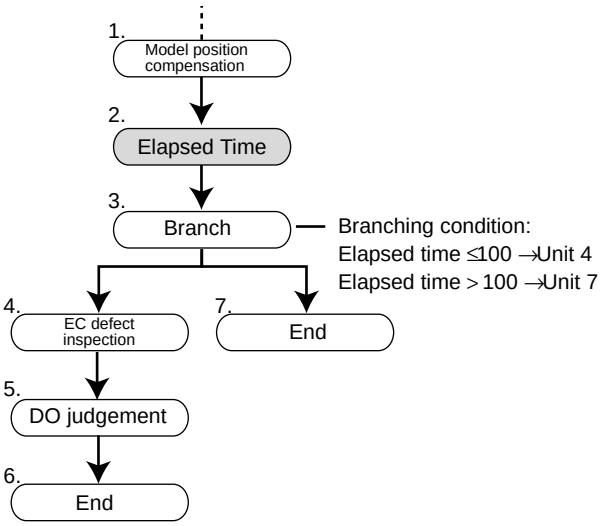
The processing time can then be calculated by setting the Elapsed Time processing item for units before and after other units, and then using the Calculation processing item to find the time.



If an expression to find [3. Elapsed Time] –[1. Elapsed Time] is set, the processing time between units 2 and 3 can be found.

Example 2: Stopping Measurement if Processing Time Exceeds Set Time

The settings are combined with conditional branching.



Branching condition:
Elapsed time ≤100 →Unit 4
Elapsed time > 100 →Unit 7

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When you want to obtain measurement results externally

Submenus for Expressions

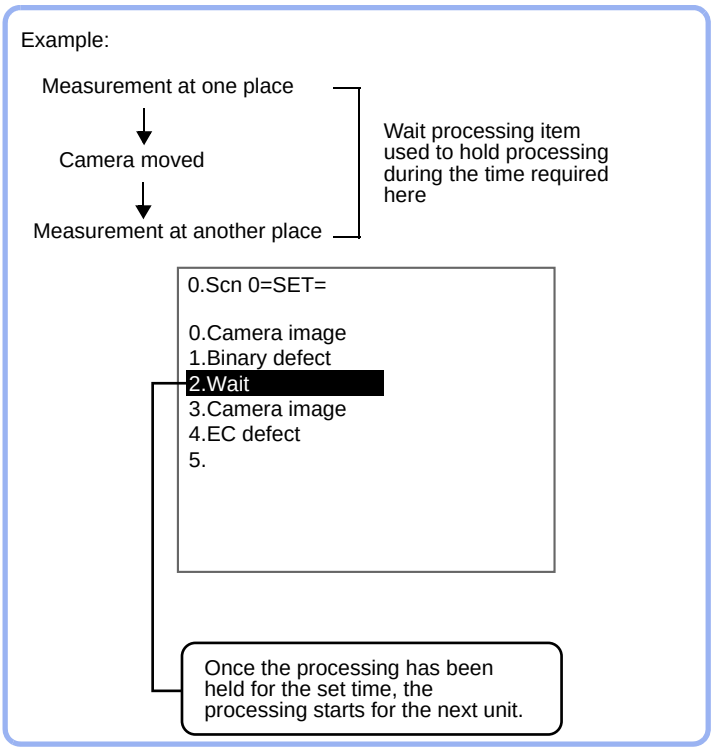
If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Elapsed Time	TM	Time since trigger input

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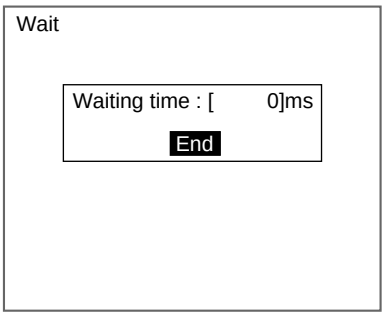
Wait

The Wait processing item temporarily stops the execution of the flowchart and holds processing for a set time. The wait time is set in ms.



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▶ [Wait]



1. Set the waiting time (0 to 9999).

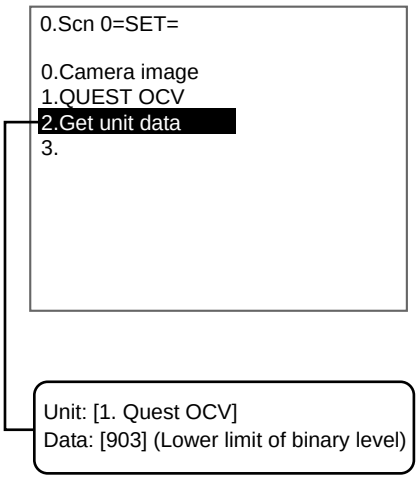
2. Select [End].

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Get Unit Data

The Get Unit Data processing item is used to obtain one piece of processing item data (measurement result, settings parameter, etc.) set in a flowchart.

Example: Obtaining Binary Level Automatically Set for QUEST Character Verification



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Setting the Data to be Obtained

Set the data to be obtained.

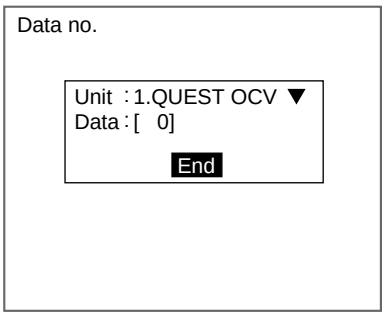
Setting data	Details
Unit	Select the number of the unit for which the processing item data is to be obtained.
Data	Select the number of the data to be obtained. The data number will differ between processing items. For details, refer to the “External Reference Table” for the processing item registered for the selected unit. SECTION 2 Processing items Setting Procedure

▶ [Get unit data/Data no.]

1. Set each item.

2. Select [End].

3. Press the ESC Key.



When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

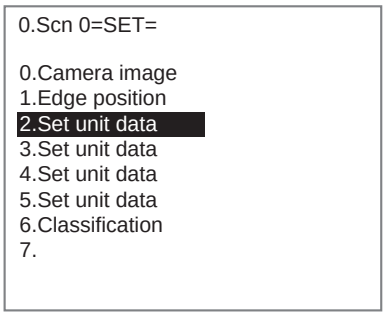
Measurement item	String	Details
Judgement	JG	judgement result (-2: Not measured -1: NG 0: OK)
Acquired data	DT	Obtained unit data

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Set Unit Data

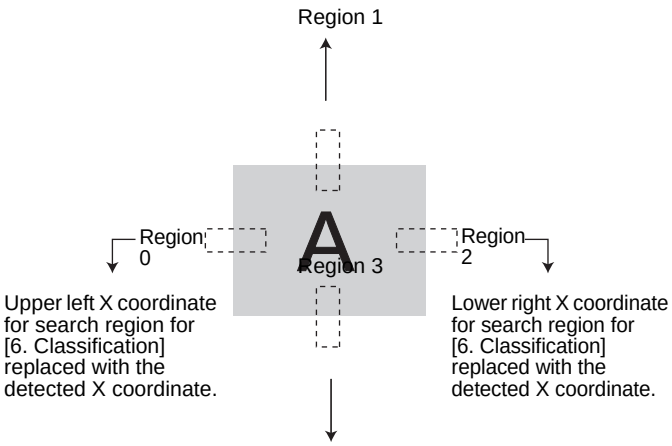
The Set Unit Data processing item is used to replace data during measurement with processing item data (e.g., set parameters) set in the flowchart.

Example: Adjusting Search Regions According to Measurement Object Size



- Detects outline of measurement object in regions 0 to 3 of [1. Edge position].
- Adjusts the search region for [6. Classification] based on that result.

Upper left Y coordinate for search region for [6. Classification] replaced with the detected Y coordinate.



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Selecting Unit and Data Numbers

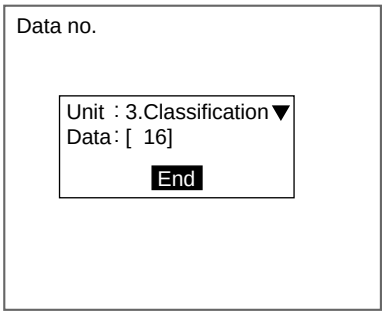
Select the unit number and data number to be replaced. The data number allocations differ for each processing item. For details, refer to the “External Reference Table” for the processing item registered for the selected unit.

SECTION 2 Processing items Setting Procedure

▶ [Set unit data/Data no.]

1. Set each item.

2. Select [End].

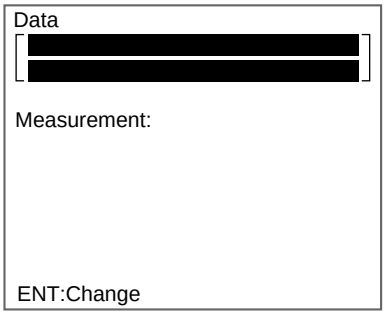


Setting the Replacement Details

Set an expression for the data to be replaced.

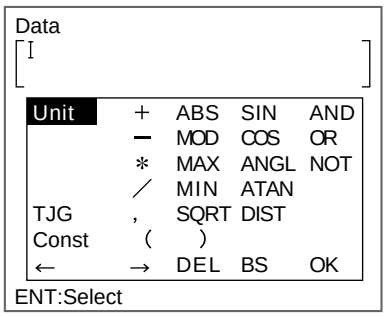
▶ [Set unit data/Data]

1. Place the cursor in the square brackets and press the ENT Key.



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The setting items will be displayed.

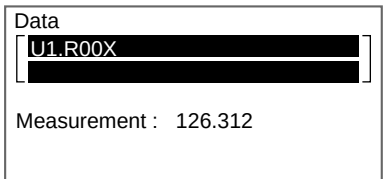


2. Select the items to be set and set the expression.

SECTION 2, 4.1 Calculation “Setting Expressions”

3. Once the expression has been set, select [OK].

The settings will be saved and the screen in **2.** will return.



4. Press the ESC Key.

When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

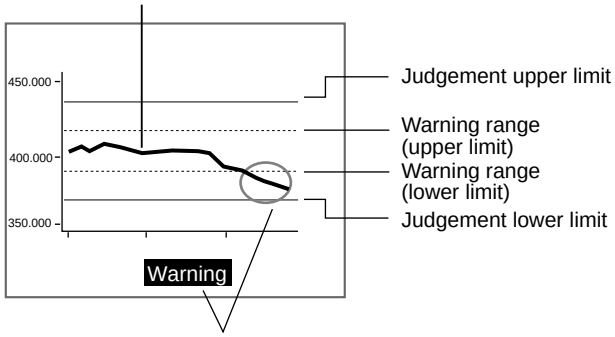
Measurement item	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Setting Data	DT	Calculation result for set data

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Trend Monitor

The Trend Monitor processing item is used to display the measurement results history on the Monitor. Observation of the measurement value trends helps to prevent frequent occurrences of non-conforming articles and to find the cause of NG results when they occur.

Measurement results over time are shown on a graph.
The latest 1,000 measurement results are held.



Feedback can be provided to earlier processes by setting the warning range and sounding a [Warning] before too many NG results occur.

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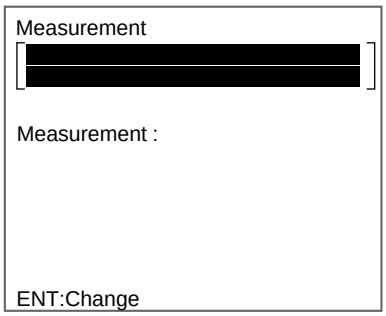
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Selecting Measurement Values to be Displayed

Select the measurement values that are to be displayed on the Trend Monitor. The measurement values are set using expressions.
One item can be displayed for each Trend Monitor unit.

▶ [Trend monitor/Measurement]

1. Place the cursor in the square brackets for the expression and press the ENT Key.

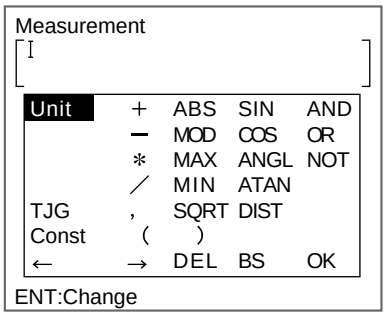


The setting items will be displayed.

2. Select the items to be set.

When setting unit, select the unit number before the Trend Monitor.
The trend graph will not be displayed if later unit numbers are selected.

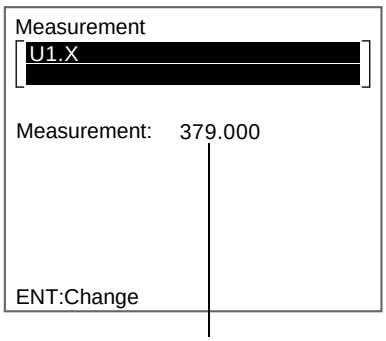
SECTION 2, 4.1 Calculation “Setting Expressions”



3. Once the expression has been set, select [OK].

The settings will be saved and the screen in **3.** will return.

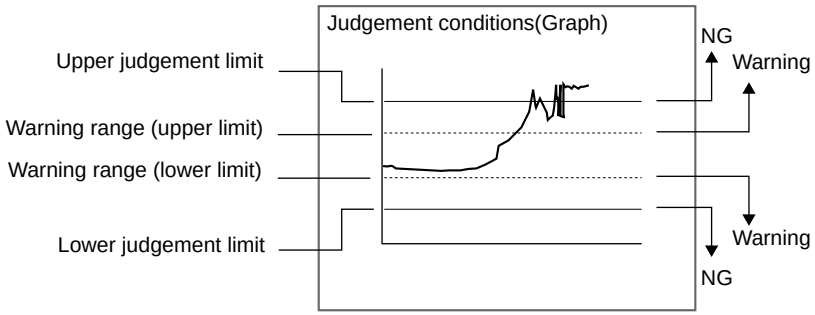
4. Press the ESC Key.



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Setting Warning Ranges and judgement Conditions

Set the judgement conditions for determining if a measurement result will be OK or NG and set the warning range to encourage caution before too many NG results are obtained. There are two setting methods: [Parameter] and [Graph].



CHECK!

- A warning count can be specified to set the number of times the measurement value must consecutively enter the warning range before a warning is generated.

p.11

- When a warning is generated, the word Warning appears on the screen.
  If an expression is set to output the Trend Monitor measurement result (warning) using DO judgement Output or other results output processing items, an external device can be notified that a warning was generated.

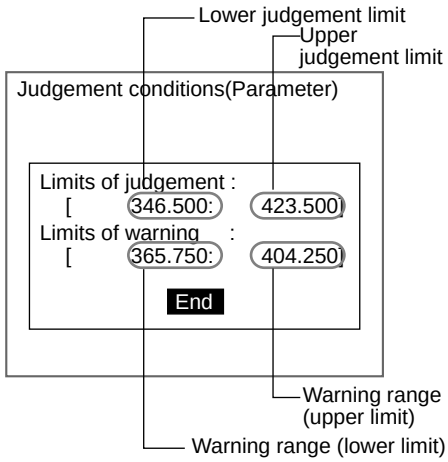
Parameter

Use parameters to set the upper and lower judgement limits and the warning range.

▶ [Trend monitor/Judgement conditions/Parameter]

1. Set the judgement conditions.

2. Select [End].



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Graph

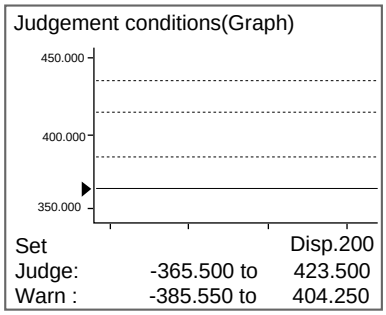
Move lines on the graph to set the upper and lower judgement limits and the warning range.

CHECK! Actual measurements can be executed and the measurement values displayed on a graph to be used as a guide when setting lines here.
p.6

▶ [Trend monitor/Judgement conditions/Graph]

1. The graph will be displayed.

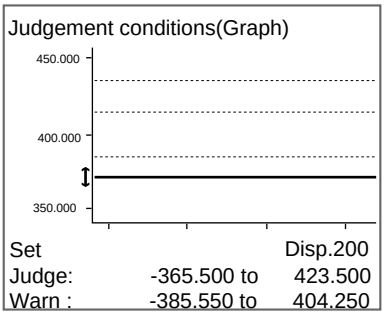
The scale of the vertical axis in the graph and the display range are automatically set based on the measurement values for the displayed image. Press the SHIFT+ESC Keys to move to the screen for changing the display range.
p.8



2. Use the Up and Down Keys to specify the line to be changed and press the ENT Key.

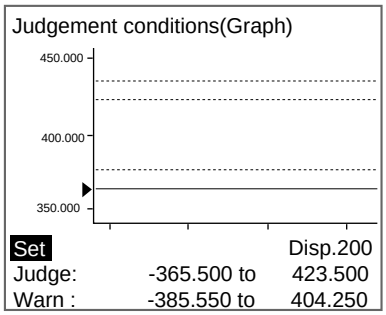
The cursor will change to a vertical movement cursor.

3. Use the Up and Down Keys to move the line and press the ENT Key to set the position.



The setting will be registered.
Repeat steps **2.** to **3.** to change other lines.

4. Select [Set].



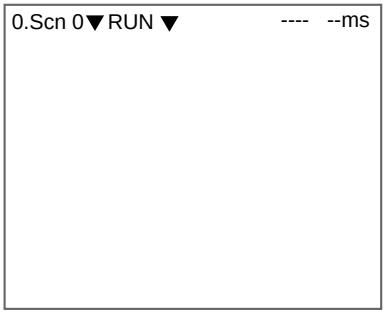
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Performing Measurement

Perform an actual measurement and display the Trend Monitor.

1. Enter Monitor or Run modes.

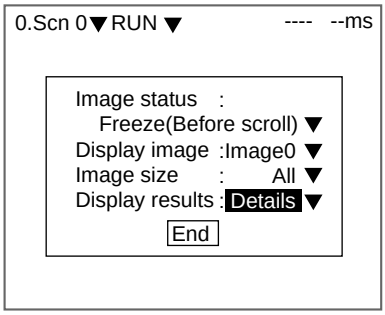
2. Press the SHIFT+ESC Keys.



The screen for changing display data will be displayed.

3. Change [Display results] to [Details].

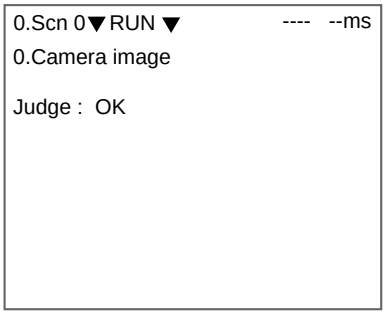
4. Select [End].



The settings will be registered and the Details Screen will be displayed.

5. Press the Down Key to display the unit to which the Trend Monitor is set.

6. Execute the measurement.

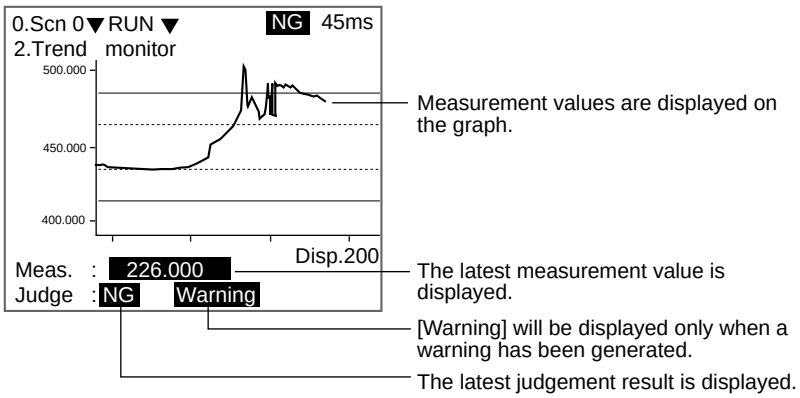


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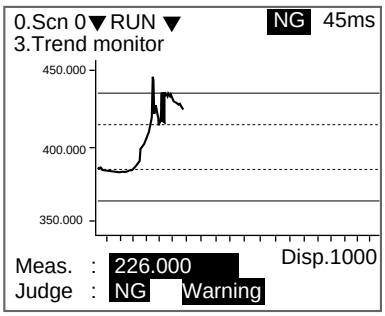
- Measurement Screens

Press the Shift+Right/Left Keys to display following three graphs in order.

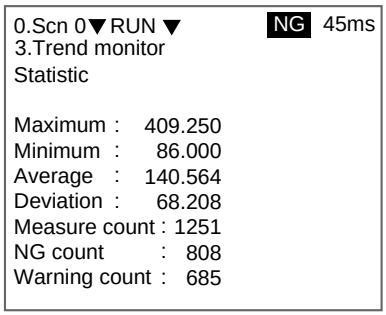
(1) 200 Measurement Results Display



(2) 1000 Measurement Results Display



(3) Statistics



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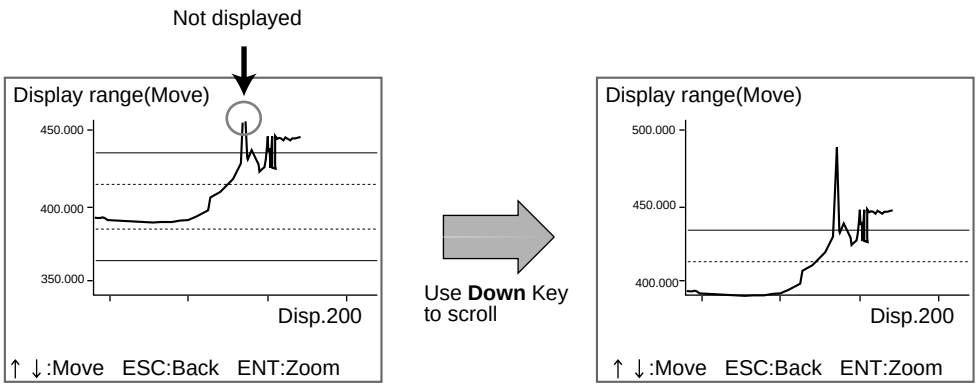
Changing Graph Display Ranges

If the section required is not displayed, scroll the vertical display range of the graph and enlarge or reduce the display.
The number of measurement results shown horizontally can also be switched. (Between 200 or 1,000)

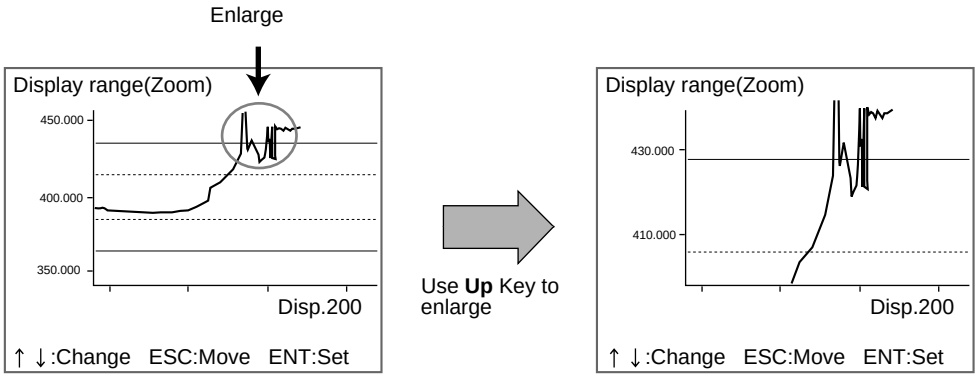
Changing the Vertical Display Range

The vertical axis can be scrolled and the scale of the vertical display can be changed.

Example: NG Measurement Results Not Shown with Default Display Range



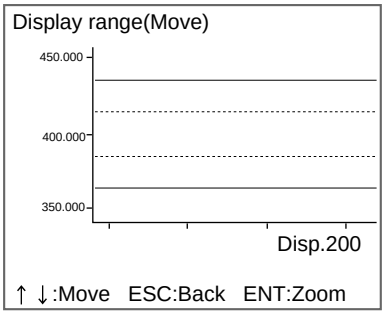
Example: Enlarging the part of graph where the measured value fluctuates excessively



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▶ [Trend monitor/Display range]

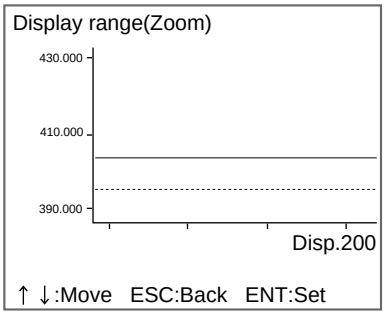
1. The Display Range (Move) Screen will be displayed.



2. Use the Up and Down Keys to scroll up and down the vertical axis.

3. Press the ENT Key.

The Display Range (Zoom) Screen will be displayed.



4. Use the Up and Down Keys to change the vertical scale.

Up Key: Enlarges the scale.
Down Key: Reduces the scale.

5. Press the ENT Key.

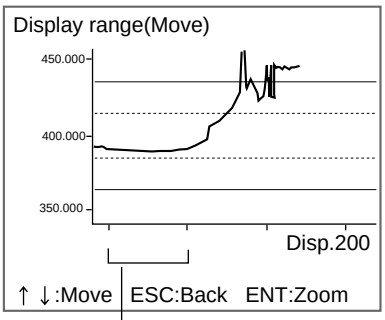
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Changing the Number of Displayed Measurement Results

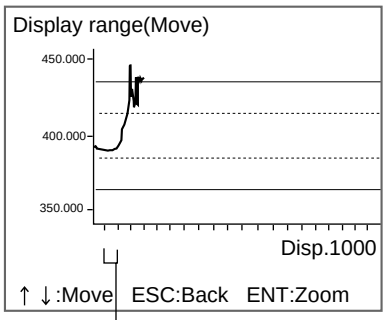
The number of measurement results displayed horizontally on the graph can be changed to either 200 or 1,000.

The display number can be changed any time the graph is displayed on the Monitor.

200 Measurement Results Display

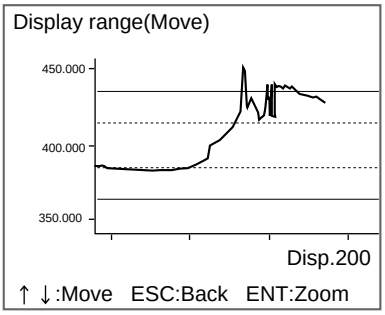


1,000 Measurement Results Display



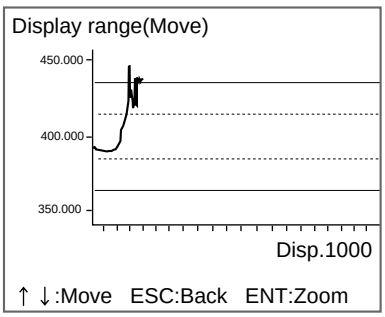
Each graduation indicates 50 measurements.

1. Press the SHIFT+Left/Right Keys while the graph is displayed.



The number of displayed measurement results changes.

Each time the SHIFT+Left/Right Keys are pressed, the display switches between 200 and 1,000 measurement results.

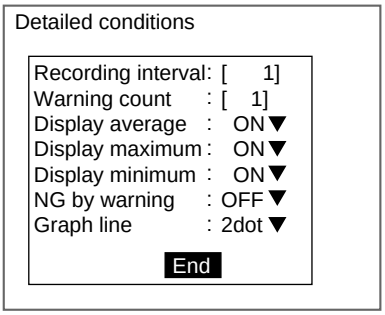


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Changing Detailed Conditions

The items displayed on the Trend Monitor and the timing of warnings can be changed. Change these detailed conditions as required.

▶ [Trend monitor/Detailed conditions]

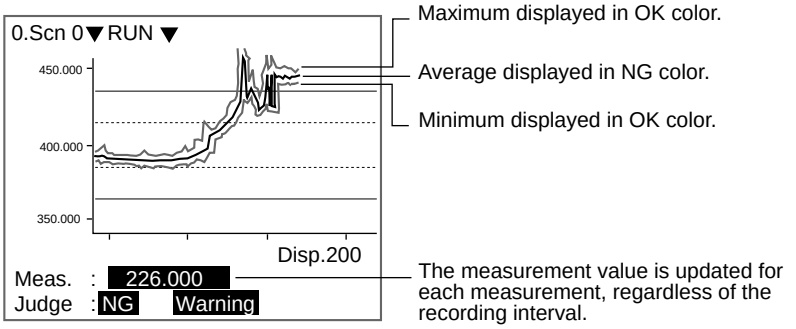


1. Set each item.

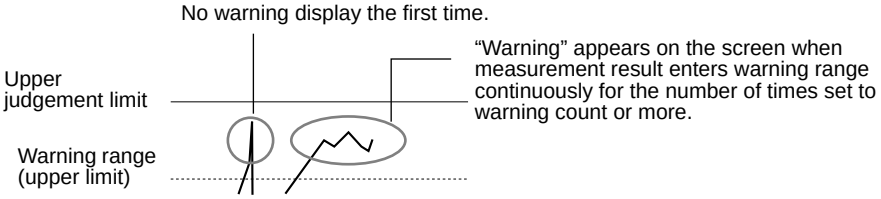
2. Select [End].

Setting data	Selection	Details
Recording interval *1	1 to 99999 (default setting: 1)	Specify an interval for recording values for the graph, i.e., the number of measurements before a value is recorded.
Warning count *2	1 to 999 (default setting: 1)	Specify the number of times the measurement must fall in the warning range before a warning is generated.
Display average	ON (default setting) None	Select whether or not to display the average for the number of measurements set under recording interval.
Display maximum	ON OFF (default setting)	Select whether or not to display the maximum and minimum for the number of measurements set under recording interval.
Display minimum		
NG by warning	ON OFF (default setting)	Select whether or not to set the judgement for this unit to NG if a warning is generated.
Graph line	1dot 1dot (default setting)	Lines are finer if set to 1 dot and processing time is faster than if 2 dot is set.

*1: If the recording interval is set to 2 or higher, the minimum and maximums for that interval will be displayed as shown in the following diagram.



*2: If the warning count is set to 2 or higher, Warning will appear on the screen if the measurement result enters the warning range continuously that number of times or more.



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Referencing NG Results

The NG measurement values and time the NG results were generated can be browsed from the measurement results recorded on the Trend Monitor. Up to the latest 35 NG results can be browsed.
This NG referencing function is useful for analyzing the cause of NG results by giving a grasp of the time frame in which the NG results occurred.

CHECK!

To View the Trend Monitor NG Image

Set the conditions as described below to save measurement images on the Trend Monitor only when NG results are returned.

- Set System/Measurement control/Save image to NG only.
- Set all units other than Trend Monitor unit to OK.

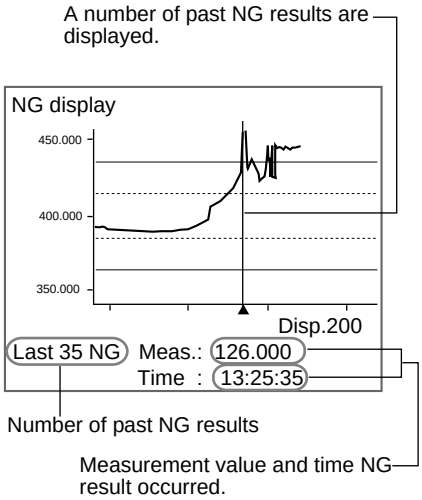
Press the SHIFT+Up/Down Keys on the Measurement Screen to display the desired NG image and then go to NG display on the Trend Monitor and switch to the NG result for that NG image.

▶ [Trend monitor/NG display]

1. The graph will be displayed.

2. Use the Left/Right Keys to switch the displayed NG result.

Left Key: Previous result
Right Key: Next result



CHECK!

To Change the Graph Display Range

Press the SHIFT+ESC Keys to move to the screen for changing the display range.

p.8

To Change the Number of Displayed Results per Screen

Press the SHIFT+Left/Right Keys to switch between 200 and 1,000 measurement results per screen.

3. Press the ESC Key.

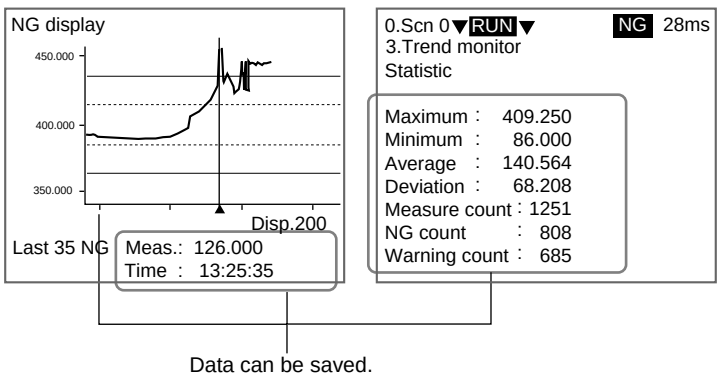
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Saving Measurement Conditions

Measurement data recorded by the Trend Monitor can be saved to a Memory Card. The data is saved in CSV format and can be edited on a personal computer.
All the statistical data, the measurement values and times for up to 36 NG results, and up to 1,000 measurement results on the graph are saved.
Before saving data, make sure that the memory card is inserted.

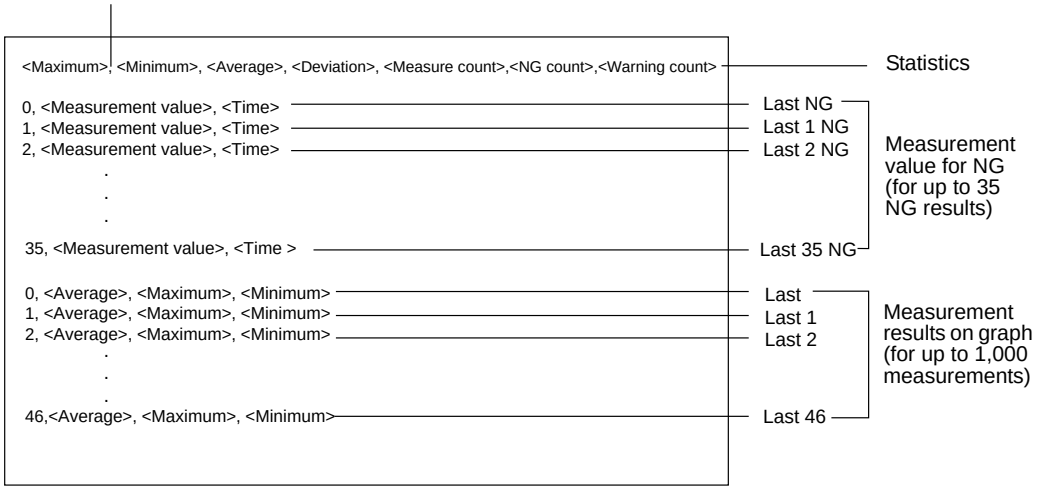
CHECK!

- If the data save function is used, a directory called [TRENDMON] is automatically created in the root directory on the Memory Card and the data is saved to that directory.



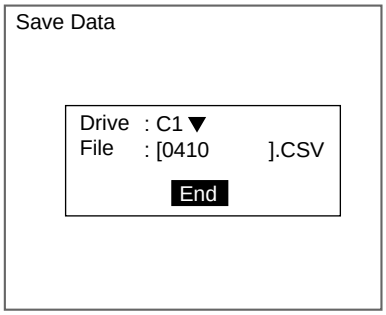
- CSV Data Format

Data delimited by commas.



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▶ [Trend monitor/Save data]

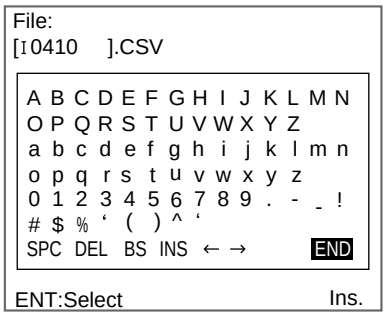


1. Select the drive to which the Memory Card is mounted (either CO or C1).

2. Move the cursor to the file name square brackets and press the ENT Key.

CHECK! Before the file name is set, the date for the data save is displayed in the square brackets.

The software keyboard will be displayed.

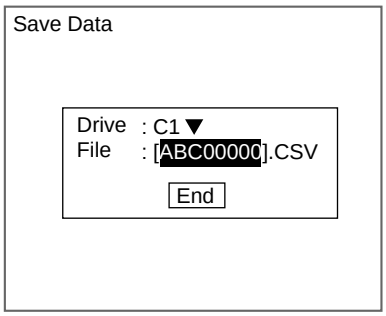


3. Set the file name (up to 8 characters).

CHECK! Periods (.) cannot be used in file names.

4. Move the cursor to [END] and press the ENT Key.

The screen in **1.** will returun.



5. Select [End].

6. The data will be saved to the [TRENDMON] directory.

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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Measured values	DT	Latest measurement
Warning	WN	Warnings generated (1: Warning 0: No warning)
Maximum	MX	Maximum measurement value for recording interval
Minimum	MN	Minimum measurement value for recording interval
Average	AV	Average measurement value for recording interval
Deviation	DV	Deviation in measurement results for recording interval
Measure count	MC	Number of measurements since measurement started
NG count	NC	Number of NG results for the number of measurements
Warning count	WC	Number of warnings for the number of measurements

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement Data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Latest measurement
2	Warnings generated (1: Warning 0: No warning)
3	Maximum measurement value for recording interval
4	Minimum measurement value for recording interval
5	Average measurement value for recording interval
6	Deviation in measurement results for recording interval
7	Number of measurements since measurement started
8	Number of NG results for the number of measurements
9	Number of warnings for the number of measurements

■ Setting Data

Data type	Details
17	Judgement lower limit (-9,999,999.999 to 9,999,999.999)
18	Judgement upper limit (-9,999,999.999 to 9,999,999.999)
19	Warning lower limit (-9,999,999.999 to 9,999,999.999)
20	Warning upper limit (-9,999,999.999 to 9,999,999.999)
21	Display range lower limit (-9,999,999.999 to 9,999,999.999)
22	Display range upper limit (-9,999,999.999 to 9,999,999.999)
23	Recording interval (1 to 99,999)
24	Warning count (1 to 999)
25	Display average (0: ON 1: OFF)
26	Display maximum (0: ON 1: OFF)
27	Display minimum (0: ON 1: OFF)
28	NG by warning (0: ON 1: OFF)
29	Graph line (0: 1 dot 1: 2 dot)

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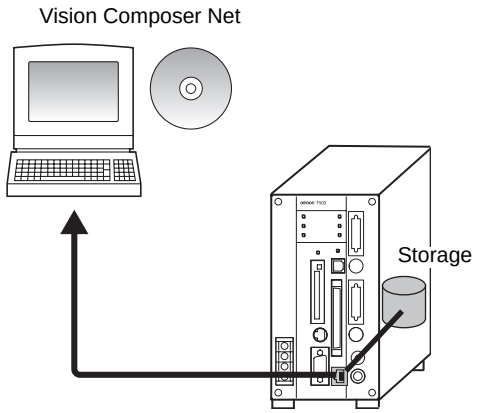
Data logging

ETN

This processing item can be used with controllers which support Ethernet connection.

This item is used to output measured data to the storage.

Measurement values and calculation results can be output.



The data output to the storage can be handled by Vision Composer Net. For the operating method of loading the data to the personal computer, refer to the Operation Manual of Vision Composer Net.

Data can be output only when [Only NG] or [All] is set for [Data Log] under [SYS/Network/Logging].

Furthermore, if the controller is set so as to save log images, data logging is useful since it enables simultaneous check of measured data and image data.

SECTION 5 System Settings
"Setting the Logging Conditions (Network Function)"

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Selecting Output Formats

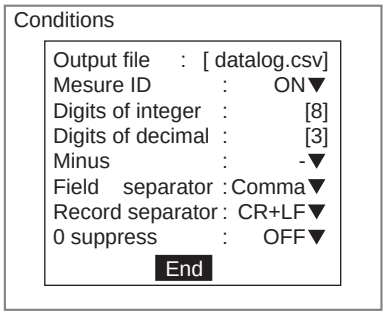
This section describes how to select the format of data to be output to the storage.

▶ [Data logging/Conditions]

1. Change the settings for each item.

2. Move the cursor to the square bracket for [Output file] and press the ENT Key.

Use the Down Key to scroll the cursor and display the output file name.

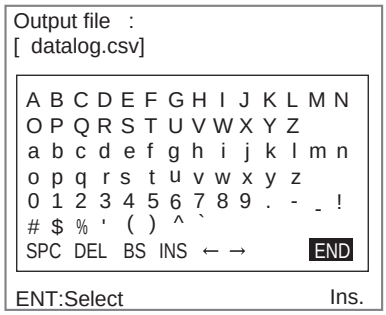


A software keyboard will be displayed.

3. Set the file name and extension.

File name: Up to 8 characters
Extension: "." + 3 characters

The output file will be saved in the [LOGDATA] directory in the storage.



4. Move the cursor to [END] and press the ENT Key.

The screen in **1.** will return.

5. Select [End].

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The following items can be set.

Setting data	Details	
Output file	Set the name and extension of the file that will store the output data. File name: Up to 8 characters Extension: "." + 3 characters Data will not be output if no file name is set.	
Measure ID	Select whether the measurement ID is to be output at the beginning of the output data. (Select either ON or OFF. Default setting: ON)	
Digits of integer	Set the number of digits for integer output. When 0 is selected, all digits of data are output without leading zeros. (Select a value between 0 and 8. Default setting: 8) If the data has more digits than the number set, 9 will be output for each digit.	
	Example:	If 4 digits have been set and the data is "15619" the output will be "9999".
Digits of decimal	Set the number of digits for decimal output. When 0 is selected, the decimal places are rounded off. (Select a value between 0 and 3. Default setting: 3)	
Minus	Select what sign will be displayed for negative values. (Select either - or 8. Default setting: -)	
Field separator	Select the separator between data fields. (Select none, comma, tab, space, or CR+LF. Default setting: comma)	
Record separator	Select the separator between data records. (Select none, comma, tab, space, or CR+LF. Default setting: CR+LF)	
0 suppress	Select how to adjust any empty digits to the left of output data. (Select either ON or OFF. Default setting: OFF) Inserts a 0 into empty digits. OFF: Inserts a space into empty digits.	
	Example:	If "5" has been set for Digits of integer and "3" for Digits of decimal, and the data is 100.000, the following output will be made. When ON is set:00100.000 When OFF is set: _100.000 (a space is inserted)

The data is output in ASCII format, and the following header is added.

Measure ID, Data 0, Data 1, … Data N + Delimiter
*

* Measure ID: YYYY-MM-DD_HH-MM-SS-SS of measured date/time

Example: When measurement is performed at 11:10:25.500, July 24, 2004
The Measure ID will be "2004-07-24_11-10-25-50".


CHECK!

Since the same Measure ID is attached to the logging image file name, the measured data and image data can be checked by referring to the Measure ID.

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Each “Data Logging” processing item allows output of eight data. If you want to output nine or more data as one record, make the following settings.

Register two or more “Data Logging” to one scene.
Set the same output file name for every “Data Logging”.
Make a setting so that a “record separator” will be attached to the last data.

Example: Outputting XY coordinate data for five points obtained by “EC Positioning” as one record

0. Camera image
1. EC positioning
   Region 0 multiple cross points (measurement of coordinate data of five points)
2. Data logging
   Condition
   Output file: logdata.csv
   Measure ID: ON
   Digits of integer: 8
   Digits of decimal: 3
   Minus: -
   Field separator: Comma
   Record separator: Comma
   0 Suppress: OFF

   Calculation 0. U1.R00CX1 (X coordinate of 1st point)
   Calculation 1. U1.R00CY1 (Y coordinate of 1st point)
   Calculation 2. U1.R00CX2 (X coordinate of 2nd point)
   Calculation 3. U1.R00CY2 (Y coordinate of 2nd point)
   Calculation 4. U1.R00CX3 (X coordinate of 3rd point)
   Calculation 5. U1.R00CY3 (Y coordinate of 3rd point)
   Calculation 6. U1.R00CX4 (X coordinate of 4th point)
   Calculation 7. U1.R00CY4 (Y coordinate of 4th point)
3. Data logging
   Condition
   Output file: logdata.csv
   Measure ID: OFF
   Digits of integer: 8
   Digits of decimal: 3
   Minus: -
   Field separator: Comma
   Record separator: CR+LF
   0 Suppress: OFF

   Calculation 0. U1.R00CX5 (X coordinate of 5th point)
   Calculation 0. U1.R00CY5 (Y coordinate of 5th point)



Output record:
YYYY-MM-DD_HH-MM-SS-SS,X1,Y1,X2,Y2,X3,Y3,X4,Y4,X5,Y5+CR+LF

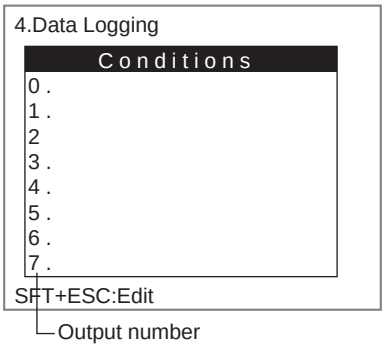
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Setting Output Details

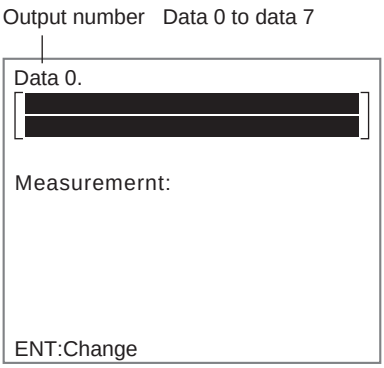
Use expressions to set the output data.
For each unit, 8 expressions (0 to 7) can be set.

▶ [Data Logging]

1. Select the output number to which the expression will be set.

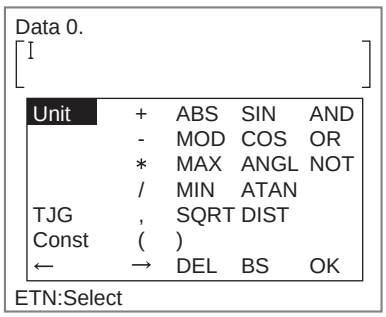


The Expression Settings Screen will be displayed.



2. Move the cursor to the square bracket for [Data 0] and press the ENT Key.

The setting items will be displayed.



3. Select the items to be set and set the expression.

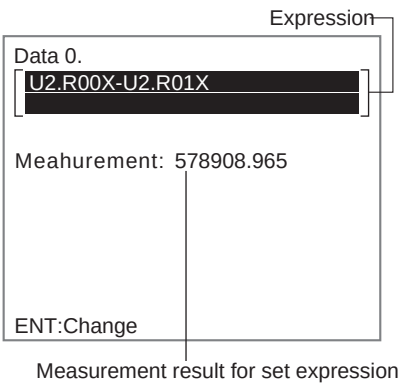
SECTION 2, 4.1 Calculation, “Setting Expressions”

4. Once the expression has been set, Select [OK].

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The settings will be saved and the screen in **2.** will return.

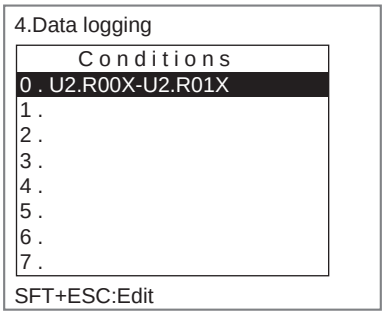
5. Press the ESC Key.



The Expression Settings Screen will return.
Press the SHIFT+ESC Keys in this screen to copy or clear the expression.

6. Repeat steps **1.** to **5.** to set the expressions.

7. Once the expressions have been set, press the ESC Key.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Data 0	DO0	Result of expression set to output number 0
Data 1	DO1	Result of expression set to output number 1
Data 2	DO2	Result of expression set to output number 2
Data 3	DO3	Result of expression set to output number 3
Data 4	DO4	Result of expression set to output number 4
Data 5	DO5	Result of expression set to output number 5
Data 6	DO6	Result of expression set to output number 6
Data 7	DO7	Result of expression set to output number 7

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement Data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Result of expression set to output number 0
2	Result of expression set to output number 1
3	Result of expression set to output number 2
4	Result of expression set to output number 3
5	Result of expression set to output number 4
6	Result of expression set to output number 5
7	Result of expression set to output number 6
8	Result of expression set to output number 7

■ Setting Data

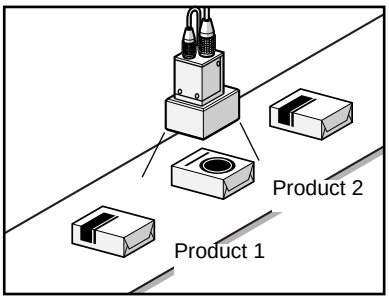
Data type	Details
9	Expression set to output number 0
10	Expression set to output number 1
11	Expression set to output number 2
12	Expression set to output number 3
13	Expression set to output number 4
14	Expression set to output number 5
15	Expression set to output number 6
16	Expression set to output number 7
18	Integer digits (0 to 8)
19	Decimal digits (0 to 3)
20	Negative expression (0: - 1: 8)
21	Field separator (0: None 1: Comma 2: Tab 3: Space 4: CR+LF)
22	Record separator (0: None 1: Comma 2: Tab 3: Space 4: CR+LF)
23	0 suppress (0: OFF 1: ON)
25	Output file (File name [Up to 8 characters] +. [Dot] + Extension [3 characters])
26	Measure ID (0: OFF 1: ON)

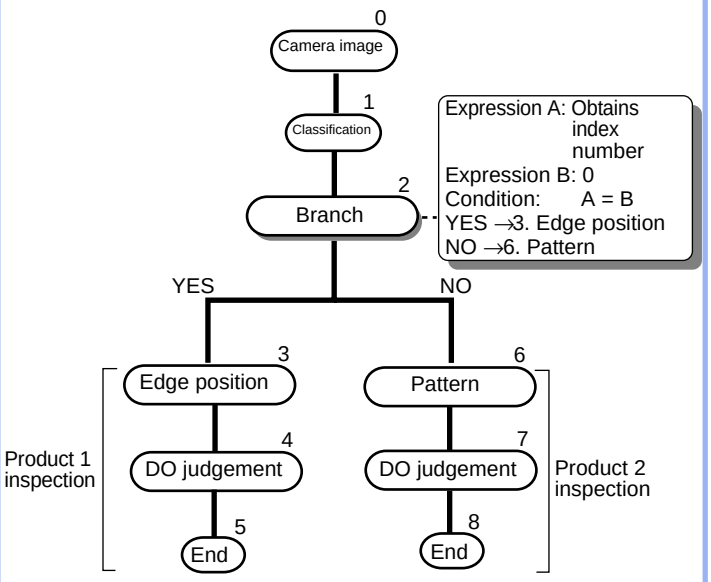
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Conditional Branching

When the Branch processing item is used, two expressions and a condition are set and the processing is branched depending on the result of the comparison for the condition.
This processing item is used, for example, when two or more products are being processed on the same production line and a different inspection is required for each.

Example: Inspecting Printing on Confectionery Packaging





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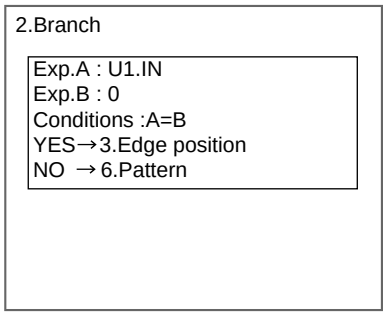
Submenus for Expressions 7

External Reference Table 7

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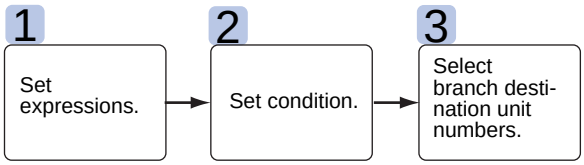
Making Branch Settings

The settings details are shown below.



Setting data	Details
Exp. A	Set the evaluation expressions that will serve as the basis for conditional branching. The evaluation expressions must be set using calculation. SECTION 2, 4.1 Calculation, “Setting Expressions”
Exp. B	
Conditions	Specify the evaluation method for expressions A and B. The two data obtained by the evaluation expressions are compared. (A = B, A ≤B, A ≥ B, A < B, A > B default setting: A = B)
YES	Set the unit number for when the comparative calculation result is true.
NO	Set the unit number for when the comparative calculation result is true.

■ Operational Flow



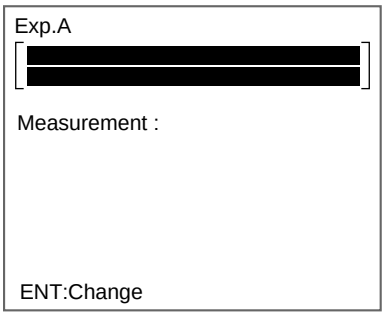
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1 Setting Expressions

Set the evaluation expression for conditional branching. Set the expressions A and B.

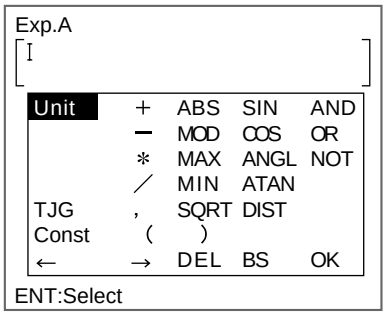
▶ [Branch/Exp. A]

1. Move the cursor to the square brackets for [expression A] and press the ENT Key.



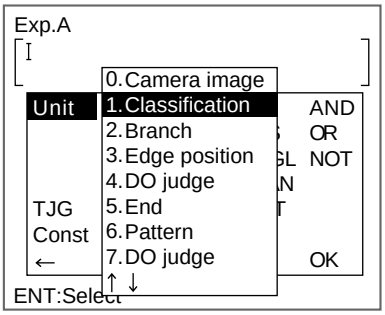
The expression items will be displayed.

2. Select the items to be set. (The explanation here will be based on [Unit] being selected.)



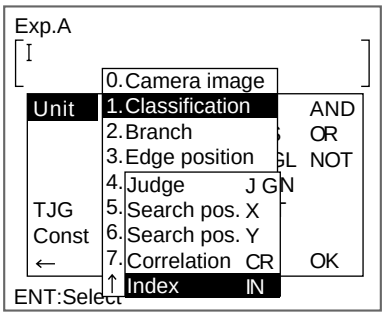
A list of units for the current scene will be displayed.

3. Select the unit number to be set.



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A submenu will be displayed.



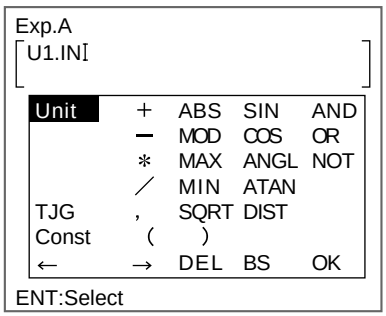
4. Select the desired item from the submenu.

The displayed submenu will differ depending on the processing item.

For details, refer to [Submenus for Expressions] for the processing item registered for the selected unit.

SECTION 2 Processing items Setting Procedure

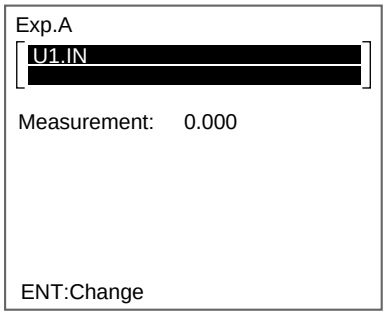
The selected item will be set to the expression.



5. Create the expression.

6. Once the expression has been set, select [OK].

Expression A will be registered.



7. Set the [expression B] in the same way as for expression A.

Repeat steps **1.** to **6.** to set the desired expression.

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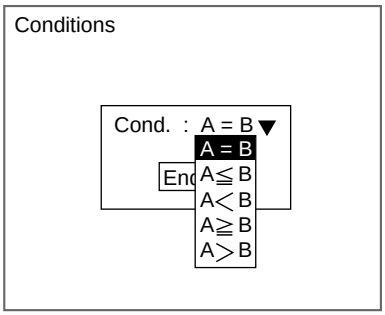
2 Setting Conditions

Select the method for comparing the two pieces of data obtained by expressions A and B.

▶ [Branch/Conditions]

1. Select the evaluation method.

2. Select [End].



3 Selecting the Branch Destination Unit Numbers

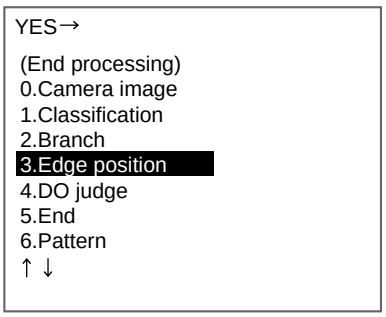
Select the numbers of the branching destination units. Select a destination unit for both YES and NO results (for when the comparative calculation results are true and false).

▶ [Branch/YES →(End processing)]

1. A list of units for the current scene will be displayed.

2. Select the branch destination unit and press the ENT Key.

Set a unit number after the Branch unit number. If an earlier unit number is set, the processing may continue in a loop.

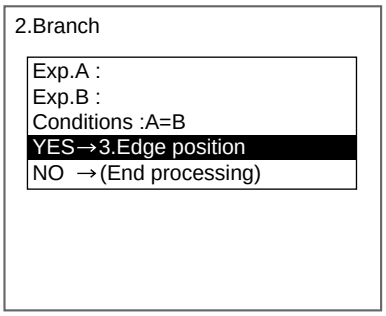


The settings will be registered.

3. Make setting for [No →(End processing)] destination unit in the same way.

Always register End as the last of the processing items for the branch destination units for both Yes Æ and No Æ to indicate that the branch has ended.

SECTION 2, "5.3 End"



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judge	JG	Judgement result (0: OK -1: NG -2: Not measured)
Data A	D0	Result of expression set to Exp. A
Data B	D1	Result of expression set to Exp. B
Value	RS	Comparative expression result (0: NO 1: YES)
Destination	BU	Number of the unit that was branched to

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement Data

Data type	Details
0	Judgement result (0: OK -1: NG -2: Not measured)
1	Result of expression set to Exp. A
2	Result of expression set to Exp. B
3	Comparative expression result (0: NO, 1: YES)
4	Number of the unit that was branched to

■ Setting Data

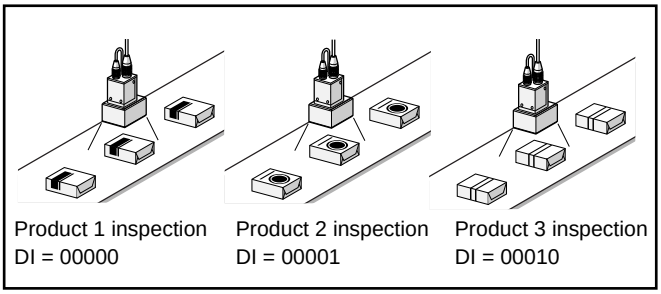
Data type	Details
6	Unit number to be used for branch (true) (-1: End processing 0 to 32767: Unit number)
7	Unit number to be used for branch (false) (-1: End processing 0 to 32767: Unit number)
10	Condition type (0: A=B, 1: A ≤B, 2: A<B, 3: A ≥ B, 4: A>B)

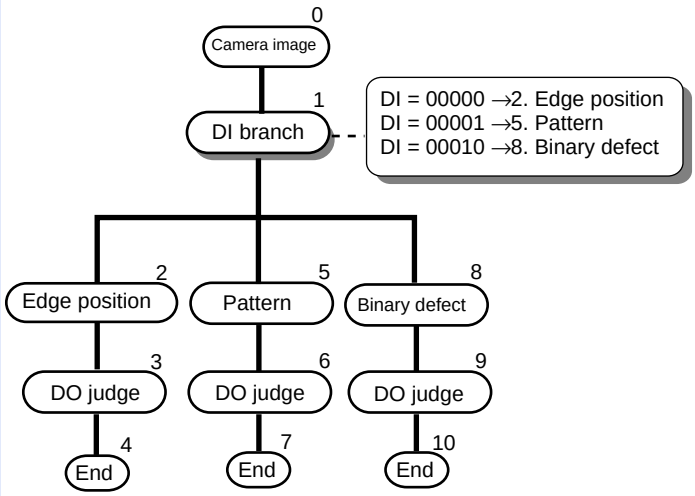
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DI branching

The DI Branch processing item is useful for applications such as differentiating between product inspections on the same production line based on the time.
The subsequent processing items are branched based on the information input to DI0 to DI4 on the terminal block. Up to 32 branches can be set.

Example: Different Product Inspections for Confectionery Based on Time





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Making Branch Settings

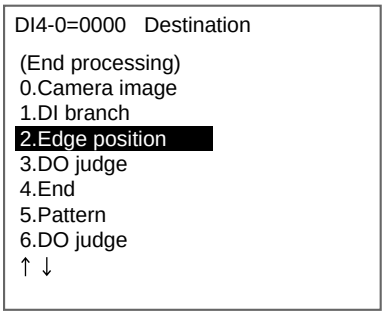
Select the branch destination unit. Set a unit for each DI input data.

▶ [DI branch/DI input number]

1. A list of units for the current scene will be displayed.

2. Select the branch destination unit.

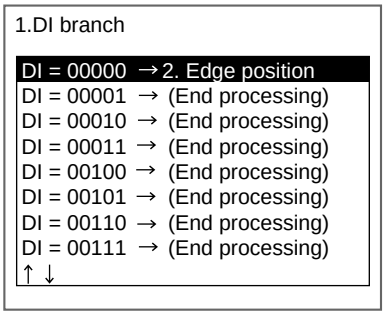
Set a unit number after the DI branch unit number. If an earlier unit number is set, the processing may continue in a loop.



The settings will be registered.

3. Set the branch destination units for other DI input numbers in the same way.

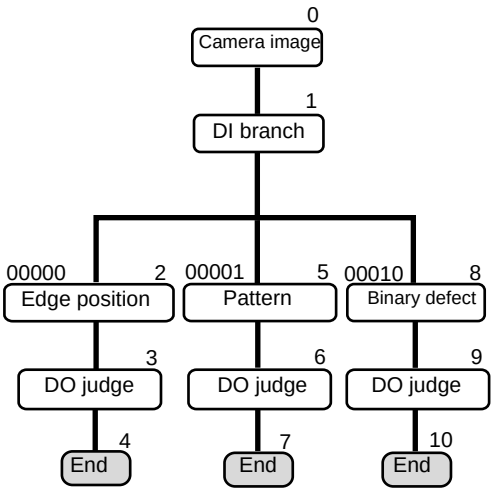
4. Once the branch destination have been set, press the ESC Key.



CHECK!

- Always register [End] as the last of the processing items for the branch destination units to indicate that the branch has ended.

SECTION 2, 5.3 End



- The controller refers to the status of the DI signal when the DI Branch processing item is processed.

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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Judgement result (0: OK -1:NG -2: Not measured)
DI data	DI	Result of expression set to DI
Branch destination	BU	Number of the unit that was branched to

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement Data

Data type	Details
0	Judgement result (0: OK -1: NG -2: Not measured)
1	Result of expression set to DI
2	Number of the unit that was branched to

■ Setting Data

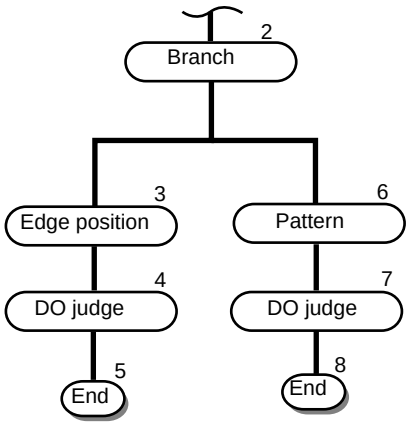
Data type	Details
4	Branch destination (DI = 0) (-1: End processing 0 to 32767: Unit number)
5	Branch destination (DI = 1) (-1: End processing 0 to 32767: Unit number)
(DI = 2 to DI = 31 are the same as for DI = 0)	

Destination settings can be made for 0 to 31. Select the data number to match the DI number.

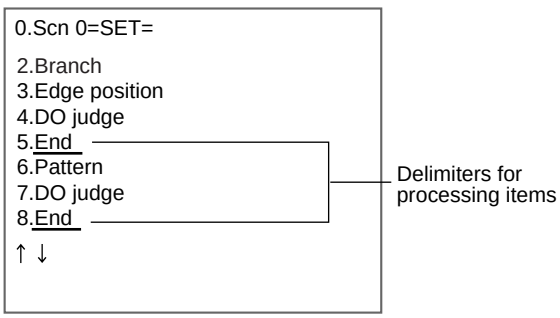
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End

The End processing item is the processing item set to the last unit in a branch flow.
The End item is used to end the processing after branching.
No other conditions need to be set when this processing item is added to the flowchart.



Screen image

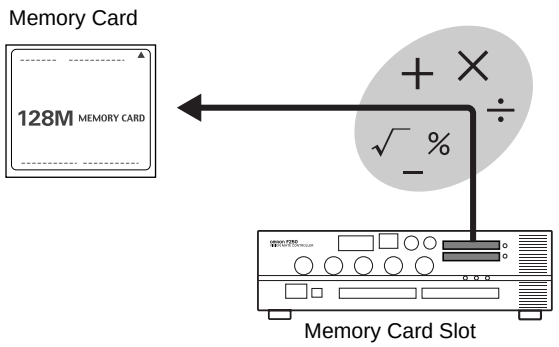


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Memory card data

Use the Memory Card Data processing item to output data to a Memory Card.

Measurement values and calculation results can be output.



Data is output only when measurement is performed in Run Mode. Data will not be output if measurement is executed in Monitor Mode. The overall judgement for the set processing items will be output to the parallel interface OR signal, regardless of whether or not the Normal Data processing item is set.

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Selecting Output Formats

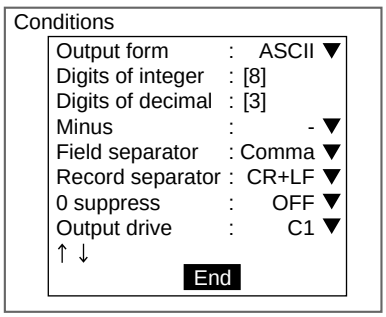
Select the format for outputting data to the Memory Card.

▶ [Memory card data/Conditions]

1. Change the settings for each item.

2. Move the cursor to the square bracket for [Output file] and press the ENT Key.

Use the Down Key to scroll the cursor and display the output file name.

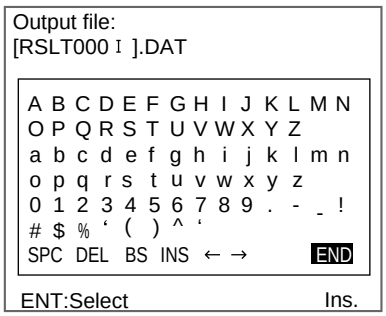


A software keyboard will be displayed.

3. Set the file name (up to 8 characters).

The output file will be saved in the OUTFILE directory in the root directory.

4. Move the cursor to END and press the ENT Key.



The screen in **1.** will return.

5. Select [End].

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- ASCII Format

The following items can be set.

Setting data	Details
Output form	Select ASCII*.
Digits of integer	Set the number of digits for integer output. When 0 is selected, all digits of data are output without leading zeros. (Select a value between 0 and 8. Default setting: 8) If the data has more digits than the number set, 9 will be output for each digit. Example: If 4 digits have been set and the data is “15619” the output will be “9999”.
Digits of decimal	Set the number of digits for decimal output. When 0 is selected, the decimal places are rounded off. (Select a value between 0 and 3. Default setting: 3)
Minus	Select what sign will be displayed for negative values. (Select either - or 8. Default setting: -)
Field separator	Select the separator between data fields. (Select none, comma, tab, space, or CR+LF. Default setting: comma)
Record separator	Select the separator between data records. (Select none, comma, tab, space, or CR+LF. Default setting: CR+LF)
0 suppress	Select how to adjust any empty digits to the left of output data. (Select either ON or OFF. Default setting: OFF) ON: Inserts a 0 into empty digits. OFF: Inserts a space into empty digits. Example: If “5” has been set for Digits of integer and “3” for Digits of decimal, and the data is 100.000, the following output will be made. When ON is set: 00100.000 When OFF is set: “space” 100.000 (i.e., a space is inserted).
Output drive	Select the number of the drive to which the Memory Card is mounted. (Select either C0 or C1. Default setting: C1)
Output file	Set the name of the file that will store the measurement results. Data will not be output if no file name is set.

- Binary Format

The measurement result multiplied by 1,000 is output as four consecutive bytes as one unit of data.

Setting data	Details
Output form	Select Binary.
Digits of integer	These settings are only for ASCII format. No settings are required for binary format.
Digits of decimal	
Minus	
Field separator	
Record separator	
0 suppress	
Output drive	Select the number of the drive to which the Memory Card is mounted. (Select either C0 or C1. Default setting: C1)
Output file	Set the name of the file that will store the measurement results. Data will not be output if no file name is set.

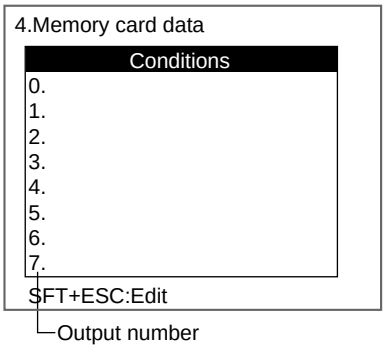
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Setting Output Details

Use expressions to set the output data.
For each unit, 8 expressions “0 to 7” can be set.

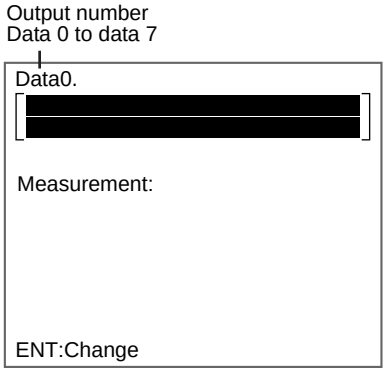
▶ [Memory card data]

1. Select the output number to which the expression will be set.



The Expression Settings Screen will be displayed.

2. Move the cursor to the square bracket for [Data 0] and press the ENT Key.

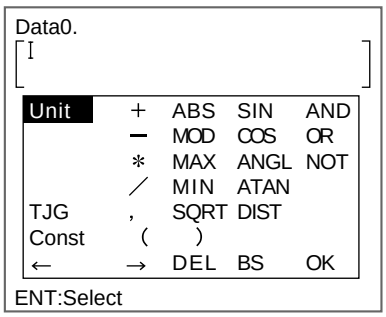


The setting items will be displayed.

3. Select the items to be set and set the expression.

SECTION 2, 4.1 Calculation “Setting Expressions”

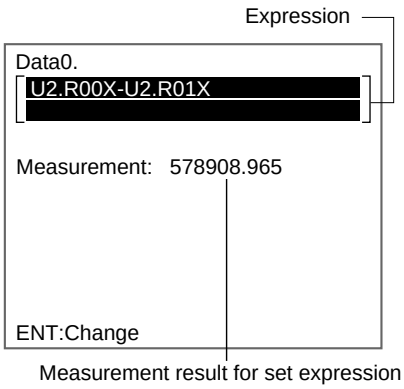
4. Once the expression has been set, select [OK].



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The settings will be saved and the screen in **2.** will return.

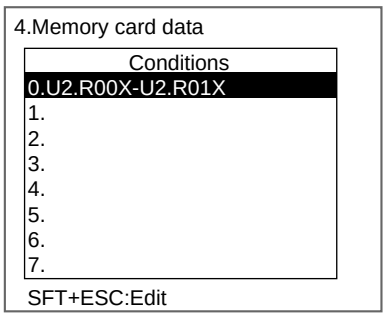
5. Press the ESC Key.



The Expression Settings Screen will return.
Press the SHIFT+ESC Keys in this screen to copy or clear the expression.

6. Repeat steps **1.** to **5.** to set the expressions.

7. Once the expressions have been set, press the ESC Key.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Data 0	DO0	Result of expression set to output number 0
Data 1	DO1	Result of expression set to output number 1
Data 2	DO2	Result of expression set to output number 2
Data 3	DO3	Result of expression set to output number 3
Data 4	DO4	Result of expression set to output number 4
Data 5	DO5	Result of expression set to output number 5
Data 6	DO6	Result of expression set to output number 6
Data 7	DO7	Result of expression set to output number 7

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement Data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Result of expression set to output number 0
2	Result of expression set to output number 1
3	Result of expression set to output number 2
4	Result of expression set to output number 3
5	Result of expression set to output number 4
6	Result of expression set to output number 5
7	Result of expression set to output number 6
8	Result of expression set to output number 7

■ Setting Data

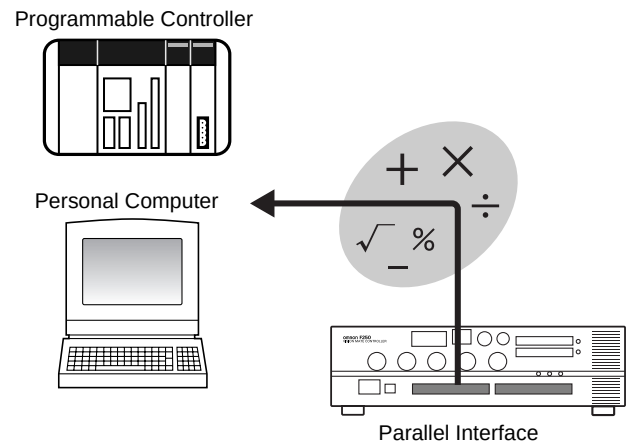
Data type	Details
9	Expression set to output number 0
10	Expression set to output number 1
11	Expression set to output number 2
12	Expression set to output number 3
13	Expression set to output number 4
14	Expression set to output number 5
15	Expression set to output number 6
16	Expression set to output number 7
17	Output format (0: ASCII 1: Binary)
18	Integer digits (0 to 8)
19	Decimal digits (0 to 3)
20	Negative expression (0: - 1: 8)
21	Field separator (0: None 1: Comma 2: Tab 3: Space 4: CR+LF)
22	Record separator (0: None 1: Comma 2: Tab 3: Space 4: CR+LF)
23	0 suppress (0: OFF 1: ON)
24	Output drive (0: C0, 1: C1)
25	Output file name (up to 8 characters)

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DO data output

Use the Normal Data processing item to output data to Programmable Controllers, personal computers, and other external devices via a parallel interface.

Measurement values and calculation results can be output.



Data is output only when measurement is performed in Run Mode. Data will not be output if measurement is executed in Monitor Mode. The overall judgement for the set processing items will be output to the parallel interface OR signal, regardless of whether or not the Normal Data processing item is set.

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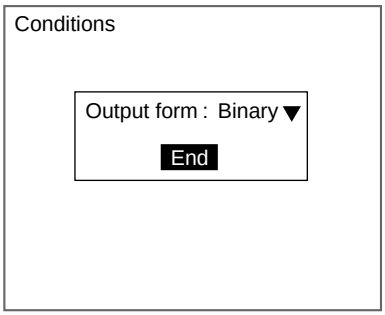
Selecting Output Formats

Select the format for outputting data.

▶ [DO data/Conditions]

1. Select the desired output format.

2. Select [End].



Selection	Details
Binary (default setting)	Data is output in 32-bit 2's complement binary format. For 2's complements SECTION 7 Appendix, "Terminology"
BCD	Sign and 7-digit integer output using 4 bits per digit (32 bits).

bit	31 to 28	27 to 24	. . . .	7 to 4	3 to 0
	Sign (See *.)	1,000,000s digit		10s digit	1s digit

Positive: 0000 Negative: 1111

CHECK! If the 2-line random trigger is selected as the Run mode in the case of F270, 16-bit data will be output for both processing 0 and 1.

For the 2-line random trigger
SECTION 3 Test/Measurement Execution, “Performing Measurement in 2-Line Random Trigger Mode”

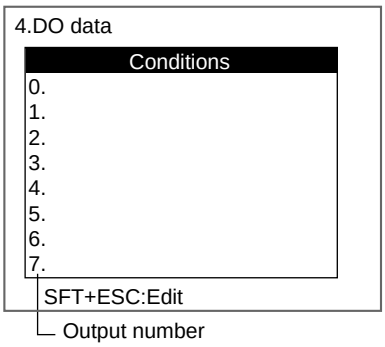
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Setting Output Details

Use expressions to set the output data.
For each unit, 8 expressions “0 to 7” can be set.

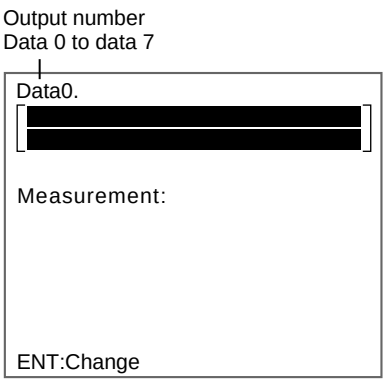
▶ [DO data output]

1. Select the output number to which the expression will be set.



The Expression Settings Screen will be displayed.

2. Move the cursor to the square bracket for Data 0 and press the ENT Key.

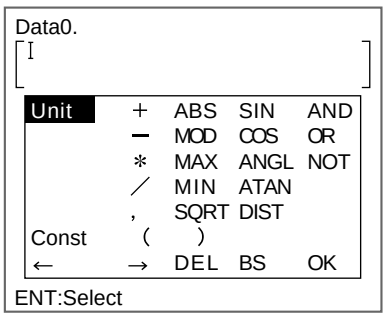


The setting items will be displayed.

3. Select the items to be set and set the expression.

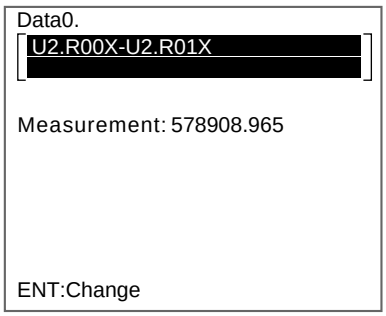
SECTION 2, 4.1 Calculation “Setting Expressions”

4. Once the expression has been set, select [OK].



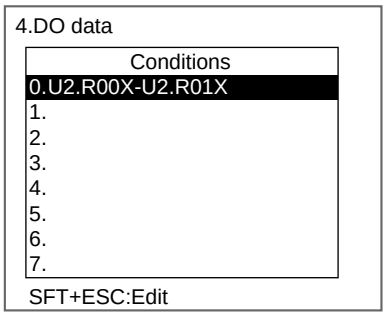
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The settings will be saved and the screen in **2.** will return.



5. Press the ESC Key.

The Expression Settings Screen will return.
Press the SHIFT+ESC Keys in this screen to copy or clear the expression.



6. Repeat steps **1.** to **5.** to set the expressions.

7. Once the expressions have been set, press the ESC Key.

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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Data 0	DO0	Result of expression set to output number 0
Data 1	DO1	Result of expression set to output number 1
Data 2	DO2	Result of expression set to output number 2
Data 3	DO3	Result of expression set to output number 3
Data 4	DO4	Result of expression set to output number 4
Data 5	DO5	Result of expression set to output number 5
Data 6	DO6	Result of expression set to output number 6
Data 7	DO7	Result of expression set to output number 7

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement Data

Measurement item	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Data 0	DO0	Result of expression set to output number 0
Data 1	DO1	Result of expression set to output number 1
Data 2	DO2	Result of expression set to output number 2
Data 3	DO3	Result of expression set to output number 3
Data 4	DO4	Result of expression set to output number 4
Data 5	DO5	Result of expression set to output number 5
Data 6	DO6	Result of expression set to output number 6
Data 7	DO7	Result of expression set to output number 7

■ Setting Data

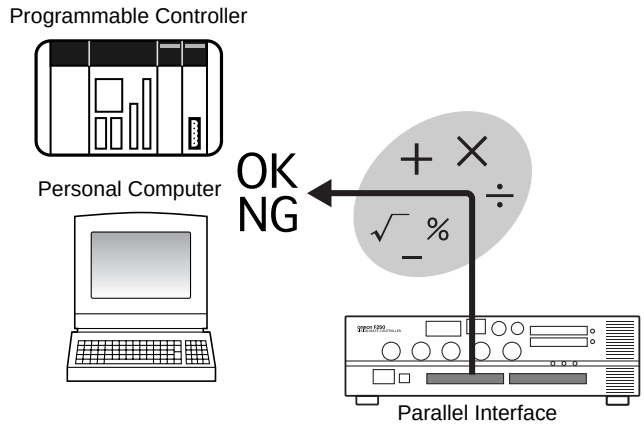
Data type	Details
9	Expression set to output number 0
10	Expression set to output number 1
11	Expression set to output number 2
12	Expression set to output number 3
13	Expression set to output number 4
14	Expression set to output number 5
15	Expression set to output number 6
16	Expression set to output number 7
17	Output format (0: Binary 1: BCD)

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DO judgement output

The DO judgement processing item is used to output Judgements to Programmable Controllers, personal computers, and other external devices via a parallel interface.

judgement results for processing items and scenes and judgement results for calculation results can be output.



Data is output only when measurement is performed in Run Mode. Data will not be output if measurement is executed in Monitor Mode. The overall judgement for the set processing items will be output to the parallel interface OR signal, regardless of whether or not the Normal Data processing item is set.

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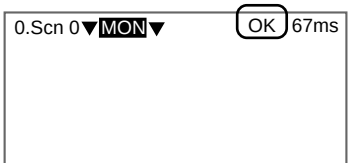
Selecting Reflection in Overall Judgement

Select whether or not to reflect the judgement result for this processing item in the overall judgement output to the parallel interface OR signal.

CHECK!

The overall judgement is also displayed on the Monitor and Measurement Screens. The overall judgement can also be set to not be displayed by using the display settings.

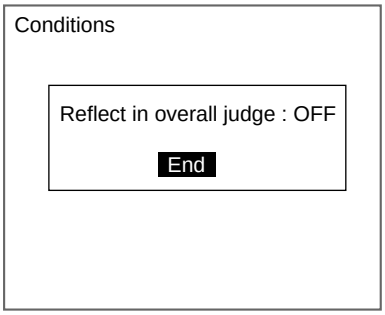
SECTION 5 System Settings, “Screen Display and Monitor”



▶ [DO judge/Conditions]

1. Change the setting.

2. Select [End].



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Setting Output Details

Use expressions to set the output data.
For each unit, 32 expressions “0 to 31” can be set.

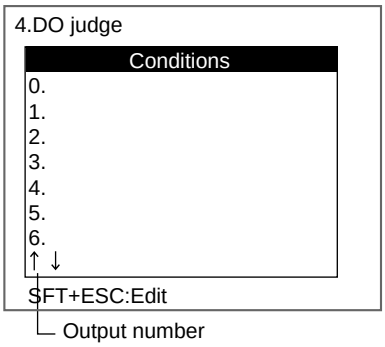
CHECK!

If the 2-line random trigger is selected as the Run mode in the case of F270, setting can be made for judgements 0 to 15 only for processing 0 and 1. No data will be output even if setting is made for judgements 16 to 31.

For the 2-line random trigger
SECTION 3 Test/Measurement Execution, “Performing Measurement in 2-Line Random Trigger Mode”

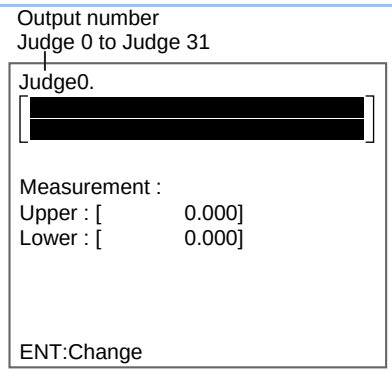
▶ [DO judge/Conditions]

1. Select the output number to which the expression will be set.



The Expression Settings Screen will be displayed.

2. Move the cursor to the square brackets for Judge 0 and press the ENT Key.

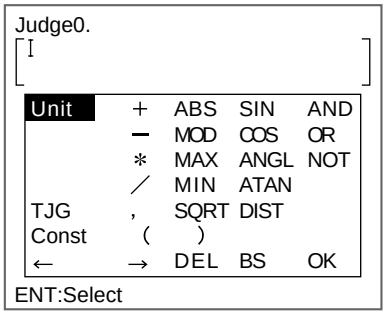


The setting items will be displayed.

3. Select the items to be set and set the expression.

SECTION 2, 4.1 Calculation “Setting Expressions”

4. Once the expression has been set, select [OK].

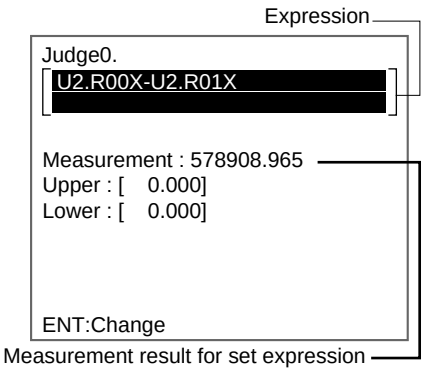


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The expression will be set.

5. Set the upper and lower limits.

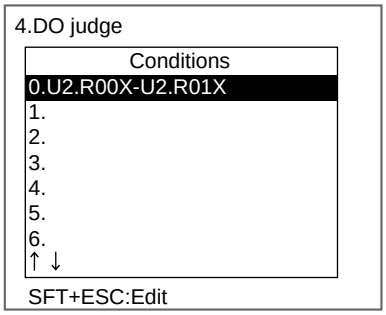
6. Press the ESC Key.



The Expression Settings Screen will return.
Press the SHIFT+ESC Keys in this screen to copy or clear the expression.

7. Repeat steps **1.** to **6.** to set the expressions.

8. Once the expressions have been set, press the ESC Key.



Setting data	Selection	Details
Upper	-9,999,999.999 to 9,999,999.999	Set the judgement conditions for the expression. Set the upper limit for an OK judgement.
Lower	-9,999,999.999 to 9,999,999.999	Set the judgement conditions for the expression. Set the lower limit for an OK judgement.

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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Data 0	DO0	Result of expression set to output number 0
Data 1	DO1	Result of expression set to output number 1
(Same as above for judgement numbers 2 to 31)		
Judgement 0	J00	Judgement result for expression set to output number 0 (-1: NG 0: OK)
Judgement 1	J01	Judgement result for expression set to output number 1 (-1: NG 0: OK)
Judgement 2	J02	Judgement result for expression set to output number 2 (-1: NG 0: OK)
(Same as above for judgement numbers 2 to 31)		

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement Data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Result of expression set to output number 0
2	Result of expression set to output number 1
(Same as above for judgement numbers 2 to 31)	
33	Judgement result for expression set to output number 0 (-1: NG 0: OK)
34	Judgement result for expression set to output number 1 (-1: NG 0: OK)
35	Judgement result for expression set to output number 2 (-1: NG 0: OK)
(Same as above for judgement numbers 2 to 31)	

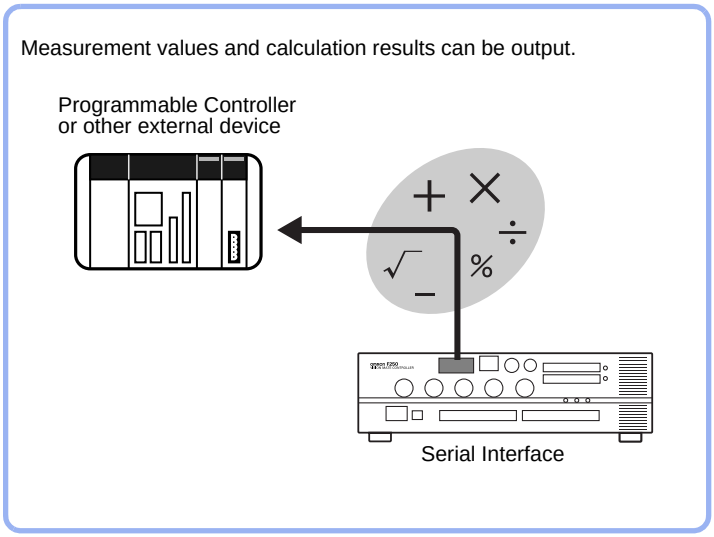
■ Setting Data

Data type	Details
65	Judgement lower limit for output number 0 (-9,999,999.999 to 9,999,999.999)
66	judgement upper limit for output number 0 (-9,999,999.999 to 9,999,999.999)
67	Judgement lower limit for output number 1 (-9,999,999.999 to 9,999,999.999)
68	judgement upper limit for output number 1 (-9,999,999.999 to 9,999,999.999)
(Same as above for judgement numbers 2 to 31)	
129	Expression set to output number 0
130	Expression set to output number 1
(Same as above for judgement numbers 2 to 31)	
161	Reflect to overall judgement (0: ON 1: OFF)

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Host link data

The Host Link Data processing item is used to output data to Programmable Controllers and other external devices via a serial interface.



Data is output only when measurement is performed in Run Mode. Data will not be output if measurement is executed in Monitor Mode. The overall judgement for the set processing items will be output to the parallel interface OR signal, regardless of whether or not the Normal Data processing item is set.

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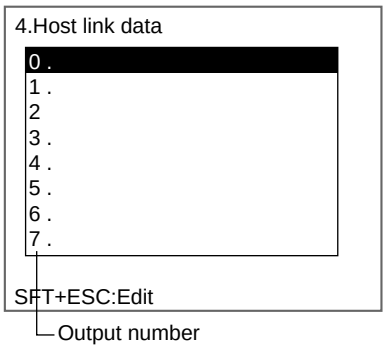
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Setting Output Details

Use expressions to set the output data.
For each unit, 8 expressions “0 to 7” can be set.

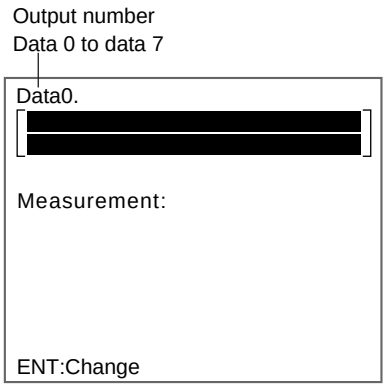
▶ [Host link data]

1. Select the output number to which the expression will be set.



The Expression Settings Screen will be displayed.

2. Move the cursor to the square bracket for [Data 0] and press the ENT Key.

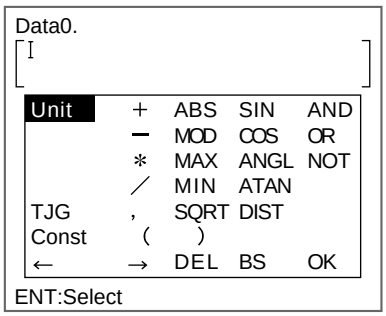


The setting items will be displayed.

3. Select the items to be set and set the expression.

SECTION 2, 4.1 Calculation, “Setting Expressions”

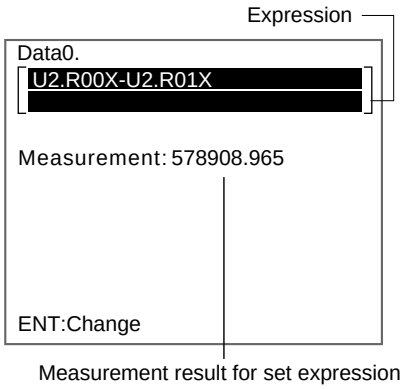
4. Once the expression has been set, select [OK].



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The settings will be saved and the screen in **2.** will return.

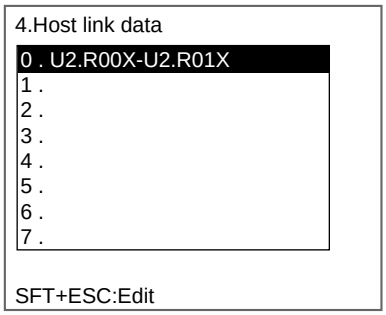
5. Press the ESC Key.



The Expression Settings Screen will return.
Press the SHIFT+ESC Keys in this screen to copy or clear the expression.

6. Repeat steps **1.** to **5.** to set the expressions.

7. Once the expressions have been set, press the ESC Key.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Data 0	DO0	Result of expression set to output number 0
Data 1	DO1	Result of expression set to output number 1
Data 2	DO2	Result of expression set to output number 2
Data 3	DO3	Result of expression set to output number 3
Data 4	DO4	Result of expression set to output number 4
Data 5	DO5	Result of expression set to output number 5
Data 6	DO6	Result of expression set to output number 6
Data 7	DO7	Result of expression set to output number 7

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement Data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Result of expression set to output number 0
2	Result of expression set to output number 1
3	Result of expression set to output number 2
4	Result of expression set to output number 3
5	Result of expression set to output number 4
6	Result of expression set to output number 5
7	Result of expression set to output number 6
8	Result of expression set to output number 7

■ Setting Data

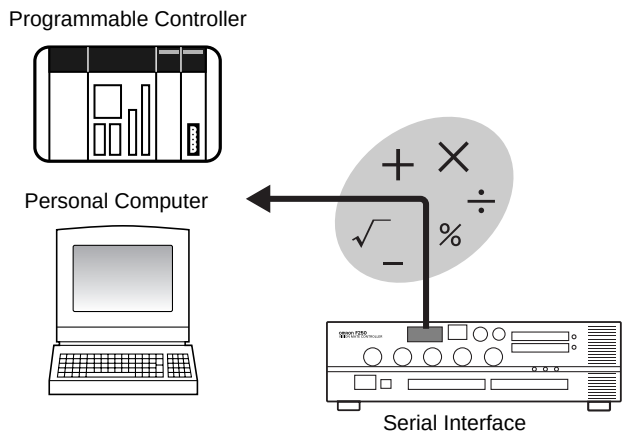
Data type	Details
9	Expression set to output number 0
10	Expression set to output number 1
11	Expression set to output number 2
12	Expression set to output number 3
13	Expression set to output number 4
14	Expression set to output number 5
15	Expression set to output number 6
16	Expression set to output number 7

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Normal data

Use the Normal Data processing item to output data to Programmable Controllers, personal computers, and other external devices via a serial interface.

Measurement values and calculation results can be output.



Data is output only when measurement is performed in Run Mode. Data will not be output if measurement is executed in Monitor Mode. The overall judgement for the set processing items will be output to the parallel interface OR signal, regardless of whether or not the Normal Data processing item is set.

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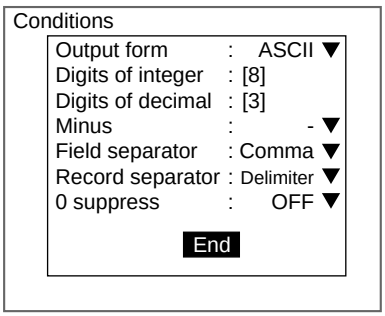
Selecting Output Formats

Select the format for outputting data to a serial interface.

▶ [Normal data/Conditions]

1. Change the settings for each item.

2. Select [End].



- ASCII Format

  The following items can be set.

Setting data	Details	
Output form	Select ASCII*.	
Digits of integer	Set the number of digits for integer output. When 0 is selected, all digits of data are output without leading zeros. (Select a value between 0 and 8. Default setting: 8) If the data has more digits than the number set, 9 will be output for each digit.	
	Example:	If 4 digits have been set and the data is “15619” the output will be “9999”.
Digits of decimal	Set the number of digits for decimal output. When 0 is selected, the decimal places are rounded off. (Select a value between 0 and 3. Default setting: 3)	
Minus	Select what sign will be displayed for negative values. (Select either - or 8. Default setting: -)	
Field separator	Select the separator between data fields. (Select none, comma, tab, space, or delimiter. Default setting: comma)	
Record separator	Select the separator between data records. (Select none, comma, tab, space, or delimiter. Default setting: delimiter)	
0 suppress	Select how to adjust any empty digits to the left of output data. (Select either ON or OFF. Default setting: OFF) ON: Inserts a 0 into empty digits. OFF: Inserts a space into empty digits.	
	Example:	If “5” has been set for Digits of integer and “3” for Digits of decimal, and the data is 100.000, the following output will be made. When ON is set: 00100.000 When OFF is set: “space” 100.000 (i.e., a space is inserted).

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- Binary Format

  The measurement result multiplied by 1,000 is output as four consecutive bytes as one unit of data.

Setting data	Details
Output form	Select Binary.
Digits of integer	These settings are only for ASCII format. No settings are required for binary format.
Digits of decimal	
Minus	
Field separator	
Record separator	
0 suppress	

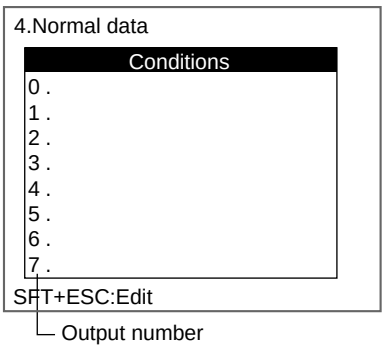
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Setting Output Details

Use expressions to set the output data.
For each unit, 8 expressions “0 to 7” can be set.

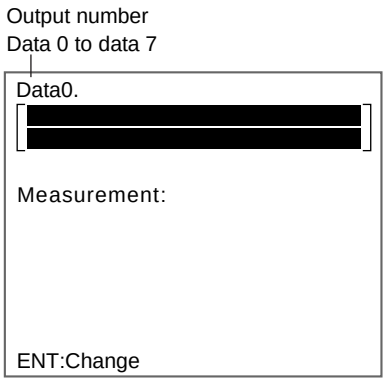
▶ [Normal data]

1. Select the output number to which the expression will be set.



The Expression Settings Screen will be displayed.

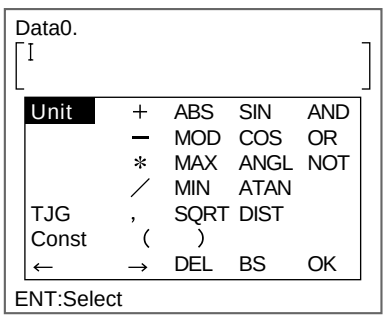
2. Move the cursor to the square bracket for [Data 0] and press the ENT Key.



The setting items will be displayed.

3. Select the items to be set and set the expression.

SECTION 2, 4.1 Calculation “Setting Expressions”

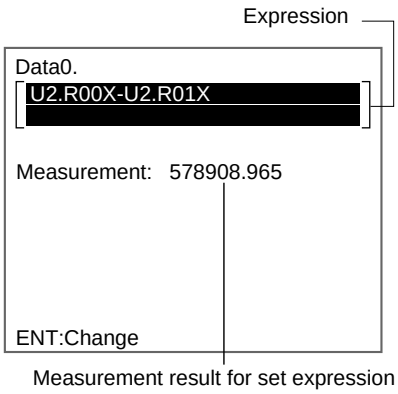


4. Once the expression has been set, select [OK].

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The settings will be saved and the screen in **2.** will return.

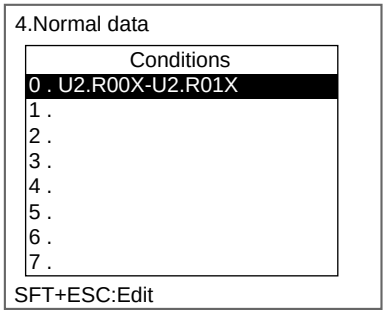
5. Press the ESC Key.



The Expression Settings Screen will return.
Press the SHIFT+ESC Keys in this screen to copy or clear the expression.

6. Repeat steps **1.** to **5.** to set the expressions.

7. Once the expressions have been set, press the ESC Key.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Judgement	JG	Judgement result (-2: Not measured -1: NG 0: OK)
Data 0	DO0	Result of expression set to output number 0
Data 1	DO1	Result of expression set to output number 1
Data 2	DO2	Result of expression set to output number 2
Data 3	DO3	Result of expression set to output number 3
Data 4	DO4	Result of expression set to output number 4
Data 5	DO5	Result of expression set to output number 5
Data 6	DO6	Result of expression set to output number 6
Data 7	DO7	Result of expression set to output number 7

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement Data

Data type	Details
0	Judgement result (-2: Not measured -1: NG 0: OK)
1	Result of expression set to output number 0
2	Result of expression set to output number 1
3	Result of expression set to output number 2
4	Result of expression set to output number 3
5	Result of expression set to output number 4
6	Result of expression set to output number 5
7	Result of expression set to output number 6
8	Result of expression set to output number 7

■ Setting Data

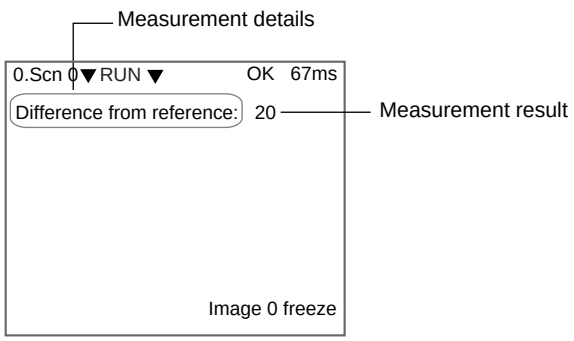
Data type	Details
9	Expression set to output number 0
10	Expression set to output number 1
11	Expression set to output number 2
12	Expression set to output number 3
13	Expression set to output number 4
14	Expression set to output number 5
15	Expression set to output number 6
16	Expression set to output number 7
17	Output format (0: ASCII 1: Binary)
18	Integer digits (0 to 8)
19	Decimal digits (0 to 3)
20	Negative expression (0: - 1: 8)
21	Field separator (0: None 1: Comma 2: Tab 3: Space 4: CR+LF)
22	Record separator (0: None 1: Comma 2: Tab 3: Space 4: CR+LF)
23	0 suppress (0: OFF 1: ON)

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Display string

The Display String processing item is used to display any characters on the Run and Monitor Mode screens.

Example: Displaying Measurement Details in Combination with Display Measurement Processing Item



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External Reference Table 5

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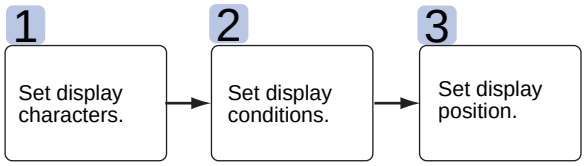
Setting the Display Contents

Use this processing item to display any alphanumeric characters in Run and Monitor Modes.

CHECK!

- The data set here will be enabled when None or Positions is selected under System/Display/Display settings/Display results.
- Even when the display image is set to be displayed as a reduced image, the characters will always be displayed in the specified position.

■ Operational Flow



1 Setting Display Characters

Up to 29 standard size alphanumeric characters can be set.
The characters can be selected from the list of characters on the displayed software keyboard.

CHECK!

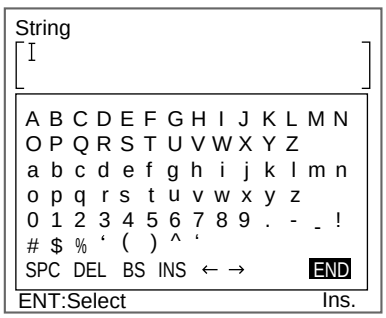
Comments can also be set in Japanese via a serial interface. However, full-size characters are equivalent to two standard size characters. Thus, if the string consists of full-size characters only, only up to 14 characters can be set.

SECTION 6, 4. Serial Interface Menu Operations, “Inputting Characters from the Computer”

▶ [Display string/String]

1. Set the characters to be displayed.

2. Once all characters have been selected, select [END].



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2 Setting Display Conditions

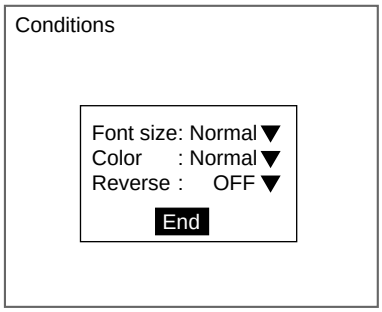
Set the conditions for display.

The font type cannot be specified. The display font will be the same as the menu font.

▶ [Display string/Conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Font size	Large	Twice the height and width of Normal
	Normal (default setting)	Same size as menu font (Normal)
	Small	1/2 the height and width of Normal
Color	Normal (default setting)	Characters are displayed in white.
	OK color	Characters are displayed in green.
	NG color	Characters are displayed in red.
Reverse	OFF (default setting)	Characters are not highlighted.
	ON	Characters are highlighted.

CHECK!

The font colors can be changed.

SECTION 5 System Settings, “Changing Character or Figure Colors”

When Color is set to Normal and the characters have been displayed on the screen once, they will continue to be displayed whether or not [Display measure] has been executed as one of the branching control processing items.

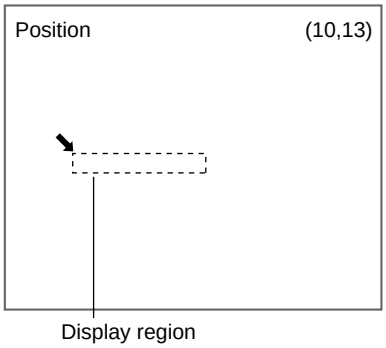
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3 Setting Display Position

Set the position for character display.
The size of the display region shown on the screen is the same as the actual size when the time is displayed. Use this as a reference for deciding positions.
Care must be taken because characters in any part of the display region that protrudes past the right edge of the screen will not be displayed.

▶ [Display string/Position]

1. The cursor for setting position and the display region will be displayed.
2. Use the Up/Down and Right/Left Keys to move the display region.
3. Press the ENT Key.



When you want to obtain measurement results externally

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement Data

No measurement data is provided.

■ Setting Data

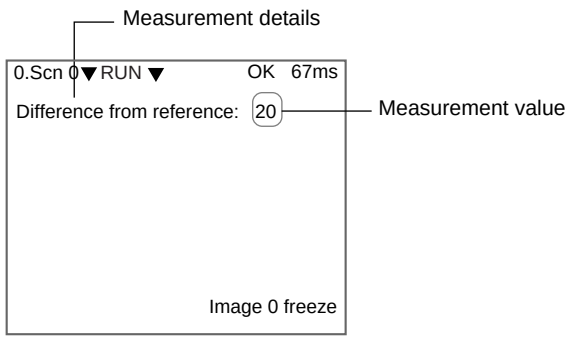
Data type	Details
32	Font size (0: Small 1: Normal 2: Large)
33	Display digit position (0 to 63)
34	Display line position (0 to 23)
35	Display color (0: Normal color 1: OK color 2: NG color)
36	Reverse display (0: OFF 1: ON)

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Display Measure

Use this processing item to display any measurement data on the screens in Run and Monitor Modes.
The display is set using expressions so the calculation results of expressions using region measurement values or measurement values can be displayed.

Example: Displaying Measurement Values in Combination with Display String



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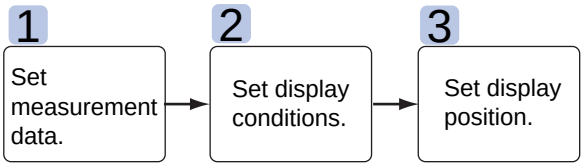
Setting the Display Contents

Use this processing item to display any measurement data on the screens in Run and Monitor Modes.
The display is set using expression, so region measurements or calculations using measurement values can be displayed.

CHECK!

- The data set here will be enabled when None or Positions is selected under System/Display/Display settings/Display results.
- Even when the display image is set to be displayed as a reduced image, the characters will always be displayed in the specified position.

■ Operational Flow



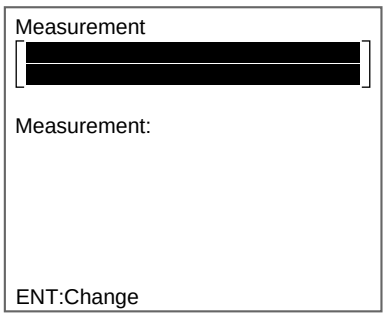
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1 Setting Measurement Conditions

Use expressions to set the measurement data to be displayed.

▶ [Display measure/Measurement]

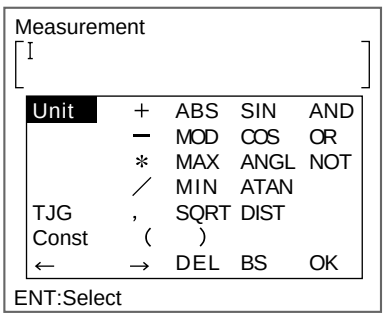
1. Move the cursor to the square bracket for the measurement data and press the ENT Key.



The setting items will be displayed.

2. Select the items to be set and set the expression.

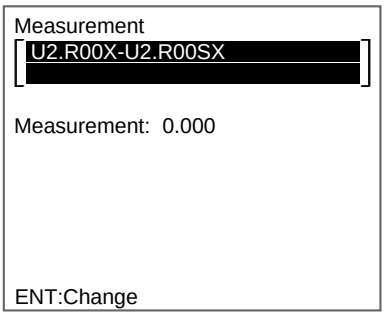
SECTION 2, 4.1. Measurement Support Items, “Calculation”



3. Once the expression has been set, select [OK].

The settings will be saved and the screen in **1.** will return.

4. Press the ESC Key.



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2 Setting Display Conditions

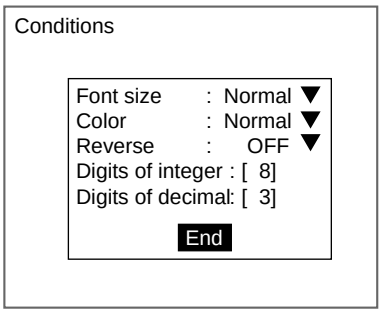
Set the conditions for display.

The font cannot be specified. The display font will be the same as the menu font.

▶ [Display measure/Conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Font size	Large	Twice the height and width of Normal
	Normal (default setting)	Same size as menu font (Normal)
	Small	1/2 the height and width of Normal
Color	Normal (default setting)	Characters are displayed in white.
	OK color	Characters are displayed in green.
	NG color	Characters are displayed in red.
Reverse	OFF (default setting)	Characters are not highlighted.
	ON	Characters are highlighted.
Digits of integer	0 to 8 (default setting: 8)	Set the number of digits for integer to be displayed.
Digits of decimal	0 to 3 (default setting: 3)	Set the digits of decimal to be displayed.

CHECK!

The font colors can be changed.

SECTION 5 System Settings, “Changing Character or Figure Colors”

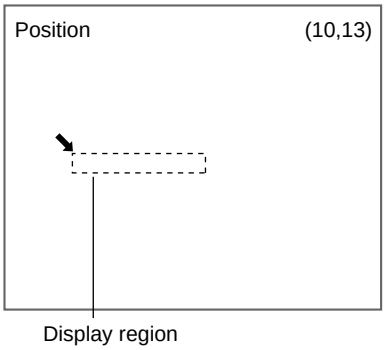
When Color is set to [Normal] and the characters have been displayed on the screen once, they will continue to be displayed whether or not [Display measure] has been executed as one of the branching control processing items.

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3 Setting Display Position

Set the position for character display.
The size of the display region shown on the screen is the same as the actual size when the time is displayed. Use this as a reference for deciding positions.
Care must be taken because characters in any part of the display region that protrudes past the right edge of the screen will not be displayed.

▶ [Display measure/Conditions]



1. The cursor for setting position and the display region will be displayed.

2. Use the Up/Down and Right/Left Keys to move the display region.

3. Press the ENT Key.

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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Measurement data	DT	Result of set expression

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement Data

Data type	Details
0	Result of set expression

■ Setting Data

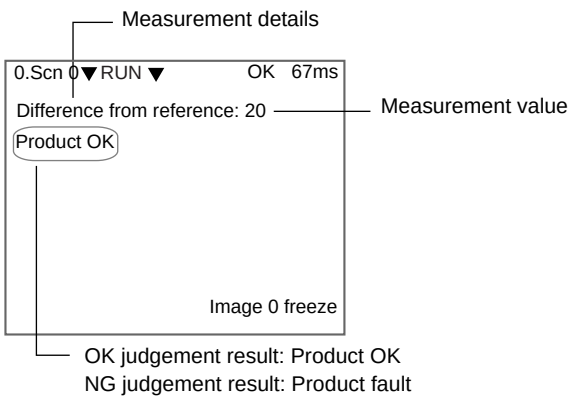
Data type	Details
32	Font size (0: Small 1: Normal 2: Large)
33	Display digit position (0 to 63)
34	Display line position (0 to 23)
35	Reverse display (0: OFF 1: ON)
36	Display color (0: Normal color 1: OK color 2: NG color)
37	Integer digits (0 to 8)
38	Decimal digits (0 to 3)
39	Expression

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Display judge

The Display judgement processing item is used to display different characters for OK and NG calculation results on the screens in Run and Monitor Modes.
Expressions are set as criteria and the characters to be displayed for the different judgement results (OK or NG) are set.

Example: Displaying the Time in Combination with Display String and Display Measure



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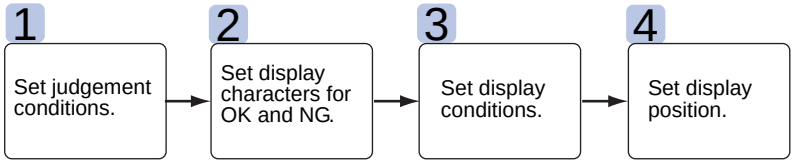
Setting the Display Contents

Use this processing item to display suitable characters in Run and Monitor Modes based on judgement results.
Set the expressions as criteria and set the characters to be displayed for the different judgement results (OK, NG).

CHECK!

- The data set here will be enabled when None or Positions is selected under System/Display/Display settings/Display results.
- Even when the display image is set to be displayed as a reduced image, the characters will always be displayed in the specified position.

■ Operational Flow



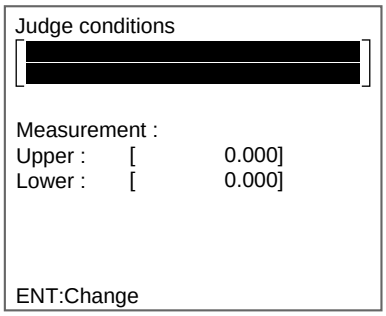
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1 Setting judgement Criteria

Use expressions to set the judgement criteria.

▶ [Display judge/Judge conditions]

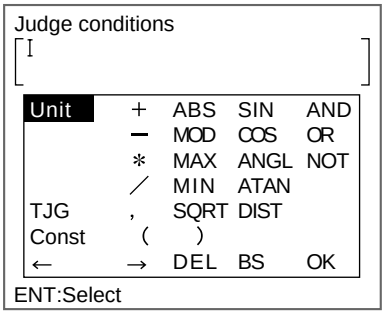
1. Move the cursor to the square bracket for the expression and press the ENT Key.



The setting items will be displayed.

2. Select the items to be set and set the expression.

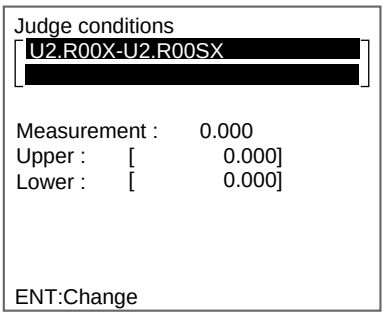
SECTION 2, 4.1 Calculation "Setting Expressions"



3. Once the expression has been set, select [OK].

The settings will be saved and the screen in **1.** will return.

4. Set the conditions for OK and NG judgements.



5. Press the ESC Key.

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2 Setting Display Characters for OK and NG Judgements

When the judgement result for the expression set in 1: Setting judgement Criteria is OK, set the characters to be displayed for a NG Judgement.
Up to 29 standard size alphanumeric characters can be set.
The characters can be selected from the list of characters on the displayed software keyboard.

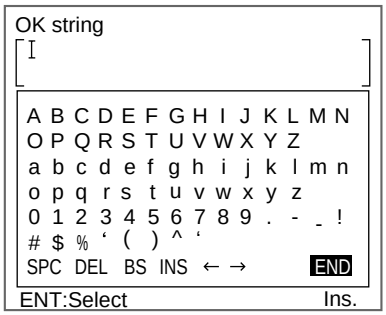
CHECK!
Comments can also be set in Japanese via a serial interface. However, full-size characters are equivalent to two standard size characters. Thus, if the string consists of full-size characters only, only up to 14 characters can be set.

SECTION 6, 4. Serial Interface Menu Operations, “Inputting Characters from the Computer”

▶ [Display judge/OK string (or NG string)]

1. Set the characters to be displayed.

2. Once all characters have been selected, select [END].



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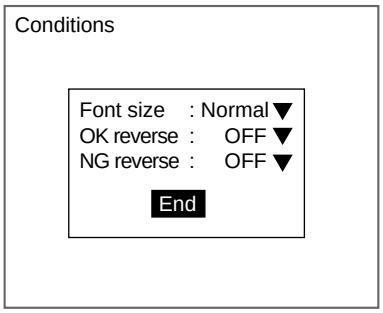
3 Setting Display Conditions

Set the conditions for display.
The font cannot be specified. The display font will be the same as the menu font.

▶ [Display judge/Conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Font size	Large	Twice the height and width of Normal
	Normal (default setting)	Same size as menu font (Normal)
	Small	1/2 the height and width of Normal
OK reverse	OFF (default setting)	“OK” is not highlighted.
	ON	“OK” is highlighted.
NG reverse	OFF (default setting)	“NG” is not highlighted.
	ON	“NG” is highlighted.

4 Setting Display Position

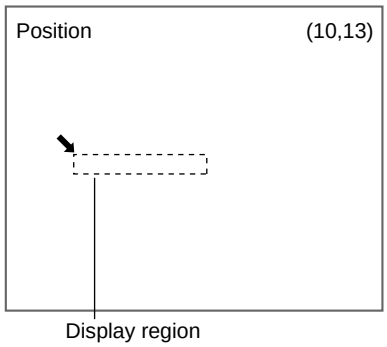
Set the position for character display.
The size of the display region shown on the screen is the same as the actual size when the time is displayed. Use this as a reference for deciding positions.
Care must be taken because characters in any part of the display region that protrudes past the right edge of the screen will not be displayed.

▶ [Display judge/Position]

1. The cursor for setting position and the display region will be displayed.

2. Use the Up/Down and Right/Left Keys to move the display region.

3. Press the ENT Key.



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When you want to obtain measurement results externally

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

Measurement item	String	Details
Display judgement	DJ	Displayed Judgement result (-2: Not measured -1: NG 0: OK)
Measurement data	DT	Result of set expression

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement Data

Data type	Details
0	Displayed Judgement result (-2: Not measured -1: NG 0: OK)
1	Result of set expression

■ Setting Data

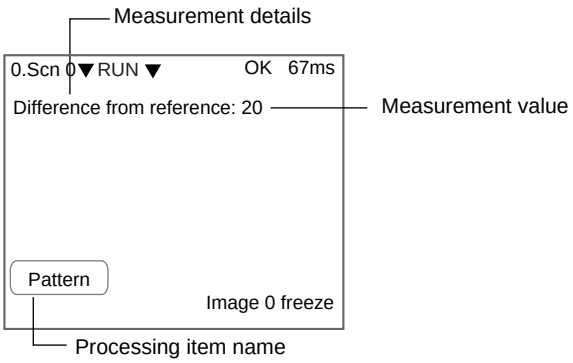
Data type	Details
32	Font size (0: Small 1: Normal 2: Large)
33	Display digit position (0 to 63)
34	Display line position (0 to 23)
35	OK reverse display (0: OFF 1: ON)
36	NG reverse display (0: OFF 1: ON)
37	Judgement lower limit (-9,999,999.999 to 9,999,999.999)
38	Judgement upper limit (-9,999,999.999 to 9,999,999.999)
39	Characters displayed for OK judgement
40	Characters displayed for NG judgement
41	Expression

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Display Item

The Display Item processing item is used to display the name of one processing item set to the current scene on the screen in Run and Monitor Modes.
If a comment is entered for the processing item, the comment will also be displayed.

Example: Displaying the Time in Combination with Display String and Display Measure



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External Reference Table 5

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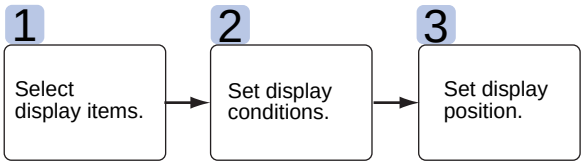
Setting the Display Contents

The name of one processing item set to the current scene is displayed on the screen in Run and Monitor Modes.
If a comment is entered for the processing item, the comment will also be displayed.

CHECK!

- The data set here will be enabled when None or Positions is selected under System/Display/Display settings/Display results.
- Even when the display image is set to be displayed as a reduced image, the characters will always be displayed in the specified position.

■ Operational Flow



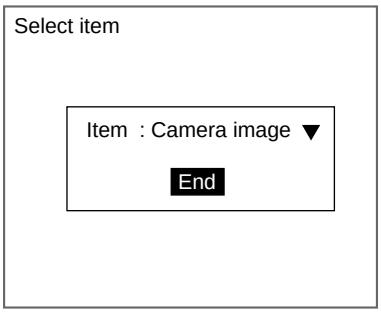
1 Selecting the Display Data

Select the processing item names to be displayed.

▶ [Display item/Select item]

1. The selection of processing items set to the current scene will be displayed.
If a comment has been set to the item, the comment will also be displayed.

2. Select the desired processing item name. Select [End].



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2 Setting Display Conditions

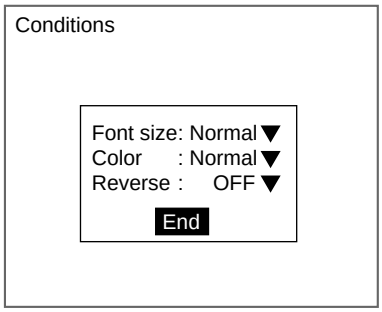
Set the conditions for display.

The font cannot be specified. The display font will be the same as the menu font.

▶ [Display item/Conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Font size	Large	Twice the height and width of Normal
	Normal (default setting)	Same size as menu font (Normal)
	Small	1/2 the height and width of Normal
Color	Normal (default setting)	Characters are displayed in white.
	OK color	Characters are displayed in green.
	NG color	Characters are displayed in red.
Reverse	OFF (default setting)	Characters are not highlighted.
	ON	Characters are highlighted.

CHECK!

The font colors can be changed.

SECTION 5 System Settings, “Changing Character or Figure Colors”

When Color is set to Normal and the characters have been displayed on the screen once, they will continue to be displayed whether or not [Display item] has been executed as one of the branching control processing items.

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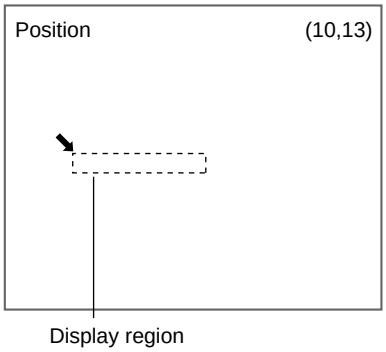
3 Setting Display Position

Set the position for character display.
The size of the display region shown on the screen is the same as the actual size when the time is displayed. Use this as a reference for deciding positions.
Care must be taken because characters in any part of the display region that protrudes past the right edge of the screen will not be displayed.

▶ [Display item/Position]

1. Use the Up/Down and Right/Left Keys to move the display region.

2. Press the ENT Key.



When you want to obtain measurement results externally

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement Data

Data No.	Details
0	Display Processing Items

■ Setting Data

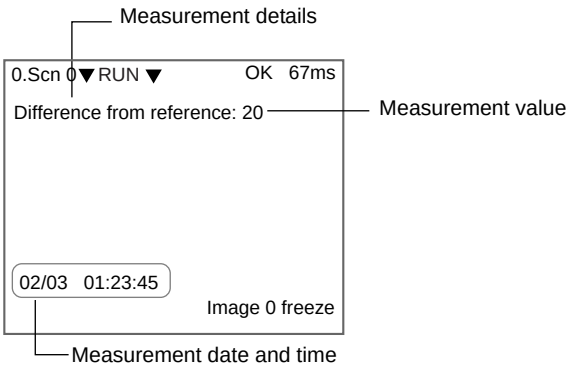
Data No.	Details
32	Font size (0: Small 1: Normal 2: Large)
33	Display digit position (0 to 63)
34	Display line position (0 to 23)
35	Reverse display (0: OFF 1: ON)
36	Display color (0: Normal color 1: OK color 2: NG color)
37	Display unit number (0 to 9,999)

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Display Time

The Display Time processing item is used to display the date and time measurement was performed on the screens in Run and Monitor Modes.

Example: Displaying the Time in Combination with Display String and Display Measure



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External Reference Table 5

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Setting the Display Contents

This processing item displays the date and time of the measurement on the screens in Run and Monitor Modes.

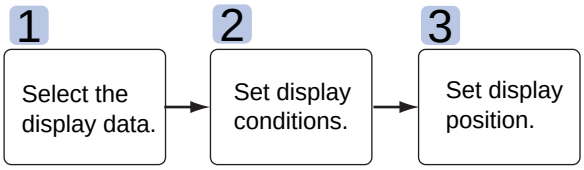
The calendar in the Controller must be adjusted and set beforehand.

SECTION 5 System Settings, “Setting the Calendar Date and Time (Date/Time)”

CHECK!

- The data set here will be enabled when None or Positions is selected under System/Display/Display settings/Display results.
- Even when the display image is set to be displayed as a reduced image, the characters will always be displayed in the specified position.

■ Operational Flow



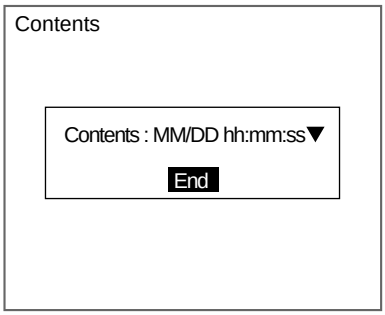
1 Selecting the Display Data

Select the format for the date and time display.

▶ [Display time/Contents]

1. Select the desired display contents.

2. Select [End].



Setting data	Selection	Display sample
Contents	MM/DD hh:mm:ss (default setting)	10/01 01:23:45
	MM/DD hh:mm	10/01 01:23
	hh:mm:ss	01:23:45
	hh:mm	01:23

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2 Setting Display Conditions

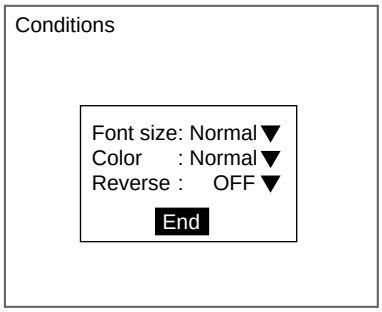
Set the conditions for display.

The font cannot be specified.The display font will be the same as the menu font.

▶ [Display time/Conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Font size	Large	Twice the height and width of Normal
	Normal (default setting)	Same size as menu font (Normal)
	Small	1/2 the height and width of Normal
Color	Normal (default setting)	Characters are displayed in white.
	OK color	Characters are displayed in green.
	NG color	Characters are displayed in red.
Reverse	OFF (default setting)	Characters are not highlighted.
	ON	Characters are highlighted.

CHECK!

The font colors can be changed.

SECTION 5 System Settings, “Changing Character or Figure Colors”

When Color is set to Normal and the characters have been displayed on the screen once, they will continue to be displayed whether or not Display time has been executed as one of the branching control processing items.

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3 Setting Display Position

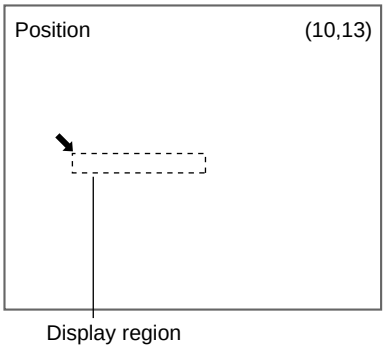
Set the position for character display.
The size of the display region shown on the screen is the same as the actual size when the time is displayed.Use this as a reference for deciding positions.
Care must be taken because characters in any part of the display region that protrudes past the right edge of the screen will not be displayed.

▶ [Display time/Position]

1. The cursor for setting position and the display region will be displayed.

2. Use the Up/Down and Right/Left Keys to move the display region.

3. Press the ENT Key.



When you want to obtain measurement results externally

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement Data

Data type	Details
0	Display time

■ Setting Data

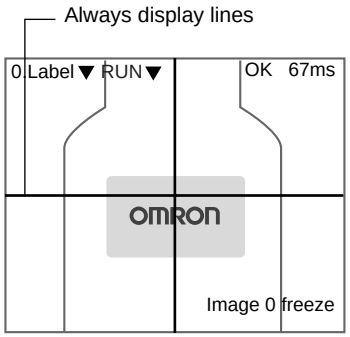
Data type	Details
32	Font size (0: Small 1: Normal 2: Large)
33	Display digit position (0 to 63)
34	Display line position (0 to 23)
35	Reverse display (0: OFF 1: ON)
36	Display color (0: Normal color 1: OK color 2: NG color)
37	Contents (0: MM/DD hh:mm:ss 1: MM/DD hh:mm 2: hh:mm:ss 3: hh:mm)

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Display Figure

The Display Figure processing item is used to display figures (lines, boxes, circles, and arcs) at fixed positions on the screens in Run and Monitor Modes.

Example: Displaying Lines To Indicate the Center of the Screen as a Guide to the Position of the Measurement Object



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External Reference Table 6

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Setting the Display Contents

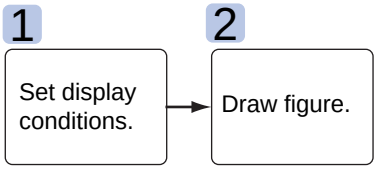
Use this processing item to display lines, boxes, circles, and arcs at a fixed position on screens in Run and Monitor Modes.

CHECK!

- The data set here will be enabled when None or Positions is selected under System/Display/Display settings/Display results.
- Even when the display image is set to be displayed as a reduced image, the reduced figure is displayed in the corresponding position.
- The figure will be displayed if it is registered to the unit, regardless of whether or not [Display figure] is executed using the branching control processing items.
- Select [Display Line], [Display Box], [Display Circle] or [Display Cursor] under displaying results to display figures using measurement results.

SECTION 2, 7.7 Display Line, Display Box, Display Circle, and Display Cursor

■ Operational Flow



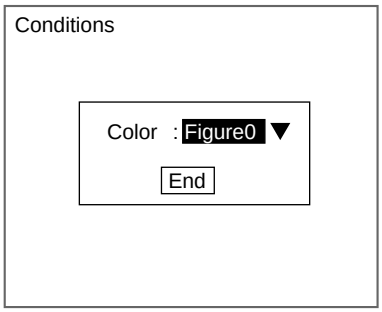
1 Setting Display Conditions

Set the conditions for display.

▶ [Display figure/Conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Color	Figure 0 to Figure 6 (default setting: Figure 0)	Set the figure color for display

Figure Color:

SECTION 5 System Settings, “Changing Character or Figure Colors”

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2 Drawing Figures

Select a line, box, circle, circumference, or arc.

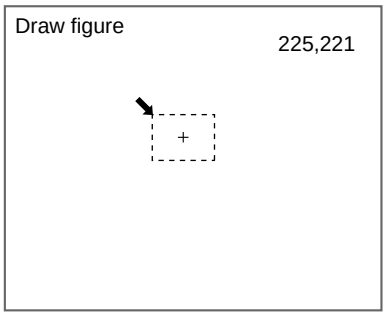
The operational flow will be described here using [Box] as an example. Make adjustments as necessary when other options are selected.

▶ [Display figure/Draw figure/Box]

1. The Draw Figure Screen will be displayed.

When Line has been selected, line options of Solid line and Dash line will be displayed.

2. Draw the figure in the position where it is to be displayed.



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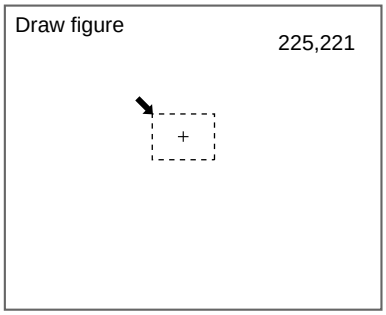
■ Correcting Figures

Select Correct to correct figures that have already been drawn.

▶ [Display figure/Draw figure/Correct]

1. The Draw Figure Screen will be displayed.

2. Draw the figure in the position where it is to be displayed.

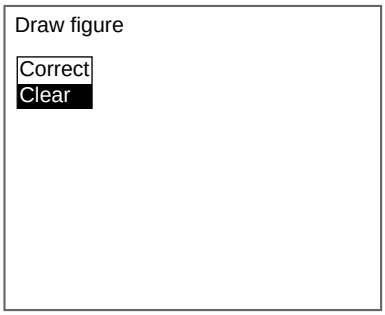


■ Clearing Figures

Select Clear to delete drawn figures.

▶ [Display figure/Draw figure]

1. Select [Clear].



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When you want to obtain measurement results externally

External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Measurement Data

No measurement data is provided.

■ Setting Data

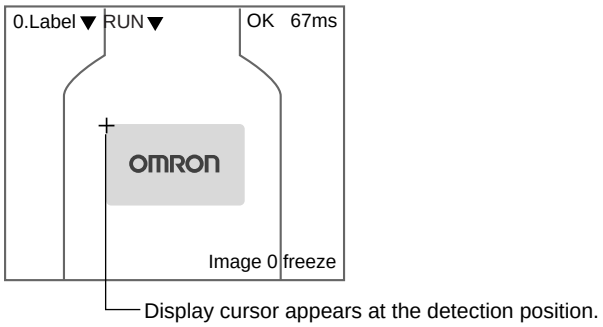
Data type	Details
32	Display color (0: Normal color 1: OK color 2: NG color)
33	Line type (for lines only) (0: Solid line 1: Dash line)

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Display Line, Display Box, Display Circle, and Display Cursor

Use the Display Line, Display Box, Display Circle, and Display Cursor processing items to display figures based on measurement results on screens in Run and Monitor Modes. The position of the figure coordinates is set using an expression.

Example: Displaying a Cursor at the Label Detection Position



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Submenus for Expressions 6

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Setting the Display Contents

Use these processing items to display on screens in Run and Monitor Modes the figures based on measurement results. Set the coordinates of the position of the figure using expressions.

The operational flow will be described here using Display box as an example.

Make adjustments as necessary when other options are selected.

CHECK!

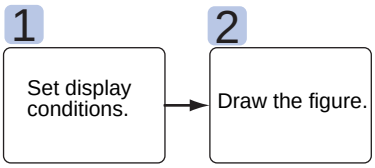
- The data set here will be enabled when None or Positions is selected under System/Display/Display settings/Display results.

SECTION 5 System Settings, “Screen Display and Monitor”

- Even when the display image is set to be displayed as a reduced image, the reduced figure is displayed in the corresponding position.
- If the display image size has been changed, the figure is displayed in the corresponding position.

SECTION 2, “7.6 Display Figure”

■ Operational Flow



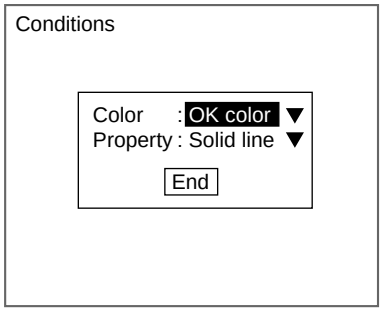
1 Setting Display Conditions

Set the conditions for display.

▶ [Display box/Conditions]

1. Set each item.

2. Select [End].



Setting data	Selection	Details
Color	OK color: Green (default setting) NG color: Red	Set the conditions for display.
Property	Solid line (default setting) Dash line	Only displayed for lines, boxes, and circles.

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2 Drawing Figures

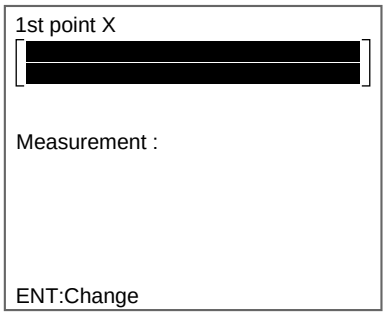
The coordinates for the figure are set using expressions.

Selection	Coordinate specification method
Display box	Upper left coordinate (1st point X, 1st point Y) Lower right coordinate (2nd point X, 2nd point Y)
Display circle	Center coordinate (Center X, Center Y) Radius
Display line	Start point (1st point X, 1st point Y) End point (2nd point X, 2nd point Y)
Display cursor	X coordinate, Y coordinate

▶ [Display box/1st point X]

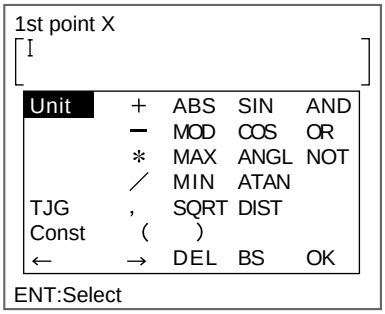
1. The 1st Point X Settings Screen will be displayed.

2. Place the cursor in the square bracket for 1st point X and press the ENT Key.



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The setting items will be displayed.

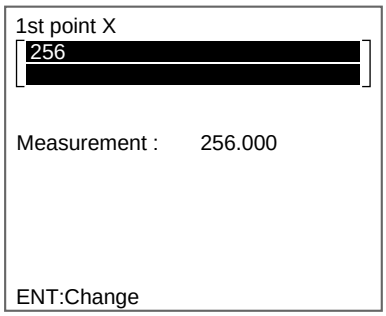


3. Select the items to be set and set the expression.

SECTION 2, 4.1 Calculation “Setting Expressions”

4. Once the expression has been set, select [OK].

The settings will be registered and the screen in **1.** will return.



5. Press the ESC Key.

The settings will be registered.
Repeat the above steps to set the 1st point Y, 2nd point X, and 2nd point Y.

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When you want to obtain measurement results externally

Calculation Result

If an equation that refers to the measurement results of another processing item has been selected, the coordinates in effect before scroll will be effective during measurement, irrespective of the coordinate mode setting made for that processing item.

Submenus for Expressions

If a unit is selected from the list of processing items in the equation settings screen, the following submenu will be displayed.
This section describes each item displayed in the submenu.
For details on equation setting method, refer to SECTION 2, 4.1 Calculation.

■ Line Result Display and Box Result Display

Measurement item	String	Details
1st point X	X1	Result of expression set to 1st point X
1st point Y	Y1	Result of expression set to 1st point Y
2nd point X	X2	Result of expression set to 2nd point X
2nd point Y	Y2	Result of expression set to 2nd point Y

■ Circle Result Display

Measurement item	String	Details
Center X	X	Result of expression set to center X
Center Y	Y	Result of expression set to center Y
Radius	R	Result of expression set to radius

■ Cursor Display Results

Measurement item	String	Details
X coordinate	X	Result of expression set to X coordinate
Y coordinate	Y	Result of expression set to Y coordinate

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External Reference Table

Types of data that can be referred to from other processing items or external devices as well as their corresponding numbers are given in the tables below. For the input method, refer to explanations of the corresponding processing items or the external device.

■ Line Result Display and Box Result Display

- Measurement Data

Data type	Details
0	Result of expression set to 1st point X
1	Result of expression set to 1st point Y
2	Result of expression set to 2nd point X
3	Result of expression set to 2nd point Y

- Setting Data

Data type	Details
32	Display color (0: OK color 1: NG color)
33	Display properties (0: Solid line 1: Dash line)
34	Expression for 1st point X
35	Expression for 1st point Y
36	Expression for 2nd point X
37	Expression for 2nd point Y

■ Circle Result Display

- Measurement Data

Data type	Details
0	Result of expression set to center X
1	Result of expression set to center Y
2	Result of expression set to radius

- Setting Data

Data type	Details
32	Display color (0: OK color 1: NG color)
33	Display properties (0: Solid line 1: Dash line)
34	Expression for center X
35	Expression for center Y
36	Expression for radius

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■ Cursor Display Results

- Measurement Data

Data type	Details
0	Result of expression set to X coordinate
1	Result of expression set to Y coordinate

- Setting Data

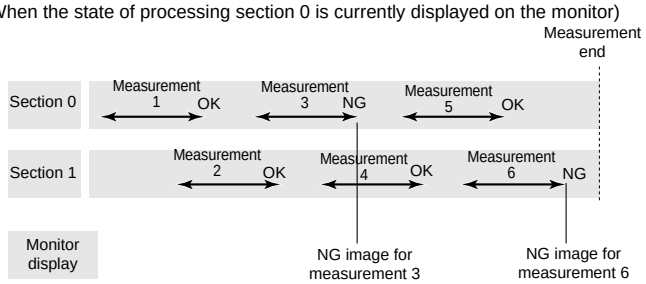
Data type	Details
32	Display color (0: OK color 1: NG color)
33	Expression for X coordinate
34	Expression for Y coordinate

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Display Last NG Image

The Display Last NG Image processing item is used to exit measurement after displaying the latest NG image on the monitor when performing measurement in 1-line fast mode (or 2-line random trigger mode) with F270.
Register this item to the end of the flowchart.
With this item, operations such as setting conditions are not required.

Display example
(When the state of processing section 0 is currently displayed on the monitor)

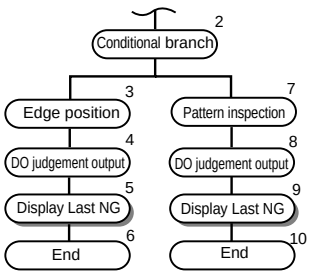


When [Display Last NG Image] is registered
At the end of measurement, NG image (measurement(6)) of processing section 1 is displayed on the monitor.

(When [Display Last NG Image] is not registered
Normally, the latest NG image (measurement (3)) of processing section 0 currently displayed on the monitor is displayed.)

Operation of the console after the end of measurement can be performed for the currently displayed processing section (i.e. processing section 1 in this example).

In the case of a flowchart that has branches, this processing item must be registered at the end (before [End]) of all the branch destinations.



CHECK! To use this item, [Image status] must be set to either [Last NG (before scroll)] or [Last NG (after scroll)] under [SYS/Conditions/ Display setting].

SECTION 5 System Settings
Measurement Screen Settings

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