F250-UME Application Software

Operation Manual

Revised December 2001

Notice:

OMRON products are manufactured for use according to proper procedures by a qualified operator and only for the purposes described in this manual.

The following conventions are used to indicate and classify precautions in this manual. Always heed the information provided with them. Failure to heed precautions can result in injury to people or damage to property.

⚠ **DANGER** Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ **WARNING** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ **Caution** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

OMRON Product References

All OMRON products are capitalized in this manual. The word “Unit” is also capitalized when it refers to an OMRON product, regardless of whether or not it appears in the proper name of the product.

Visual Aids

The following headings appear in the left column of the manual to help you locate different types of information.

Note Indicates information of particular interest for efficient and convenient operation of the product.

1,2,3... 1. Indicates lists of one sort or another, such as procedures, checklists, etc.

Precaution Indicates information required to take full advantage of the functions and performance of the product. Incorrect application methods may result in the loss of damage or damage to the product. Read and follow all precautionary information.

CHECK Indicates points that are important in using product functions or in application procedures.

SeeAlso Indicates where to find related information.

HELP Indicates information helpful in operation, such as the definition of terms.

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Revision History

About this Manual:

This manual describes the operation of the F250-UME Application Software and it includes the sections described below.

This is one of a pair of manuals. Refer to the following table for the contents of each manual.

Manual	Contents	Cat. No.
1: Setup Manual	Provides information on system hardware and installation. **Be sure to read this manual first.** This manual is provided with the Controller.	SCHB-736
2: Operation Manual	Describes the operation of the F250-UME Application Software, including installation of the Application Software, basic operating methods, setting methods for processing items, communications methods for external devices, and other operating procedures. This manual is provided on CD-ROM.	Z153-E1-02

Please read the above manuals carefully and be sure you understand the information provided before attempting to install or operate the Application Software.

Section 1 Basic Operating Procedures describes the basic operating procedures for the Application Software.

Section 2 Processing Item Setting Procedures explains in more detail the basic setting operations for the processing items that control Application Software operation.

Section 3 Testing and Starting Measurements describes the procedures used to test operation and then actually take measurements.

Section 4 Other Functions describes additional functions, such as changing the measurement setup or backing up data.

Section 5 System Settings describes how to set conditions related to the system environment.

Section 6 Communicating with External Devices describes the methods used to connect to and communicate with external devices.

Section 7 Appendices provides information on terminology, character codes, troubleshooting, and answers to FAQs.

⚠ **WARNING** Failure to read and understand the information provided in this manual may result in personal injury or death, damage to the product, or product failure. Please read each section in its entirety and be sure you understand the information provided in the section and related sections before attempting any of the procedures or operations given.

SECTION 1
Basic Operating Procedures

This section describes the basic operating procedures for the Application Software.

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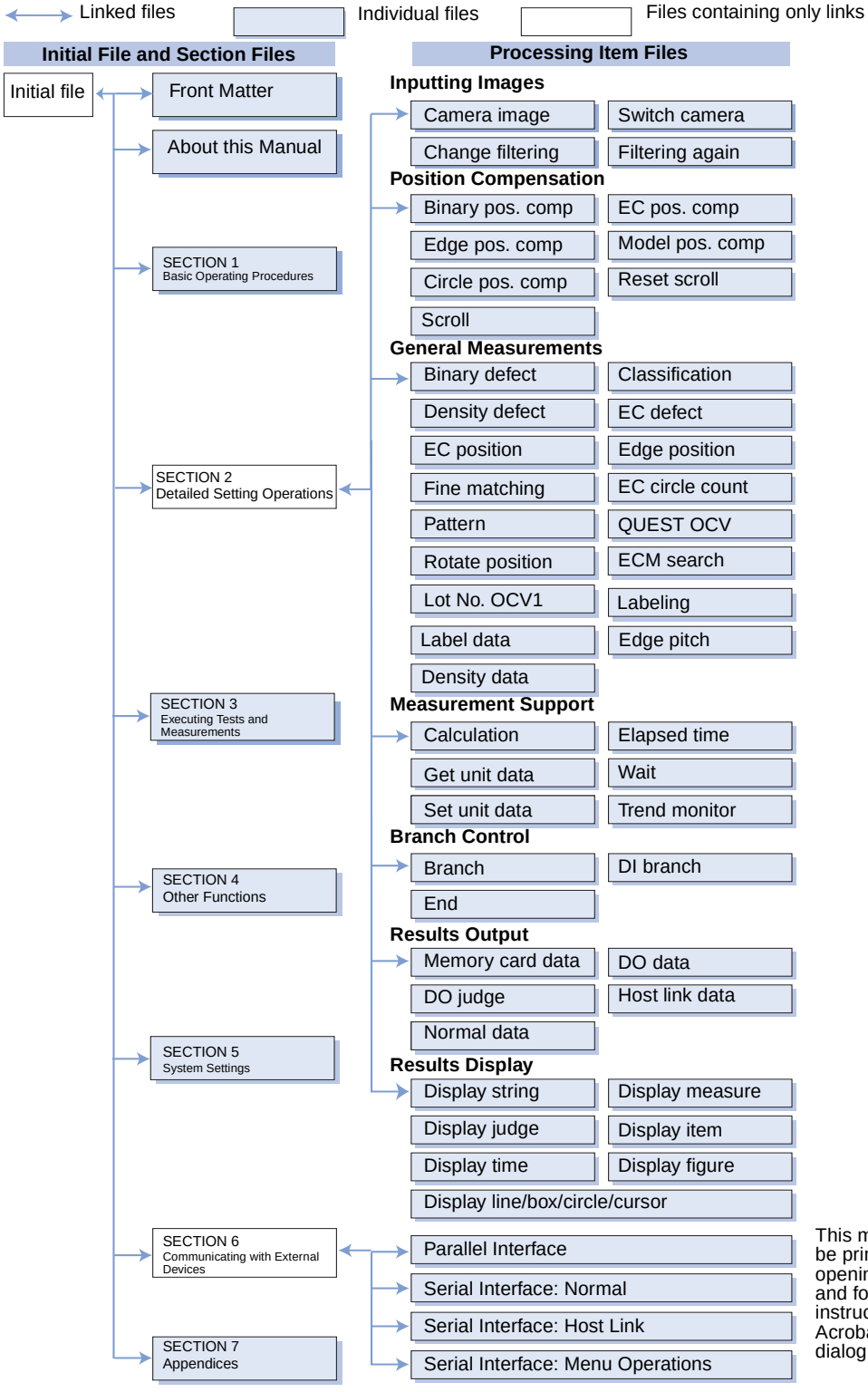
1-1 Using this Manual

The structure of the PDF files in this manual is shown below. Bookmarks are provided to link the initial file to sections and sections to detailed information.



This manual can be printed out by opening the file and following the instructions in the Acrobat printing dialog box.

1-2 Operational Flow

Preparations

Install the Application Software in the Controller. Refer to *1-3 Installing the Application Software*.

SeeAlso Refer to *1-6 Basic Operations* to learn about the basic operational flow from setting detection conditions to executing measurements.

Setting Detection Conditions

STEP 1: Make the settings required to input images. Refer to*1-6-1 STEP 1: Settings for Image Input*.

STEP 2: Make settings to correct positioning. Refer to *1-6-2 STEP 2: Settings for Position Displacement Compensation*.

STEP 3: Set the actual measurement methods. Refer to *1-6-3 STEP 3: Setting Measurement Methods*.

STEP 4: Make settings to output the results. Refer to *1-6-4 STEP 4: Setting Results Output Methods*.

Confirming Settings and Executing

STEP 5: Perform test measurements and start executing measurements. Refer to *1-6-5 STEP 5: Start Test or Measurement* and to *SECTION 3 Monitor Mode and Run Mode*.

Selecting Processing Items that Suit the Application

Refer to *SECTION 2 Processing Items Setting Procedures*.

Changing and Deleting Settings

Copy, clear, and change units and unit names by refer to *Changing to Other Processing Items on page 1-(19)*.

Saving Settings

1. Save detection conditions. Refer to *1-8 Saving Settings and Shutting Down*.
2. Back up image, system, and scene data. Refer to *4-2 Backing Up Data* for information on how to back up settings.

Application Setting Operations

1. Set conditions by product type. Refer to *4-1 Changing Scenes and Scene Groups* for information on scene and scene-group functions.
2. Set system environment conditions. Refer to *SECTION 5 System Settings*.
3. Initialize the measurement conditions that have bee set. Refer to *4-1-3 Initializing Measurement Conditions: Clearing Scenes* and *7-1 Set Up Menu.*
4. Set communications specifications and I/O format for communications with external devices. Refer to *SECTION 6 Communicating with External Devices*.

Additional Functions

1. Use Memory Cards if required. Refer to *4-6 Memory Card Operations.*
2. Check communications status with external devices if required. Refer to *4-5 Checking I/O Status with External Devices*.

Troubleshooting

HELP When an error message is displayed on the screen, refer to *7-4 Terminology*.

HELP If you have a question, refer to *7-3 FAQ.*

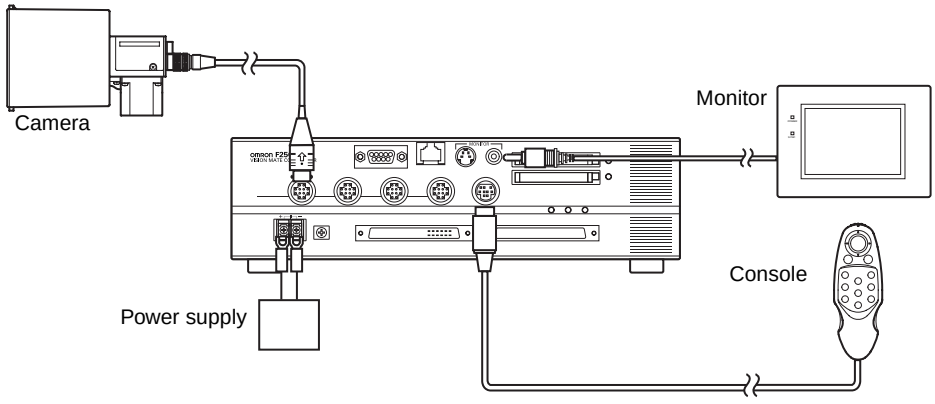
HELP If you don't understand a term, refer to *7-4 Terminology.*

1-3 Installing the Application Software

This section describes how to install the processing items in the F250-UME Application Software to the Controller. The Setup Menus are used to install these processing items.

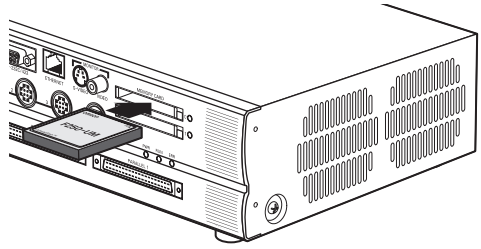
1-3-1 Starting the Setup Menu

1. Check that the basic components are connected.



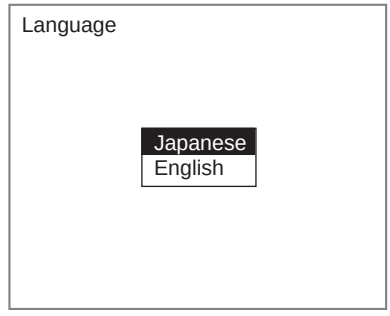
CHECK Always refer to the *Setup Manual* when connecting components or wiring the power supply or ground wires.

2. Mount the F250-UME Application Software Card to Memory Card slot 0.



3. Turn ON the power supply switch to the Monitor.
4. Turn ON the Controller power supply.

   The Language Selection Screen for the Setup Menus will be displayed.



CHECK The language selected here applies only to the Setup Menus.

5. Select a language.

   Use the **Up** or **Down** Key on the Console to move the cursor.

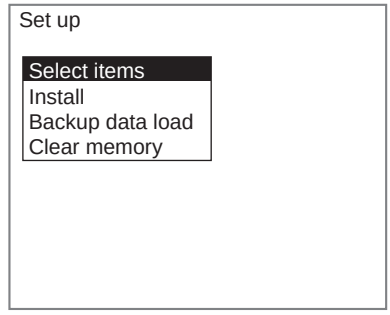
   Japanese: Messages will be displayed in Japanese.

   English: Messages will be displayed in English.

   This manual shows screens displayed with English messages.

6. Press the **ENT** Key on the Console to confirm the language selection.

   After a short time, the Basic Screen for the Setup Menus will be displayed.



Precaution About the F250-UME Application Software

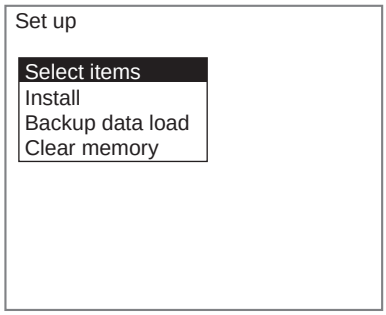
If the F250-UME Application Software Card is mounted to a personal computer or other device and the data changed, the Setup Menus will no longer start properly. Never perform any of the following operations.

- Do not change file names.
- Do not move or delete files.
- Do not write data to the F250-UME Application Software Card.
- Do not format the F250-UME Application Software Card.

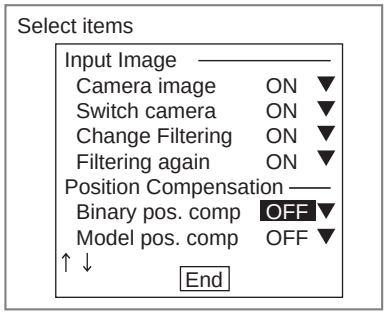
1-3-2 Selecting Installation Processing Items

The F250-UME has many processing items. Select the processing items required for the application. Refer to *SECTION 2 Processing Items Setting Procedures* for an outline of each processing item.

1. Select ***Select items***.

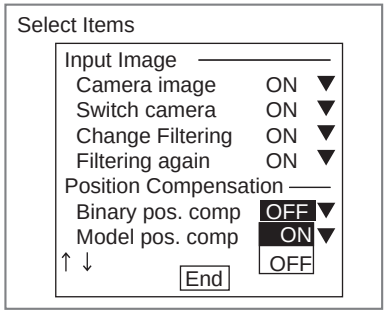


A list of processing items will be displayed.



2. Move the cursor to the item to be installed.
3. If that item is "OFF," press the **ENT** Key.

   The selections (ON/OFF) will be displayed.



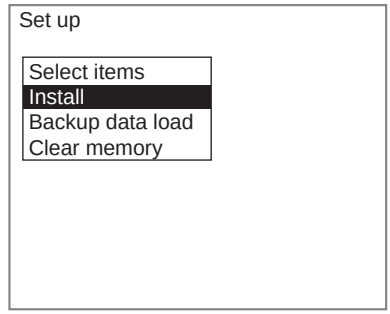
4. Select ***ON***.
5. Repeat this process to set to ON the processing items to be installed and set to OFF the items that are not to be installed.
6. Select ***END***.

   The settings will be registered and the screen in (1.) will return.

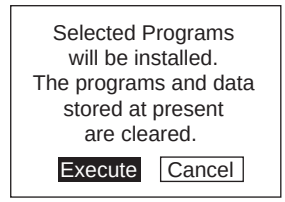
1-3-3 Executing Installation

This section describes how to install the selected processing items to the Controller.

1. Select ***Install***.



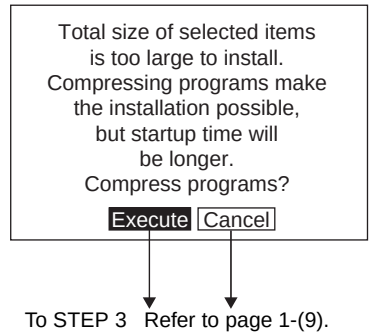
A confirmation message will be displayed.



2. Select ***Execute***.

The size of the processing items will be calculated to determine if they can be installed.

If the total size of the selected processing items is too large to be installed, a confirmation message will be displayed to ask if the files are to be compressed.

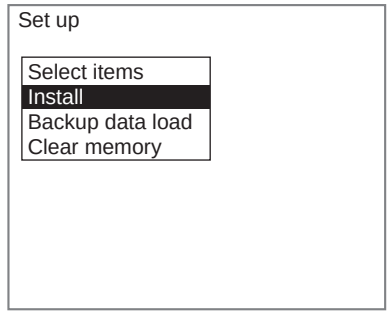


Precaution Do not input the RESET signal or turn OFF the power supply while the processing message is being displayed. If the RESET signal is input or the power is turned OFF, data may be lost and the Controller may not start correctly the next time.

A confirmation message will be displayed once the installation has been completed.

3. Press the **ENT** Key.

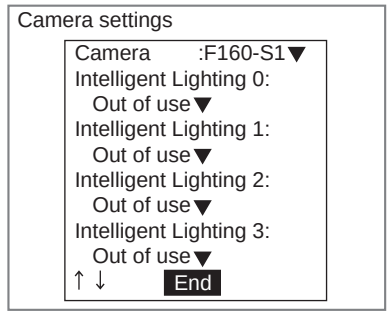
   The Main Screen for the Setup Menu will return.



4. Turn OFF the power supply to the Controller.
5. Remove the F250-UME from Memory Card slot 0.
6. Turn ON the Controller power supply.

CHECK If the power is turned ON while the F250-UME is still mounted, the Setup Menus will open. Always remove the F250-UME before turning ON the power supply.

After a while the Camera Settings Screen will be displayed.



SeeAlso Refer to page *SECTION 5 System Settings*.

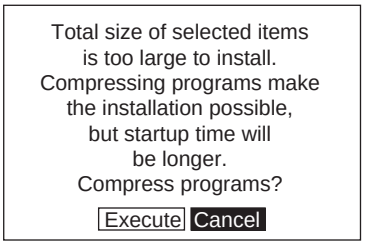
7. Select the camera to be connected.
8. If using Intelligent Lighting, select the model.
9. Select ***END***.

   The Basic Screen will be displayed.

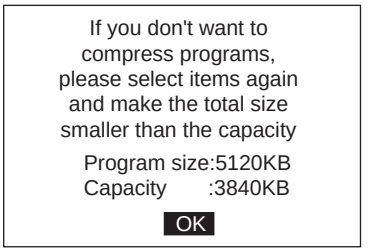
Installation without Compressing Files

If the total program size of the selected items is greater than the file size that can be installed, a confirmation message will be displayed asking if the files are to be compressed. If the files are compressed, the Controller startup time will be longer. Use the following procedure to change the selected processing items without compressing the files.

1. Select ***Cancel*** from the confirmation message.

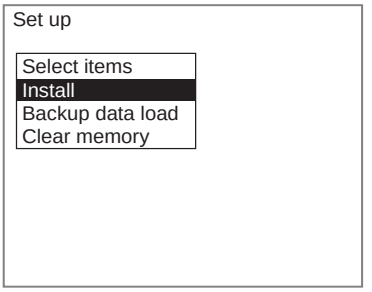


The program size and capacity will be displayed.



2. Select ***OK***.

The Main Screen for the Setup Menu will return.



3. Select ***Select items*** and reselect the items so that the memory capacity is not exceeded.

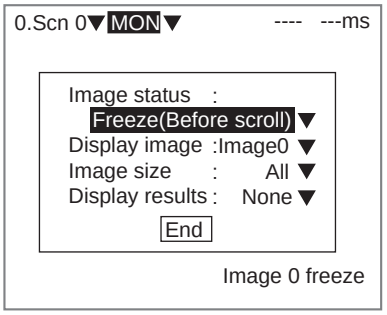
SeeAlso Refer to page 1-(6).

1-4 Displaying Images and Focussing

This section explains how to check what kind of image is being displayed by changing the display image to through display and how to adjust the position of the measurement object and focus the camera.

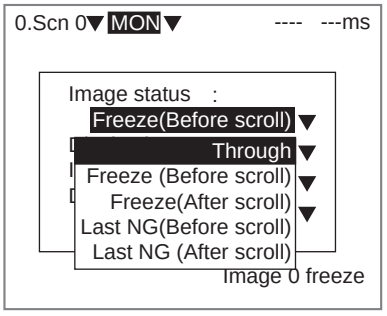
1. Change the display image to through display to check what kind of image is being displayed by pressing the **SHIFT + ESC** Keys.

The screen for changing the display image will be displayed.



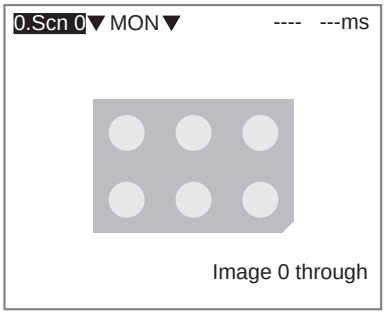
2. Move the cursor to ***Freeze (Before Scroll)***.
3. Press the **ENT** Key.

   A list of options will be displayed.

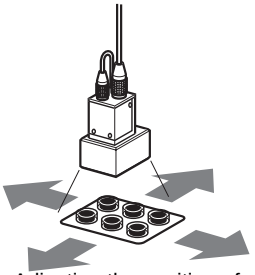


4. Select ***Through***.
5. Select ***End***.

The Through Display Screen will be displayed.



6. Adjust the position of the measurement object so that it appears at the center of the monitor screen.



Adjusting the position of the measurement object.

7. Focus the Camera.
   - Cameras with a light (including Intelligent Lighting) have lenses with a fixed focal point. Adjust the Camera position based on the positioning distances in the *Setup Manual* to focus the Camera.

CHECK

The light level for Intelligent Lighting can be adjusted from the Controller. Refer to page 1-(31).

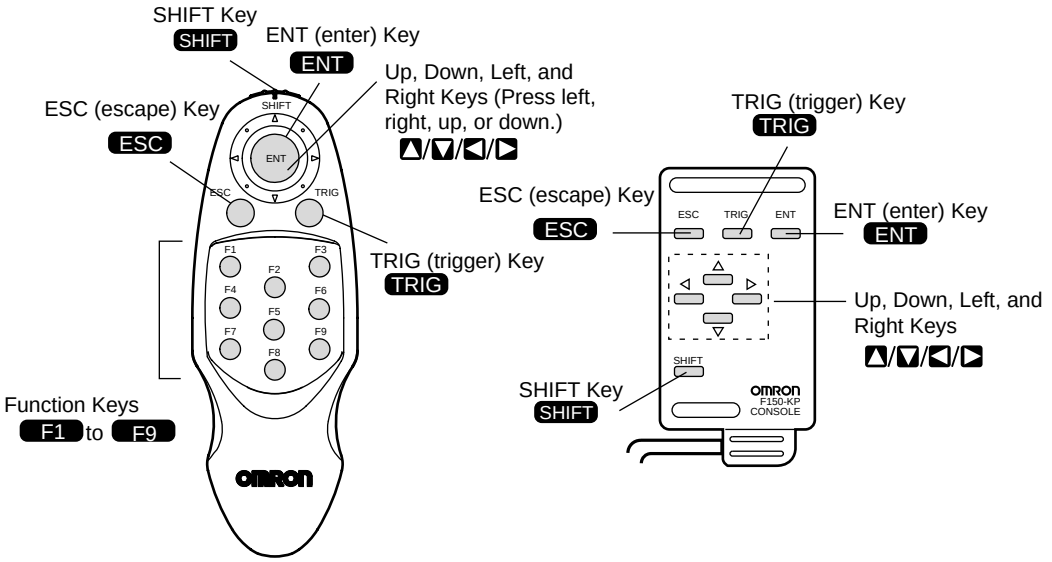
- When using a Camera Unit that does not have a light, turn the focus ring to focus the Camera.

1-5 Menu Operations

1-5-1 Input Devices

Menu operations are performed from either the Console or the serial interface.

■F160-KP Console ■F150-KP Console

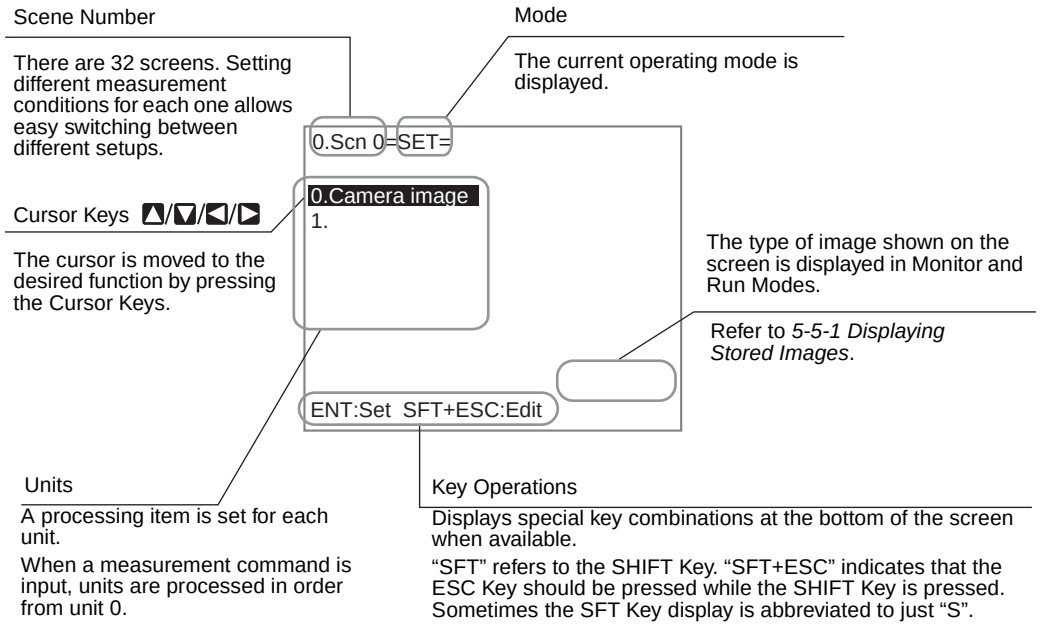


Key	Function
ESC: Escape Key	Returns the user to the previous menu display or operation.
TRIG: Trigger Key	Starts object measurement.
ENT: Enter Key	Executes a function or sets a value. Note: On the F160-KP, also functions as a Cursor Key.
SHIFT Key	Must be pressed in combination with another key to have any effect. Specific functions are assigned to combinations of the SHIFT Key and other keys for specific screens.
Up, Down, Left, and Right Keys	The Up and Down Keys are used to move the cursor up and down and also to set values. The Up Key will increase a value by 1 and the Down Key will decrease a value by 1. Hold down the Up or Down Key to quickly increase or decrease a value. The Left and Right Keys are used to move the cursor left or right.
Function Keys	Functions can be assigned to function keys F1 to F8. Refer to *5-4-1 Changing Console Key Allocations*. The display can be captured using F9. Refer to *5-4-2 Capturing and Saving Images*.

CHECK Menu operations can be performed from a personal computer via a serial interface. Refer to *6-4 Serial Interface Menu Operations*.

1-5-2 Screen Displays

The Application Software is operated by selecting functions from menus displayed on the screen. Familiarize yourself with each function before operating the Controller.



Mode

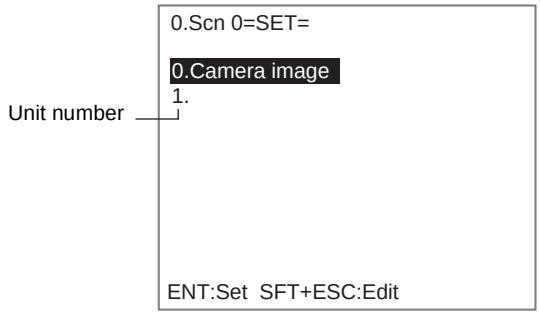
Display	Meaning
SET	Used to set the inspection conditions.
MON (Monitor)	Used to check whether inspections are being performed correctly under the set inspection conditions. The measurement results are displayed on the monitor only. The results cannot be output to external devices.
RUN	Performs inspection. The measurement results are output to an external device via the parallel interface or serial interface.
SYS (System)	Used to set system conditions.
TOOL	Used to save settings and images to a computer as backup.
SAVE	Used to saves data to flash memory in the Controller. If new settings have been made, be sure to save the data before quitting.

1-5-3 Creating Flowcharts

In the Application Software, measurement processing is broken up into different processing items to facilitate a variety of applications.

Flowcharts are created using a combination of processing items to suit each application.

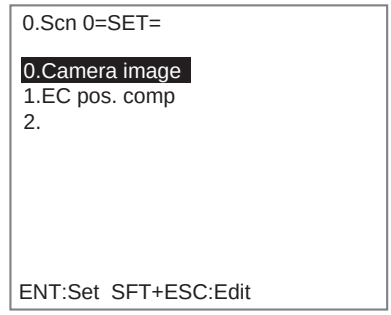
When Set Mode is entered, the number 1 will be displayed below 0.*Camera image*. This number is called the unit number. Processing items set for the unit numbers.



CHECK "Camera image" is set for unit 0 as the default processing item.

The processing items are set in order from unit 0.

Once a processing item is set for unit 1, unit 2 will automatically be displayed.

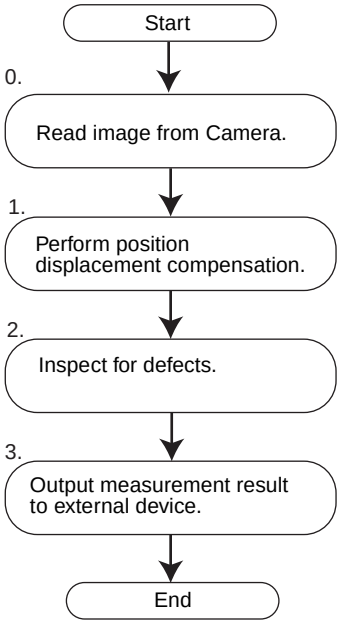


CHECK There is no limit to the number of units. Any number of units can be set provided the Controller has enough free memory.

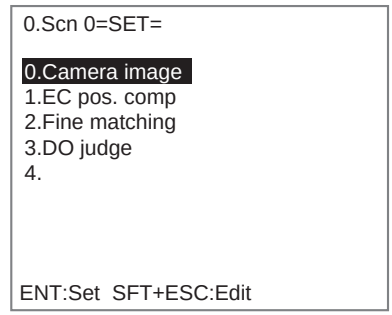
SeeAlso Refer to *SECTION 5 System Settings* for information on how to check the remaining free work memory (main memory) space.

When a measurement command is input, the processing will be executed in order from the item set to unit 0. Register processing items for each unit, just like creating a flowchart.

Flowchart Image

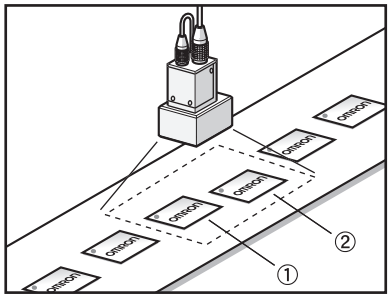


Screen Image

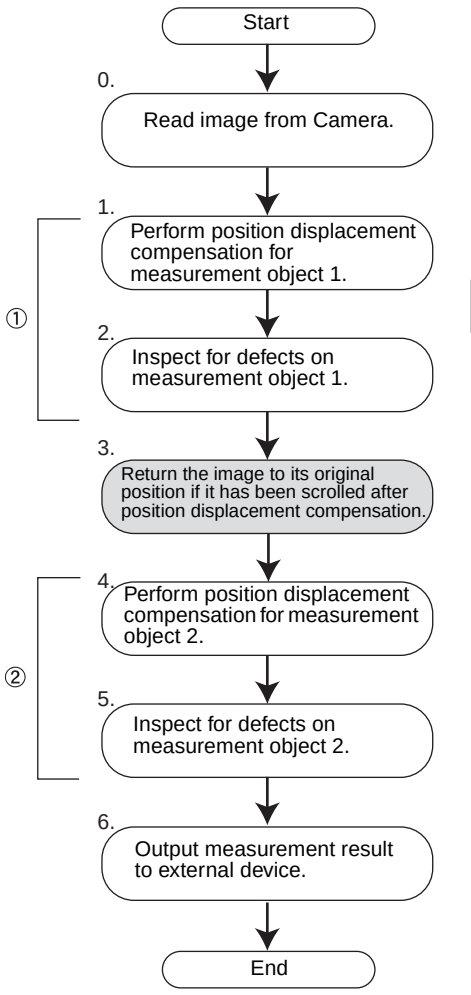


The following type of processing is also possible by adjusting the registered order.

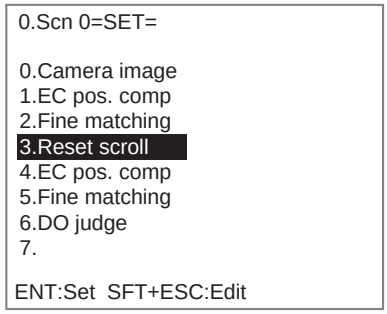
Example: Performing Position Displacement Compensation for Two Measurement Objects in the Same Field of Vision



Flowchart Image

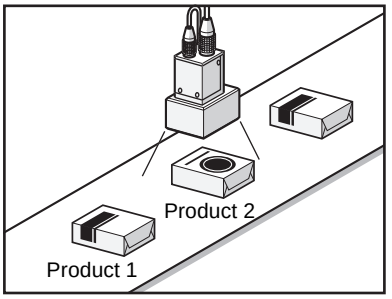


Screen Image

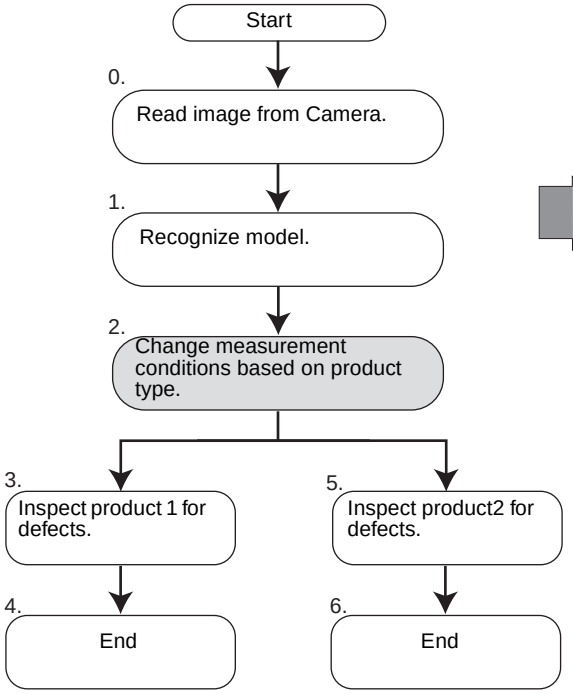


The Application Software also has branch control processing items.

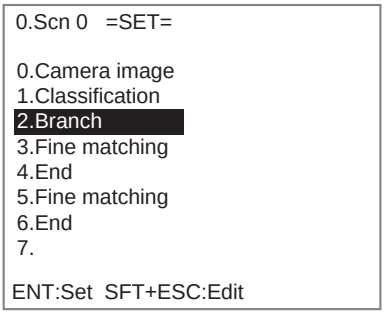
Example: Changing Inspection Conditions Based on the Upcoming Product



Flowchart Image



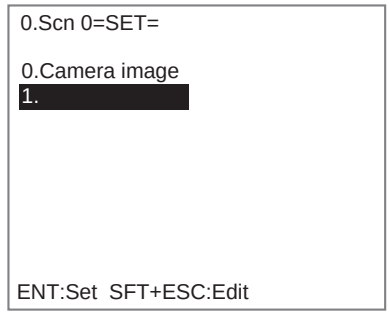
Screen Image



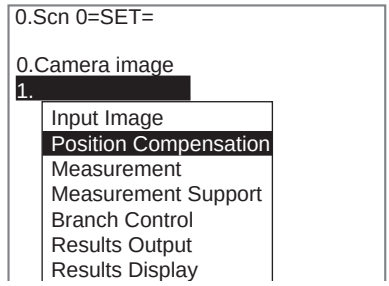
Registering Processing Items to Units

The registration procedure will be explained using the example of registering binary position compensation, one of the position compensation processing items. Change the procedure as required to register other processing items.

1. Move the cursor to a free unit number and press the **ENT** Key.

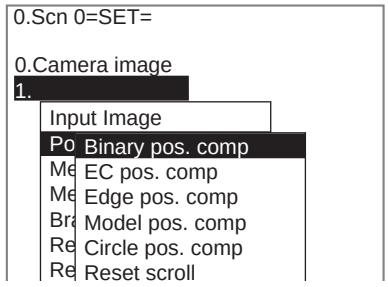


The processing item groups will be displayed.



2. Select ***Position Compensation***.

A list of the installed position compensation processing items will be displayed.

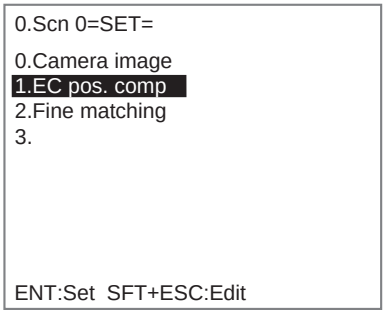


3. Select ***Binary pos. comp.***

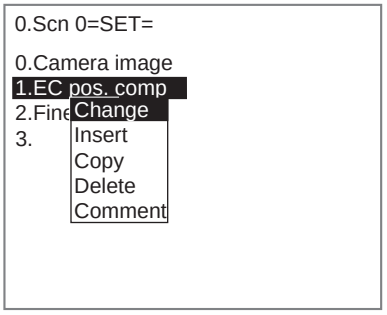
Binary position compensation will be set for unit 1 and the next unit number (unit 2 in this case) will be displayed.

Changing to Other Processing Items

1. Move the cursor to the unit number of the processing item to be changed. Press the **SHIFT+ESC** Keys.

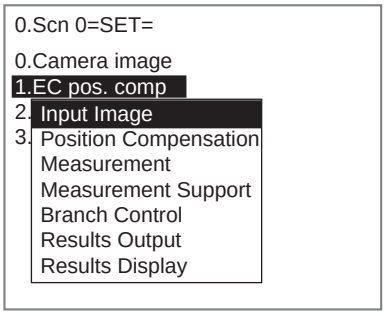


A list of options will be displayed.



2. Select ***Change***.

   A list of processing items will be displayed.

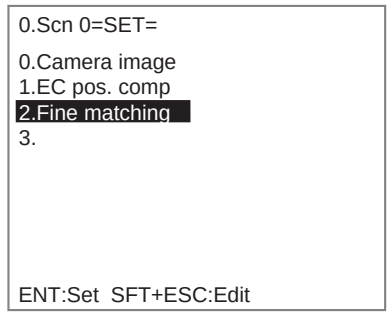


3. Use the same procedure as for registering new processing items to register a different item.

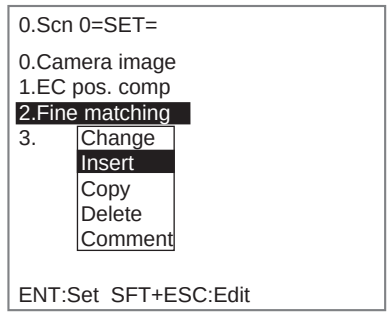
Inserting Units

CHECK When a unit is inserted, the subsequent unit numbers will be increased. The unit numbers set in other units for outputting results and branching will also be increased automatically.

1. Move the cursor to the unit number where a new unit is to be inserted. Press the **SHIFT+ESC** Keys.

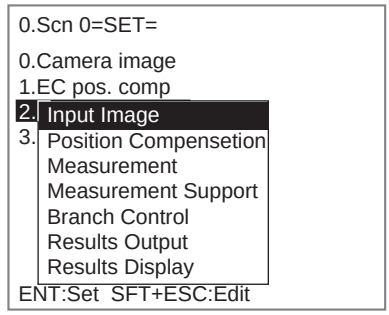


A list of options will be displayed.



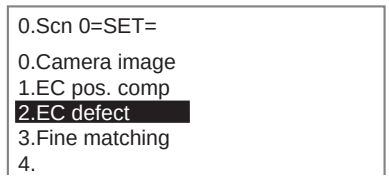
2. Select ***Insert***.

   A list of processing items will be displayed.



3. Use the same procedure as for registering new processing items to register items for the inserted unit.

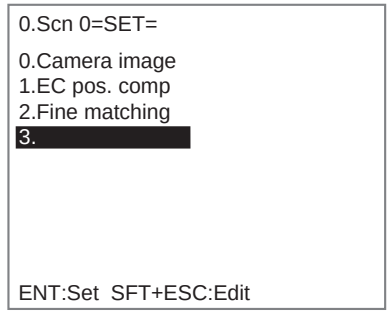
   The selected processing item will be inserted.



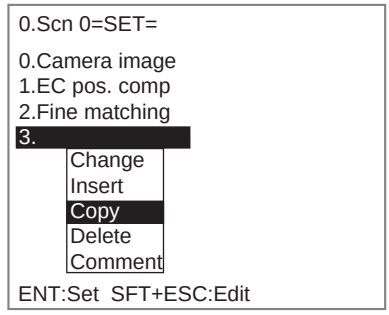
Copying from Other Units

Settings data can be copied, which is convenient for reusing data when only a part of the settings need to be changed.

1. Move the cursor to the unit where the data to be copied is located. Press the **SHIFT+ESC** Keys.

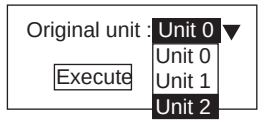


A list of options will be displayed.



2. Select ***Copy***.

   A screen for selecting the source unit for the data to be copied will be displayed.



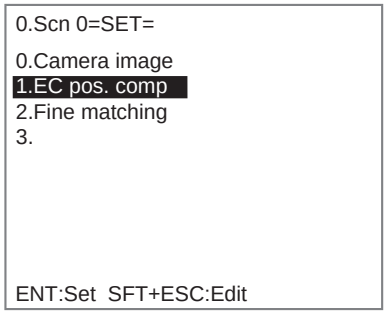
3. Select the appropriate unit number.
4. Select ***Execute***.

   The data will be copied.

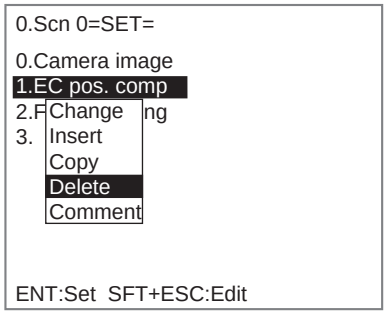
Deleting Units

CHECK When units are deleted, the subsequent unit numbers will be decreased. The unit numbers set in other units for outputting results and branching will also be reduced automatically.

1. Move the cursor to the unit to be deleted.
   Press the **SHIFT+ESC** Keys.

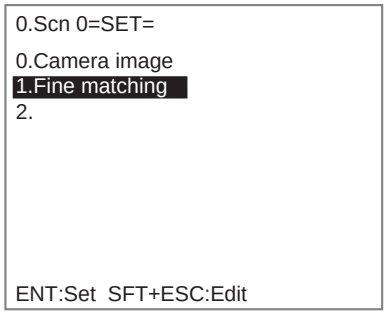


   A list of options will be displayed.



2. Select ***Delete***.

   The selected unit will be deleted and the subsequent unit numbers will be moved up one.

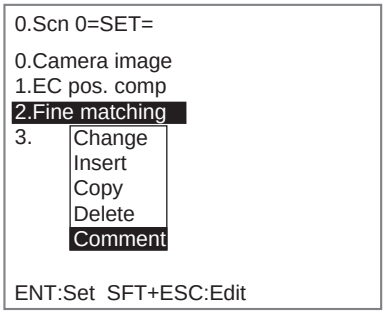


Changing Processing Item Names

The names of processing items set to units can be changed to any name up to 16 characters long. This is a useful function for easy understanding of the settings and when setting the same processing item to many units.

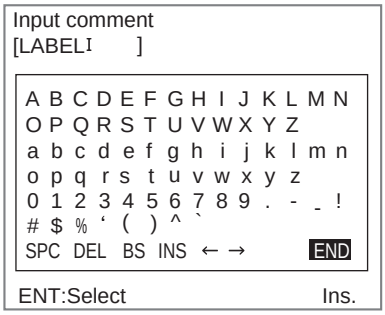
1. Move the cursor to the unit for which the name of the processing item is to be changed. Press the **SHIFT+ESC** Keys.

A list of options will be displayed.



2. Select ***Comment***.

   A software keyboard will be displayed.



SeeAlso Refer to page 1-(27) for information on inputting characters.

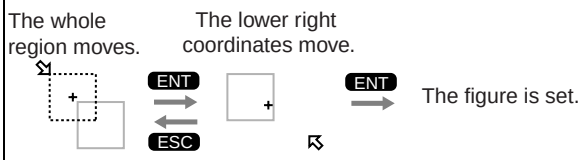
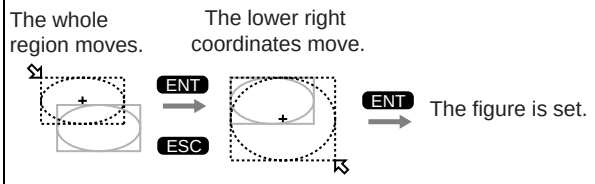
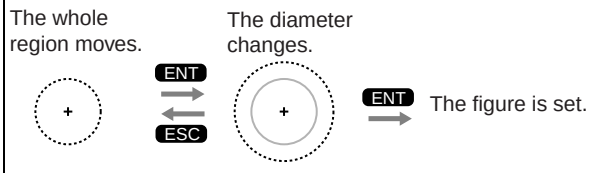
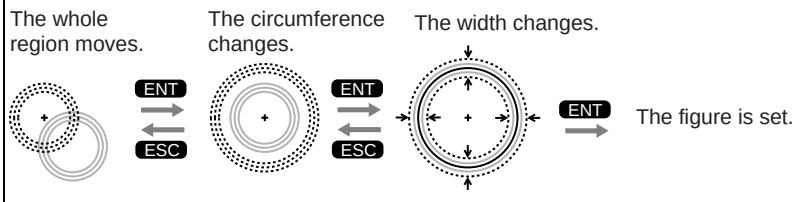
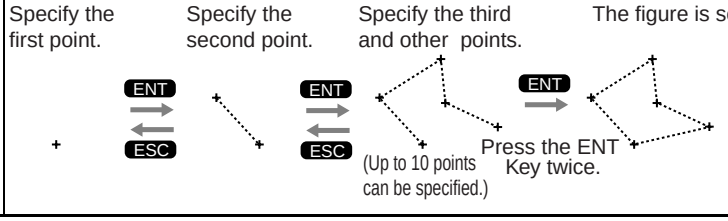
3. Set an item name of up to 16 characters long.
4. Move the cursor to **END** and press the **ENT** Key.

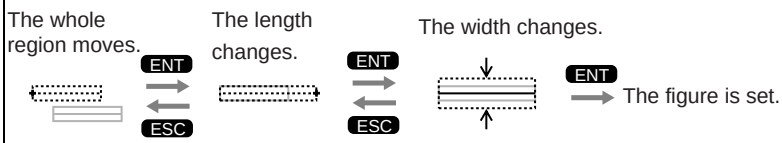
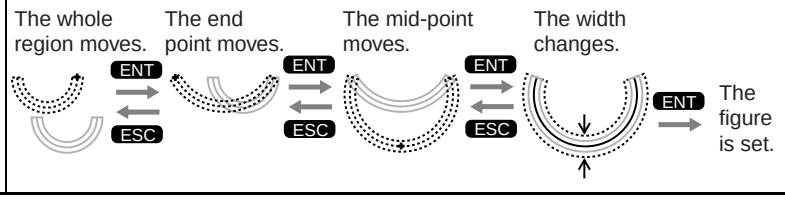
   The item name will be changed.

1-5-4 Drawing a Region

Use the following method to draw model regions and measurement regions. The region figures that can be drawn depend on the processing item. Refer to the explanation for each processing item for information on what figures can be drawn.

Move the cursor with the **Up**, **Down**, **Left**, and **Right** Keys. Use these keys together with the **SHIFT** Key to move the cursor quickly. Press the **ENT** Key at the desired positions and press the **ESC** Key to undo the setting.

Measurement region selection	Drawing method
Box	
Ellipse	
Circle	
Circumference	
Polygon	

Measurement region selection	Drawing method
Line	
Arc	

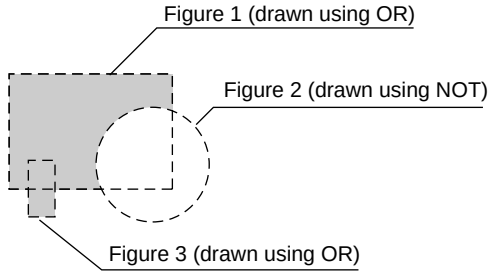
Drawing Mode

For many processing items, up to 3 figures can be combined to draw a measurement region. Select either the OR or NOT drawing mode.

Drawing mode	Function
OR	Use this mode to draw a shape as a model or measurement region. All of the shapes that are drawn are registered as one region.
NOT	Use to delete part of a region.

In this example, the gray area will be the measurement region.

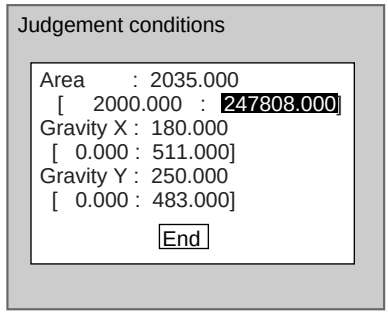
Regions with complicated shapes can be drawn and areas can be omitted from the measurement region by combining figures.



1-5-5 Inputting Values

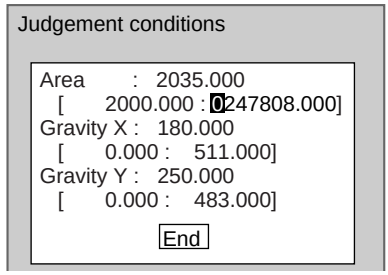
This section explains how to input values when setting measurement conditions or communications specifications.

1. Move the cursor to the item for which a value is to be changed.



2. Press the **ENT** Key.

   The cursor will change to a cursor the size of a single digit.



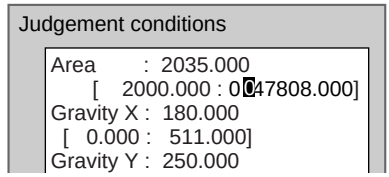
3. Move the cursor to the digit to be changed.

   Use the **Left** and **Right** Keys to move the cursor.

4. Change the value.

   Use the **Up** Key to increase the value.

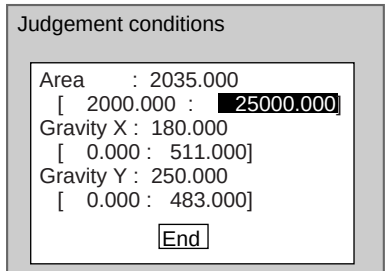
   Use the **Down** Key to decrease the value.



5. Repeat these steps to change other values.

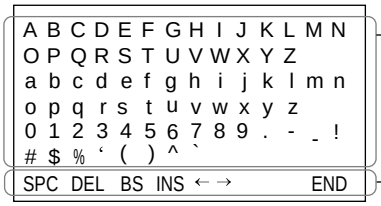
6. Press the **ENT** Key.

   The values will be set.



1-5-6 Inputting Characters

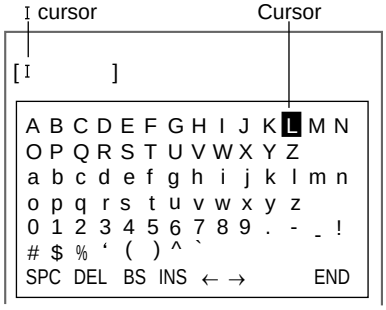
This section explains how to input characters. The software keyboard shown below is displayed on the screen where characters are input.



These characters can be input.

SPC	Inserts a space.
DEL	Deletes 1character to the right of the I cursor.
BS	Deletes 1character to the left of the I cursor.
INS	Switches between insert (default)/overwrite.
←	Moves the I cursor to the left.
→	Moves the I cursor to the right.
END	Ends character input.

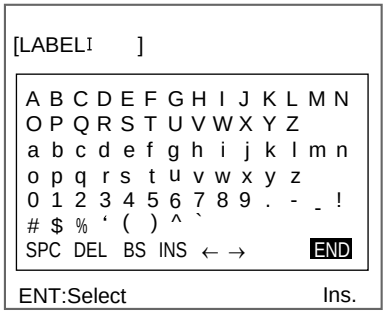
1. Move the cursor to the character to be input.



2. Press the **ENT** Key.

   The character is set and the I cursor moves one space to the right.

3. Repeat these steps to input more characters.
4. Once all required characters have been input, move the cursor to **END**.



5. Press the **ENT** Key.

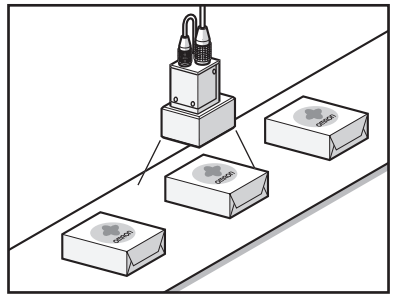
   The characters will be set.

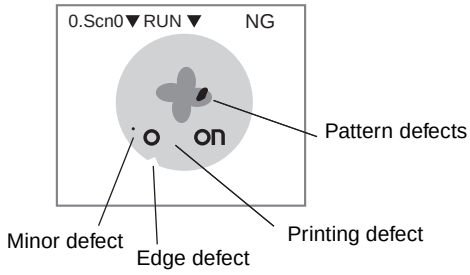
CHECK Characters can be input from a personal computer via a serial interface. Refer to *6.4 Serial Interface (Menu Operations*).

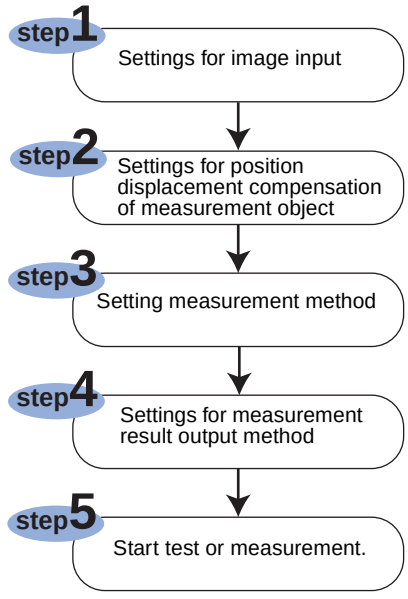
1-6 Basic Operations

This section describes the basic flow of operations up to the setting of measurement conditions and executing measurements. The explanation is based on the use of the Fine Matching processing item for the measurement method.

Detecting Label Defects





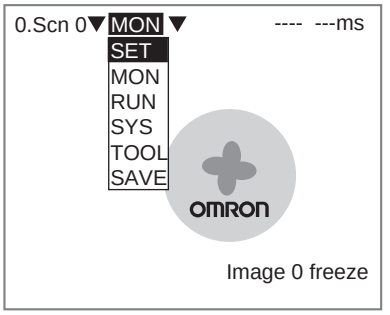


1-6-1 STEP 1: Settings for Image Input

To set the inspection conditions, change first to Set Mode.

When Set Mode is entered, the default processing item for unit 0 will be “Camera image.” The conditions for inputting images are set under this processing item.

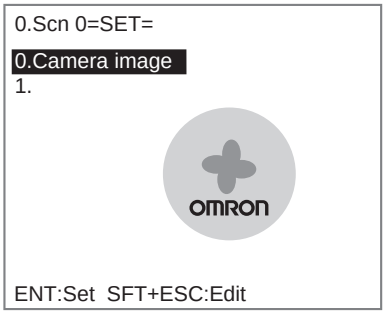
1. Display the Basic Screen and move the cursor to ***MON*** and press the **ENT** Key.



2. Select ***SET***.

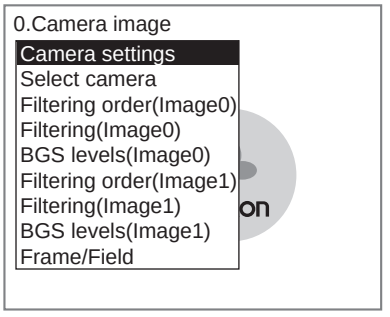
   The initial screen for Set Mode will be displayed.

   Camera Image is the default processing item for unit 0.



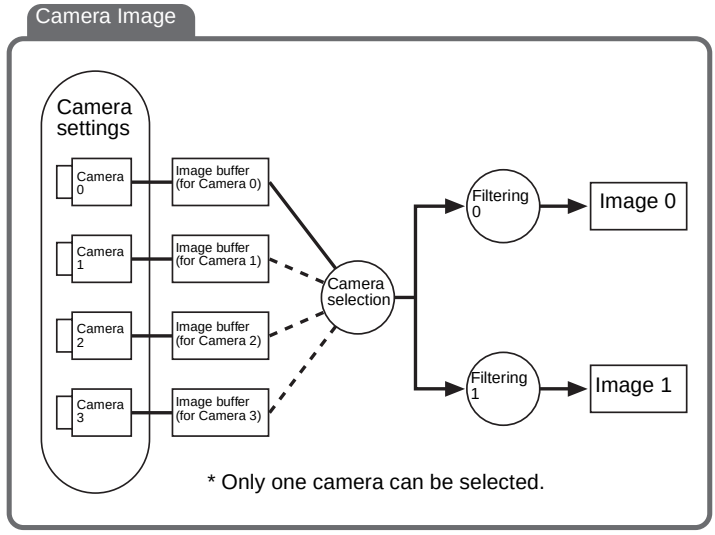
3. Select ***0. Camera image***.

   The initial screen for Camera Image will be displayed.



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).



The Controller has two image memories. 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. Refer to the explanations for each item for details.

In this section where the example of Fine Matching is used, measurements will be performed on Image 0.

1-6-1-1 Camera Settings

Shutter Speed

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

The shutter speed can be changed from the menu for F150-S1A and F160-S1 Cameras only.

For F150-S1A Cameras

Object movement	Shutter speed
Slow	1/100 s
	1/500 s
	1/2000 s
Fast	1/10000 s

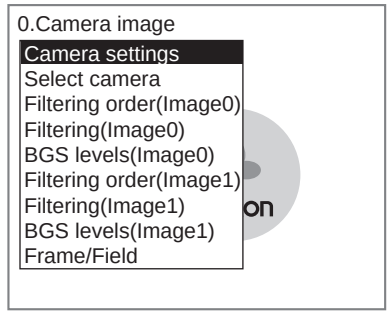
(Default setting: 1/2000 s)

For F160-S1 Cameras

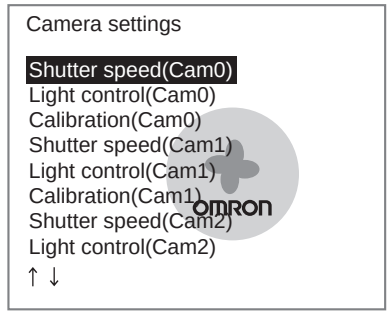
Object movement	Shutter speed
Slow	1/120 s
	1/200 s
	1/500 s
	1/1000 s
	1/2000 s
	1/4000 s
	1/8000 s
Fast	1/20000 s

(Default setting: 1/2000 s)

1. Select ***Camera settings***.

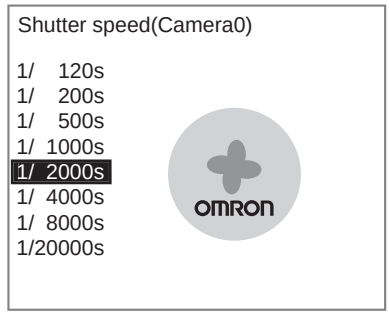


The initial Camera Settings Screen will be displayed.



2. Select ***Shutter speed*** for the Camera to be used.

   The shutter speed selections will be displayed.



3. Select the shutter speed while monitoring the image.
4. Press the **ENT** Key.

   The setting will be registered and the screen in (1.) will return.

Light 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*.

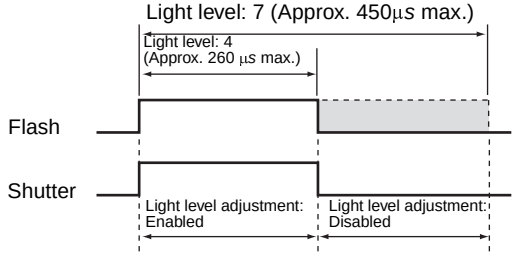
SeeAlso Refer to *5-2 Camera Settings*.

CHECK When the shutter speed is faster than 1/2000 s, the brightness of the lighting may not change even if the light level is changed.

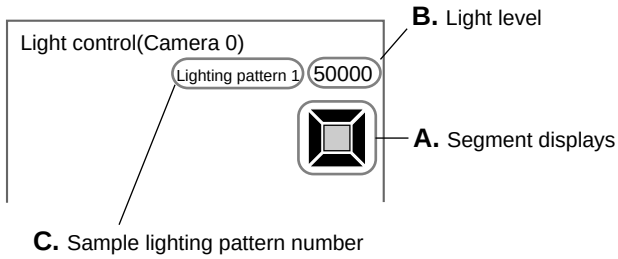
Intelligent lighting uses pulse lighting synchronized with the shutter speed and the light level can be adjusted by changing the pulse width. If the light level is at the maximum setting of 7, the pulse width is approximately 450 μs and the time the shutter is open is about the same as when the shutter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

change) if the shutter speed is faster than 1/2000 s and the light level setting is high.

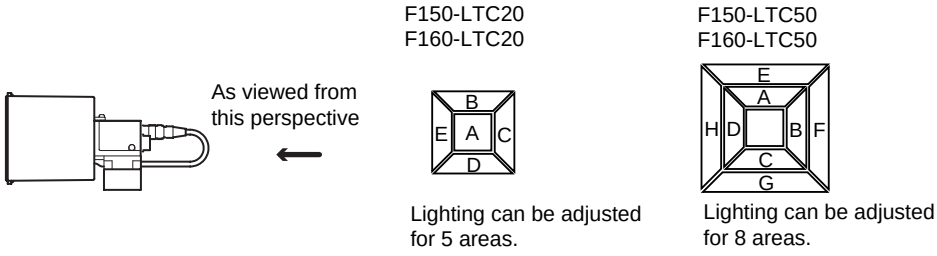
Example: When Shutter Speed is 1/4000 s, Light Level Adjusted to 4



■ Lighting Control Screen



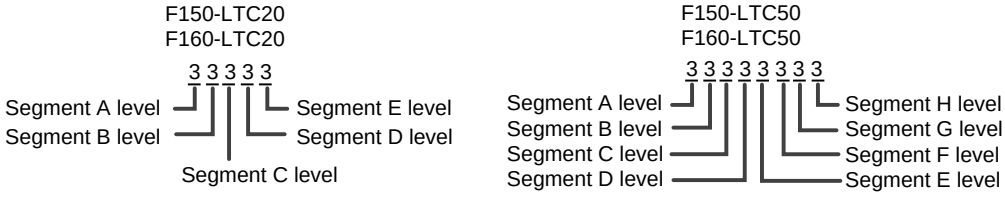
A. Segment Display



CHECK The lit segments are displayed with thick lines. The brightness depends on the set light level. Refer to page 1-(33).

B. 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.



C. Number of Sample Lighting Patterns

There are 15 sample lighting patterns registered in advance.

■ 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

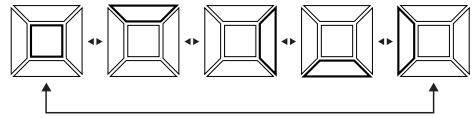
Pattern No.	Light level	Pattern No.	Light level	Pattern No.	Light level	Pattern No.	Light level	Pattern No.	Light level
1	77777777 	4	00004444 	7	07070707 	10	00700000 	13	00000700 
2	44440000 	5	00007777 	8	70000000 	11	00070000 	14	00000070 
3	77770000 	6	70707070 	9	07000000 	12	00007000 	15	00000007 

■ Adjustment Method 2: Adjusting Light Levels by Segment

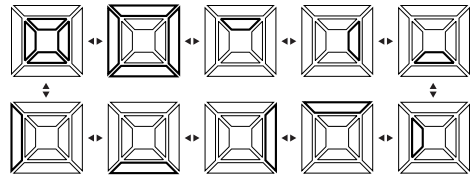
The light level for each segment can be set separately to a value between 0 and 7. The setting "0" represents the unlit state, and the higher the setting value the higher the light level. Light levels can also be set by adjusting the light levels for the segments separately after selecting a sample lighting 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.

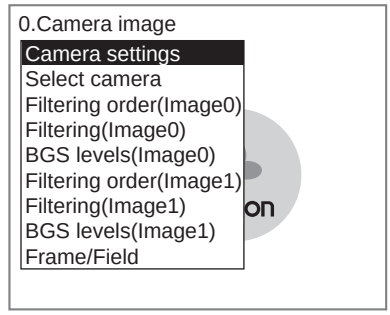
F150-LTC20, F160-LTC20



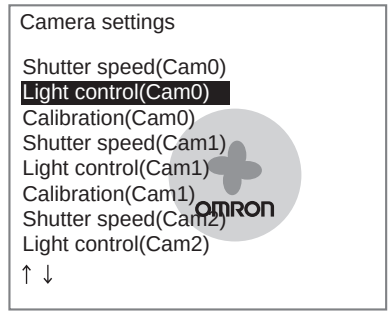
F150-LTC50, F160-LTC50



1. Select ***Camera settings***.

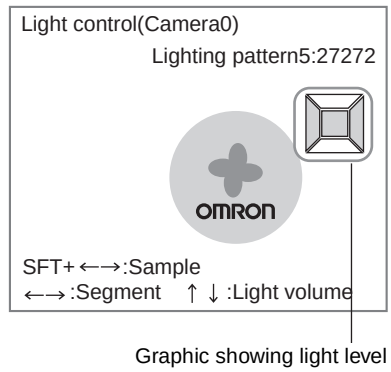


The initial Camera Settings Screen will be displayed.



2. Select ***Light control*** for the Camera number being used.

The Light Control Settings Screen will be displayed.



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

CHECK 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.

4. Press the **ENT** Key.

   The setting will be registered and the screen in (1.) will return.

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.

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

Set the relationship between the physical coordinates and the camera coordinates to convert the measurement results from pixels to physical units, such as μm, mm, or cm.

This section gives an outline only. Refer to *2-1 Inputting Camera Images* for details on calibration.

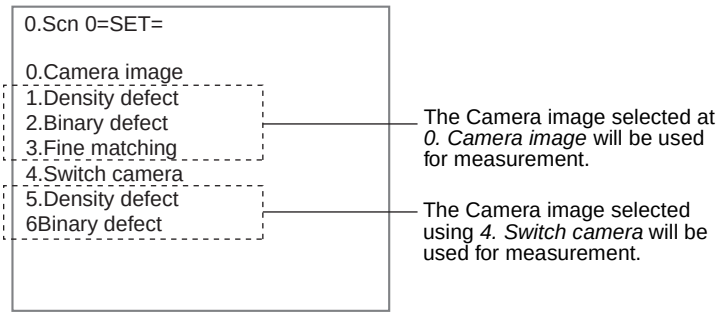
CHECK To output measurement results in physical units, set *Coordinate mode/Calibration* to *ON* for each processing item.

If *Calibration* remains set to *OFF*, the default settings will remain, and measurements using the Camera coordinates will be output.

1-6-1-2 Selecting the Camera

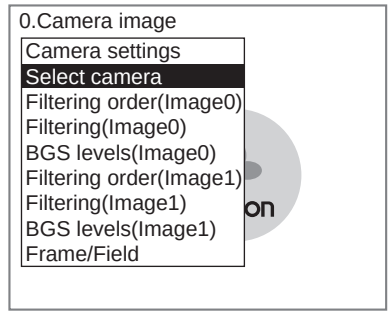
Up to 4 Cameras can be connected. The Select Camera setting is used to select the Camera image that will be used for measurement.

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.

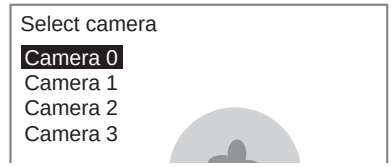


Note *Switch camera* only switches between the images saved to Image 0 and Image 1 from the image buffers. New images cannot be sent to the image buffers using this processing item.

1. Select ***Select camera*.**



A list of Camera numbers will be displayed.

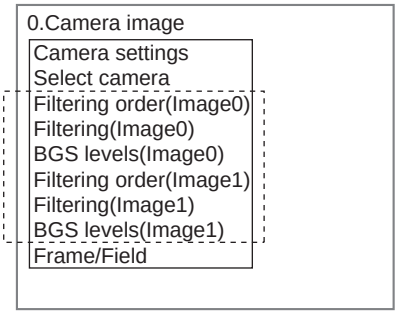


2. Select the number of the Camera to be used.
3. Press the **ENT** Key.

   The setting will be registered and the screen in (1.) will return.

1-6-1-3 Filtering

The image read by the Camera can be manipulated to create an image that is easier to measure. Image filtering is set by using 3 functions: Filtering Order, Filtering, and BGS Levels.



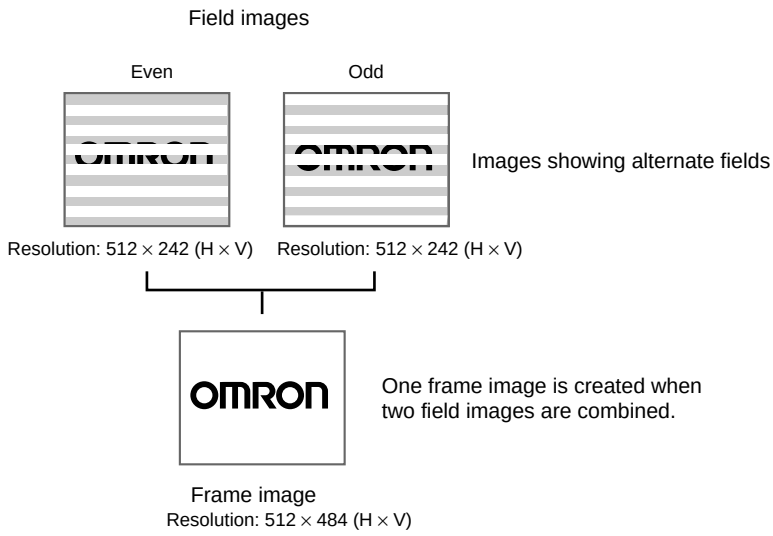
The Controller has two image memories, and Filtering, BGS Levels, and Filtering Order can be set for each.

This section gives an outline only. Refer to *2-1 Inputting Camera Images* for details on filtering.

1-6-1-4 Frame/Field

The Frame/Field function is used to select the unit for one image. Normally, it is sufficient to use the default setting of *Frame*.

If the unit is changed to *Field*, the resolution in the vertical direction is halved but the image input time is reduced, allowing faster processing.



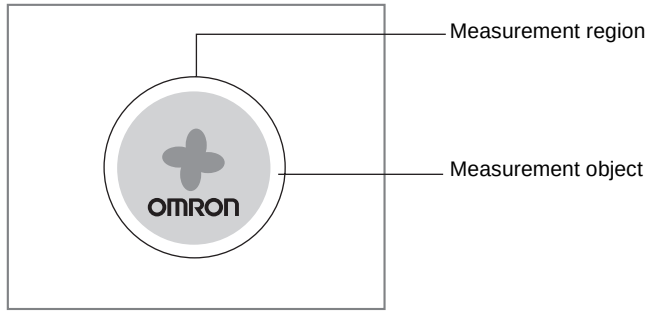
This section gives an outline only. Refer to *2-1 Inputting Camera Images* for details on Frame/Field.

1-6-2 STEP 2: Settings for Position Displacement Compensation

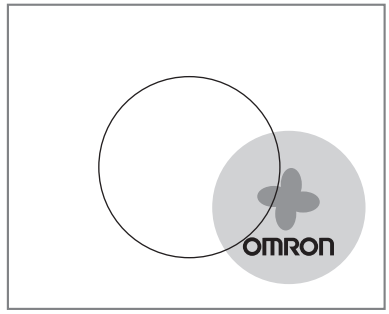
The position displacement compensation processing items are used when the position and orientation of measurement objects are not consistent. By using this function, the displacement between a reference position and the current position is obtained, and this displacement is compensated for in measurements.
Select the position compensation processing items suitable for the measurement object.

Reference Position

The reference position is used so that the measurement region and measurement object are in the correct positions.



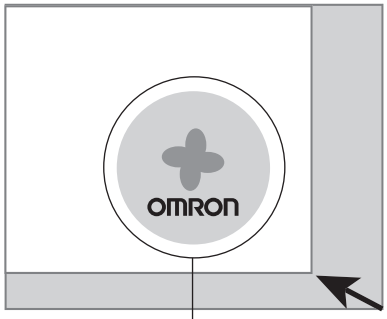
Measurement Object Displaced



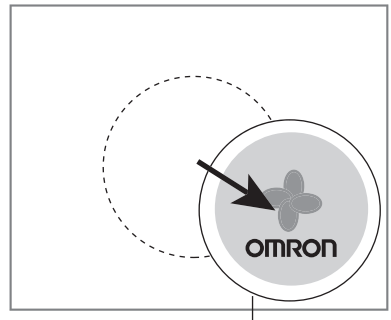
Without compensation, measurement is performed with part of the measurement object outside the measurement region.

By making position displacement compensation settings...

Measurement is performed after the image is returned to the reference position.



Measurement is performed after the measurement region is moved to compensate for the displacement.

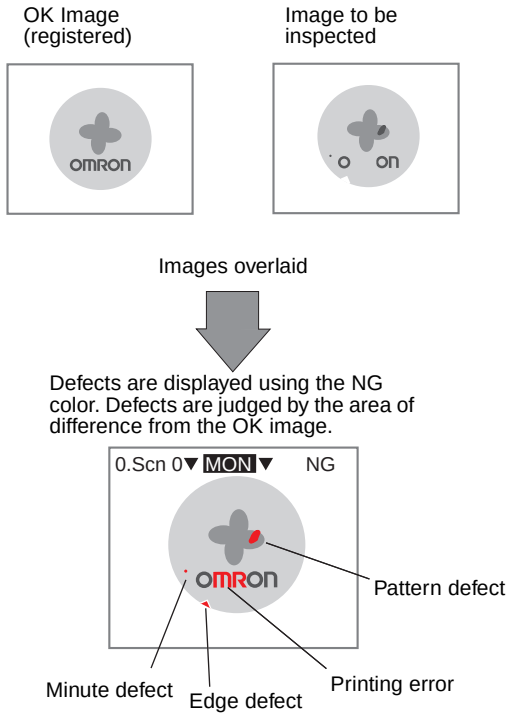


In either case, measurement is performed with the whole measurement object in the measurement region.

1-6-3 STEP 3: Setting Measurement Methods

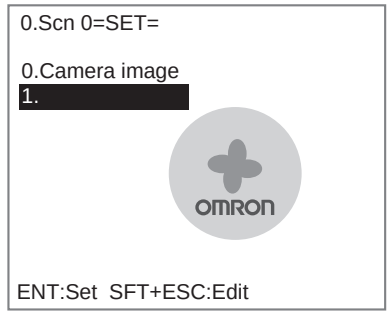
This section describes how to inspect for defects using the Fine Matching processing item.

The registered image for an acceptable product and the input image are overlaid (matched) and the differences are detected. This enables small defects in the pattern and writing on the measurement object to be detected with a high level of accuracy.

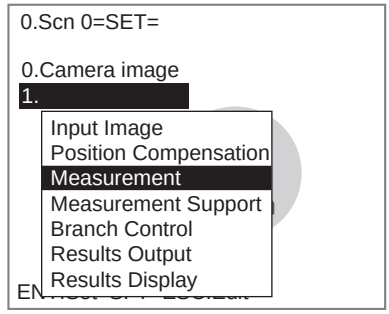


Use the following procedure to set Fine Matching for unit 1.

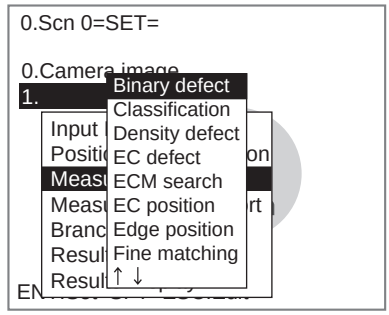
1. Move the cursor to unit 1 and press the **ENT** Key.



The processing item groups will be displayed.



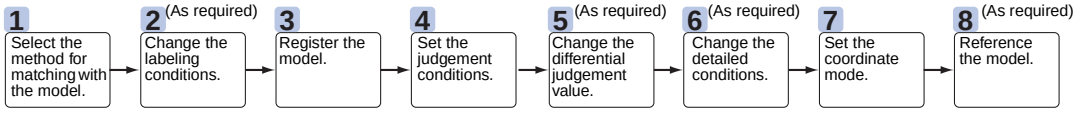
2. Select ***Measurement***.
   A list of processing items will be displayed.



3. Select ***Fine matching***.
   Fine Matching will be set for unit 1.

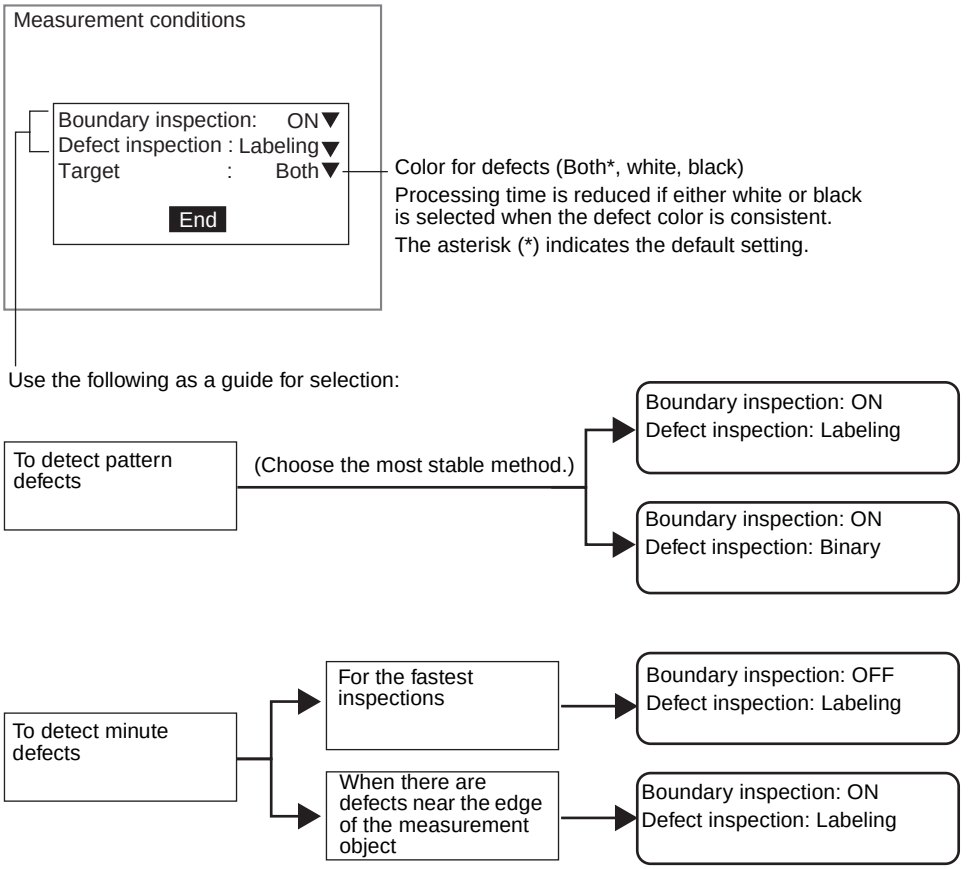
CHECK If processing items are set for units after the unit to which Fine Matching has been set, care must be taken when manipulating images. Refer to page 1-(57).

Operational Flow



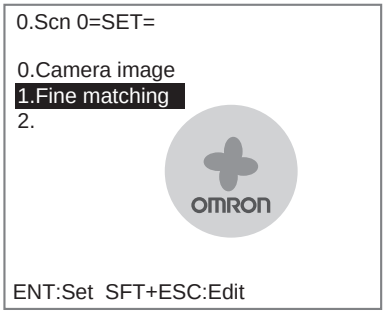
1-6-3-1 Selecting the Method for Matching with Model

This section describes how to select a matching method suitable for the measurement object.

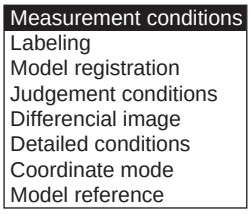


HELP Refer to page 1-(43) for information on boundary inspection and defect inspection methods.

1. Select ***Fine matching***.

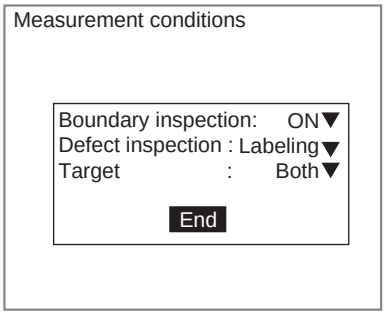


The initial screen for fine matching will be displayed.



2. Select ***Measurement conditions***.

   The Measurement Conditions Settings Screen will be displayed.



3. Make the settings for each item.
4. Select ***End***.

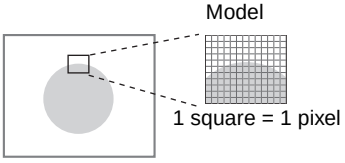
   The setting will be registered and the screen in (1.) will return.

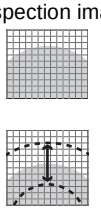
HELP Boundary Inspections

Boundary inspections match the boundary areas (areas where the density changes).

- OFF
  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.

SeeAlso See page 1-(53).





If the measurement object is displaced slightly higher, the boundary will be detected as differing from the registered model.

When Boundary inspection is OFF: The range of pixels set for the boundary level are excluded from the measurement on both sides of the boundary.

- ON*
  The whole area is inspected and defects near the boundary will 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.

  The asterisk (*) indicates the default setting.

SeeAlso See page 1-(53).

Dilated Model

Example: Dilation by 3 pixels when the boundary level is set to 3.

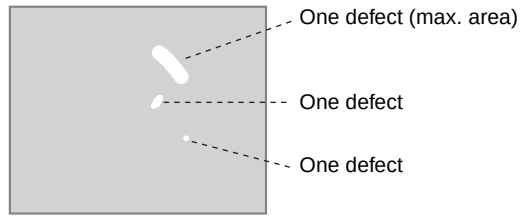
Eroded Model

Example: Erosion by 3 pixels when the boundary level is set to 3.

HELP Defect Inspection Methods

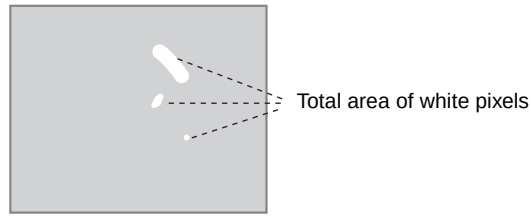
An image showing the difference between the model image and inspection image will be converted internally to a binary image. The method for inspecting defects from those binary images is selected here.

- Labeling*
  One group of white pixels is detected as one label and one label that matches the set conditions will be evaluated to determine if it is a defect or not.



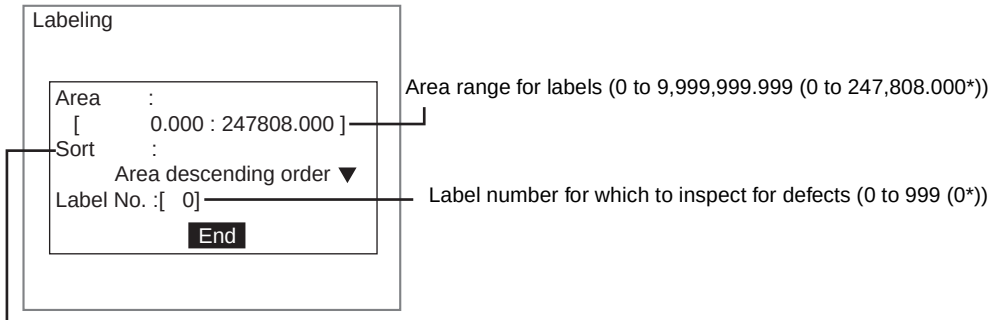
  The asterisk (*) indicates the default setting.

- Binary
  The total area of the white pixels is evaluated to determine if there are defects or not.



1-6-3-2 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.

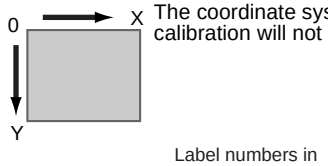


Conditions for reassigning label numbers

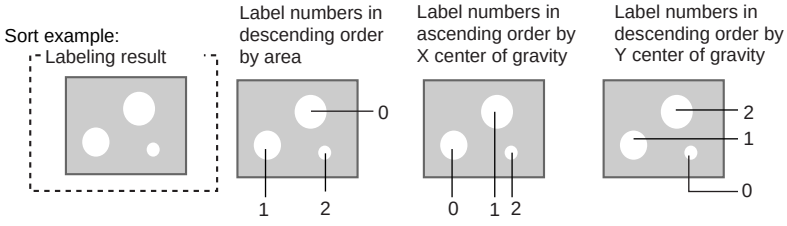
Area descending order:*	Sorts in descending order by area.
Area ascending:	Sorts in ascending order by area.
Gravity X descending:	Sorts in descending order by center of gravity X coordinate. (See note.)
Gravity X ascending:	Sorts in ascending order by center of gravity X coordinate. (See note.)
Gravity Y descending:	Sorts in descending order by center of gravity Y coordinate. (See note.)
Gravity Y ascending:	Sorts in ascending order by center of gravity Y coordinate. (See note.)

The asterisk (*) indicates the default setting.

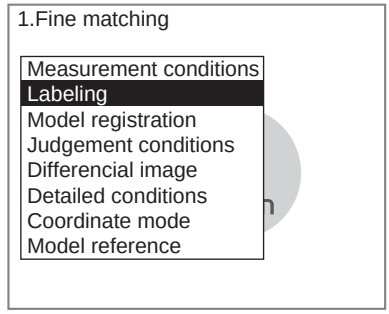
Note When X and Y center of gravity are sorted, the upper left corner of the screen is the origin.



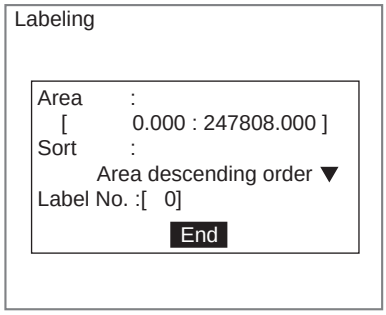
The coordinate system set under calibration will not be affected.



1. Select ***Labeling***.



The Labeling Conditions Settings Screen will be displayed.



SeeAlso Refer to page 1-(26) for information on inputting values.

2. Change the settings.
3. Select ***End***.

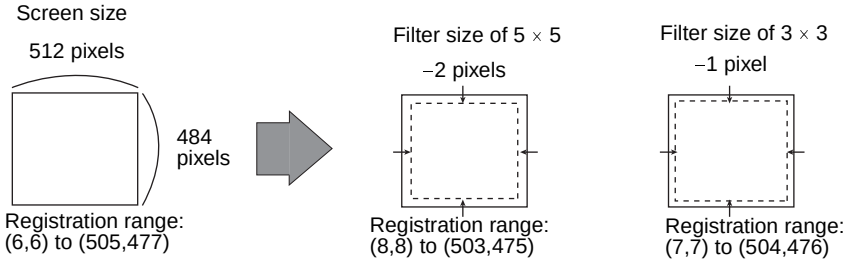
   The settings will be registered and the screen in (1.) will return.

1-6-3-3 Registering Models

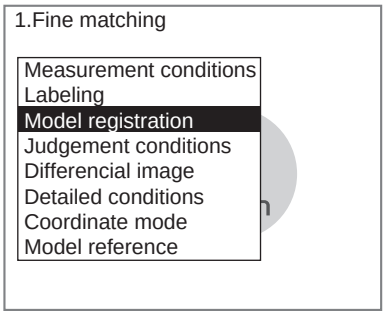
An image of an acceptable product is registered as the model. The image of the measurement object read by the Camera is compared with this model and defects are detected where there are differences from the model.

CHECK The image stored to Image 0 is used as the measurement image for Fine Matching.

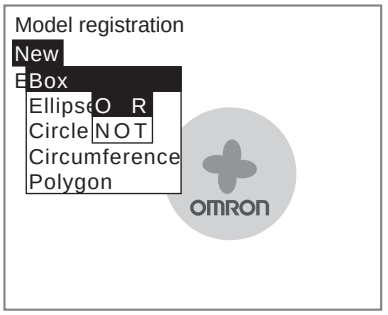
CHECK The model registration range is (6,6) to (505,477).
If pre-processing (filtering) is set for the measurement image, the range that can be registered will be reduced further.



1. Select ***Model registration***.

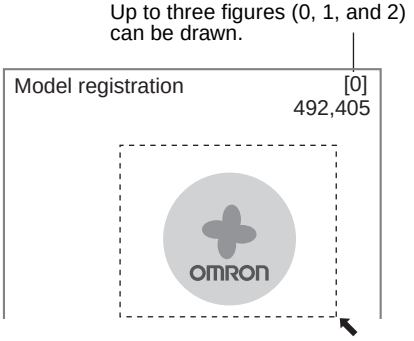


The Model Registration Screen will be displayed.



SeeAlso Refer to page 1-(24) for methods for drawing regions.

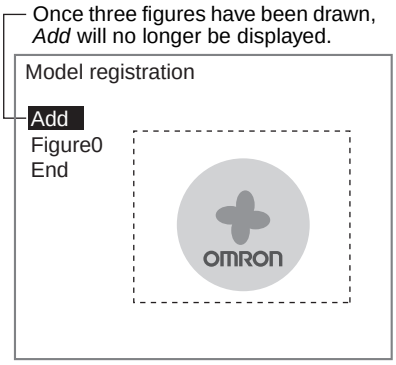
2. Select ***New***.
3. Select the desired figure.
4. Select the desired drawing mode (***OR***/***NOT***).
   An arrow cursor will appear.



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

CHECK The range that can be registered as a model is (6,6) to (505,477).

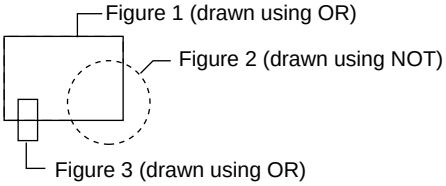
The figure will be registered.



6. If additional figures are to be drawn, select ***Add***.
7. Repeat steps 3 to 5 as necessary to create the desired shape.
8. After drawing is completed, select ***End.***

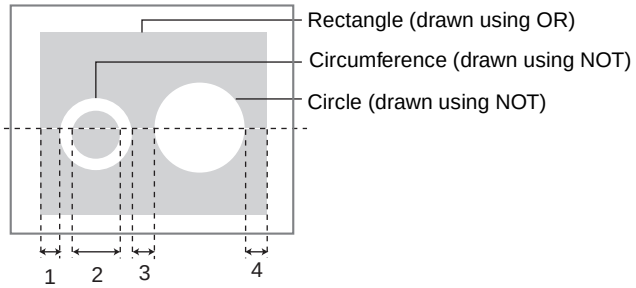
   The measurement region will be registered and the screen in (1.) will return. The model region will be displayed.

CHECK Figures drawn using OR mode are displayed with solid lines and figures drawn using NOT mode are displayed with dotted lines.



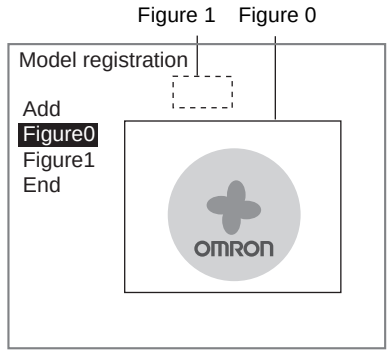
CHECK Set the model region so that no more than three areas lie along any one straight line.

INCORRECT



Correcting or Clearing Figures

1. In the screen for step 5 above, select the figure to be changed or cleared using the **Up** and **Down** Keys and press the **ENT** Key.



The figure for the figure number selected using the cursor will be displayed with solid lines. The selections ***Correct*** and ***Clear*** will be displayed.

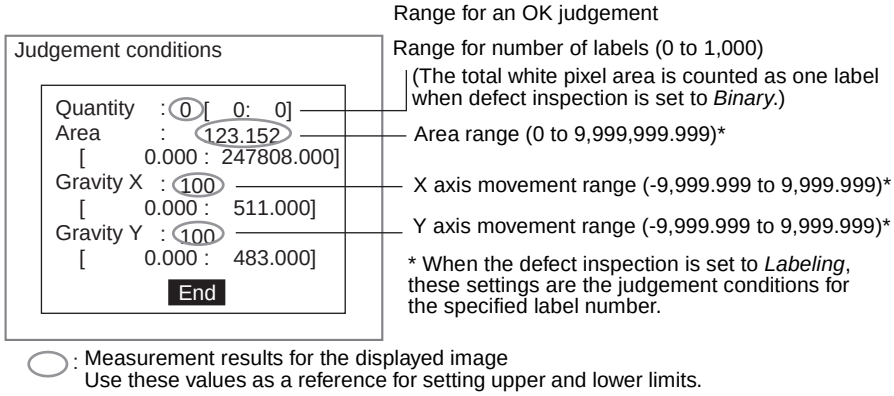
2. Select either ***Correct*** or ***Clear*** and press the **ENT** Key.

   If ***Correct*** is selected, the cursor will be displayed. Correct the size and position of the figure as desired.

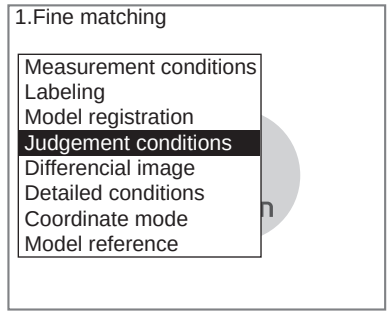
   If ***Clear*** is selected, the selected figure will be cleared.

1-6-3-4 Setting the Judgement Conditions

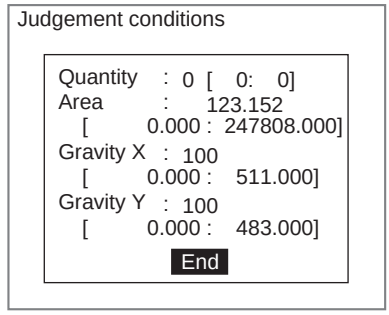
Make the setting for number of labels, area, and center of gravity.



1. Select ***Judgement conditions***.



The settings screen will be displayed.



SeeAlso Refer to page 1-(26) for information on inputting values.

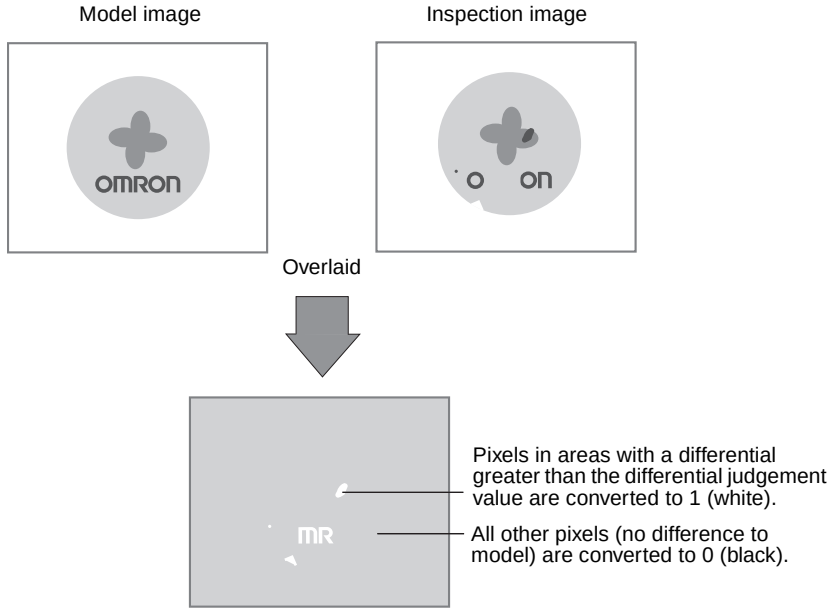
2. Make the settings for each item.
3. Select ***End***.

   The judgement condition settings will be registered and the screen in (1.) will return.

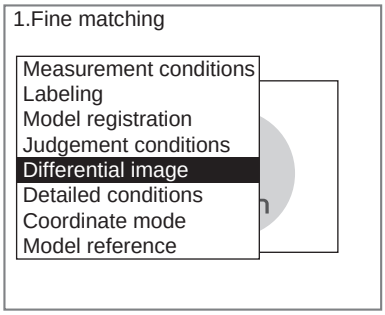
1-6-3-5 Changing Differential Judgements as Required

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 of 50 is usually sufficient, but change this value if the defects are not being detected properly.

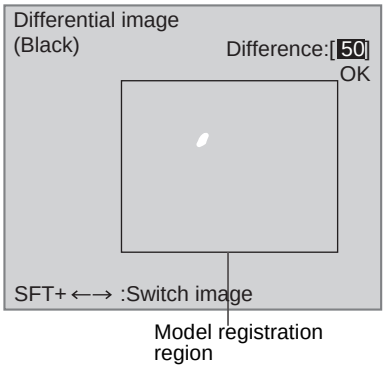


1. Display the image of an NG object to enable the differential judgement value to be adjusted while looking at the differential image.



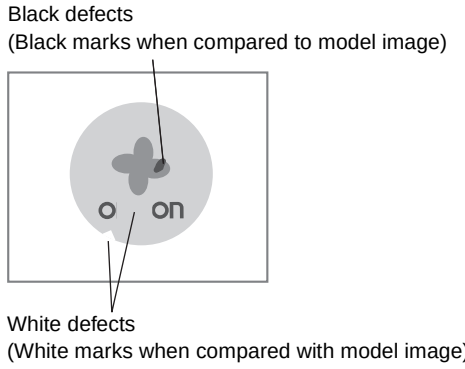
2. Select ***Differential image***

   The settings screen will be displayed.
   The differential image will be shown within the model registration region. The rest of the screen will be black.

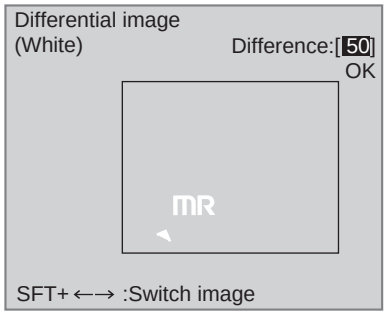


CHECK There are two differential images, one showing only black defects and the other showing only white defects. The differential value can be set separately for each.

Example:



3. Use the **SHIFT+Left** and **SHIFT+Right** Keys to switch between the white defect and black defect images.



4. 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.
   Right Key: Increases the value by 1.
   Left Key: Decreases the value by 1.

   Repeat the above two steps to adjust the differential value for the other image.

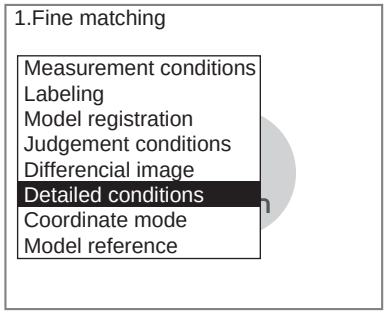
5. Select ***OK***.

   The settings will be registered and the screen in (1.) will return.

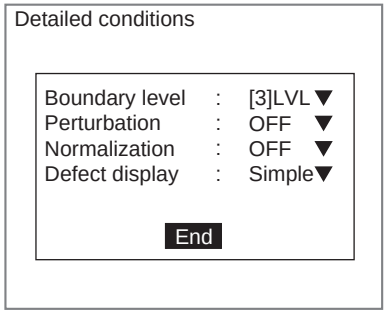
1-6-3-6 Changing Detailed Conditions as Required

Change the detailed conditions if required when matching is not stable.

1. Select ***Detailed conditions***.



The Detailed Conditions Settings Screen will be displayed.



SeeAlso Refer to page 1-(26) for information on inputting values.

2. Make the settings for each item.
   Refer to the next page for details.

3. Select ***End***.

   The detailed conditions settings will be registered and the screen in (1.) will return.

CHECK Re-register the model if the edge level has been changed.

Boundary Level Select the extent to which the boundary difference (change in density) will be absorbed. Set a value between 1 and 5 (3*). The usage of the boundary level setting depends on the setting for the *Boundary Inspection.* Refer to the following information for details.

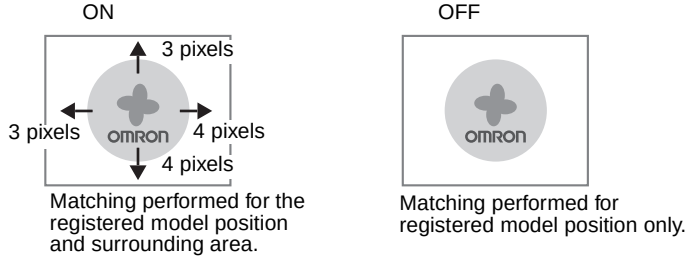
The asterisk (*) indicates the default setting.

SeeAlso See page 1-(43).

CHECK Re-register the model if the boundary level has been changed.

Perturbation Select whether or not to perform a search near the registered model position. This function can be set to OFF* or ON. If OFF is selected, matching is performed only at the registered position, which reduces processing time.

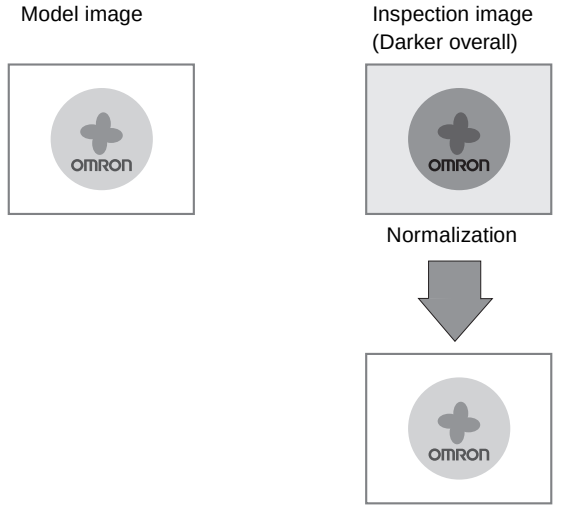
The asterisk (*) indicates the default setting.



Density Normalization This function is used to select whether or not to normalize the density in line with the brightness of the registered model. The selections are OFF* and ON.

The asterisk (*) indicates the default setting.

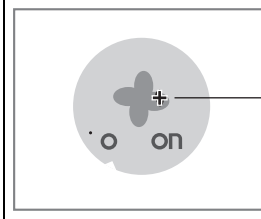
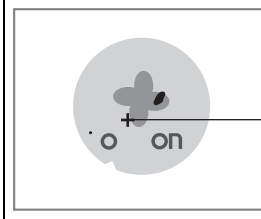
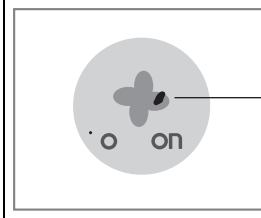
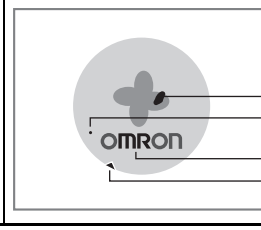
If ON is selected, matching is performed after the density is compensated, even if the overall brightness of the image has changed. This means that the measurement is less likely to be affected by lighting variations.



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.

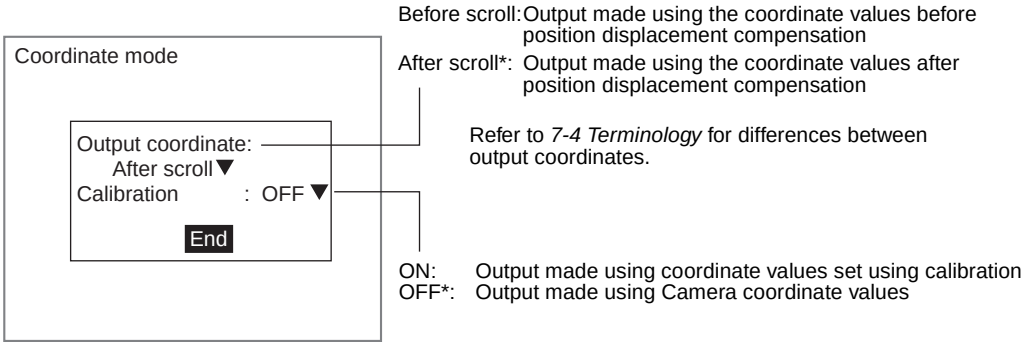
SeeAlso See page 1-(44).

Selection	Defect inspection method	Defect display position
Simple*	Labeling	 The cursor will be displayed at the center of the set label.
	Binary	 The cursor will be displayed at the center of gravity of the defects. If there is more than one defect, the cursor will be displayed at the center of the white pixels, so it may not be on a defect.
Detail	Labeling	 The set label will be displayed in the NG color.
	Binary	 All defects will be displayed in the NG color.

The asterisk (*) indicates the default setting.

1-6-3-7 Setting the Coordinate Mode

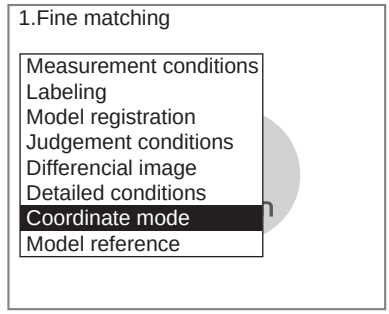
When outputting the defect position coordinates, select the type of coordinates.



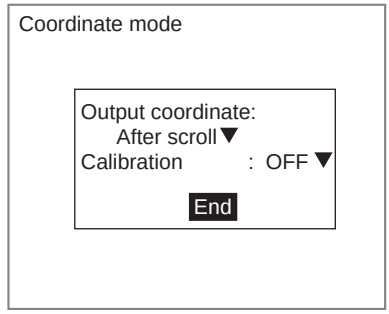
The asterisk (*) indicates the default setting.

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.

1. Select ***Coordinate mode***.



The Coordinate Mode Settings Screen will be displayed.



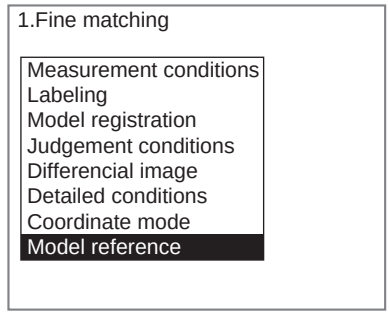
2. Make the settings for each item.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

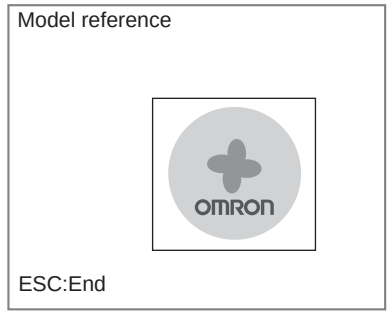
1-6-3-8 Referencing Models

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

1. Select ***Model reference.***



The image that is registered as the model will be displayed.



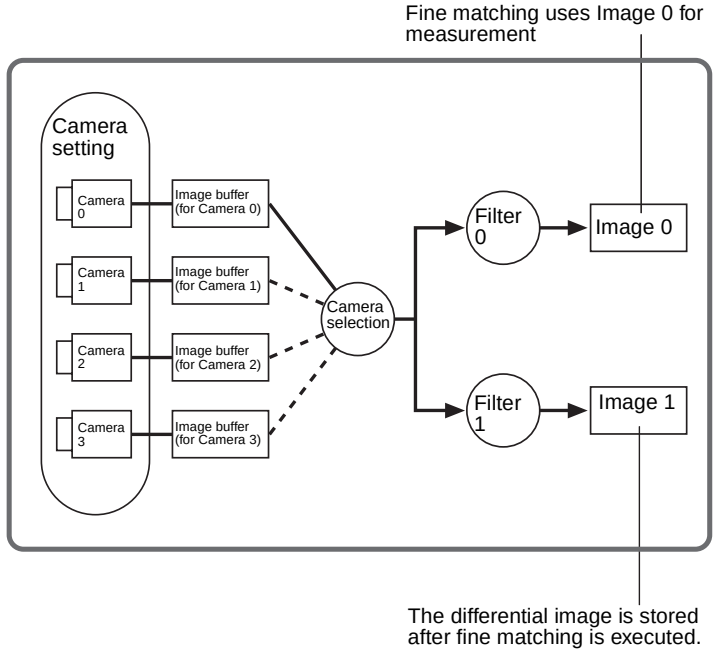
2. Press the **ESC** Key.

   The screen in (1.) will return.

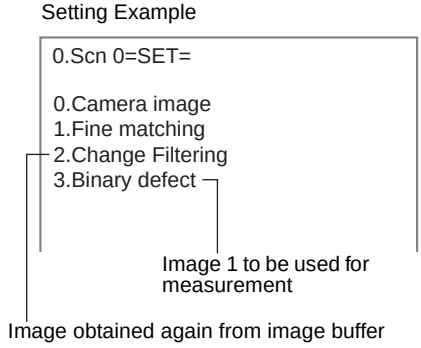
HELP Handling Images for Fine Matching

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.



Setting Example



1-6-4 STEP 4: Setting Results Output Methods

This function is used to set the method for outputting measurement results to an external device.

When measurement is executed, the overall judgement (OK or NG) for the set data is output to the parallel interface OR signal.

Only results from measurements performed in Run Mode will be output. Results of measurements executed in Monitor Mode will not be output to an external device.

Set the processing items for the desired results output as outlined in the following table.

Data to be output	Appropriate processing items
Judgement (OK or NG) output via a parallel interface	DO Judgement
Measurement output via a parallel interface	DO Data
Measurement in normal format output via a serial interface	Normal Data
Measurement in Host Link format output via a serial interface	Host Link Data
Measurement output to a Memory Card	Memory Card Data

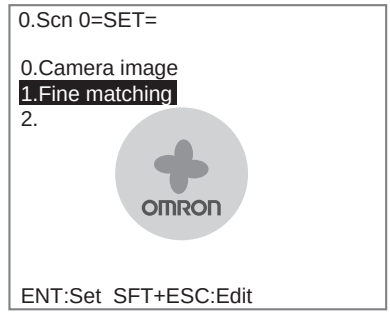
1-6-5 STEP 5: Start Test or Measurement

This section explains how to check if measurements are being correctly performed with the set measurement conditions using Monitor Mode, and how to make actual measurements using Run Mode.

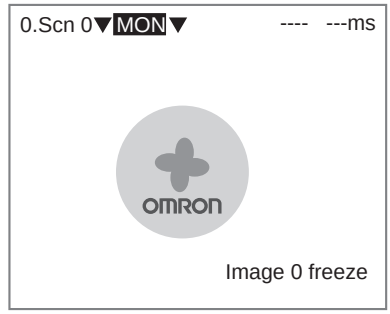
1-6-5-1 Entering Monitor Mode

Use the following procedure to check that measurements are being correctly performed with the set measurement conditions.

1. Display the Set Mode Screen.



2. Press the **ESC** Key to leave Set Mode and enter Monitor Mode.

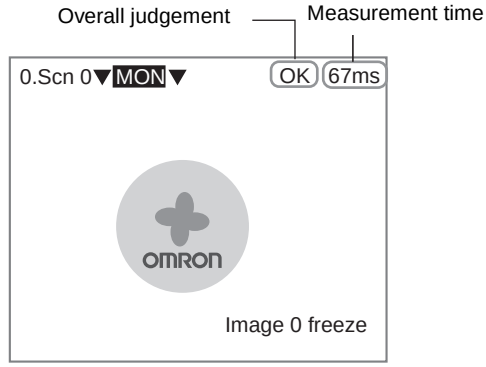


1-6-5-2 Test Measurement

Use the following procedure to execute measurements according to the conditions set for the scene currently displayed. The test is completed internally by the Controller and the measurement results are not output via serial or parallel interfaces. The measurement commands can be input, however, via serial or parallel interfaces.

SeeAlso Refer to *SECTION 6 Communicating with External Devices*.

1. Press the **TRIG** Key on the Console or input the measurement command from an external device.

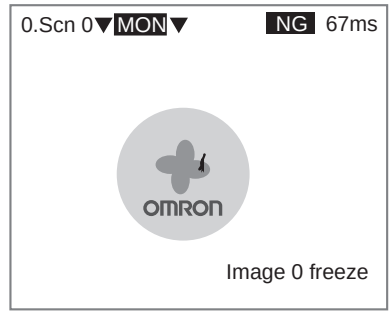


Measurement will be executed and the measurement results displayed on the screen.

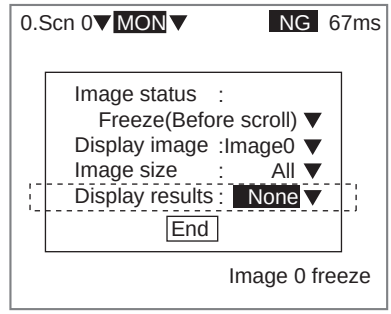
1-6-5-3 Changing Results Display

Detailed measurements results can be displayed on the screen in Monitor or Run mode. This is useful when adjusting measurement conditions.

1. Press the **SHIFT+ESC** Keys.



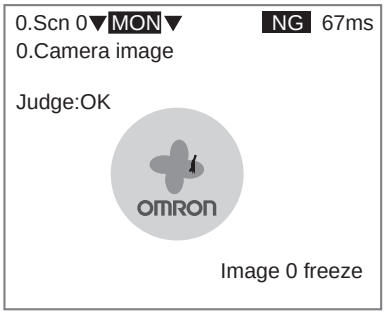
The screen for changing the measurement display settings will be displayed.



2. Change ***Display results*** to ***Details***.
3. Select ***End***.

   The Measurement Screen will return.

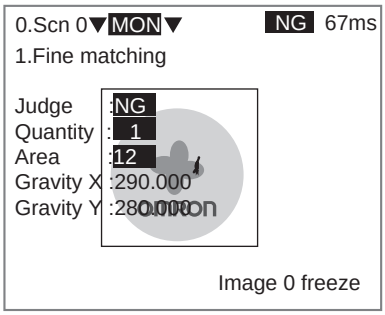
   The detailed screen for unit 0 will be displayed.



4. Press the **Down** Key to switch to unit 1 display.

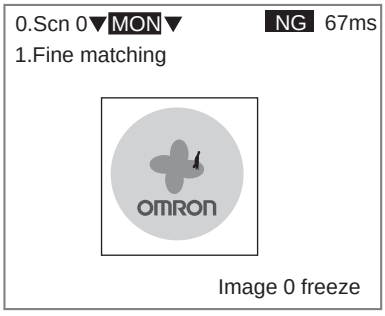
   The detailed screen for unit 1 (Fine Matching) will be displayed.

Measurement display



5. Press the **SHIFT+ Right** or **Left** Key to switch between measurement display and position display.

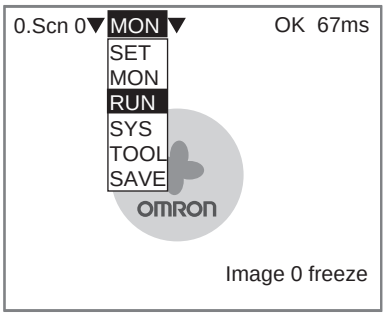
Position display



1-7 Run Mode

1-7-1 Entering Run Mode

1. Move the cursor to ***MON*** and press the **ENT** Key.



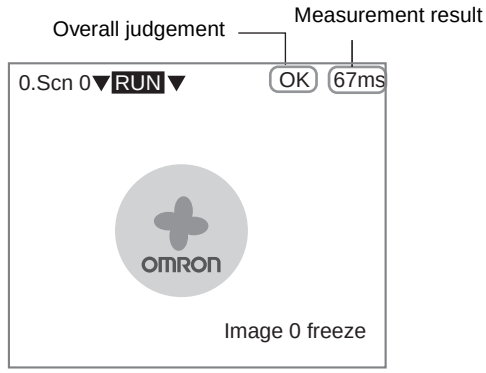
The mode selections will be displayed.

2. Select ***RUN*** to enter Run Mode.
Run Mode will be entered.

1-7-2 Performing Measurement

Use the following procedure to execute measurement according to the conditions set for the scene currently displayed. The measurement results will be output to external devices as well.

Press the **TRIG** Key on the Console or input the measurement command from an external device.



Measurement will be executed and the measurement results will be displayed on the screen.

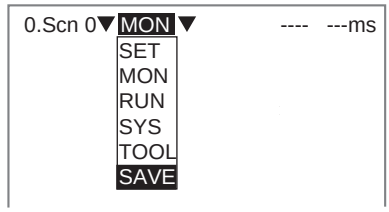
1-8 Saving Settings and Shutting Down

Save settings to flash memory before turning the power OFF.

Precaution Flash memory data is loaded each time the Controller is started. Therefore, when settings have been changed, be sure to save then to flash memory before turning OFF the power. If the power is turned OFF without saving new settings, all of the setting changes will be lost.
Stored images cannot be saved to flash memory so all stored images will be cleared when the power is turned OFF. If stored images are to be kept, backup the images to a personal computer or Memory Card. Refer to *SECTION 4 Other Functions*.

1. Display the Basic Screen for Monitor Mode or Run Mode.

2. Move the cursor to ***MON*** (or ***RUN***) and press the **ENT** Key.
   The mode selections will be displayed.



3. Select ***SAVE***.
   A confirmation message will be displayed.

4. Select ***Execute***.

Precaution Do not turn OFF the power or input a RESET signal while a message is being displayed in any save or load operation. Data in memory will be destroyed, and the Controller may not operate correctly the next time it is started.

Once the setting data has been saved, the screen in (1.) return.

5. Turn OFF the power supply to the Controller to shut down.

CHECK Using the Scene Group Function

The scene data set to scene group 0 and the system data will be saved to the Controller flash memory. If this save operation is executed, the settings data for scene groups 1 to 31 will be saved to the Memory Card mounted to drive 1. The Memory Card data will be overwritten.

SECTION 2
Processing Items Setting Procedures

This section describes the methods for setting processing items.

Inputting Images

2-1 Inputting Camera Images ..... 2-1-(1)
2-2 Switching Cameras ..... 2-2-(1)
2-3 Changing Filtering ..... 2-3-(1)
2-4 Filtering Again ..... 2-4-(1)

Position Compensation

2-5 Binary Position Compensation ..... 2-5-(1)
2-6 EC Position Compensation ..... 2-6-(1)
2-7 Edge Position Compensation ..... 2-7-(1)
2-8 Model Position Compensation ..... 2-8-(1)
2-9 Circle Position Compensation ..... 2-9-(1)
2-10 Reset Scroll ..... 2-10-(1)
2-11 Scroll ..... 2-11-(1)

General Measurements

2-12 Detecting Binary Defects ..... 2-12-(1)
2-13 Classification ..... 2-13-(1)
2-14 Density Defects ..... 2-14-(1)
2-15 EC Defect ..... 2-15-(1)
2-16 EC Positioning ..... 2-16-(1)
2-17 Edge Position ..... 2-17-(1)
2-18 Fine Matching ..... 2-18-(1)
2-19 EC Circle Count ..... 2-19-(1)
2-20 Pattern ..... 2-20-(1)
2-21 QUEST Character Verification ..... 2-21-(1)
2-22 Rotation Positioning ..... 2-22-(1)
2-23 ECM Search ..... 2-23-(1)
2-24 Lot Number OCV 1 ..... 2-24-(1)
2-25 Labeling ..... 2-25-(1)
2-26 Label Data ..... 2-26-(1)
2-27 Edge Pitch ..... 2-27-(1)
2-28 Density Data ..... 2-28-(1)

Measurement Support

2-29 Calculation ..... 2-29-(1)
2-30 Elapsed Time ..... 2-30-(1)
2-31 Get Unit Data ..... 2-31-(1)
2-32 Wait ..... 2-32-(1)
2-33 Set Unit Data ..... 2-33-(1)
2-34 Trend Monitor ..... 2-34-(1)

Branch Control

2-35 Conditional Branching ..... 2-35-(1)
2-36 DI Branch ..... 2-36-(1)
2-37 End ..... 2-37-(1)

Results Output

2-38 Memory Card Data ..... 2-38-(1)
2-39 DO Data ..... 2-39-(1)
2-40 DO Judgement ..... 2-40-(1)
2-41 Host Link Data ..... 2-41-(1)
2-42 Normal Data ..... 2-42-(1)

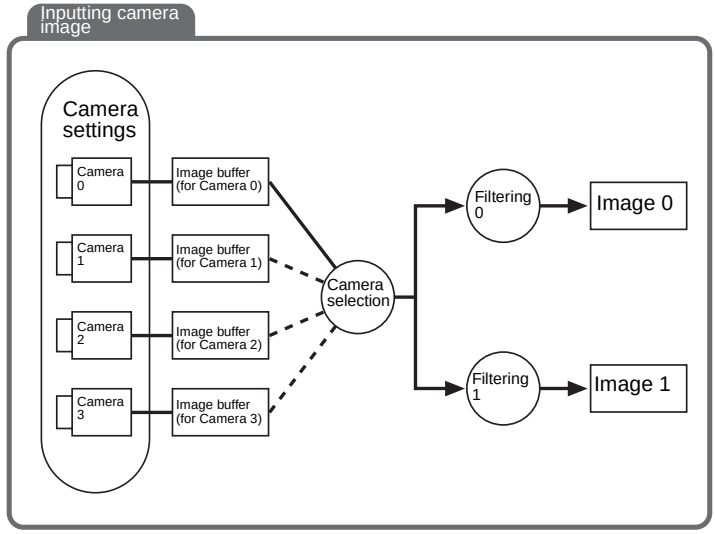
Results Display

2-43 Display String ..... 2-43-(1)
2-44 Display Measurement ..... 2-44-(1)
2-45 Display Judgement ..... 2-45-(1)
2-46 Display Item ..... 2-46-(1)
2-47 Display Time ..... 2-47-(1)
2-48 Display Figure ..... 2-48-(1)
2-49 Display Line, Display Box, Display Circle, and Display Cursor 2-49-(1)

2-1 Inputting Camera Images

This section describes how to make the series 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.



2-1-1 Camera Settings

2-1-1-1 Shutter Speed

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

The shutter speed can be changed from the menu for F150-S1A and F160-S1 Cameras only.

Refer to *SECTION 1 Basic Operating Procedures* for information on shutter speed operations.

2-1-1-2 Lighting Control

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

Refer to *SECTION 1 Basic Operating Procedures* for information on lighting control operations.

2-1-1-3 Calibration

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

There are four settings for calibration: Sampling, Specifying point, Specifying coordinate axis, and Parameter input.

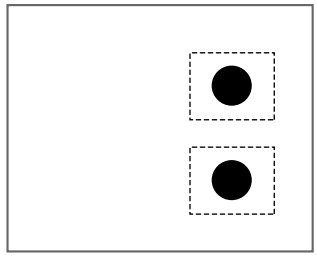
HELP Refer to *7-4 Terminology* for information on calibration.

CHECK To output measurement results in physical units, set *Coordinate mode/Calibration* to *ON* for each processing item.

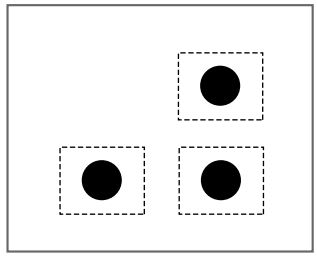
If *Calibration* remains set to *OFF*, the default settings will remain, and measurements using the Camera coordinates will be output.

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, make sample measurements in 2 places only.

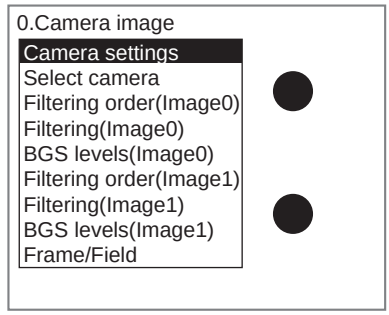


- When the magnifications in the X and Y directions are different, perform sampling measurement in 3 places.

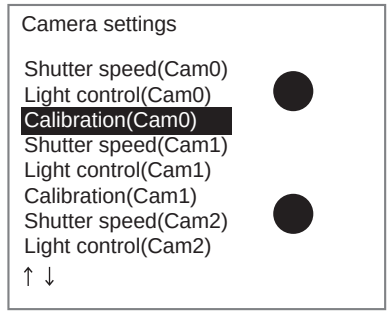


CHECK The point measured by the Controller becomes the specified point for calibration, giving a higher degree of accuracy than when using *Point specification*.

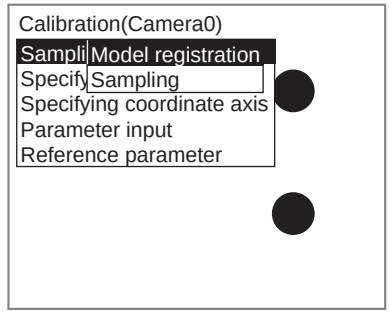
1. Select ***Camera settings***.



The initial Camera Settings Screen will be displayed.

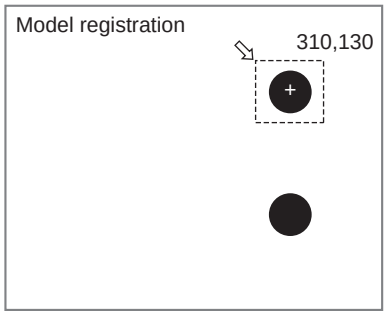


2. Select calibration for the camera number to be used.
   The initial Calibration Screen will be displayed.



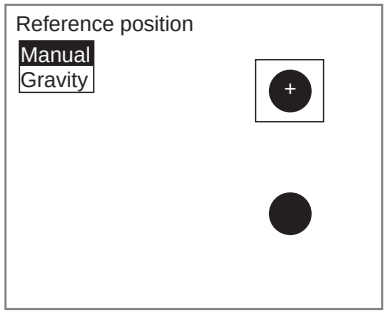
3. Select ***Sampling***.
4. Select ***Model registration***.

The Model Registration Settings Screen will be displayed.



5. 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.



6. Select ***Manual*** or ***Gravity***.

   Manual: Any reference position can be set.

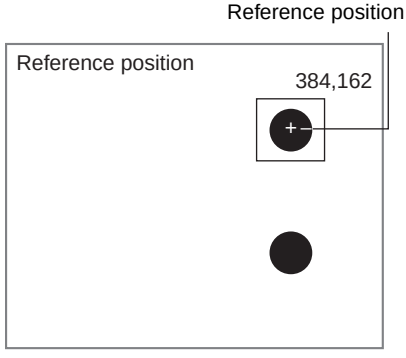
   Gravity: The image is converted to binary and the center of gravity is set as the reference position.

   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.

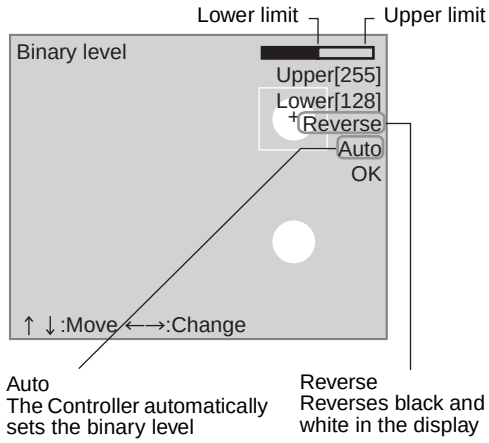
   When ***Gravity*** is selected, the Gravity Settings Screen will be displayed.

7. Set the reference position.

   Manual:
   Use the **Up**/**Down** and **Right**/**Left** Keys to move the cursor to the reference position and press the **ENT** Key.



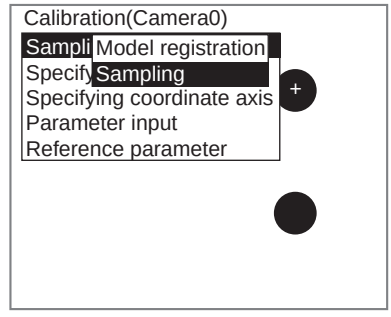
Gravity:
Specify the binary level so that the reference figure will be white and select ***OK***.



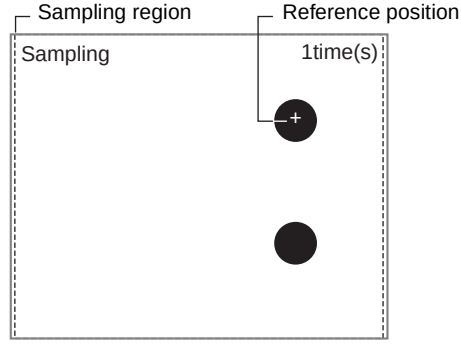
Move the cursor to the upper limit or lower limit and use the **Left** and **Right** Keys to change the value.

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 10 times faster.
Up and Down Keys:	Switches between setting items.

The model will be registered and the screen in (2.) will return.



8. Select ***Sampling***.
   The first Sampling Screen will be displayed.

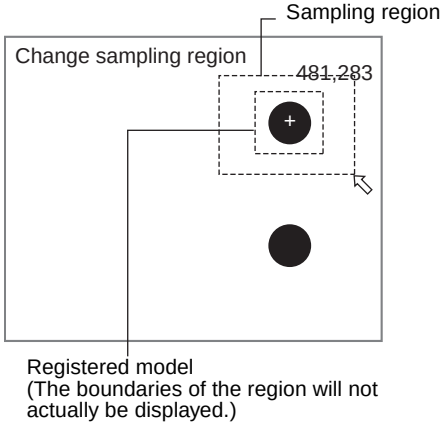


9. Decide whether or not to change the sampling region.

When there are 2 or more figures with the same shape on the screen, press the **SHIFT**+**ENT** Keys. Go to step 10.

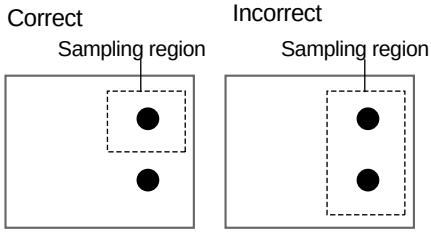
When there are no similar-shaped objects on the screen, go to step 11.

The Change Sampling Region Settings Screen will be displayed.

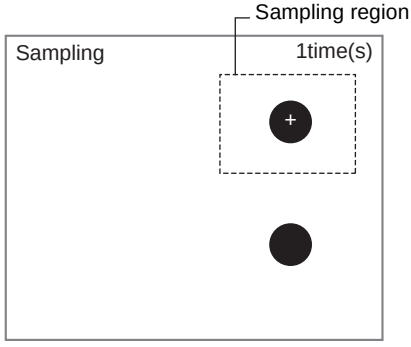


10. Change the region.

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

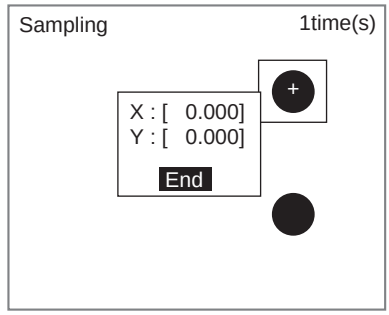


The region will be set and the Sampling Screen will return.



11. Press the **TRIG** Key to execute the first sampling.

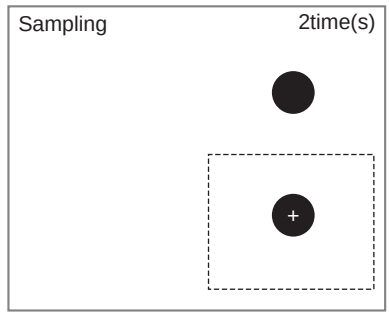
A frame and display cursor will appear where the model was found and the screen for inputting physical coordinates will be displayed.



12. Input the coordinates for the model position (display cursor) and select ***End***.

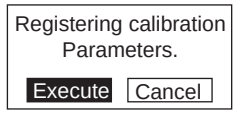
CHECK Correcting Mistakes
Press the SHIFT+ESC Keys. The previous sampling can be corrected and re-executed.

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



13. Repeat steps 9 to 12 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.



14. Select ***Execute***.

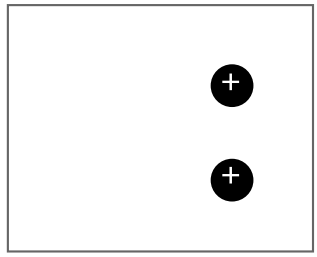
    The settings will be registered and the screen in (2.) will return.

Specifying Points

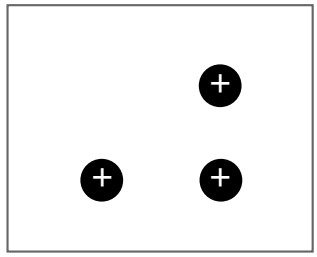
This function is used to specify and set any point in pixel units.

If the coordinates of the specified position are input, the calibration data is automatically calculated. Up to 3 points can be specified.

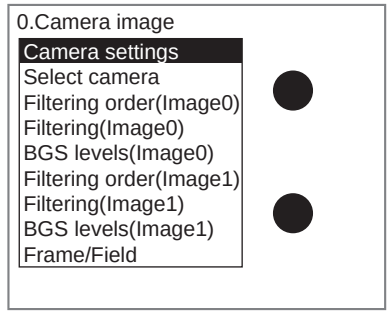
- When the magnifications are the same for the X and the Y directions, make sample measurements in 2 places only.



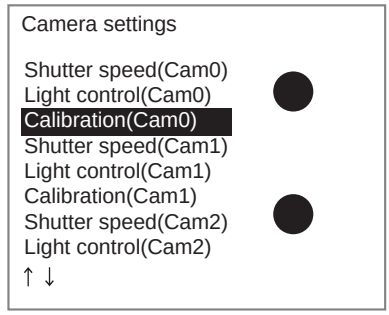
- When the magnifications in the X and Y directions are different, perform sampling measurement in 3 places.



1. Select ***Camera settings***.

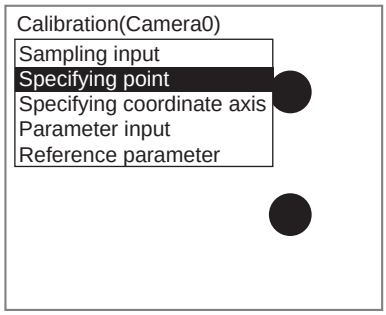


The initial Camera Settings Screen will be displayed.



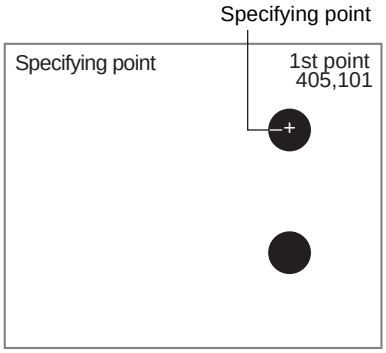
2. Select ***Calibration***.

The initial Calibration Screen will be displayed.



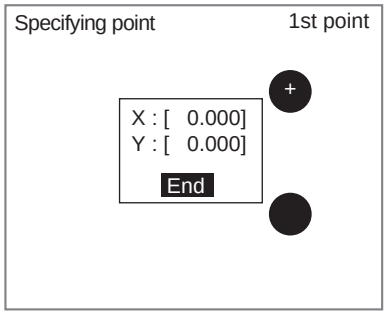
3. Select ***Specifying point***.

   The Specifying Point Screen for the 1st point and a cursor for specifying the point will be displayed.



4. Use the **Up**/**Down** and **Right**/**Left** Keys to move the cursor to the position to be specified and press the **ENT** Key.

   The screen for inputting coordinates will be displayed.

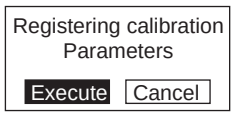


5. Input the coordinates for the point to be specified and select ***End***.

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

6. Repeat steps 4 and 5 and specify 2 or more points.

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



7. Select ***Execute***.

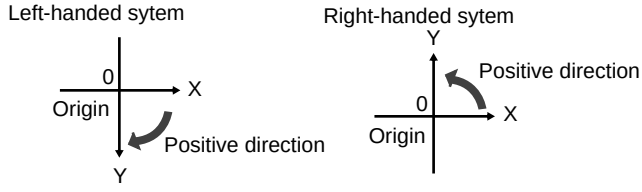
The settings will be registered and the screen in (2.) will return.

Specifying Coordinate Axis

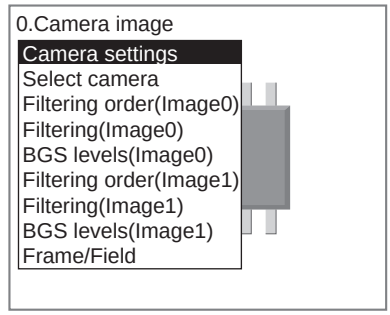
This method is used to specify the coordinate axis while monitoring the messages displayed on the screen. The coordinate system, the origin, the rotation angle, and the magnification, are set in that order. The magnification for X and Y directions is the same setting when specifying the coordinate axis.

Coordinate System

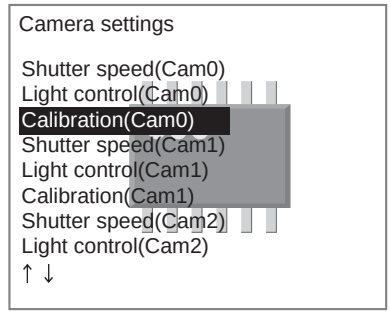
Select the coordinate system.



1. Select ***Camera settings***.

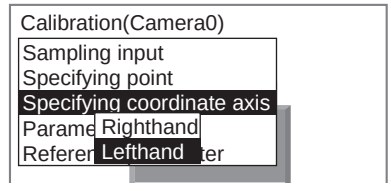


The initial Camera Settings Screen will be displayed.



2. Select ***Calibration***.

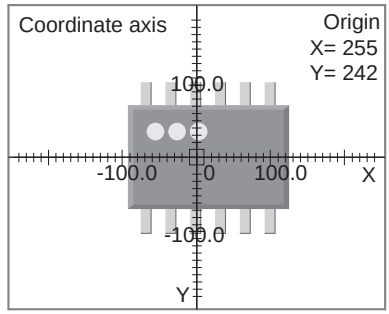
The initial Calibration Screen will be displayed.



3. Select ***Specifying coordinate axis***.

4. Select ***Righthand*** or ***Lefthand***.

   The screen for specifying the origin will be displayed.

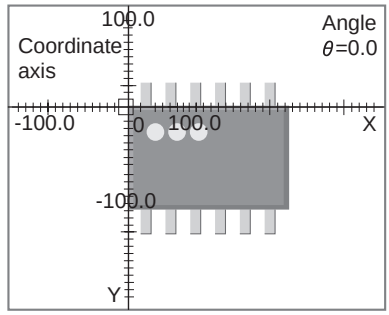


5. Use the **Up**/**Down** and **Right**/**Left** Keys to move the cursor to the position to be specified and press the **ENT** Key.

   Up/Down and Right/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.



6. Specify the angle for the axis and press the **ENT** Key.

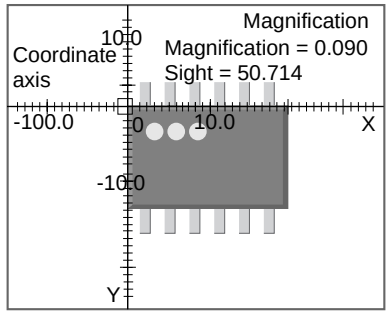
   Right and Down Keys: Rotates the angle by 0.5° in the clockwise direction.

   SHIFT+Right and Down Keys: Rotates the angle by 5° in the clockwise direction.

   Left and Up Keys: Rotates the angle by 0.5° in the counterclockwise direction.

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

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



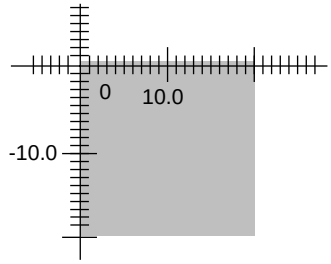
7. Specify the magnification.

   Use the following procedure to specify the actual dimensions that correspond to one pixel.

Right and 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+Left and Up Keys:	Reduces 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.



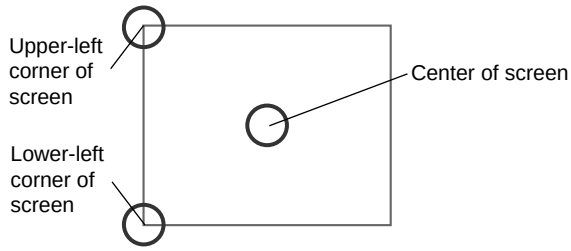
8. Press the **ENT** Key.

   The settings will be registered and the screen in (2.) will return.

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

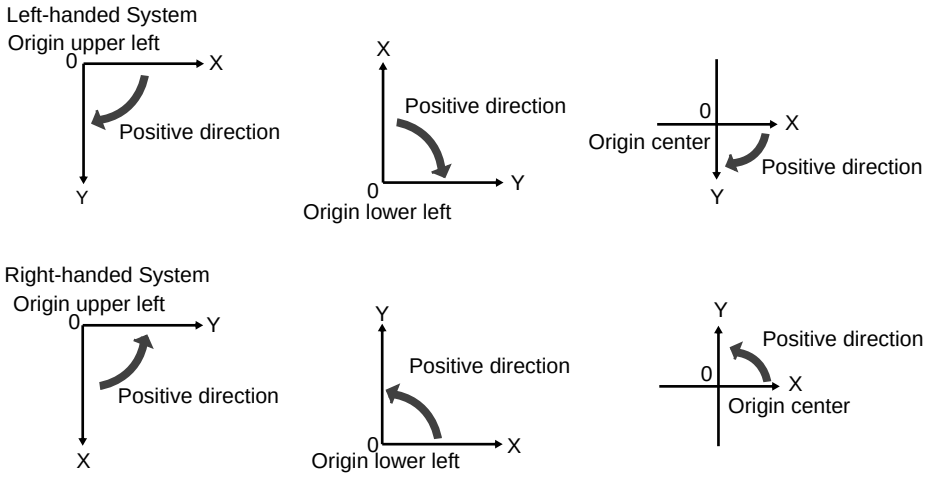
Origin

Specify the physical coordinates for the position of the origin as desired.



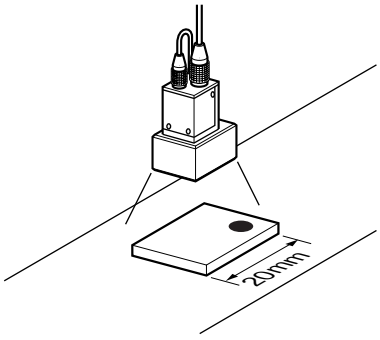
Coordinate System

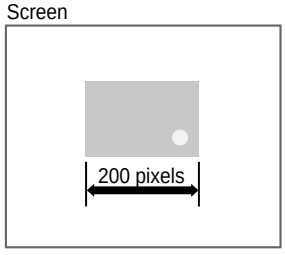
Select the coordinate system for the physical coordinates.



Magnification and Units

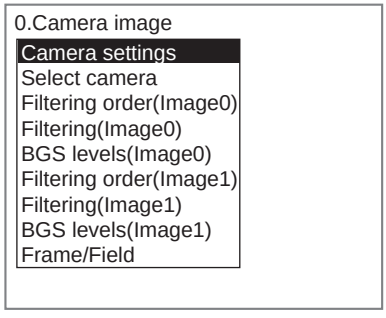
Set the physical unit that will correspond to one pixel. Set a value in the range 0.00100 to 9.99999 for the magnification.



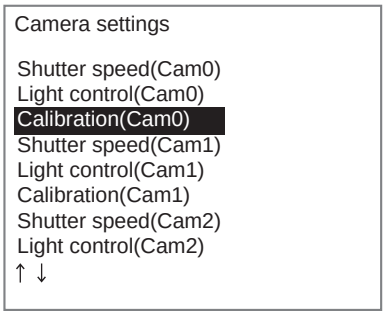


The magnification is 20(mm) / 200(pixels) = 0.1(mm/pix).
In other words, 1 pixel in camera coordinates will correspond to 0.1 mm in physical units.
In the menu, pixel is denoted as "pix."

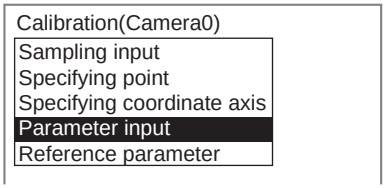
1. Select ***Camera settings***.



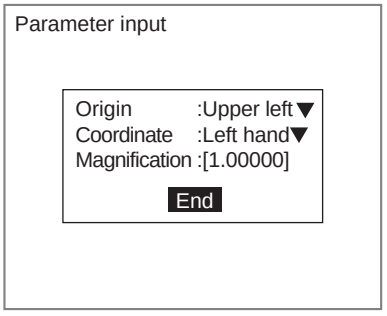
The initial Camera Settings Screen will be displayed.



2. Select ***Calibration***.
   The initial Calibration Screen will be displayed.



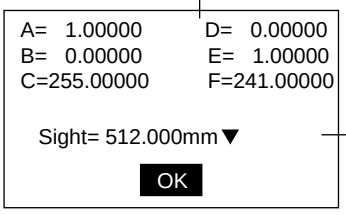
3. Select ***Parameter input***.
   The Parameter Input Screen will be displayed.



4. Make the settings for each item.
5. Select ***End***.
   The settings will be registered and the screen in (2.) will return.

Reference Parameters

This screen is used to check data settings.



● 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:

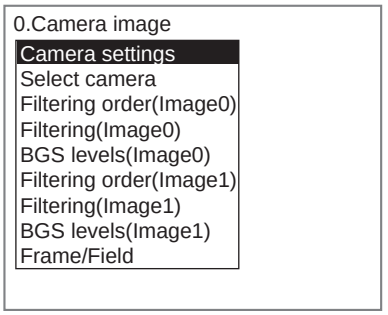
$X' = A \times X + B \times Y + C$

$Y' = D \times X + E \times Y + F$

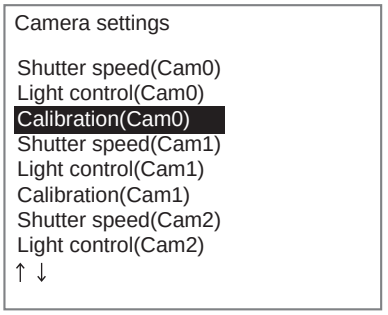
(X,Y): measurement position (camera coordinates), unit: pixels
(X',Y'): conversion position (physical coordinates), units: mm

● The physical unit for X direction on the screen can be selected from μ m, mm, cm, and m.

1. Select ***Camera settings***.

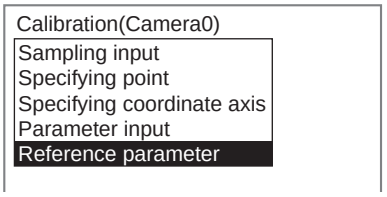


The initial Camera Settings Screen will be displayed.



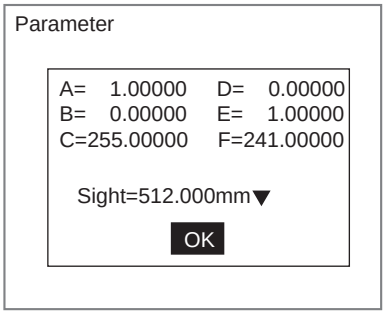
2. Select ***Calibration***.

   The initial Calibration Screen will be displayed.



3. Select ***Reference parameter***.

   The parameters will be displayed.



4. Select ***OK*** to exit this screen.

   The screen in (2.) will return.

2-1-2 Camera Selection

Up to four Cameras can be connected. *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.

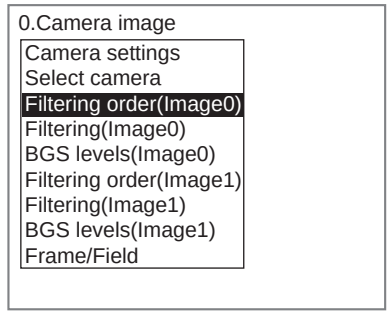
Refer to *SECTION 1 Basic Operating Procedures* for information on Camera selection operations.

2-1-3 Filtering Order

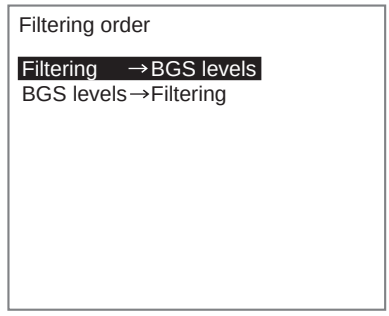
The processing order for filtering and BGS levels can be selected. This processing order can be set separately for Image 0 and Image 1.

The cursor can be moved on the image to see the effects of filtering. Select the order while confirming the results on the image.

1. Select ***Filtering order***.



The settings screen for filtering order will be displayed.



2. Select the filtering order while monitoring the image.
3. Press the **ENT** Key.

   The setting will be registered and the screen in (1.) will return.

2-1-4 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: Weak smoothing, strong smoothing, dilation, erosion, median, edge enhancement, vertical edge extraction, horizontal edge extraction, and edge extraction. The filtering can be set separately for Image 0 and Image 1.

The cursor can be moved on the image to see the effects of filtering. Select filtering while confirming the results on the image.

Filtering	Target	Function	Example application
OFF	---	---	---
Weak smoothing	Measurement objects with slight surface irregularity	Reduces the irregularity through smoothing. Select either weak or strong smoothing.	Stable searches
Strong smoothing			
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 inspection (using binary processing)
Horizontal edge extraction	Measurement objects difficult to extract due to bad image contrast	Extracts the horizontal edges (light and dark) of an image.	Defect inspection (using binary processing)
Edge extraction	Measurement objects difficult to extract due to bad image contrast	Extracts the vertical edges (light and dark) of an image.	Defect inspection (using binary processing)

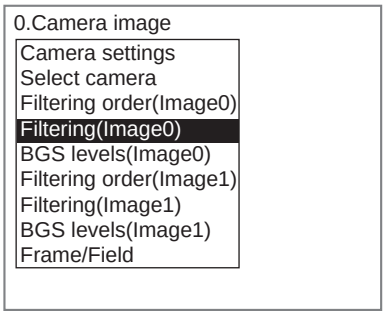
CHECK Filter Size

The strength of the filtering can be selected if *Frame/Field* is set to *Frame*.

3×3 ◄► 5×5
Weak Strong

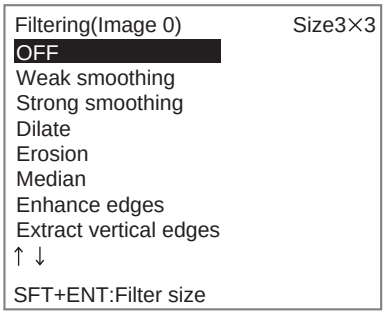
SHIFT + ENT The image changes each time these keys are pressed.

1. Select ***Filtering***.



The settings screen for filtering will be displayed.

If *Frame/Field* is set to *Frame*, the filter size will be displayed in the top right-hand corner of the screen.



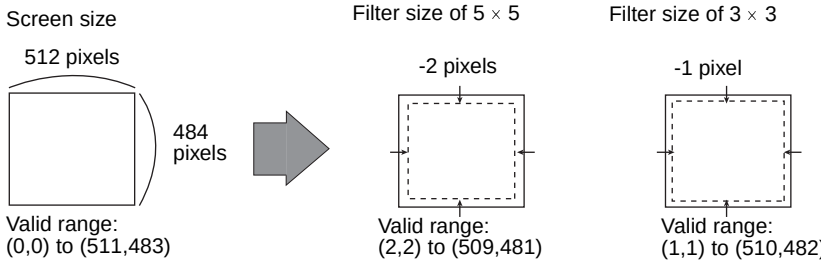
2. Select the filtering method while monitoring the image.

   Press the **SHIFT** + **ENT** Keys to change the filter size.

3. Press the **ENT** Key.

   The setting will be registered and the screen in (1.) will return.

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

Filter size of 5 × 5: -2 pixels × 2 = -4 pixels
Filter size of 3 × 3: -1 pixel × 2 = -2 pixels

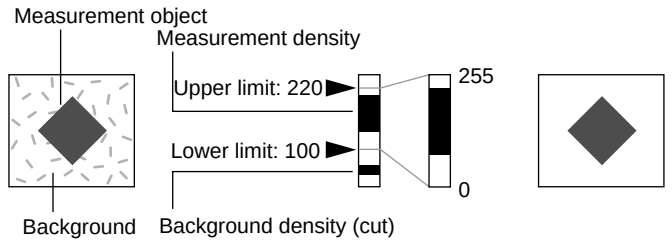
2-1-5 Background Suppression

Background suppression (BGS) excludes the background of the measurement object from the measurement process for easier measurement. BGS can be set separately for Image 0 and Image 1.

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

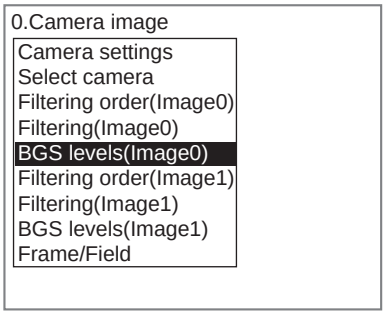
BGS changes image areas with densities below the lower limit to 0, and image areas with densities above the upper limit to 255. Image areas with densities between the lower and upper limits are graded from 0 to 255 so that only images with densities between the lower and upper limits are measured.

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

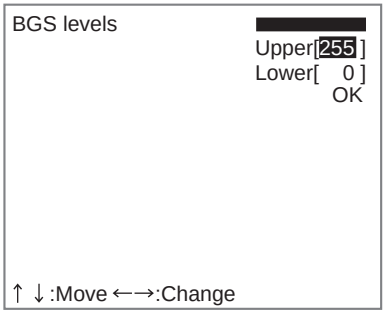


- Images with densities set to less than 100 are not measured and the density becomes 0.
- Only images with densities between 100 and 220 are measured and the images are graded between 0 and 255.

1. Select ***BGS levels***.



The settings screen for BGS levels will be displayed.



2. Move the cursor to the upper value and use the **Left** and **Right** Keys to adjust 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 10 times faster.

   Up and Down Keys: Switches between setting items.

3. Use the same method to change the lower value.
4. Select ***OK***.

   The settings will be registered and the screen in (1.) will return.

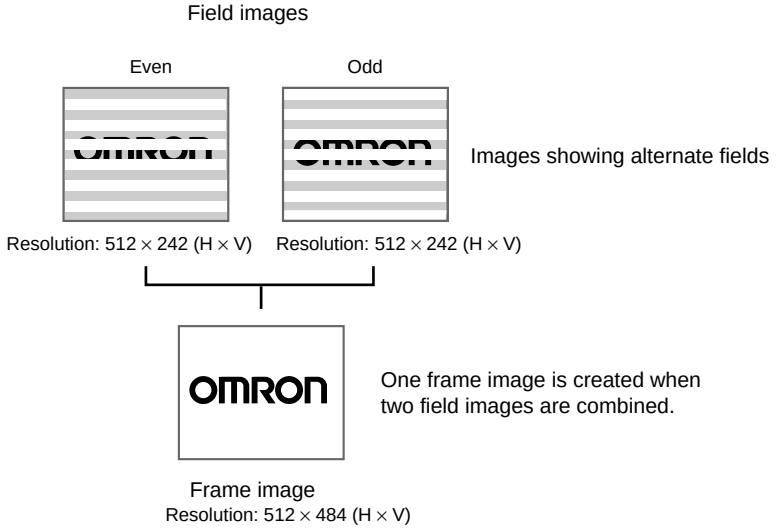
2-1-6 Frame/Field

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

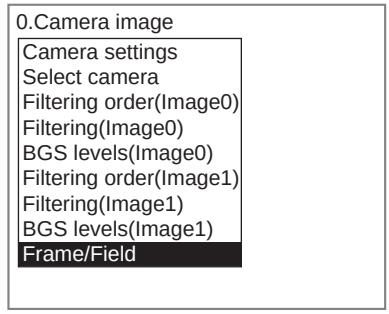
Selection	Details
Frame*	Measures using frame images.
Field	Measures images in fields. The processing time can be reduced but the accuracy of the measurement will be reduced because the measurement is performed on an image with low resolution in the vertical direction.

The asterisk (*) indicates the default setting.

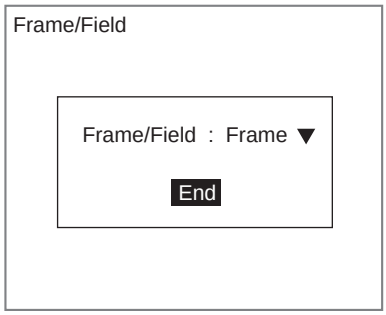
CHECK This setting can only be made once for each scene. If *Camera image* is set for more than one unit, the Frame/Field menu will be displayed under *Camera image* only for the unit with the lowest number.



1. Select ***Frame/Field***.



The Frame/Field Settings Screen will be displayed.

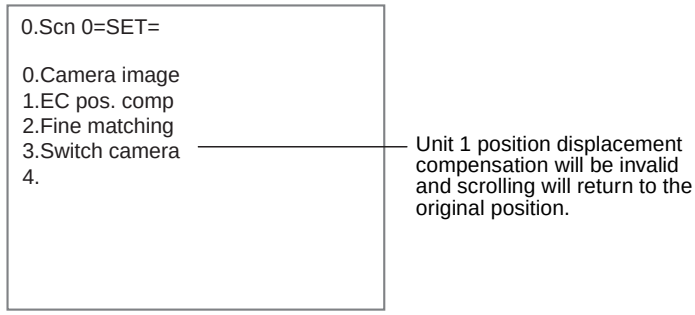


2. Make the setting.
3. Select ***End***.
   The setting will be registered and the screen in (1.) will return.

2-1-7 Additional Information

Setting *Camera Image* after Position Displacement Compensation

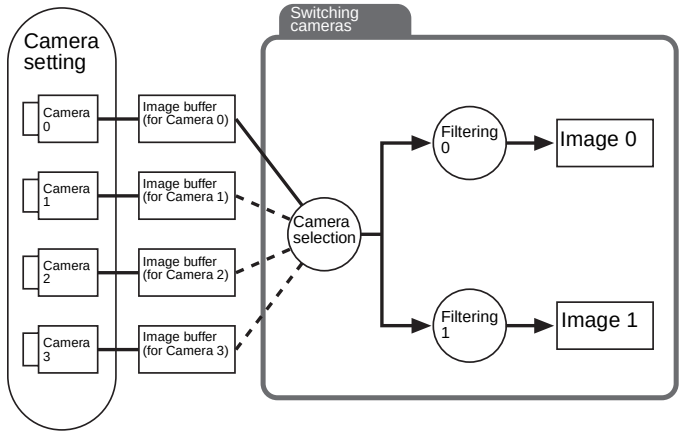
Scrolling for position displacement compensation will return to the original position.



2-2 Switching Cameras

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 for this processing item.

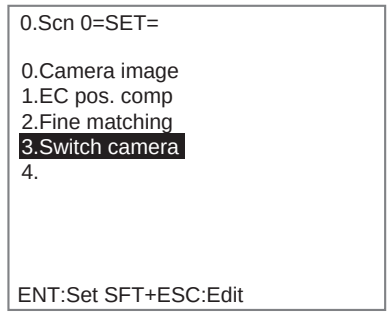
The filtering settings will be changed at the same time.



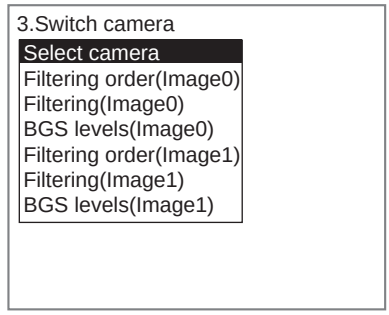
2-2-1 Camera Selection

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.

1. Select ***Switch camera***.

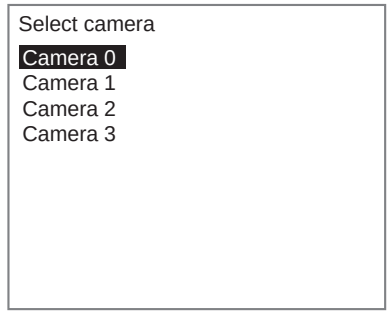


The initial Switch Camera Screen will be displayed.



2. Select ***Select camera***.

   A list of Camera numbers will be displayed.



3. Select the number of the Camera to be used.
4. Press the **ENT** Key.

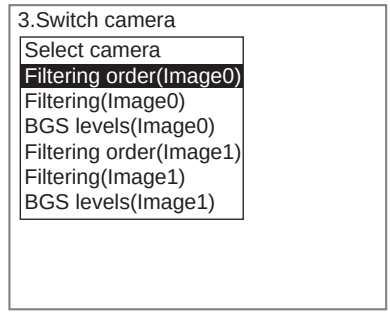
   The setting will be registered and the screen in (1.) will return.

2-2-2 Filtering Order

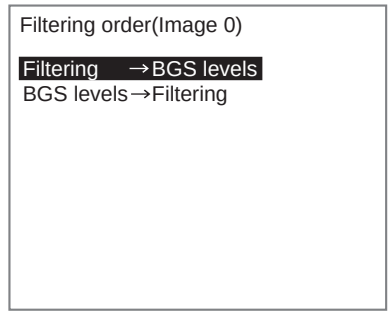
The processing order for filtering and BGS levels can be selected. This processing order can be set separately for Image 0 and Image 1.

The cursor can be moved on the image to see the effects of filtering. Select the order while confirming the results on the image.

1. Select ***Filtering order***.



The settings screen for filtering order will be displayed.



2. Select the filtering order while monitoring the image.
3. Press the **ENT** Key.

   The setting will be registered and the screen in (1.) will return.

2-2-3 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: weak smoothing, strong smoothing, dilation, erosion, median, edge enhancement, vertical edge extraction, horizontal edge extraction, and edge extraction. The filtering can be set separately for Image 0 and Image 1.

The cursor can be moved on the image to see the effects of filtering. Select filtering while confirming the results on the image.

Filtering	Target	Function	Example application
OFF	---	---	---
Weak smoothing	Measurement objects with slight surface irregularity	Reduces the irregularity through smoothing. Select either weak or strong smoothing.	Stable searches
Strong smoothing			
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 inspection (using binary processing)
Horizontal edge extraction	Measurement objects difficult to extract due to bad image contrast	Extracts the horizontal edges (light and dark) of an image.	Defect inspection (using binary processing)
Edge extraction	Measurement objects difficult to extract due to bad image contrast	Extracts the vertical edges (light and dark) of an image.	Defect inspection (using binary processing)

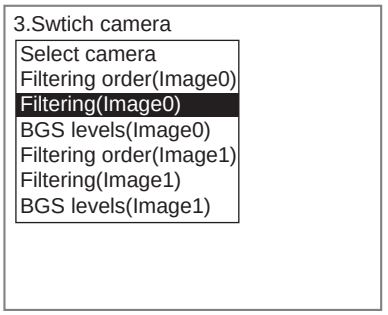
CHECK Filter Size

The strength of the filtering can be selected if *Frame/Field* is set to *Frame*.

3×3 ⟷ 5×5
Weak Strong

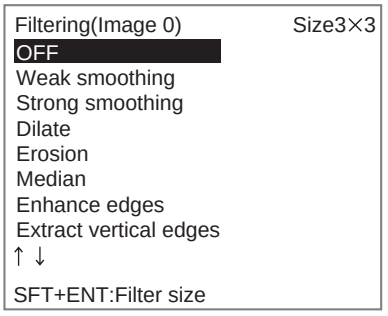
SHIFT + ENT The image changes each time these keys are pressed.

1. Select ***Filtering***.



The settings screen for filtering will be displayed.

If *Frame/Field* is set to *Frame*, the filter size will be displayed in the top right-hand corner of the screen.



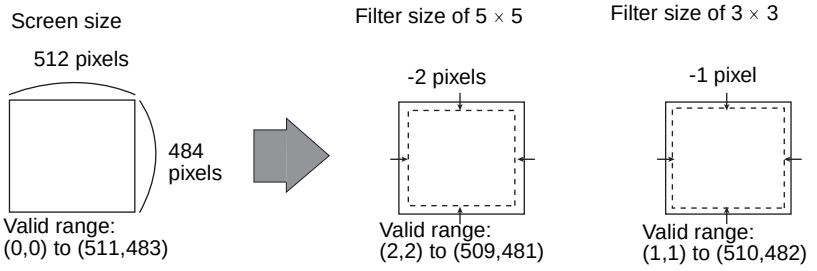
2. Select the filtering method while monitoring the image.

   Press the **SHIFT** + **ENT** Keys to change the filter size.

3. Press the **ENT** Key.

   The setting will be registered and the screen in (1.) will return.

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

Filter size of 5 × 5: -2 pixels × 2 = -4 pixels
Filter size of 3 × 3: -1 pixel × 2 = -2 pixels

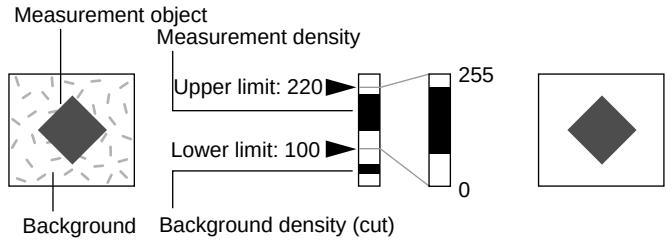
2-2-4 Background Suppression

Background suppression (BGS) excludes the background of the measurement object from the measurement process for easier measurement. BGS can be set separately for Image 0 and Image 1.

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

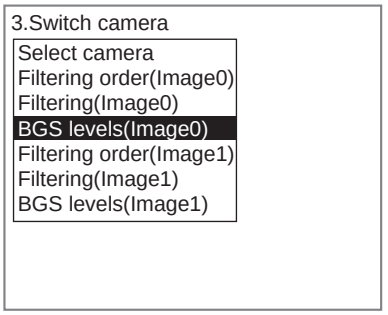
BGS changes image areas with densities below the lower limit to 0, and image areas with densities above the upper limit to 255. Image areas with densities between the lower and upper limits are graded from 0 to 255 so that only images with densities between the lower and upper limits are measured.

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

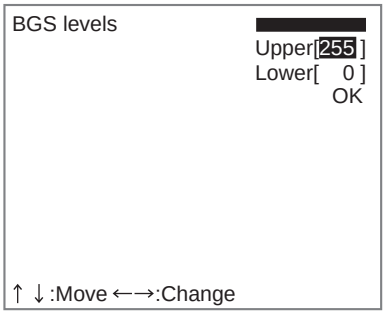


- Images with densities set to less than 100 are not measured and the density becomes 0.
- Only images with densities between 100 and 220 are measured and the images are graded between 0 and 255.

1. Select ***BGS levels***.



The settings screen for BGS levels will be displayed.



2. Move the cursor to the upper value and use the **Left** and **Right** Keys to adjust 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 10 times faster.

Up and Down Keys: Switches between setting items.

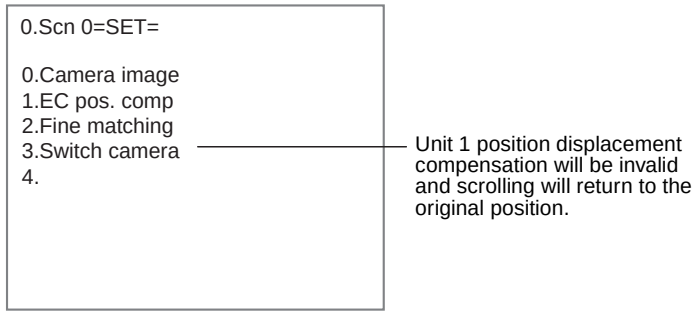
3. Use the same method to change the lower value.
4. Select ***OK***.

   The settings will be registered and the screen in (1.) will return.

2-2-5 Additional Information

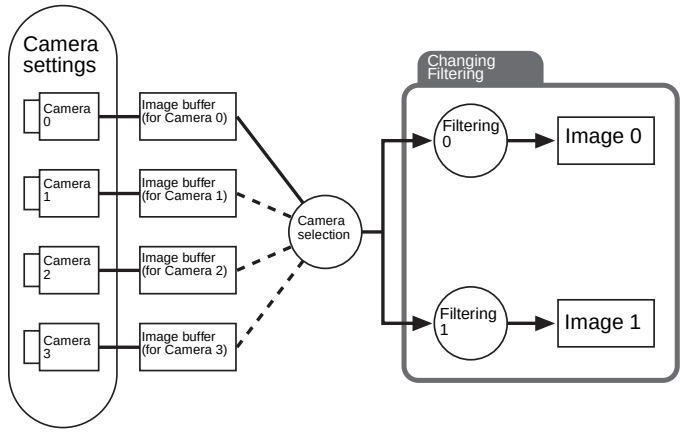
Setting *Switch Camera* after Position Displacement Compensation

Scrolling for position displacement compensation will return to the original position.



2-3 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.

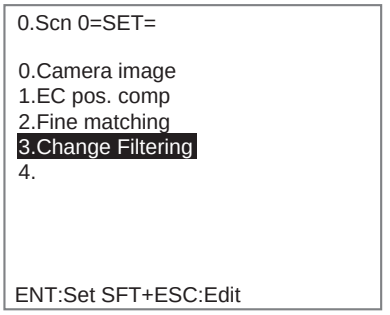


2-3-1 Filtering Order

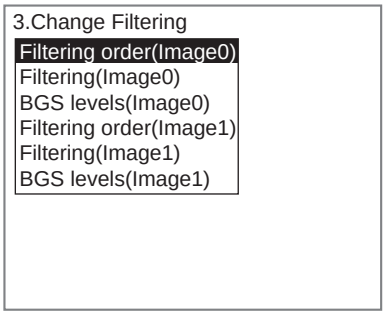
The processing order for filtering and BGS levels can be selected. The settings can be made separately for Image 0 and Image 1.

The cursor can be moved on the image to see the effects of filtering. Select the order while confirming the results on the image.

1. Select ***Change filtering***.

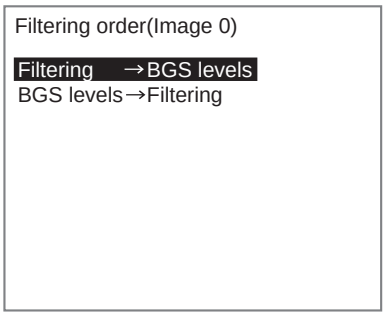


The settings screen for changing filtering will be displayed.



2. Select ***Filtering order***.

The settings screen for filtering order will be displayed.



3. Change the settings while monitoring the image.
4. Press the **ENT** Key.

The setting will be registered and the screen in (1.) will return.

2-3-2 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: Weak smoothing, strong smoothing, dilation, erosion, median, edge enhancement, vertical edge extraction, horizontal edge extraction, and edge extraction. The settings can be made separately for Image 0 and Image 1.

The cursor can be moved on the image to see the effects of filtering. Select filtering while confirming the results on the image.

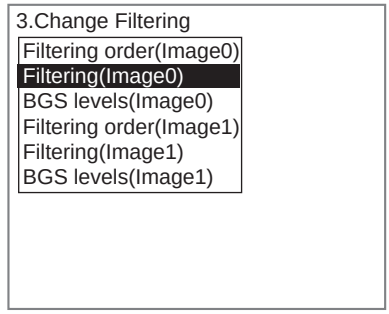
Filtering	Target	Function	Example application
OFF	---	---	---
Weak smoothing	Measurement objects with slight surface irregularity	Reduces the irregularity through smoothing. Select either weak or strong smoothing.	Stable searches
Strong smoothing			
Dilation	White measurement objects with black noise	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 inspection (using binary processing)
Horizontal edge extraction	Measurement objects difficult to extract due to bad image contrast	Extracts the horizontal edges (light and dark) of an image.	Defect inspection (using binary processing)
Edge extraction	Measurement objects difficult to extract due to bad image contrast	Extracts the vertical edges (light and dark) of an image.	Defect inspection (using binary processing)

CHECK The strength of the filtering can be selected if *Frame/Field* is set to *Frame*.

3×3 ⟷ 5×5
Weak Strong

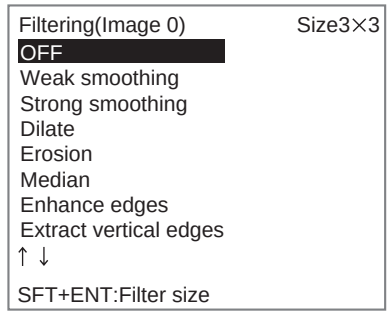
SHIFT + ENT The image changes each time these keys are pressed.

1. Select ***Filtering***.



The settings screen for filtering will be displayed.

If *Frame/Field* is set to *Frame*, the filter size will be displayed in the top right-hand corner of the screen.



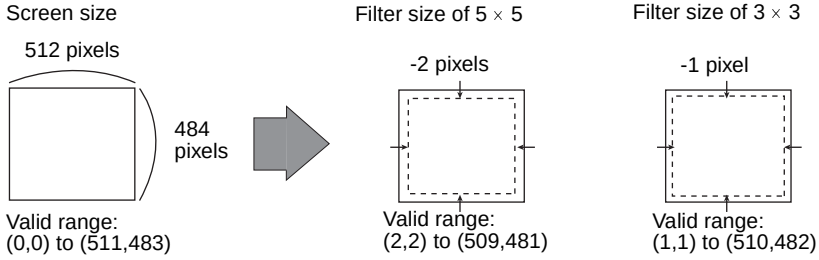
2. Select the filtering method while monitoring the image.

   Press the **SHIFT** + **ENT** Keys to change the filter size.

3. Press the **ENT** Key.

   The setting will be registered and the screen in (1.) will return.

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

Filter size of 5 × 5: -2 pixels × 2 = -4 pixels
Filter size of 3 × 3: -1 pixel × 2 = -2 pixels

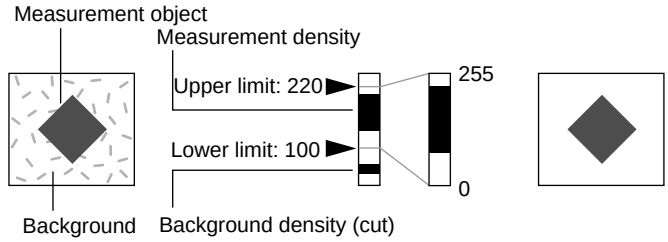
2-3-3 Background Suppression

Background suppression (BGS) excludes the background of the measurement object from the measurement process for easier measurement.

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

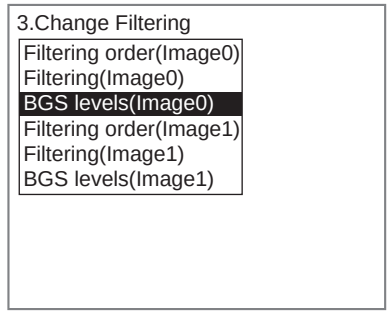
BGS changes image areas with densities below the lower limit to 0, and image areas with densities above the upper limit to 255. Image areas with densities between the lower and upper limits are graded from 0 to 255 so that only images with densities between the lower and upper limits are measured.

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

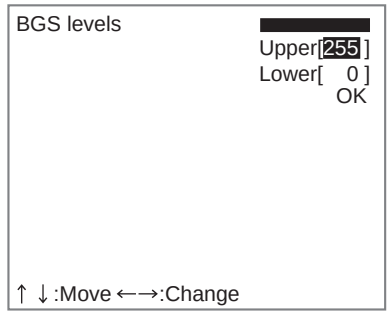


- Images with densities set to less than 100 are not measured and the density becomes 0.
- Only images with densities between 100 and 220 are measured and the images are graded between 0 and 255.

1. Select ***BGS levels***.



The settings screen for BGS levels will be displayed.



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

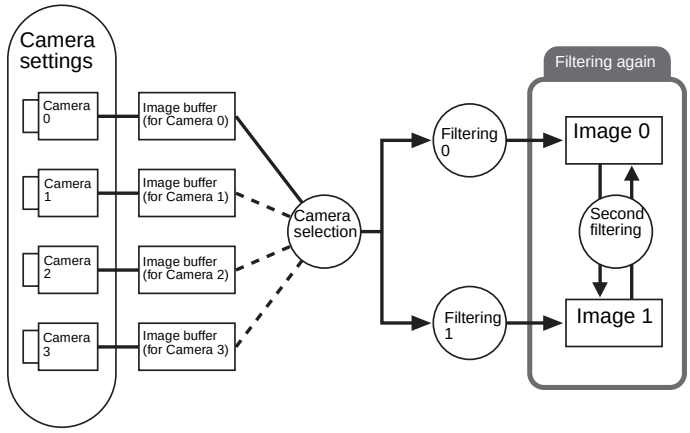
Right Key:	Increases the lowest digit by one.
SHIFT+Right Keys:	Increases the value 10 times faster.
Left Key:	Decreases the lowest digit by one.
SHIFT+Left Keys:	Decreases the value 10 times faster.

Up and Down Keys: Switches between setting items.

3. Use the same method to change the lower value.
4. Select ***OK***.
   The settings will be registered and the screen in (1.) will return.

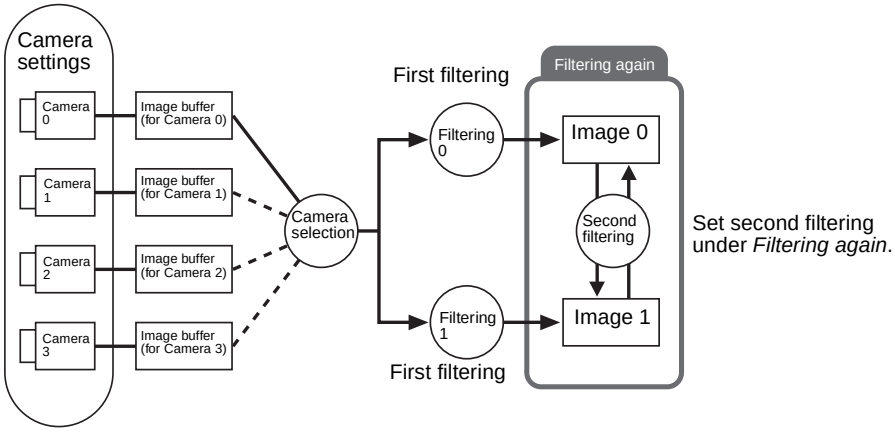
2-4 Filtering Again

The Filtering Again processing item is used to add filtering to an image. This processing item is useful if stronger smoothing is required to eliminate noise or increase edge enhancement.



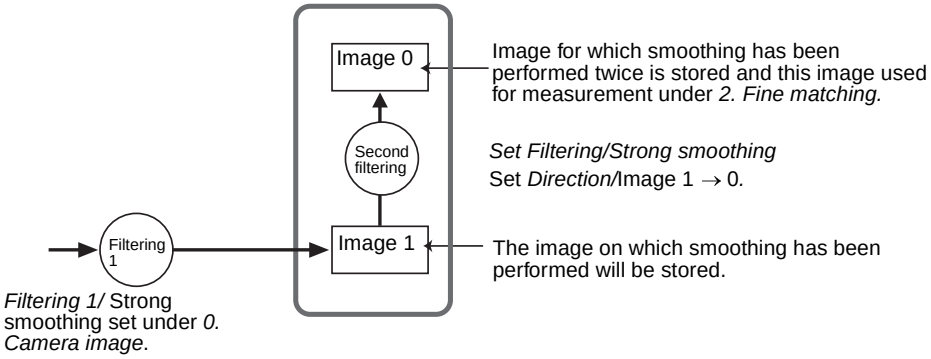
2-4-1 Direction

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. The direction function is used to select the direction of the transfer. (Which image is used for measurement, Image 0 or Image 1, depends on the processing item, so select the proper transfer direction for the processing item.)

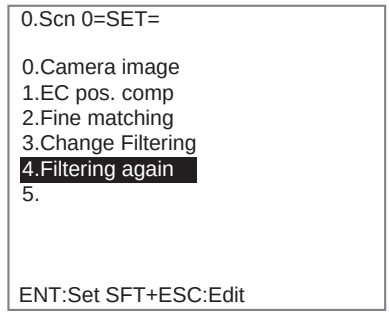


Example: To execute smoothing twice before measurement.

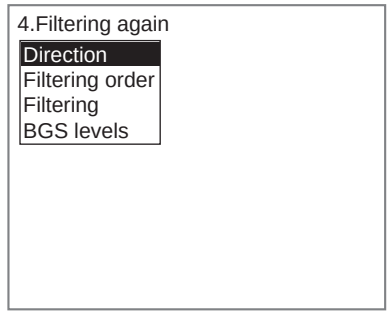
1. *Filtering again*.



1. Select ***Filtering again***.

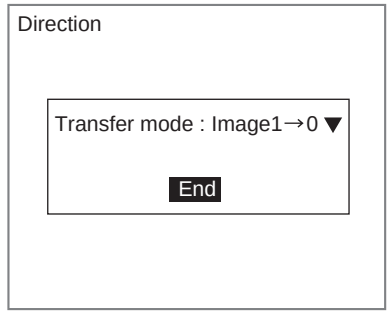


The initial Filtering Again Screen will be displayed.



2. Select ***Direction***.

   The Direction Selection Screen will be displayed.



3. Select the direction.
4. Select ***End***.

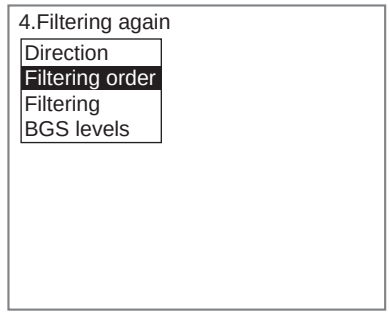
   The settings will be registered and the screen in (1.) will return.

2-4-2 Filtering Order

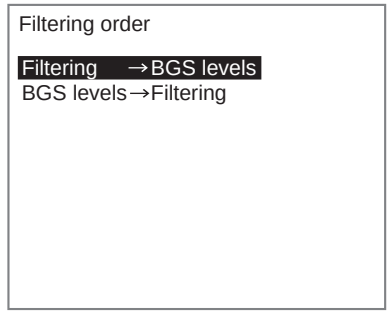
The processing order for filtering and BGS levels can be selected.

The cursor can be moved on the image to see the effects of filtering. Select the order while confirming the results on the image.

1. Select ***Filtering order***.



The settings screen for filtering order will be displayed.



2. Select the filtering order while monitoring the image.
3. Press the **ENT** Key.

   The setting will be registered and the screen in (1.) will return.

2-4-3 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: 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	Target	Function	Example application
OFF	---	---	---
Weak smoothing	Measurement objects with slight surface irregularity	Reduces the irregularity through smoothing. Select either weak or strong smoothing.	Stable searches
Strong smoothing			
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 inspection (using binary processing)
Horizontal edge extraction	Measurement objects difficult to extract due to bad image contrast	Extracts the horizontal edges (light and dark) of an image.	Defect inspection (using binary processing)
Edge extraction	Measurement objects difficult to extract due to bad image contrast	Extracts the vertical edges (light and dark) of an image.	Defect inspection (using binary processing)

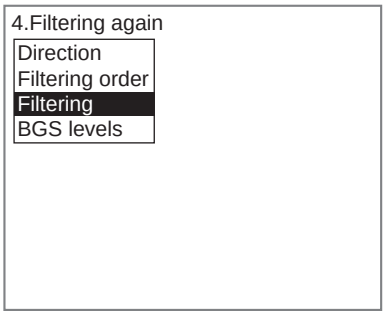
CHECK Filter Size

The strength of the filtering can be selected if *Frame/Field* is set to *Frame*.

3×3 ◄——► 5×5
Weak Strong

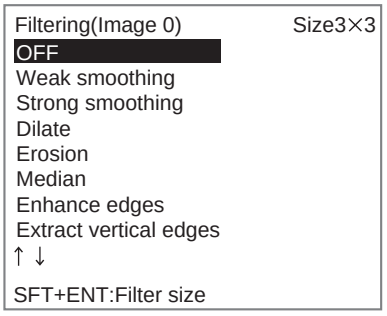
SHIFT + ENT The image changes each time these keys are pressed.

1. Select ***Filtering***.



The settings screen for filtering will be displayed.

If *Frame/Field* is set to *Frame*, the filter size will be displayed in the top right-hand corner of the screen.



2. Select the filtering method while monitoring the image.

   Press the **SHIFT** + **ENT** Keys to change the filter size.

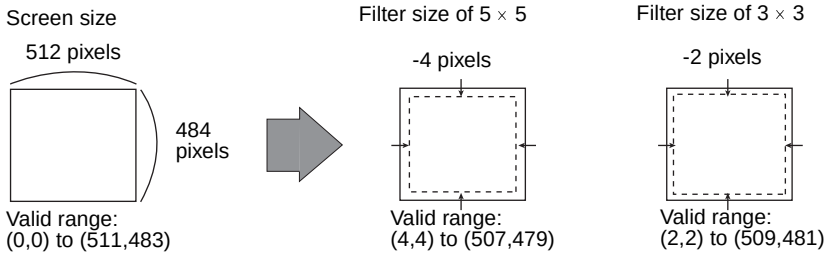
3. Press the **ENT** Key.

   The setting will be registered and the screen in (1.) will return.

CHECK If the Filtering Again processing item is set to filter the image again, the range of inaccurate pixels will be doubled. Do not include the outer edges of the screen when setting the measurement region.

For example:

Filter size of 5 × 5: -2 pixels × 2 = -4 pixels
Filter size of 3 × 3: -1 pixel × 2 = -2 pixels



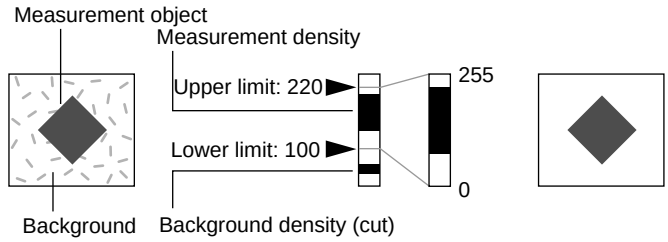
2-4-4 Background Suppression

Background suppression (BGS) excludes the background of the measurement object from the measurement process for easier measurement.

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

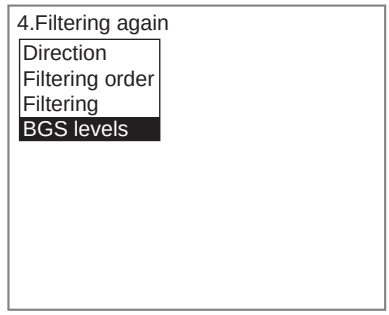
BGS changes image areas with densities below the lower limit to 0, and image areas with densities above the upper limit to 255. Image areas with densities between the lower and upper limits are graded from 0 to 255 so that only images with densities between the lower and upper limits are measured.

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

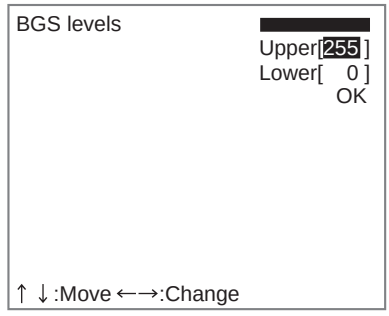


- Images with densities set to less than 100 are not measured and the density becomes 0.
- Only images with densities between 100 and 220 are measured and the images are graded between 0 and 255.

1. Select ***BGS levels***.



The settings screen for BGS levels will be displayed.



2. Move the cursor to the upper value and use the **Left** and **Right** Keys to adjust 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 10 times faster.

Up and Down Keys: Switches between setting items.

3. Use the same method to change the lower value.
4. Select ***OK***.

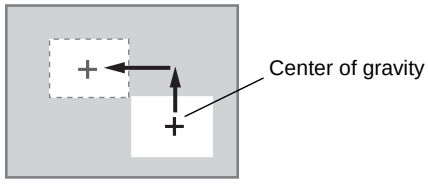
   The settings will be registered and the screen in (1.) will return.

2-5 Binary Position Compensation

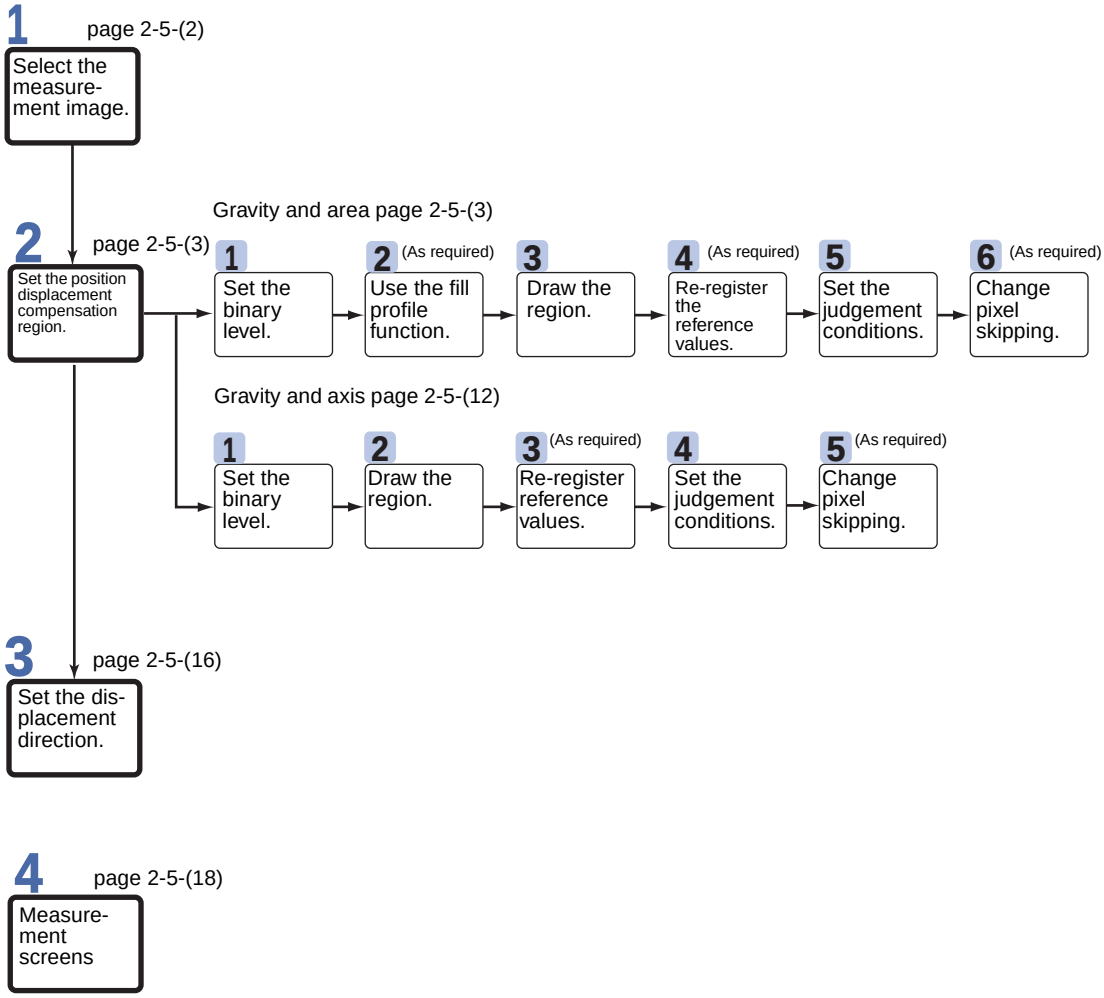
The Binary Position Compensation processing item is used to convert an image to binary, find the center of gravity of the measurement object, and detect the position compensation amount.

Binary position compensation can be performed even for measurement objects that are 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.



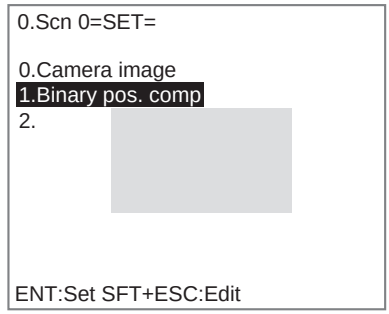
Operational Flow



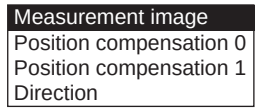
2-5-1 Selecting the Measurement Image

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

1. Select ***Binary pos. comp.***

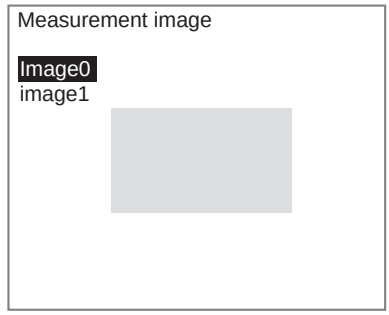


The initial Binary Position Compensation Screen will be displayed.



2. Select ***Measurement image***.

The selections will be displayed.

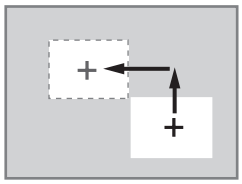
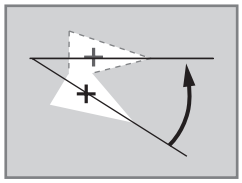


3. Select which image will be used for measurement, the image stored at Image 0 or the image stored at Image 1.
4. Press the **ENT** Key.

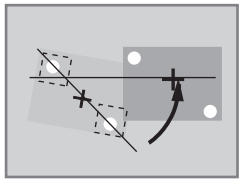
The settings will be registered and the screen in (1.) will return.

2-5-2 Setting the Position Displacement Compensation Region

There are two methods for binary position compensation.

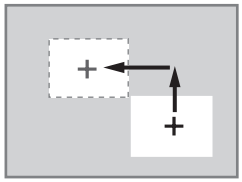
Method	Details
Gravity and area	Finds the center of gravity for the white pixel area and corrects the position displacement of the measurement object. 
Gravity and axis	Finds the center of gravity and axis angle for the white pixel area and corrects the position displacement of the measurement object. 

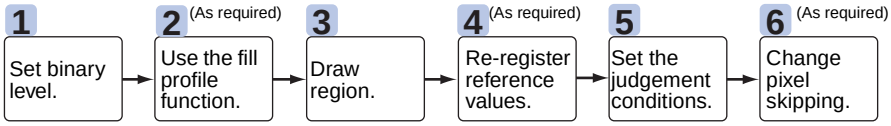
CHECK In addition, two regions can be set and position compensation performed using the center coordinates and angle connecting two points.



2-5-2-1 Position Compensation with Gravity and Area

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

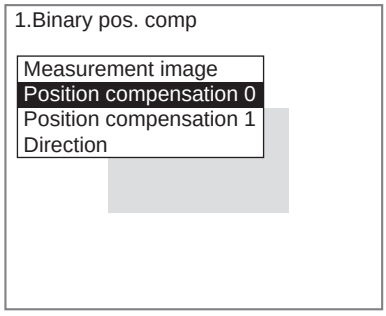




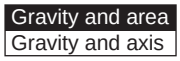
STEP 1: Setting the Binary Level

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

1. Select either ***Position compensation 0*** or ***Position compensation 1***.

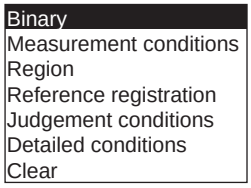


The screen for selecting the detection method will be displayed.



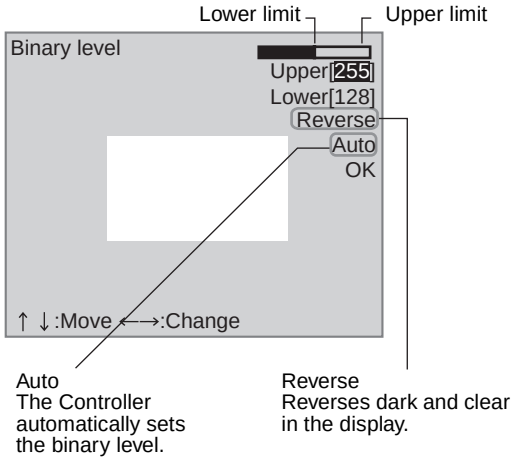
2. Select ***Gravity and area***.

The selections will be displayed.



3. Select ***Binary***.

The settings screen for binary levels will be displayed.



4. Move the cursor to the upper 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.

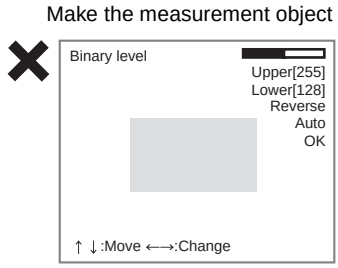
   Left Key: Decreases the lowest digit by one.

   SHIFT+Left Keys: Decreases the value 10 times faster.

   Up and Down Keys: Switches between setting items.

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

CHECK Set the upper and lower limits to make the measurement object white.



6. Select ***OK***.

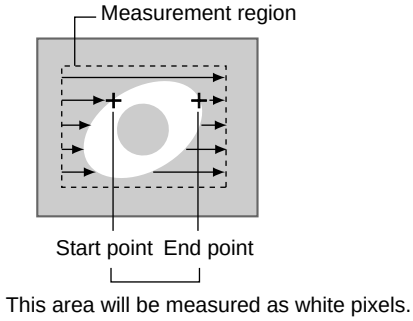
   The settings will be registered and the screen in (2.) will return.

CHECK It is also possible to set the binary level so that measurement is performed only for an intermediate density range.

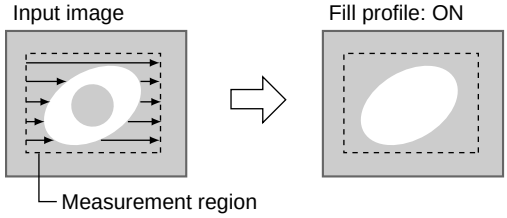
STEP 2: Using the Fill Profile Function (Setting Judgement Conditions)

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

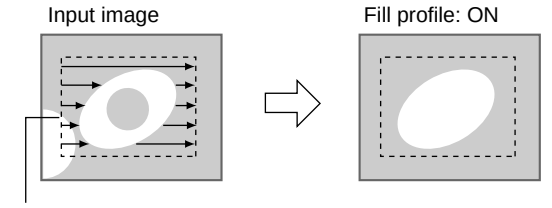
Turn ON the fill profile function to measure the whole area between the start point (black pixels to white) and the end point (white pixels to black) in the measurement region as white pixels. The default setting for this function is OFF.



Example

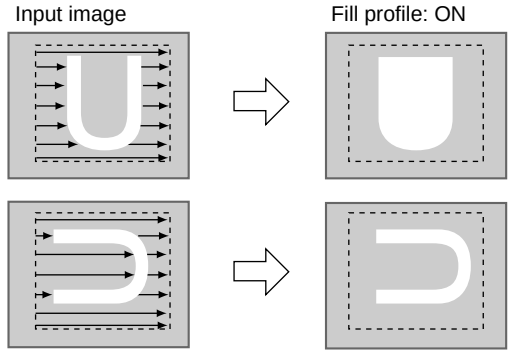


When a White-pixel Section Encroaches on the Measurement Region

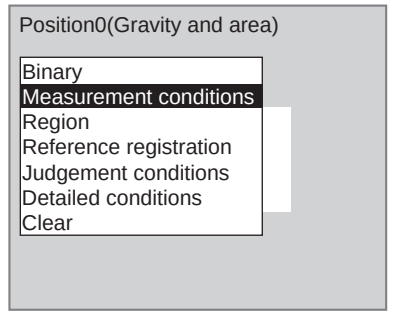


Measuring Open-form Measurement Objects

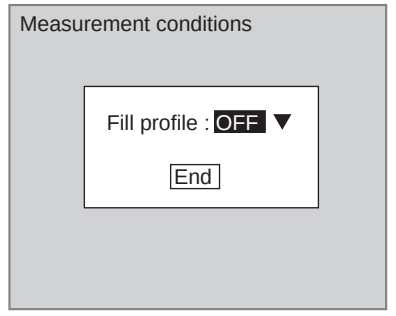
The measurement result changes depending on the orientation of the measurement object.



1. Select ***Measurement conditions***.



The screen for setting the measurement conditions will be displayed.



2. Select either ***ON*** or ***OFF***.
3. Select ***End***.

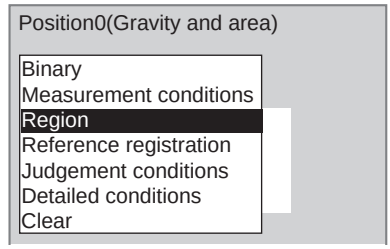
   The setting will be registered and the screen in (1.) will return.

STEP 3: Drawing Regions

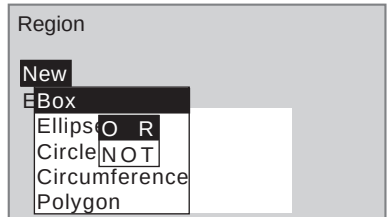
When a measurement region is drawn, measurement is performed for the displayed image and the results are registered as the reference values (area and center of gravity). This position becomes the reference position, so be sure to place the measurement object in the correct position before drawing the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

CHECK Regions 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.

1. Select ***Region***.

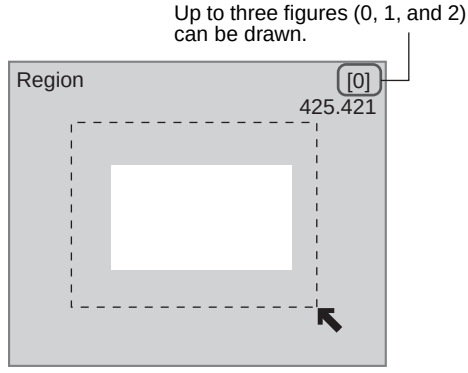


The Region Settings Screen will be displayed.



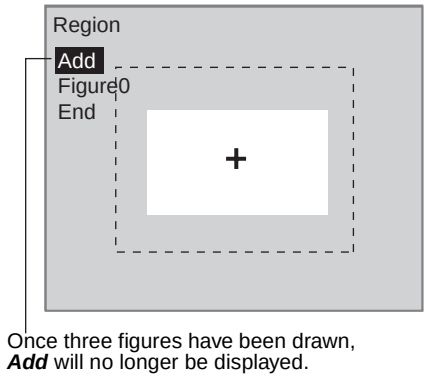
2. Select ***New***.
3. Select the desired figure.
4. Select the desired drawing mode (***OR***/***NOT***).

An arrow cursor will appear.



5. Draw the region with the selected figure.

   The figure will be registered.

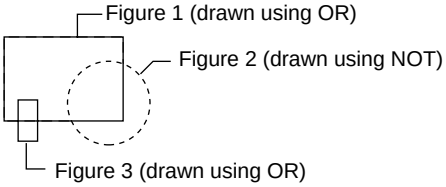


6. If additional figures are to be drawn, select ***Add***.
7. Repeat steps 3 to 5 as necessary to create the desired figure.
8. After drawing is completed, select ***End.***

   The measurement region will be registered and the screen in (1.) will return.

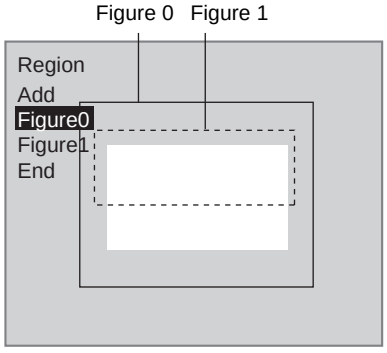
   The center of gravity (marked by an arrow cursor) and the measurement region will be displayed.

CHECK Figures drawn using OR mode are displayed with solid lines and figures drawn using NOT mode are displayed with dotted lines.



Correcting or Clearing Figures

1. In the screen for step 5 above, select the figure to be changed or cleared using the **Up** and **Down** Keys and press the **ENT** Key.



   The figure for the figure number selected using the cursor will be displayed with solid lines. The selections ***Correct*** and ***Clear*** will be displayed.

2. Select either ***Correct*** or ***Clear*** and press the **ENT** Key.

   If ***Correct*** is selected, the cursor will be displayed. Correct the size and position of the figure as desired.

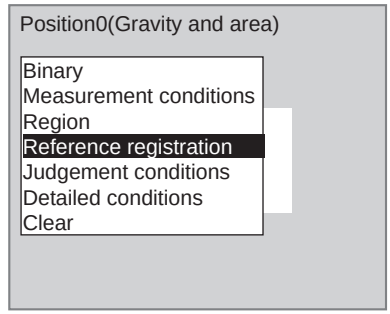
   If ***Clear*** is selected, the selected figure will be cleared.

STEP 4: Re-registering Reference Values

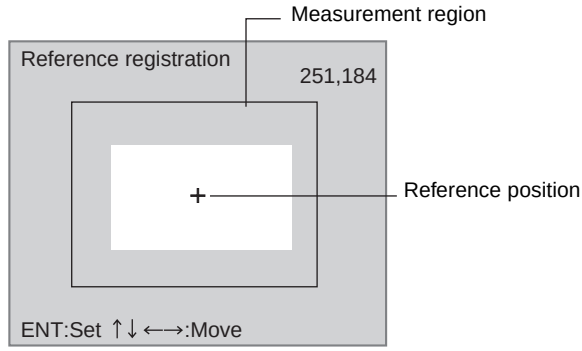
This operation is performed when only the reference values are to be re-registered.

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.

1. Select ***Reference registration***.



   A cursor will appear at the position of the center of gravity.



2. To change the position, use the **Up**/**Down** and **Right**/**Left** Keys to move the cursor.
3. Press the **ENT** Key.

   The setting will be registered and the screen in (1.) will return.

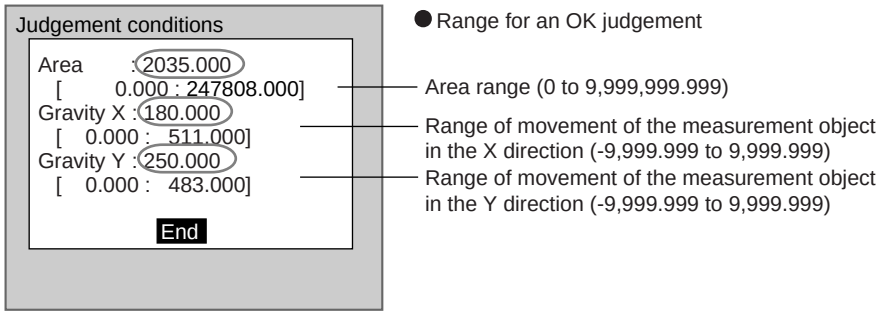
STEP 5: Setting the Judgement Conditions

Make settings for the area and center of gravity.

CHECK Position Compensation Judgement Results and Scrolling

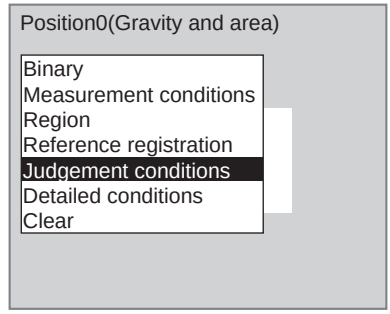
OK: Scroll will be performed.

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

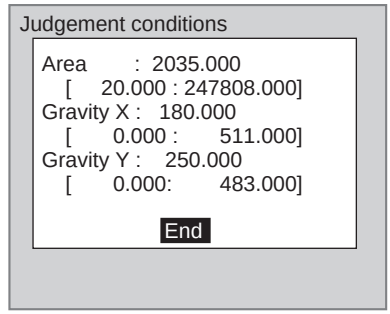


: Measurement results for the displayed image
Use these values as a reference for setting upper and lower limits.

1. Select ***Judgement conditions***.



The Judgement Conditions Settings Screen will be displayed.



2. Change the settings.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

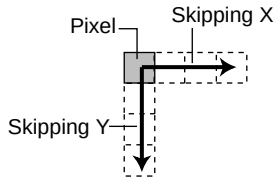
STEP 6: Changing Pixel Skipping

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.

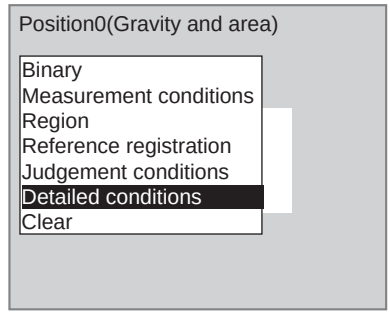
Once the skipping setting has been changed, perform a measurement and confirm that measurement can be performed correctly.

Skipping X and Skipping Y

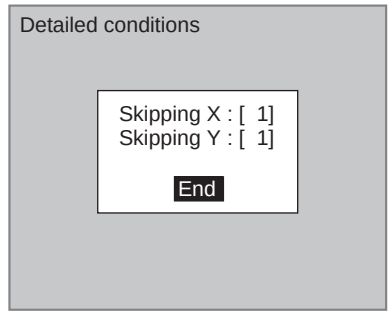
Set how many pixels to skip in the measurement region during measurement. The default setting is 1, which means that all of the measurement region will be measured.



1. Select ***Detailed conditions***.



The Detailed Conditions Settings Screen will be displayed.



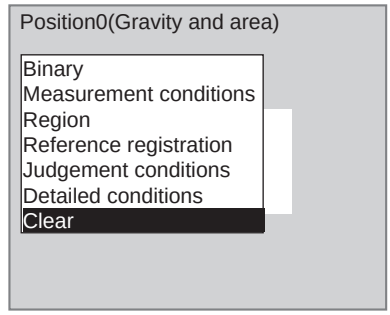
2. Set the number of pixels to skip.
3. Select ***End***.

   The setting will be registered and the screen in (1.) will return.

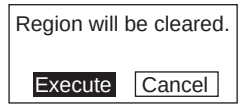
Changing to Gravity and Axis (Clearing)

Clear the settings first before changing to *Gravity and axis*.

1. Select ***Clear***.

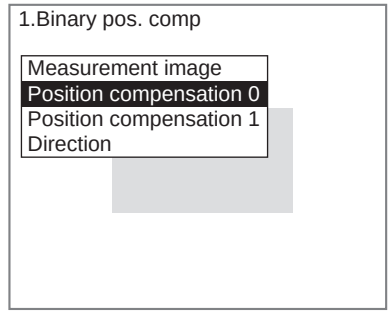


A confirmation message will be displayed.



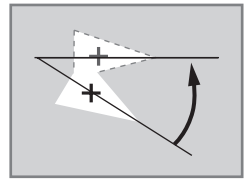
2. Select ***Execute***.

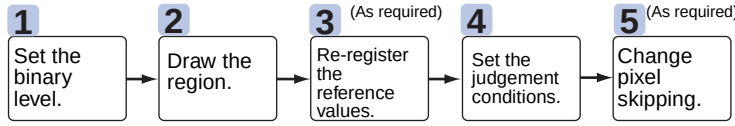
   The settings will be cleared and the initial screen for binary position compensation will be displayed.



2-5-2-2 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.

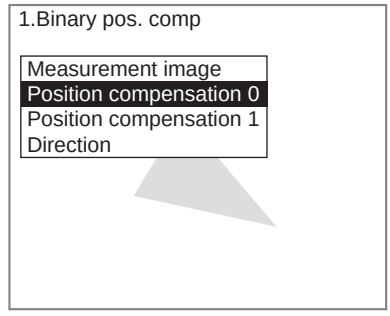




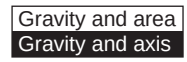
STEP 1: Setting the Binary Level

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

1. Select either ***Position compensation 0*** or ***Position compensation 1***.

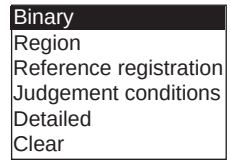


The screen for selecting the detection method will be displayed.



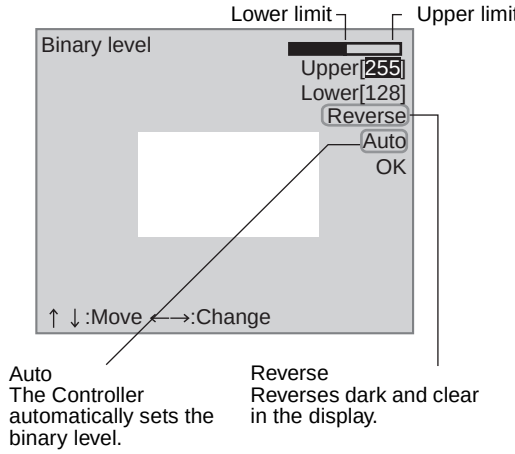
2. Select ***Gravity and axis.***

   The initial screen for gravity and axis will be displayed.



3. Select ***Binary***.

   The settings screen for binary levels will be displayed.

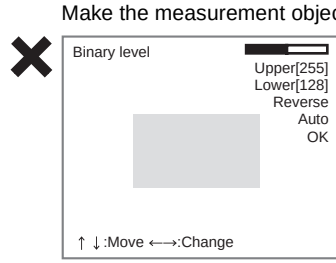


4. Move the cursor to the upper limit and use the **Left** and **Right** Keys to change the value.

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 10 times faster.
Up and Down Keys:	Switches between setting items.

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

CHECK Set the upper and lower limits to make the measurement object white.



6. Select ***OK***.

   The settings will be registered and the screen in (2.) will return.

CHECK It is also possible to set the binary level so that measurement is performed only for an intermediate density range.

STEP 2: 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, center of gravity, and axis angle). This position becomes the reference position for position compensation, so be sure to place the measurement object in the correct position before drawing the measurement region.

The settings method is the same as for *Gravity and area*.

SeeAlso Refer to page 2-5-(7).

STEP 3: Re-registering Reference Values

This operation is performed when only the reference values are 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 angle are registered for the reference values.

The settings method is the same as for *Gravity and area*.

SeeAlso Refer to page 2-5-(9).

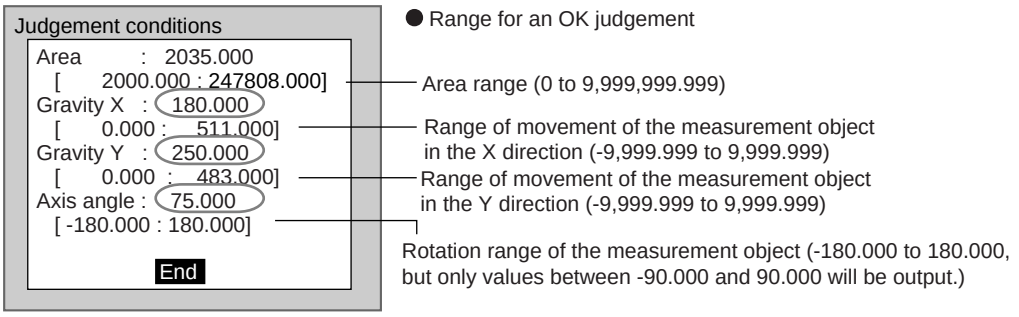
STEP 4: Setting the Judgement Conditions

Make settings for the area, center of gravity, and axis angle.

CHECK Position Compensation Judgement Results and Scrolling

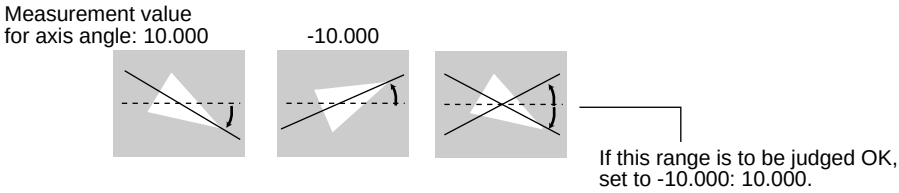
OK: Scroll will be performed.

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

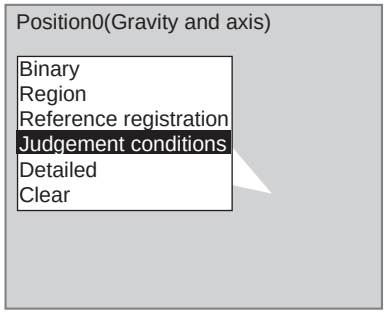


○: Measurement results for the displayed image
Use these values as a reference for setting upper and lower limits.

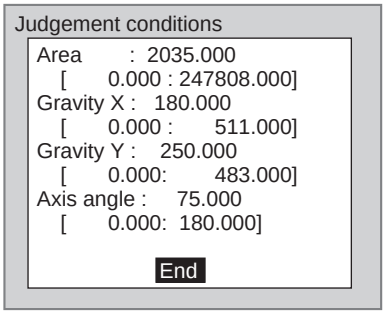
Axis Angle



1. Select ***Judgement conditions***.



The Judgement Conditions Settings Screen will be displayed.



2. Change the settings.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

STEP 5: Changing Pixel Skipping

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.

Once the skipping setting has been changed, perform a measurement and confirm that measurement can be performed correctly.

The settings method is the same as for *Gravity and area*.

SeeAlso Refer to page 2-5-(10).

Changing to Gravity and Area (Clearing)

Clear the settings before changing to *Gravity and area*.

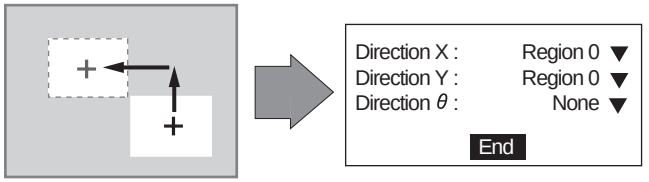
The settings method is the same as for *Gravity and area*.

SeeAlso Refer to page 2-5-(11).

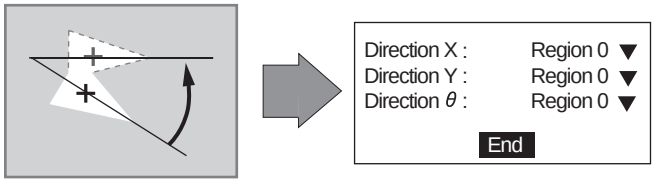
2-5-3 Setting the Displacement Direction

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.

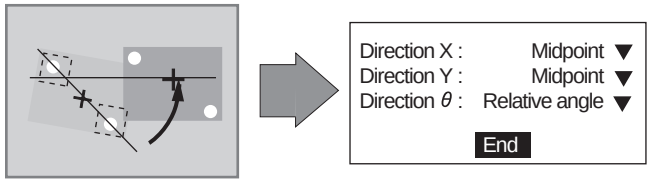
Measurement Objects Not at An Angle (Example: Gravity and Area Set to Region 0)



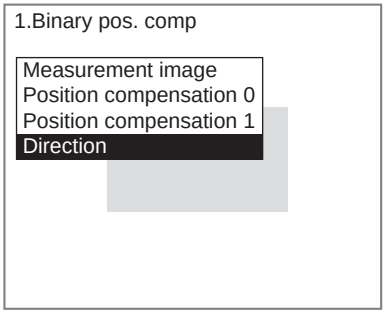
Measurement Objects at an Angle (Example: Gravity and Axis Set to Region 0)



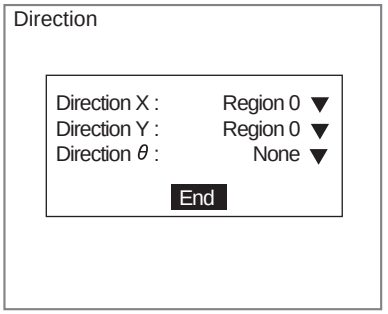
For Precision Position Compensation Using Measurement Object Angles (Example: When Region 0 and Region 1 Set)



1. Select ***Direction***.



The screen for setting direction conditions will be displayed.



2. Set the conditions.
3. Select ***End***.
   The settings will be registered and the screen in (1.) will return.

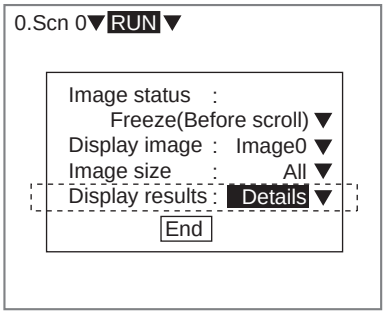
2-5-4 Measurement Screens

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

This section describes what kind of information can be displayed for binary position displacement compensation.

SeeAlso Refer to *SECTION 3 Monitor Mode and Run Mode* for details on Monitor and Run modes.

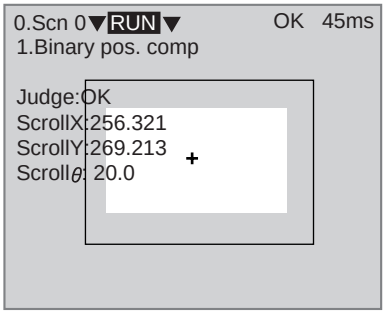
CHECK Press the **SHIFT+ESC** Keys on the Run Screen to access the following screen and change ***Display results*** to ***Details***.



Use the **Up** or **Down** Key to change to the unit for which binary position compensation is set and the following detailed screens will be displayed.

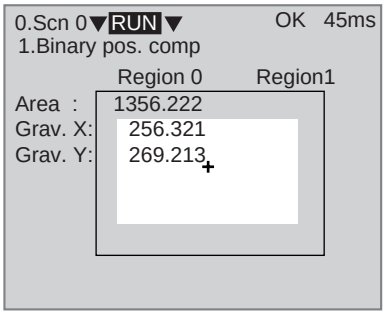
Use the **SHIFT+Right** or **Left** Keys to switch in order between the three screens.

Scroll Amount



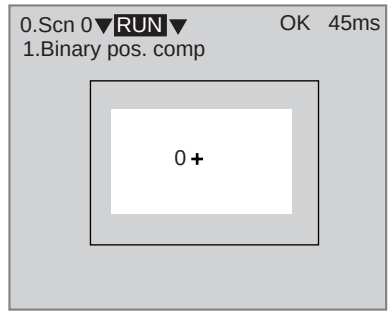
Detailed Display

The measurement values for each region will be displayed.



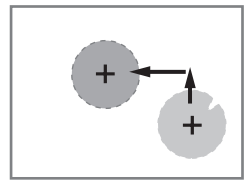
Position Display

Only the region will be displayed.

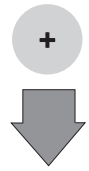


2-6 EC Position Compensation

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

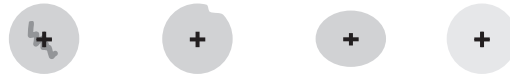


Mark used for position displacement compensation



Position displacement compensation can be performed even under the following conditions:

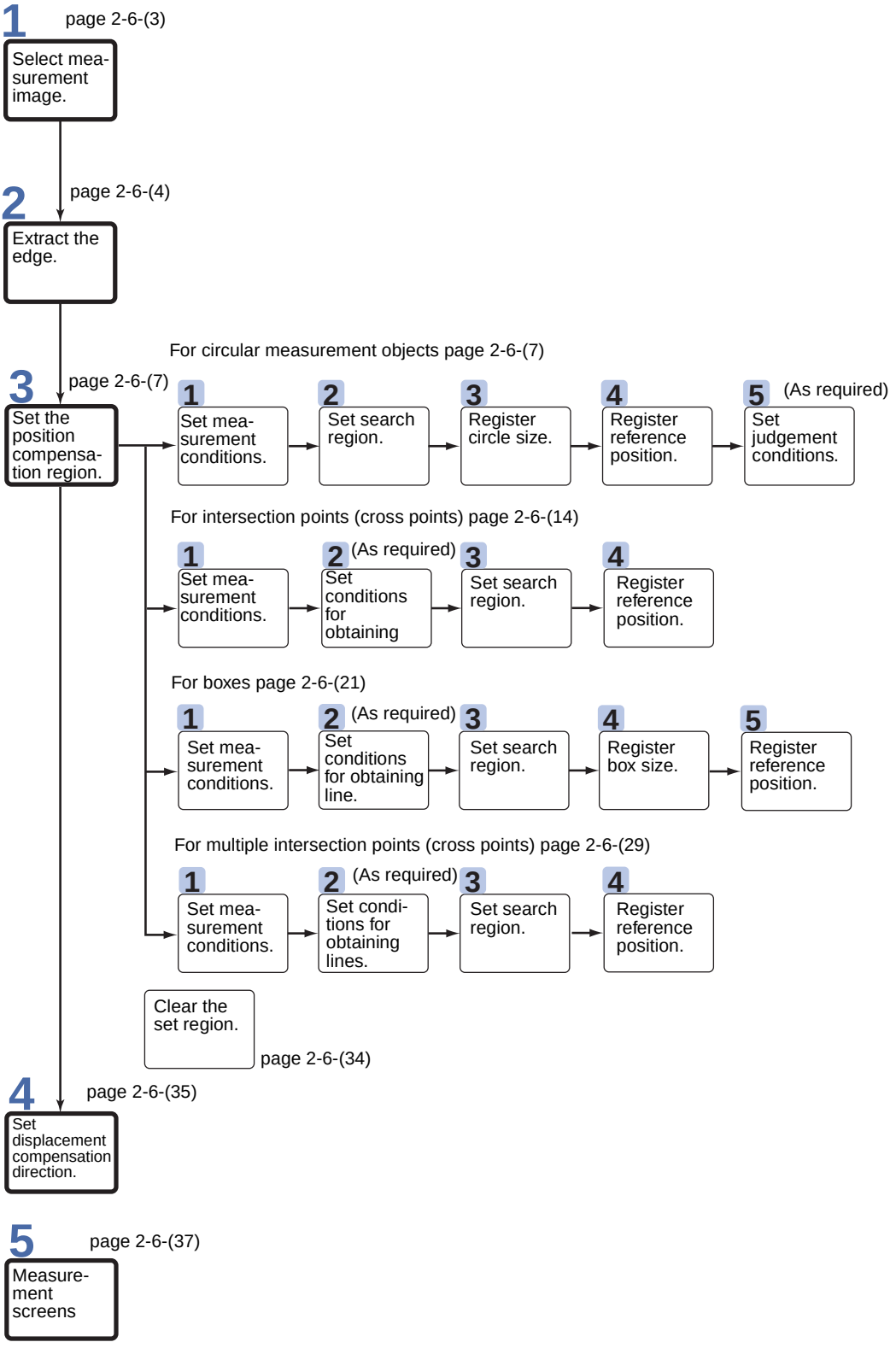
Internally altered | Chipped | Deformed | Low contrast



This function can be used for position displacement compensation of a variety of shapes.

HELP Refer to *7-4 Terminology* for information on edge codes (EC).

Operational Flow

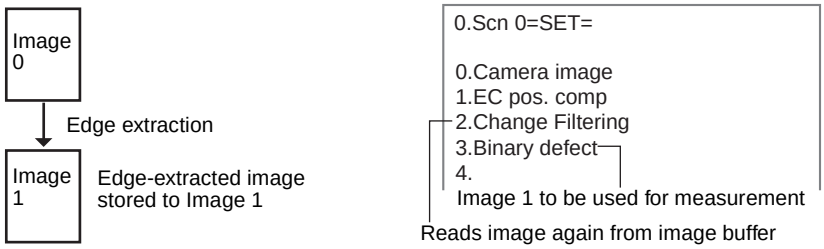


2-6-1 Selecting Measurement Images

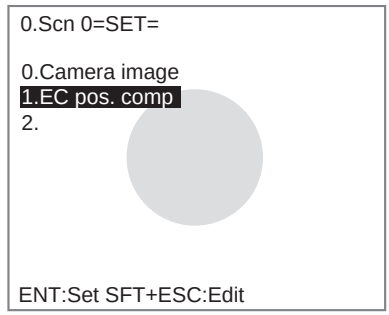
This section describes how to select an image stored at either Image 0 or Image 1 as the image for measurement.

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 Position Compensation was set. Then store the image stored in the image buffer to Image 0 or Image 1.

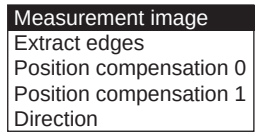
Example: When Image 0 Is Selected as Measurement Image



1. Select ***EC pos. comp.***

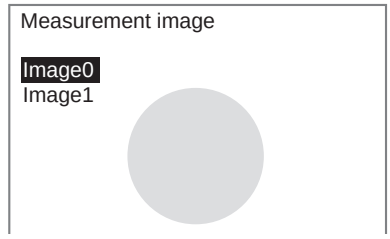


The initial screen for EC position compensation will be displayed.



2. Select ***Measurement Image***.

   The selections will be displayed.



3. Select which image will be used for measurement, the image stored at Image 0 or the image stored at Image 1.
4. Press the **ENT** Key.

   The settings will be registered and the screen in (1.) will return.

2-6-2 Extracting Edges

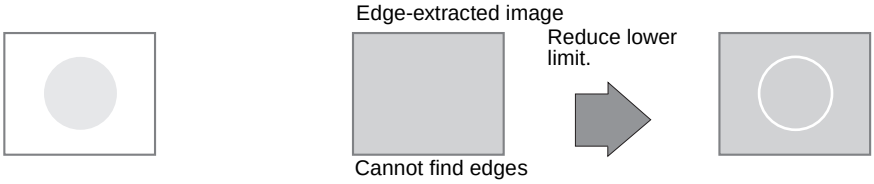
EC position compensation is performed for images for which the edges have been extracted. Adjust the upper and lower levels for edge extraction if there is low contrast between the measurement object and the background and to remove noise.

Upper and Lower Limits

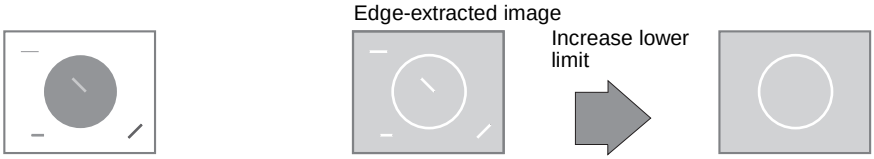
Set the level to which the background will be cut from the edge-extracted image. The levels can be set between 10 and 255 (default 100:255).

Areas with a density above the lower limit will become the edge of the measurement object. Refer to the following examples and adjust the upper and lower limits.

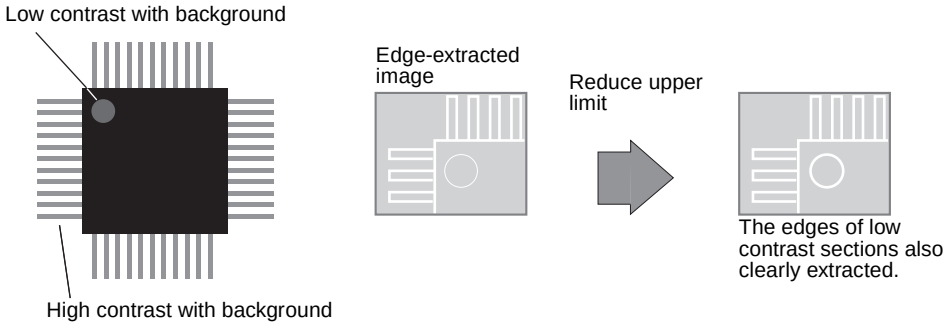
Example: Cannot Find Edges Due to Low Contrast



Example: To Remove Noise



Example: Other Edges Clearly Extracted But Cannot Find Desired Mark Edge with Stability



CHECK If the lower limit is too low, low-level noise may remain even if the image appears noise-free on the screen. If measurements are not stable, use the following methods to see if unwanted edges have been extracted and eliminate them.

- Checking Method
  Lower the upper limit to the same value as the lower limit. If many unwanted edges are displayed, then the lower limit is too low. Return the upper limit to its original value after completing this check.
- Elimination Method
  Increase the lower limit, or use smoothing or median filtering.

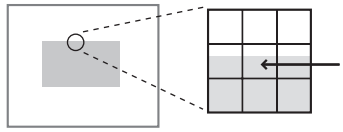
SeeAlso Refer *2-1 Inputting Camera Images* and *2-4 Filtering Again* (where smoothing can be set to be executed twice).

Mask Size

The mask size function is used when searching for edges to judge edges using peripheral information. Select how much peripheral pixel information to use. The selections are 5 × 5 (default) or 3 × 3.

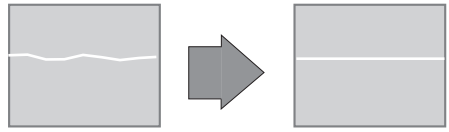
CHECK This setting will be enabled only if *Frame/Field* under *Camera image* is set to *Frame*. If set to *Field*, the effect will remain the same as if 5 × 5 is selected even if 3 × 3 is selected.

Example: Select 3 × 3



Information from the surrounding 9 pixels is used to determine whether or not the center pixel is the edge. (1 square = 1 pixel)

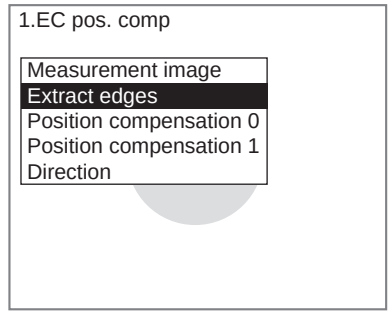
The greater the mask size, the more the variations in surrounding pixels can be absorbed. Select 5 × 5 to ignore uneven edges.



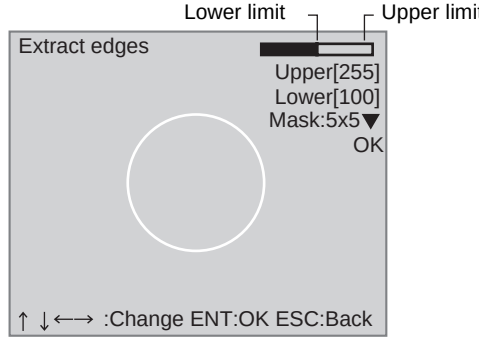
CHECK This function is even more effective if smoothing is used.

SeeAlso Refer to *2-1 Inputting Camera Images*, *2-3 Changing Filtering*, and *2-4 Filtering Again* (where smoothing can be set to be executed twice).

1. Select ***Extract edges***.



The screen for setting edge extraction levels will be displayed.



2. Set the upper and lower limits.

   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 10 times faster.

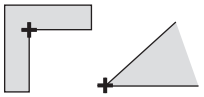
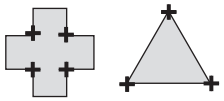
Up and Down Keys: Switches between setting items.

3. Select the mask size.
4. Select **OK**.

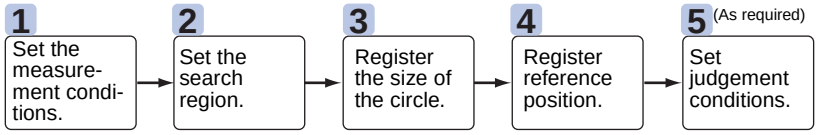
   The settings will be registered and the screen in (1.) will return.

2-6-3 Setting Position Displacement Compensation Regions

The following four figures can be chosen for position displacement compensation regions, depending on the figure of the positioning mark.

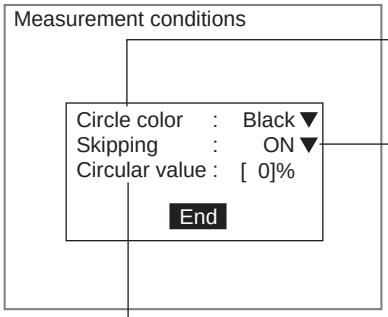
Positioning mark		Figure	Details
Circular 		Circle	Searches for a circle of a specified size and outputs the position coordinates (center of the circle).
Box 		Box	Searches for a rectangle of a specified size and outputs position coordinates. The center or one of the four corners can be selected for the position coordinates.
Other figures	One angle used as a mark 	Cross point	Outputs the position coordinates of the intersection of two lines. If there are multiple lines, the following conditions can be set: • Output the cross point only for an intersection at a certain angle. • Output the cross point only for an intersection of lines of a certain length.
	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.

2-6-3-1 Circles



STEP 1: Setting Measurement Conditions

Set the conditions to search for the positioning mark.



Select whether the color of the circle that is 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. (Black*, white, white/black)

Select whether pixel skipping (1 pixel) will be used when searching for the circle. (ON*, OFF)

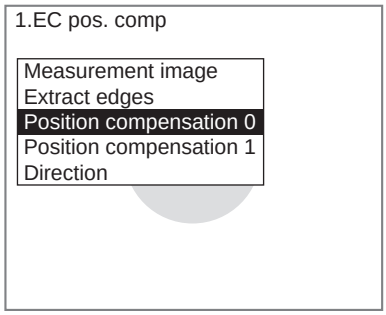
Processing is faster if pixel skipping is turned ON, so normally “ON” is appropriate. However, if the measurement values are inconsistent, set to “OFF.”

Checks circle deformation. (0% to 100% (0%*))

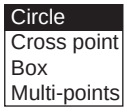
The value drops if the circle is deformed or chipped. The object is not extracted as a circle if the value is lower than the set value.

The asterisk (*) indicates the default setting.

1. Select ***Position compensation 0*** or ***Position compensation 1***.

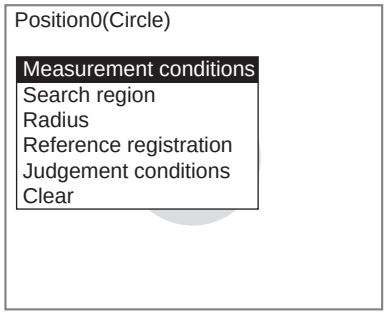


The figure selections will be displayed.



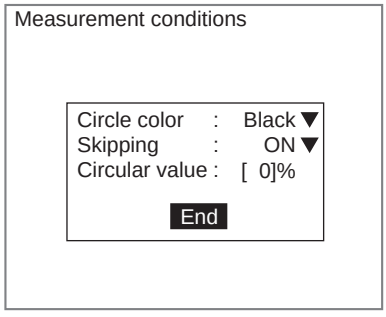
2. Select ***Circle***.

The initial Circle Screen will be displayed.



3. Select ***Measurement conditions***.

The Measurement Conditions Settings Screen will be displayed.



4. Make the settings for each item.
5. Select ***End***.

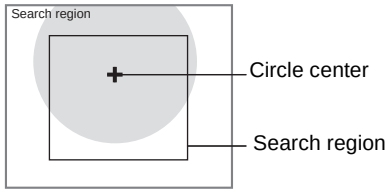
The settings will be registered and the screen in (2.) will return.

STEP 2: Setting the Search Region

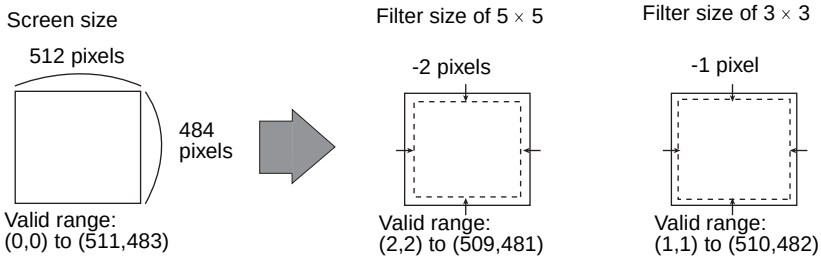
Set the region to search for the positioning mark.

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

CHECK 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.



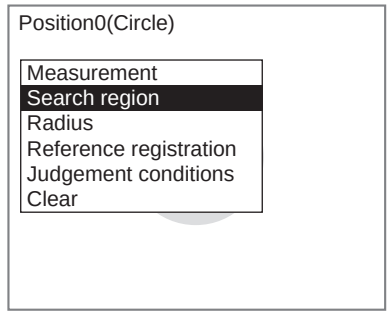
Each time the image is filtered, the range of inaccurate pixels will be increased further. For example, if filtering is performed twice, the valid range will be reduced as follows:

Filter size of 5 × 5: -2 pixels × 3 = -6 pixels

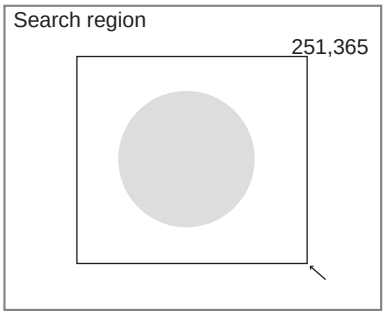
Filter size of 3 × 3: -1 pixel × 3 = -3 pixels

(Filtering is also performed once in edge extraction, so filtering is actually performed a total of three times.)

1. Select ***Search region***.



The screen for drawing search regions will be displayed.



2. Draw a rectangular search region.

   Specify the upper left and lower right coordinates.

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

   ENT Key: Confirms the settings.

   When the bottom right coordinates have been set, the screen in (1.) will return.

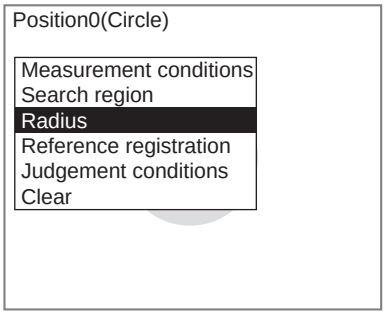
STEP 3: Registering the Size of the Circle

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

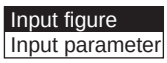
Registration method	Details
Input figure	The measurement object is displayed on the screen, a circle is drawn on the exterior edge of the object and the size of the circle is registered.
Input parameter	The radius of the circle and the permissible range are entered as parameters (in pixel units).

Inputting Figures

1. Select ***Radius***.

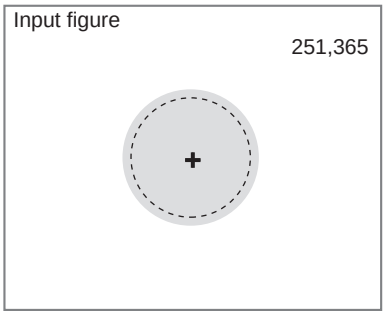


The registration selections will be displayed.

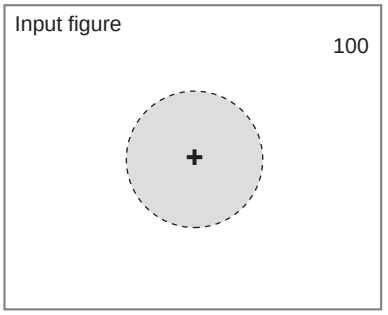


2. Select ***Input figure***.

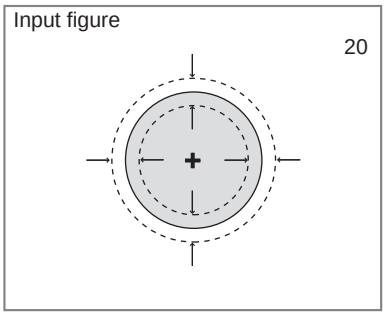
The screen for drawing figures will be displayed.



3. 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.



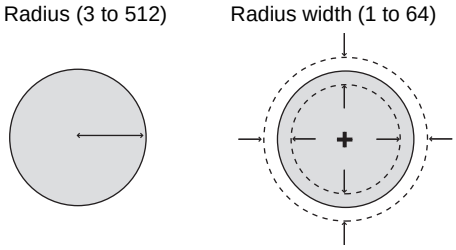
4. Specify the radius (3 to 512 pixels).
   Up/Right Keys: Larger
   Down/Left Keys: Smaller
   ENT Key: Confirms the setting.
   The screen for setting the latitude of the radius will be displayed.



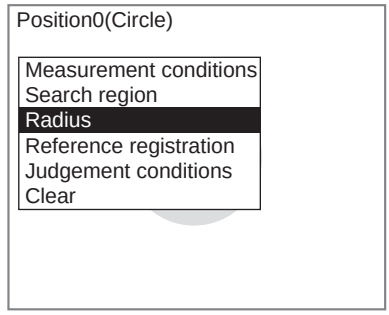
5. Specify the latitude the radius (1 to 64 pixels).
   Up/Right Keys: Larger
   Down/Left Keys: Smaller
   ENT Key: Confirms the setting.
   The settings will be registered and the screen in (1.) will return.

Inputting Parameters

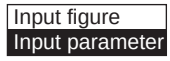
Input the parameters in pixel units for the radius and latitude of the search circle.



1. Select ***Radius***.

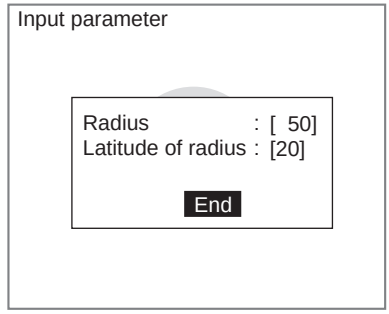


The registration selections will be displayed.



2. Select ***Input parameter***.

The Input Parameter Settings Screen will be displayed.



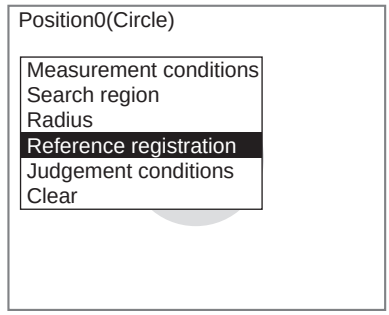
3. Make the settings for each item.
4. Select ***End***.

The settings will be registered and the screen in (1.) will return.

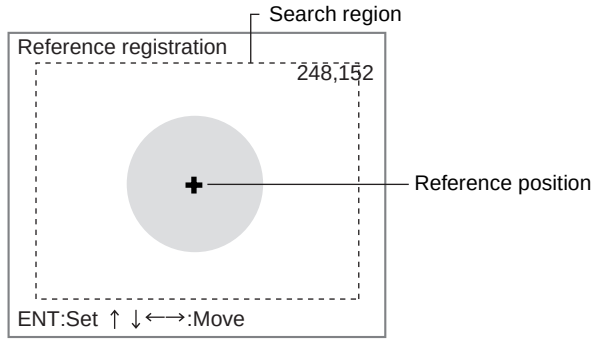
STEP 4: Registering Reference Positions

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

1. Select ***Reference registration***.



The circle will be found for the currently displayed image and a display cursor will be placed at the center of the circle.



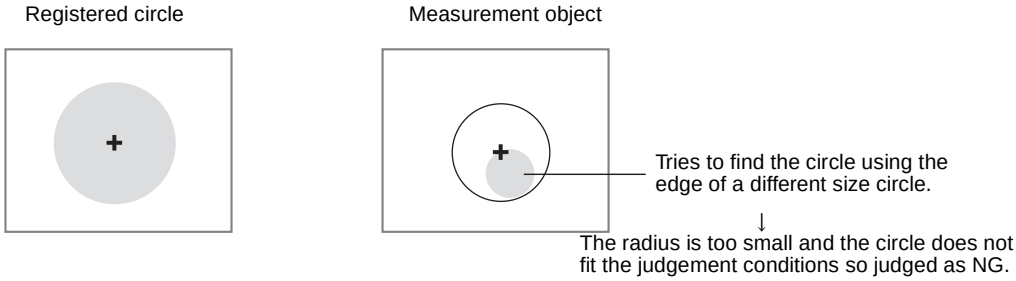
2. Use the **Up**/**Down** and **Right**/**Left** Keys to move the cursor to change the position.
3. Press the **ENT** Key to save the setting.

   The setting will be registered and the screen in (1.) will return.

STEP 5: Setting Judgement Conditions

Set the conditions for judging whether or not a circle of the registered size has been found. Set in pixel units the radius of circles to receive an OK judgement. The setting range is 1.000 to 9,999.999. Any circles found of a different size can be judged as NG.

Example: Only Circles Smaller than the Registered Size Displayed on Screen

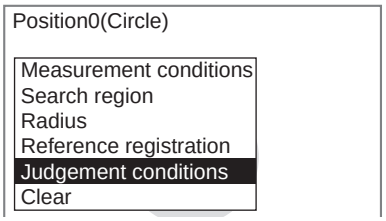


CHECK Position Compensation Judgement Results and Scrolling

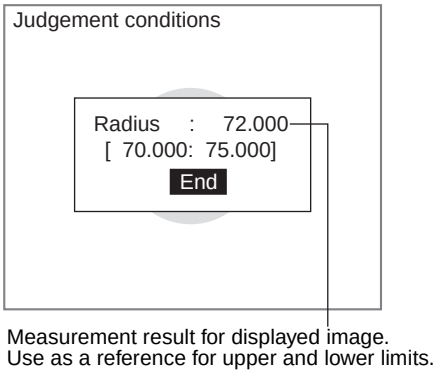
OK: Scroll will be performed.

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

1. Select ***Judgement conditions***.



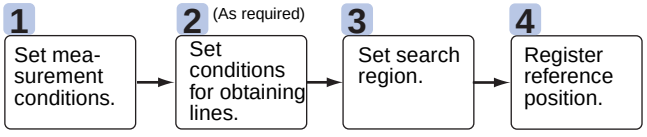
The Judgement Conditions Setting Screen will be displayed.



2. Set the radius range for an OK circle.
3. Select ***End***.

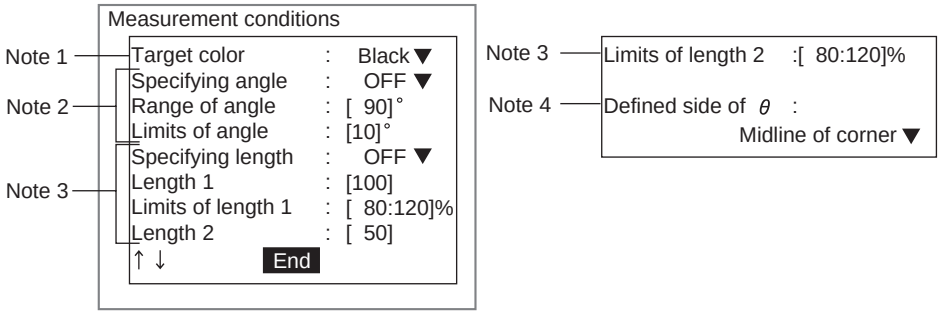
   The settings will be registered and the screen in (1.) will return.

2-6-3-2 Cross Points



STEP 1: Setting Measurement Conditions

Set the conditions for searching for the positioning mark.



Note

1. Select whether the color of the positioning mark will be white or black compared to the background. (Black*, white)

   The asterisk (*) indicates the default setting.

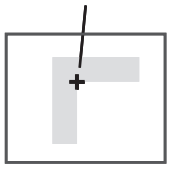
2. Angle
Use the following settings to set the angle of intersection and thus find the coordinates of only the desired intersection even though many lines exist on the screen.

Specifying angle: Set to ON.

Range of angle: Angle of the section in the target color (If the target color changes, change the angle setting too.)

Limits of angle: Set the permissible range for the angle.
Example: When the range of the angle is set to 90° and the limits of angle set to 10°, the cross point of lines that intersect at between 80° and 100° will be found.

Example: To find this point of intersection



Set the *Target color* to black, the *Specifying angle* to ON, and the *Range of angle* to 270°.

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.

Setting item	Selection
Specifying angle	ON, OFF*
Range of angle	0 to 359
Limits of angle	0 to 99 (10*)

The asterisk (*) indicates the default setting.

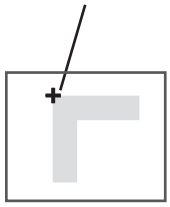
3. Length of lines
Use the following settings to set the length and thus find the coordinates of only the desired intersection even though many lines exist on the screen.

Specifying length: Set to ON.

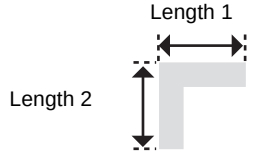
Length □: Set the line length in pixels.

Limits of length□: Set the permissible range for the length.

Example: To find this cross point



Set the *Length 1* and *Length 2* to the lengths shown below.



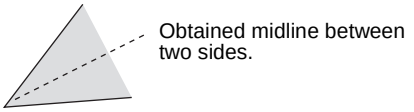
To find the coordinates of the cross point of lines regardless of their length, set *Specifying length* to OFF. The settings of the line lengths will be ignored.

Setting item	Selection
Specifying length	ON, OFF*
Length □	1 to 999
Limits of length □	1 to 200 (80:120*)

The asterisk (*) indicates the default setting.

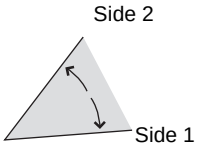
4. Only one angle (θ) will be output as the measurement results for the lines that are found. Select which position θ will be obtained.

   Midline of Corner*

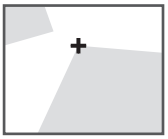


   The asterisk (*) indicates the default setting.

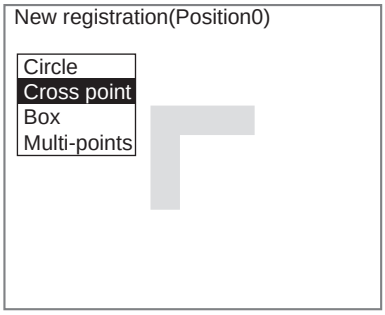
   Side 1 and Side 2
   With the target color between the two sides, the side in the clockwise direction is side 1 and the side in the counterclockwise direction is side 2.



CHECK If both the specifying angle and the 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.

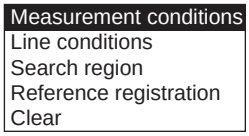


1. Display the figure selections using the same procedure as outlined under steps (1.) and (2.) for *Circle*.



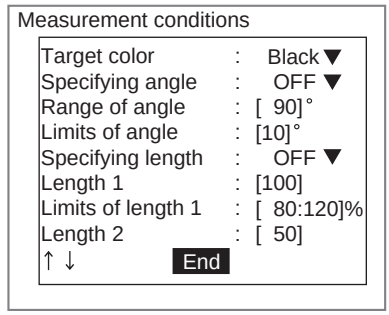
2. Select ***Cross point***.

   The initial screen for cross points will be displayed.



3. Select ***Measurement conditions***.

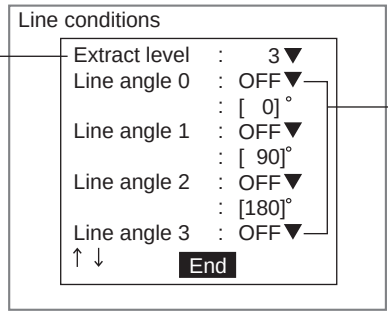
The Measurement Conditions Settings Screen will be displayed.



4. Make the settings for each item.
5. Select ***End***.
   The settings will be registered and the screen in (2.) will return.

STEP 2: Setting Conditions for Obtaining Lines

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



- To extract lines regardless of the angle:
  Line angle □: Set to OFF.
  Ignores setting in square brackets on second line.
- To extract only lines of a certain angle:
  Up to four angles can be specified.
  Line angle □: Set to ON.
  Set angle for lines to be detected in square brackets on second line.

Setting item	Selections
Line angle 0	ON, OFF*
	0 to 359 (*0)
LIne angle 1	ON, OFF*
	0 to 359 (*90)
LIne angle 2	ON, OFF*
	0 to 359 (*180)
LIne angle 3	ON, OFF*
	0 to 359 (*270)

The asterisk (*) indicates the default setting.

SeeAlso Refer to *Line Angles*, below.

The level for extracting lines can be changed. There are 5 levels (1 to 5) and the default setting is 3. Refer to the following examples and adjust the level as required.

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.

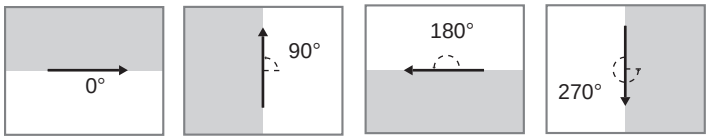
When the measurement object is small and cannot be detected easily.

Change the extraction level to a larger value.

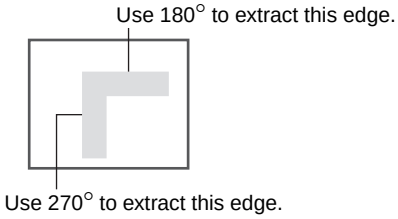
HELP Line Angles

The position where the brightness changes is extracted as an edge and the direction of the change in brightness is found. This direction is called the edge code and it indicates the direction of the edge. The way in which black and

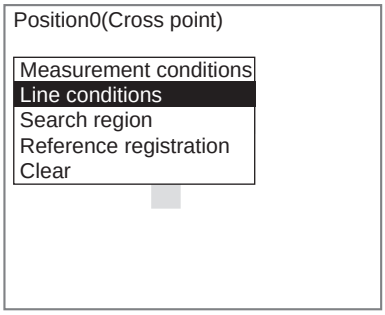
white meet determines the direction of the edge code, and the angle is calculated as shown below.



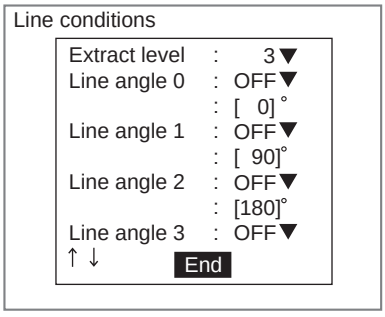
Example



1. Select ***Line conditions***.



The Line Conditions Settings Screen will be displayed.



2. Make the settings for each item.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

STEP 3: Setting the Search Region

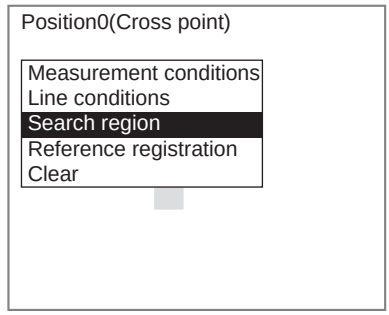
Set the region to search for the positioning mark.

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

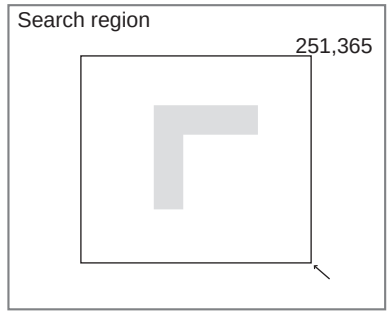
CHECK When edges are extracted, the pixels at the edges of the screen cannot be processed accurately. Do not include the outer edges of the screen when setting the search region.

SeeAlso Refer to page 2-6-(9) under *2-6-3-1 Circles*.

1. Select ***Search region***.



The screen for drawing search regions will be displayed.



2. Draw a rectangular search region.

   Specify the upper left and lower right coordinates.

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

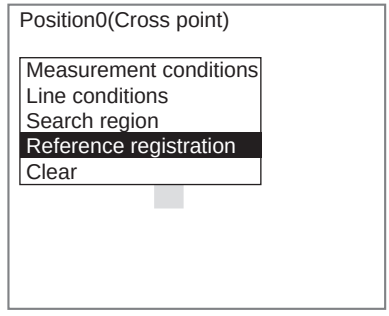
   ENT Key: Confirms the settings.

   When the bottom right coordinates have been set, the screen in (1.) will return.

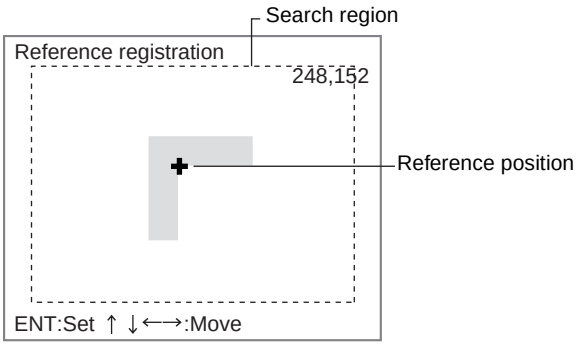
STEP 4: Registering Reference Positions

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

1. Select ***Reference registration***.



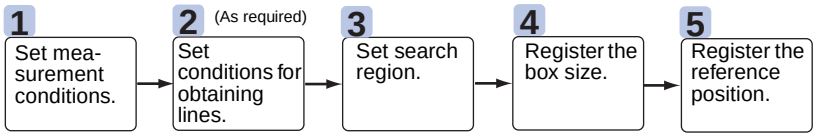
The Controller will search for the cross point in the displayed image that matches the conditions and a display cursor will appear at that position.



2. Use the **Up**/**Down** and **Right**/**Left** Keys to move the cursor to change the position.
3. Press the **ENT** Key to save the setting.

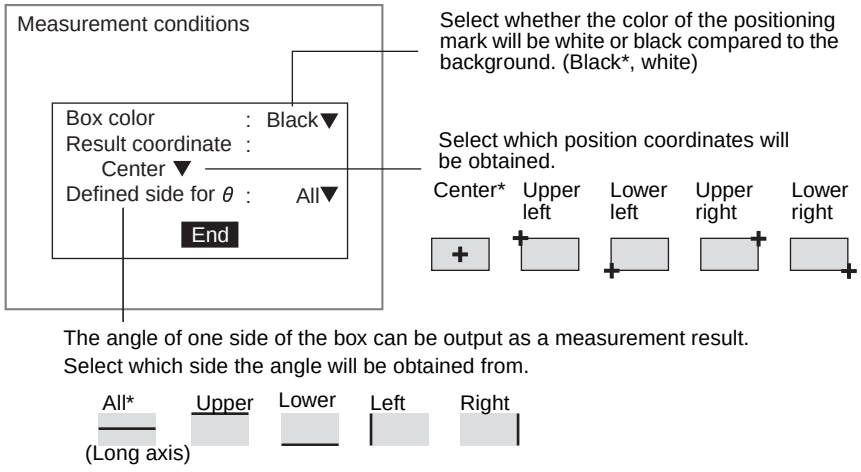
   The setting will be registered and the screen in (1.) will return.

2-6-3-3 Boxes



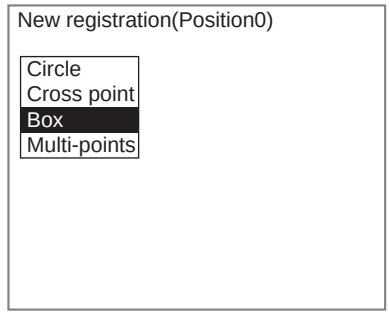
STEP 1: Setting Measurement Conditions

Set the conditions to search for the positioning mark.



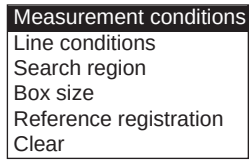
The asterisk (*) indicates the default setting.

1. Display the figure selections using the same operations as outlined under steps (1.) and (2.) for *Circle* described on page 2-6-(8).



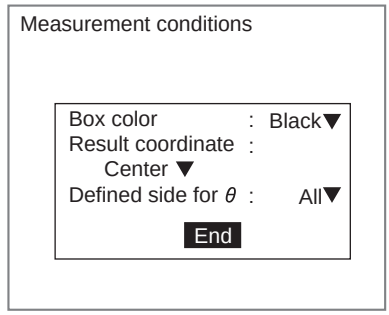
2. Select ***Box***.

   The settings selections will be displayed.



3. Select ***Measurement conditions***.

   The Measurement Conditions Settings Screen will be displayed.

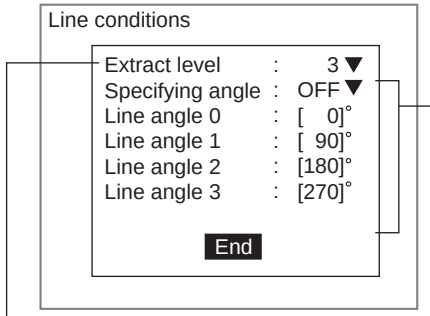


4. Make the settings for each item.
5. Select ***End***.

   The settings will be registered and the screen in (2.) will return.

STEP 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.



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.

Setting item	Selections
Specifying angle	ON, OFF*
Line angle 0	0 to 359 (*0)
Line angle 1	0 to 359 (*90)
Line angle 2	0 to 359 (*180)
Line angle 3	0 to 359 (*270)

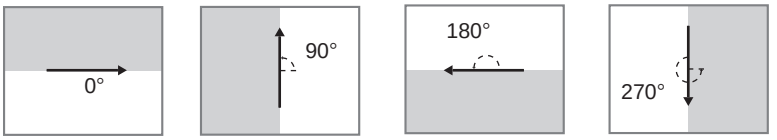
The asterisk (*) indicates the default setting.

Note: Angles cannot be specified when positioning mark may rotate.

Refer to the information about cross points for details (page 2-6-(18)).

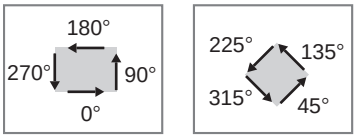
HELP Line Angles

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.

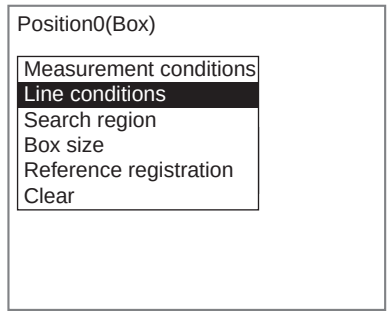


CHECK Set the angles as a combination of the four sides of the box to be found (angles 0 to 3).

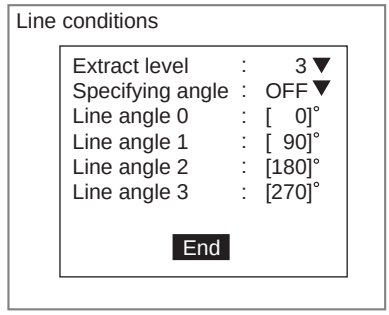
Example: The following examples are for black boxes.



1. Select ***Line conditions***.



The Line Conditions Settings Screen will be displayed.



2. Make the settings for each item.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

STEP 3: Setting Search Regions

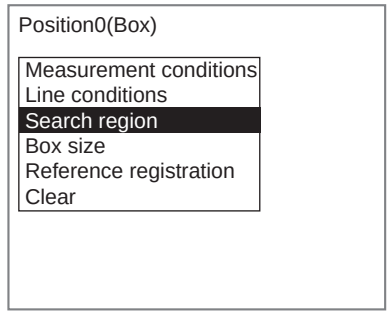
Set the region to search for the positioning mark.

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

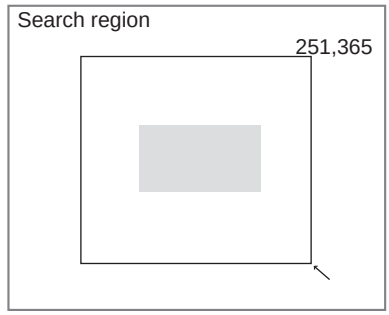
CHECK When edges are extracted, the pixels at the edges of the screen cannot be processed accurately. Do not include the outer edges of the screen when setting the search region.

SeeAlso Refer to page 2-6-(9) under *2-6-3-1 Circles*.

1. Select ***Search region***.



The screen for drawing regions will be displayed.



2. Draw a rectangular search region.

   Specify the upper left and lower right coordinates.

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

   ENT Key: Confirms the settings.

   When the bottom right coordinates have been set, the screen in (1.) will return.

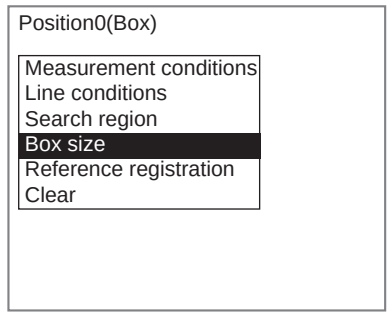
STEP 4: Registering the Size of the Box

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

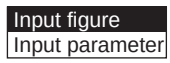
Registration method	Details
Input figure	The measurement object is displayed on the screen, a box is drawn on the exterior edge of the object and the size of the box is registered. Adjust the permissible range by inputting parameters.
Input parameter	The lengths of sides of the box and the permissible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

Inputting Figures

1. Select ***Box size***.

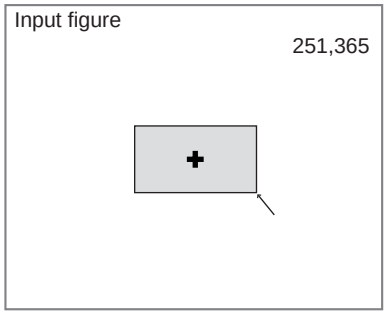


The registration methods will be displayed.



2. Select ***Input figure***.

   The Input Figure Screen will be displayed.



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

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

   ENT Key: Confirms the settings.

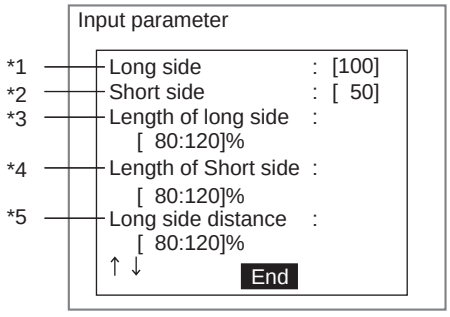
   The settings will be registered and the screen in (1.) will return.

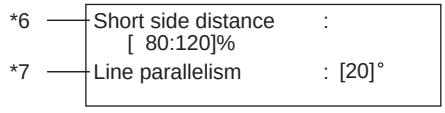
CHECK Figures can be input to make settings only for the *Long size* and *Short size* of the box. Use the parameter input screen to make permissible size range and other detailed settings.

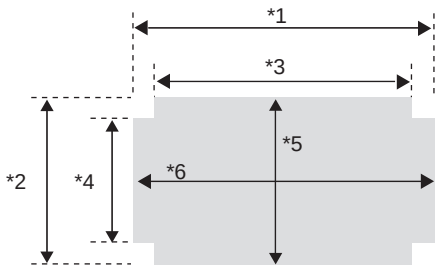
Inputting Parameters

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.







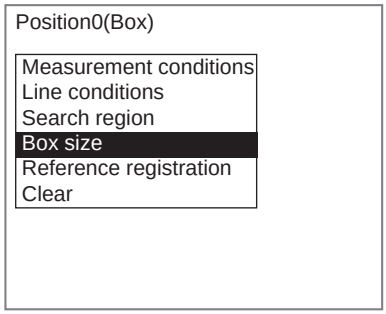
Settings Ranges and Default Values*:
*1: 1 to 512
*2: 1 to 484
*3: 1 to 200 (default: 80:120)
*4: 1 to 200 (default: 80:120)
*5: 1 to 200 (default: 80:120)
*6: 1 to 200 (default: 80:120)
*7: Parallelism of long sides and short sides: 1 to 99 (default: 20)

CHECK
- Increase the *Length of long side* and *Length of short side*.
- Increase the *Long side distance* and *Short side distance*.

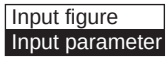
When a Box Is Chipped

- Reduce the lower limit of *Length of long side* and *Length of short side*.

1. Select ***Box size***.

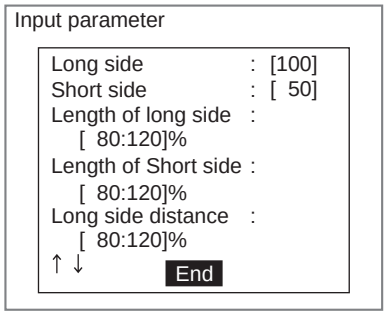


The registration methods will be displayed.



2. Select ***Input parameter.***

   The Input Parameter Settings Screen will be displayed.



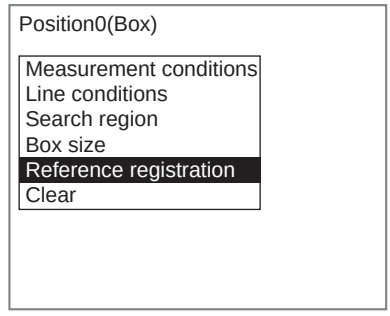
3. Make the settings for each item.
4. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

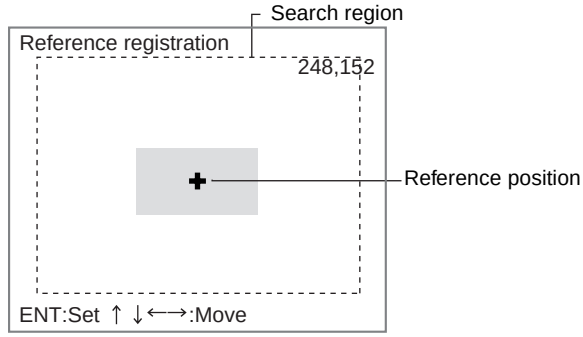
STEP 5: Registering Reference Positions

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

1. Select ***Reference registration*.**



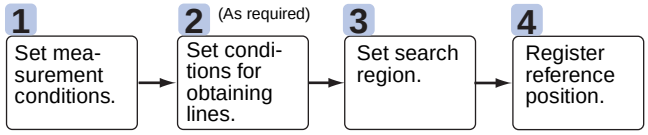
The Controller will search for the box in the displayed image that matches the conditions and a display cursor will appear at that position.



2. Use the **Up**/**Down** and **Right**/**Left** Keys to move the cursor to change the position.
3. Press the **ENT** Key to save the setting.

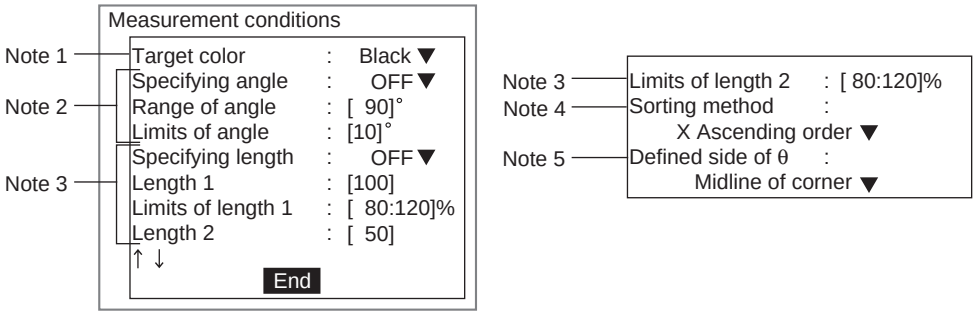
   The setting will be registered and the screen in (1.) will return.

2-6-3-4 Multi-points



STEP 1: Setting Measurement Conditions

Set the conditions for searching for the positioning mark.



Note

1. Select whether the positioning mark color will be white or black compared to the background. (Black*, white)

   The asterisk (*) indicates the default setting.

2. Angles
   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.

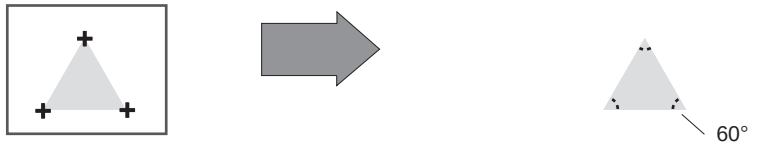
   Specifying angle: Set to ON.

   Range of angle: Angle of the section in the target color (If the target color changes, change the angle setting too.)

   Limits of angle: Set the permissible range for the angle.
   Example: When the range of the angle is set to 90° and the limits of angle set to 10°, the cross point of lines that intersect at between 80° and 100° will be found.

Example: To extract the 3 cross points shown in the following diagram

Set the *Target color* to black, the *Specifying angle* to ON, and the *Range of angle* to 60°.



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.

Setting item	Selections
Specifying angle	ON, OFF*
Range of angle	0 to 359
Limits of angle	0 to 99 (10*)

The asterisk (*) indicates the default setting.

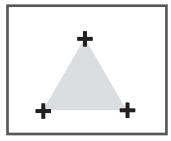
3. Length of lines
   Use the following settings to set the length and thus find the coordinates of only the desired intersection even though many lines exist on the screen.

   Specifying length: Set to ON.

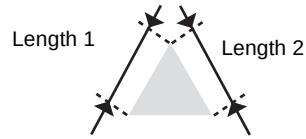
   Length □: Set the line length in pixels.

   Limits of length□: Set the permissible range for the length.

Example: To extract the 3 cross points shown in the following diagram



Set the *Target color* to black and the *Length 1* and *Length 2* to the lengths for the sides indicated in the following diagram.



To find the coordinates of the cross point of lines regardless of their length, set *Specifying length* to OFF. The settings of the line lengths and the limits of the lengths will be ignored.

Setting item	Selections
Specifying length	ON, OFF*
Length □	1 to 999
Limits of length □	1 to 200 (80:120*)

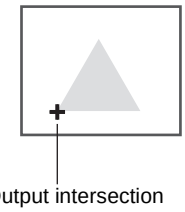
The asterisk (*) indicates the default setting.

4. 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. (X ascending order*, X descending order, Y ascending order, Y descending order)

   The asterisk (*) indicates the default setting.

5. 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.)

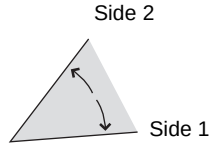
   Example: To extract the cross point shown in the following diagram, set target color to black and sorting condition to X ascending order.



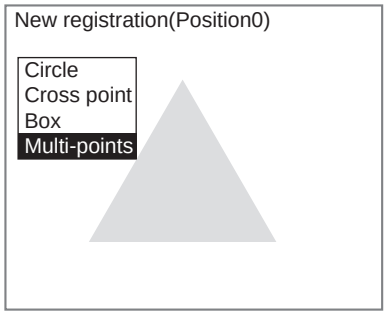
Midline of the Corner*

The asterisk (*) indicates the default setting.

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.

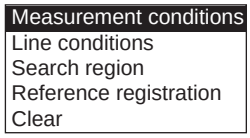


1. Display the figure selections using the same operations as outlined under steps (1.) and (2.) for *Circle*. Refer to page 2-6-(8).



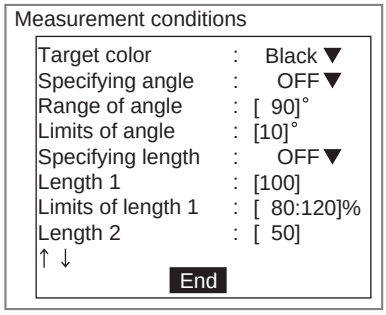
2. Select ***Multi-points***.

   The selections for setting conditions will be displayed.



3. Select ***Measurement conditions***.

   The Measurement Conditions Settings Screen will be displayed.



4. Make the settings for each item.
5. Select ***End***.

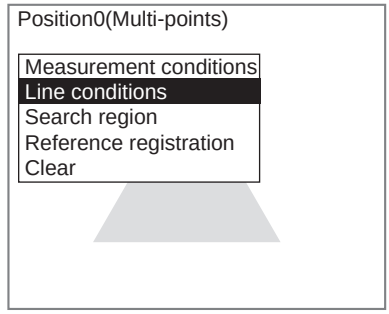
The settings will be registered and the screen in (2.) will return.

STEP 2: Setting Conditions for Obtaining Lines

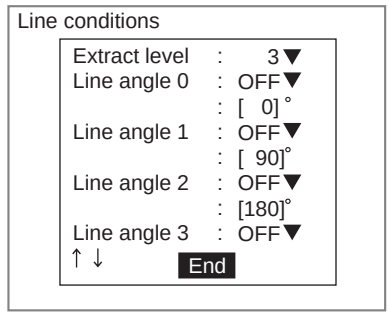
Adjust the line conditions if the lines cannot be found easily or to extract only lines of a particular angle.

Refer to *Cross Points* for an outline (page 2-6-(18)).

1. Select ***Line conditions***.



The Line Conditions Settings Screen will be displayed.



2. Make the settings for each item.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

STEP 3: Setting the Search Region

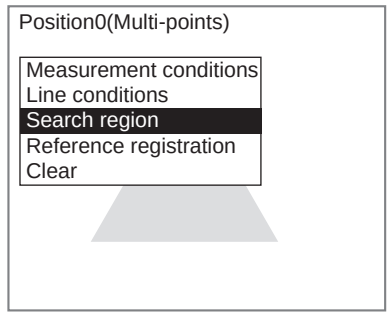
Set the region to search for the positioning mark.

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

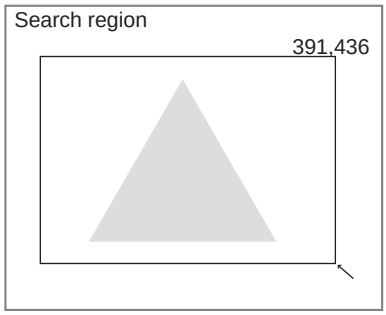
CHECK When edges are extracted, the pixels at the edges of the screen cannot be processed accurately. Do not include the outer edges of the screen when setting the search region.

SeeAlso Refer to page 2-6-(9) under *2-6-3-1 Circles*.

1. Select ***Search region***.



The screen for drawing search regions will be displayed.



2. Draw a rectangular search region.

   Specify the upper left and lower right coordinates.

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

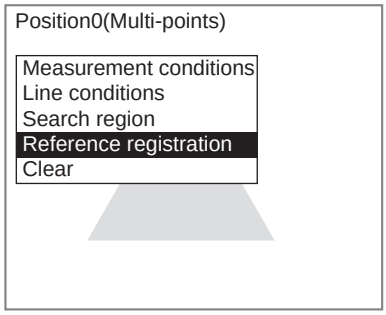
   ENT Key: Confirms the settings.

   When the bottom right coordinates have been set, the screen in (1.) will return.

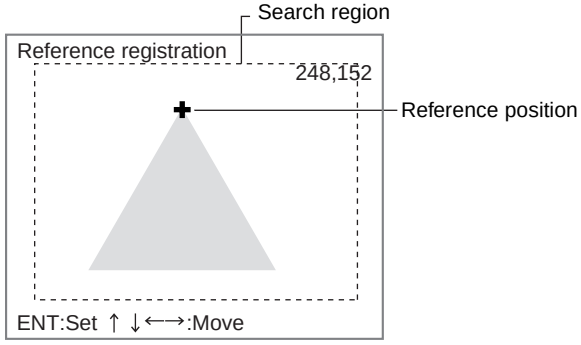
STEP 4: Registering Reference Positions

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

1. Select ***Reference registration***.



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.



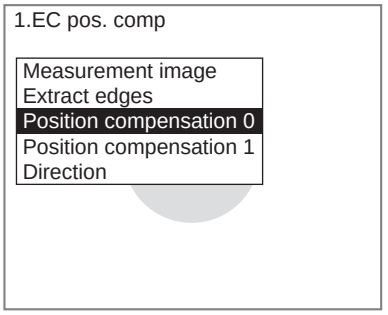
2. Use the **Up**/**Down** and **Right**/**Left** Keys to move the cursor to change the position.

3. Press the **ENT** Key to save the setting.
   The setting will be registered and the screen in (1.) will return.

Clearing Set Regions

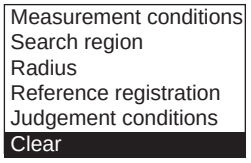
The clear operation is executed for each region.

1. Select the region number to be cleared.



   The selections will be displayed.

   Example: For circles



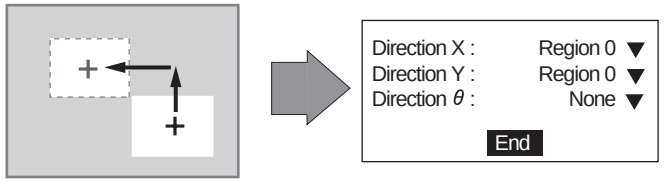
2. Select ***Clear***.
   A confirmation message will be displayed.

3. Select ***Execute***.
   The region will be cleared and the screen in (1.) will return.

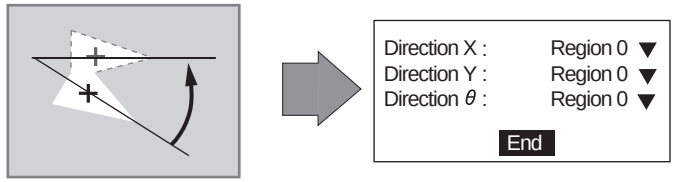
2-6-4 Setting Displacement Direction

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.

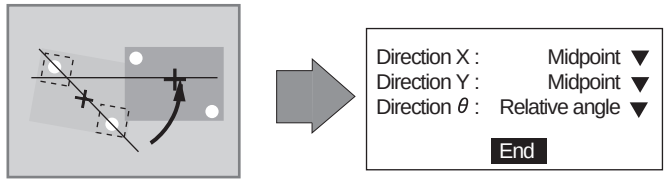
Measurement Objects Not On An Angle (Example: Region 0 Set to Box)



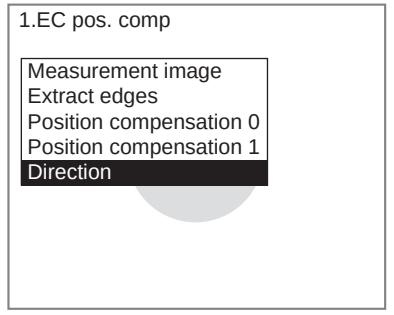
Measurement Objects On An Angle (Example: Region 0 Set to Cross Point)



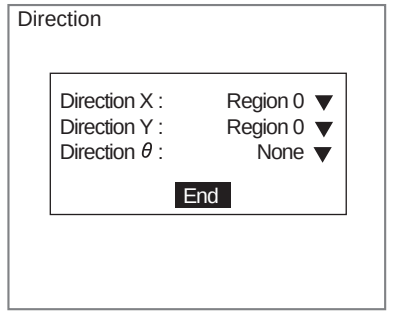
For Precision Position Compensation Using Measurement Object Angles (Example: Settings Made for Both Region 0 and Region 1)



1. Select ***Direction***.



The Direction Settings Screen will be displayed.



2. Set the conditions.
3. Select ***End***.
   The settings will be registered and the screen in (1.) will return.

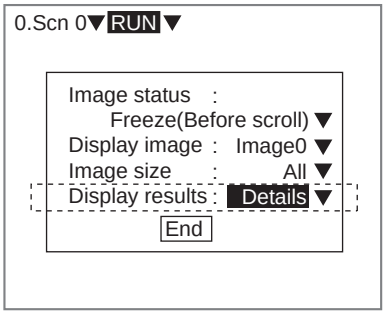
2-6-5 Measurement Screens

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

This section describes what kind of information can be displayed for EC position compensation.

SeeAlso Refer to *SECTION 3 Monitor Mode and Run Mode* for details on Monitor and Run modes.

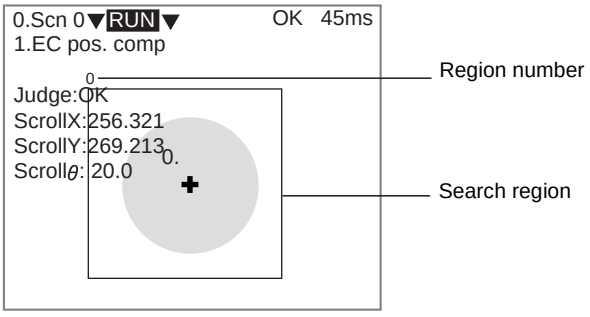
CHECK Press the **SHIFT+ESC** Keys on the Run Screen to access the following screen and change ***Display results*** to ***Details*****.**



Use the **Up** or **Down** Key to change to the unit for which EC position compensation is set and the following detailed screens will be displayed.

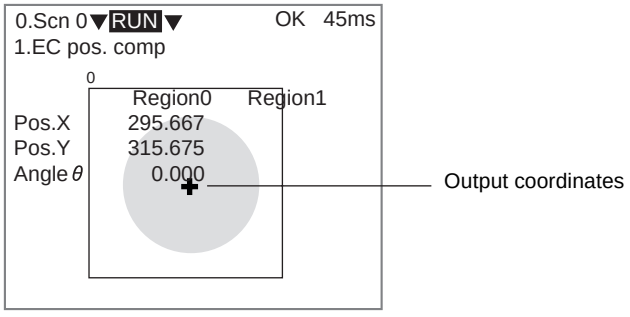
Use the **SHIFT+Right** or **Left** Keys to switch in order between the four screens.

Scroll Amount



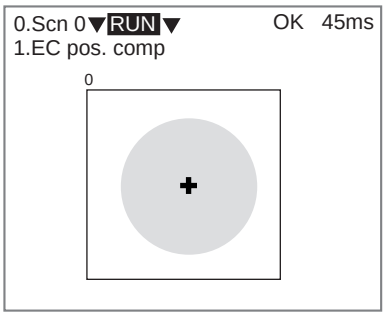
Detailed Display

The measurement results for each region will be displayed.



Position Display

Only the search region will be displayed.

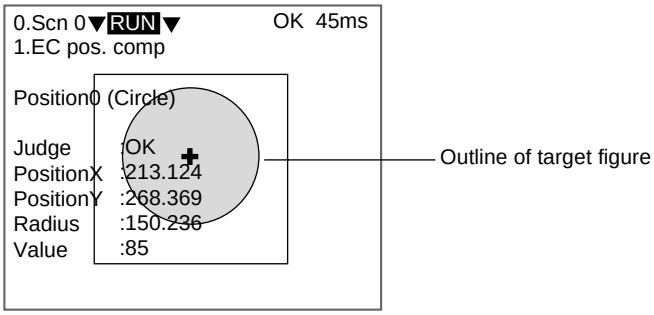


Display By Region

More detailed measurement results will be displayed for each region.

Each time the SHIFT+Right or SHIFT+Left Keys are pressed, the set regions will be displayed in order.

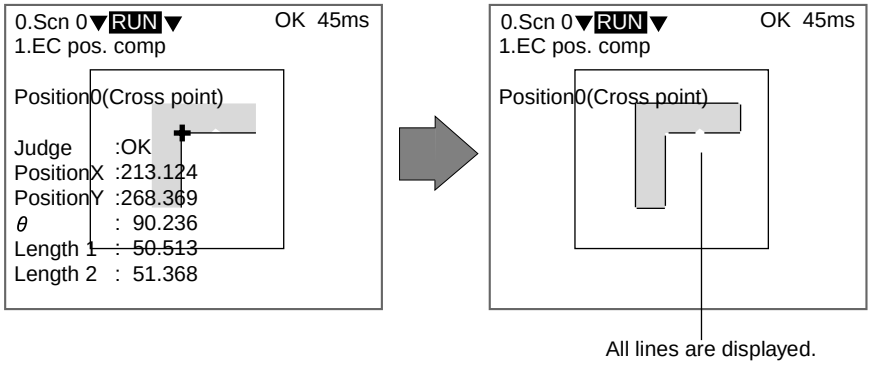
- Circles



- Cross Points, Boxes, and Multi-points
  After the measurement value for the region is displayed, a screen will be displayed so the line extraction status can be confirmed.

Example: Cross point

Measurement value display

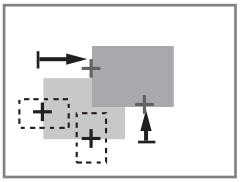


2-7 Edge Position Compensation

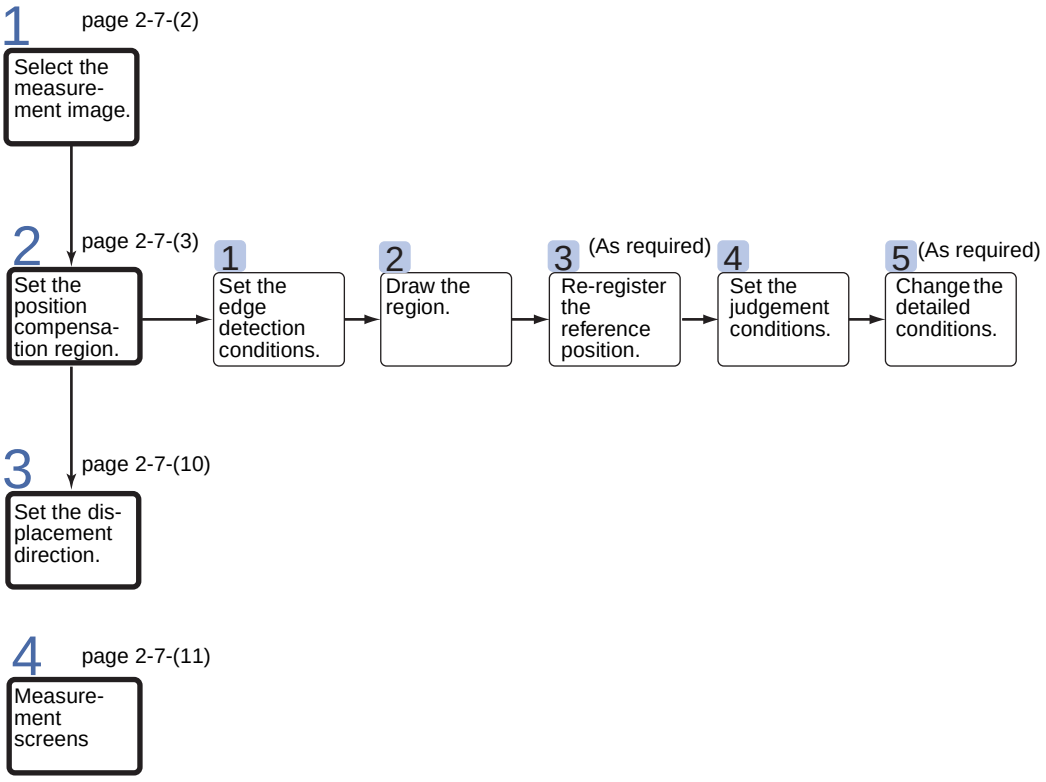
The Edge Position Compensation processing item is used to detect the amount of measurement object displacement by using the edge of the measurement region, where the density changes.

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.



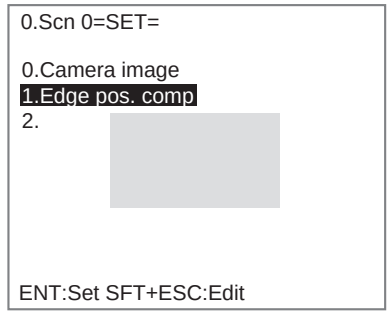
Operational Flow



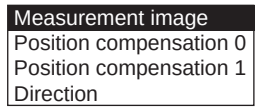
2-7-1 Selecting Measurement Images

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

1. Select ***Edge pos. comp.***

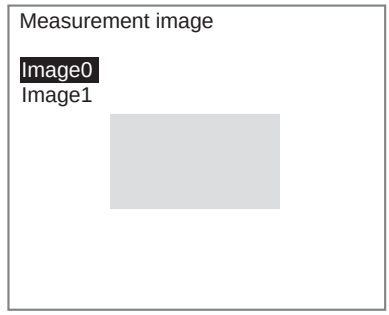


The initial Edge Position Compensation Screen will be displayed.



2. Select ***Measurement image***.

The selections will be displayed.



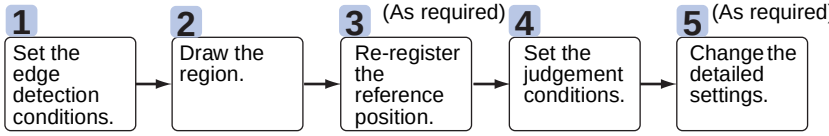
3. Select which image will be used for measurement, the image stored at Image 0 or the image stored at Image 1.
4. Press the **ENT** Key.

The settings will be registered and the screen in (1.) will return.

2-7-2 Setting the Position Displacement Compensation Region

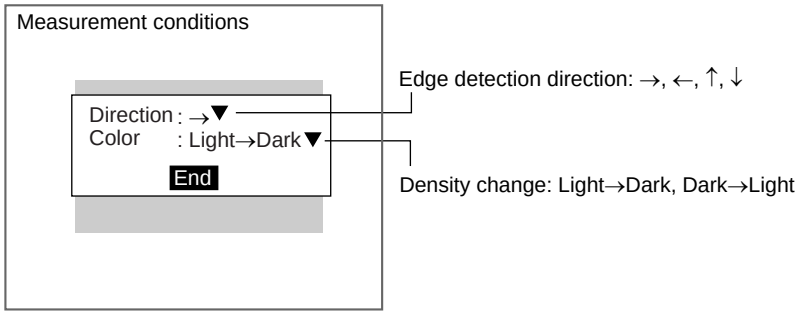
The edge is found using density changes within the measurement region.

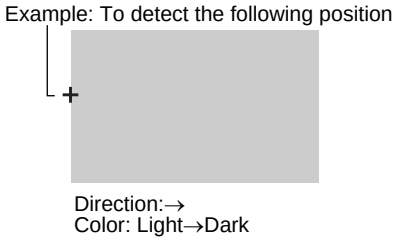
The direction for edge detection and color change can be set to suit the measurement object.



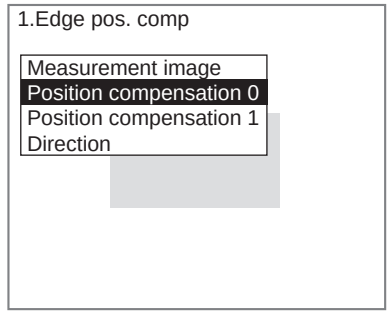
2-7-2-1 STEP 1: Setting Edge Detection Conditions

Set the direction for edge detection and the density changes.

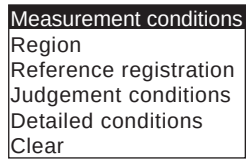




1. Select ***Position compensation 0*** or ***Position compensation 1***.

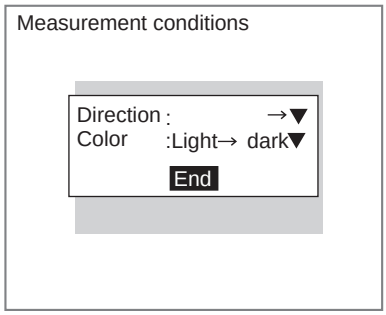


The initial screen for edge position compensation will be displayed.



2. Select ***Measurement conditions.***

The Measurement Conditions Settings Screen will be displayed.



3. Select the edge detection conditions.
4. Select ***End***.

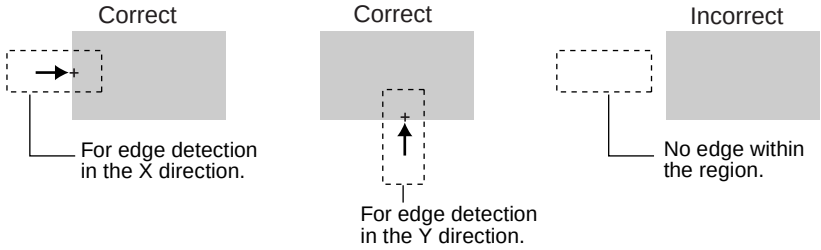
   The settings will be registered and the screen in (1.) will return.

2-7-2-2 STEP 2: Drawing Regions

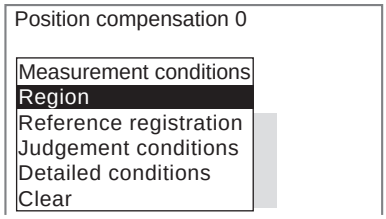
Draw a region to include the edge for detection.

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.

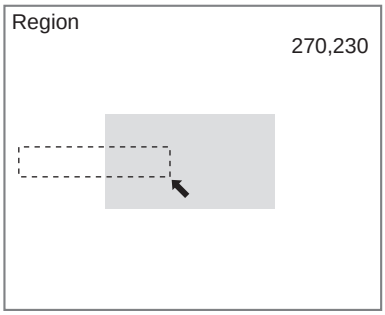
CHECK If the edge is not in the region, measurement will not be possible. Make a region of a size and position that allows for movement of the range of the measurement object.



1. Select ***Region***.



The Region Settings Screen will be displayed.



2. Draw a box-shaped region.

   The region will be set and the screen in (1.) will return. The edge position will be indicated by a display cursor.

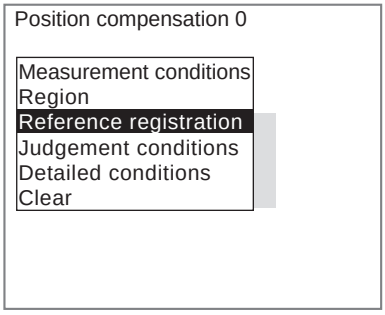
2-7-2-3 STEP 3: Re-registering Reference Values

This operation is performed when only the reference value is to be re-registered.

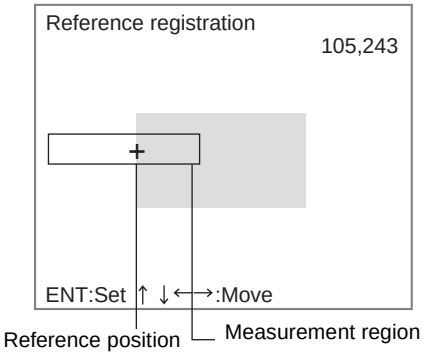
When a measurement region is drawn, the measurement is performed for the displayed image and the result is registered as the reference value. If the re-registering function explained here is used, only the reference value for the image currently displayed will be registered. Edge position is registered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

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

1. Select ***Reference registration***.



A display cursor will appear at the edge position.



2. To change the position, use the **Up**/**Down** and **Right**/**Left** Keys to move the cursor.
3. Press the **ENT** Key.

   The setting will be registered and the screen in (1.) will return.

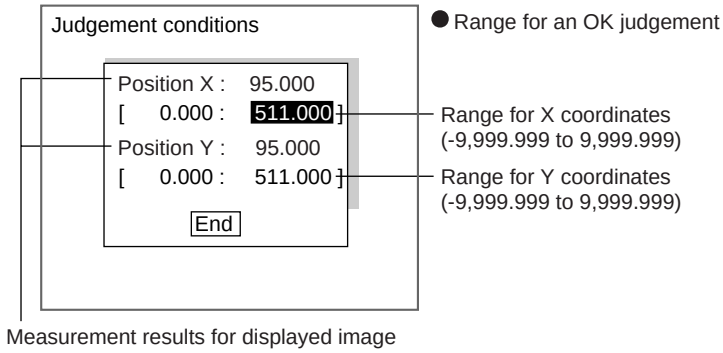
2-7-2-4 STEP 4: Setting Judgement Conditions

Set the position ranges for an OK judgement.

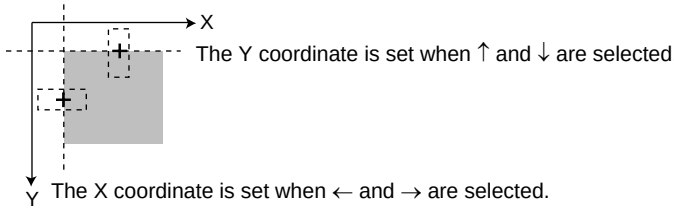
CHECK Position Compensation Judgement Results and Scrolling

OK: Scroll will be performed.

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

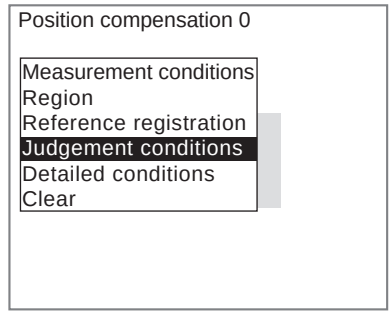


CHECK Position X and Position Y will change depending on the settings under *Measurement/Direction*.

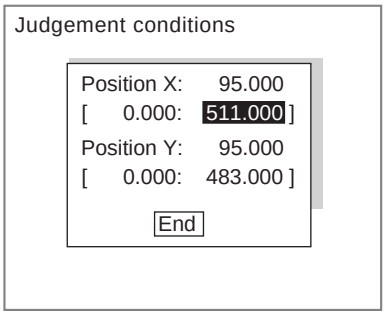


The origin and coordinate system are determined by the calibration settings.

1. Select ***Judgement conditions***.



The Judgement Conditions Settings Screen will be displayed.



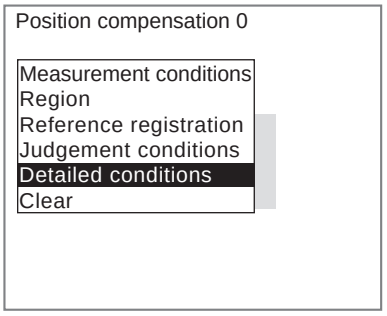
2. Change the settings.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

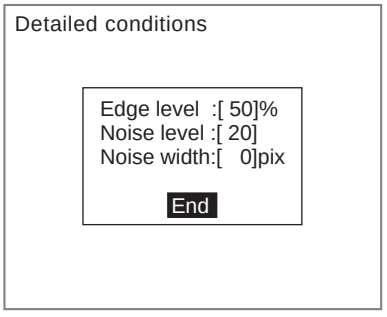
2-7-2-5 STEP 5: Changing Detailed Conditions

Change the detailed conditions when the measurement results are unstable. 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.

1. Select ***Detailed conditions***.



The Detailed Conditions Settings Screen will be displayed.



2. Change the settings.
   Refer to the information on edge level, noise level, and noise width below for details.
3. Select ***End***.

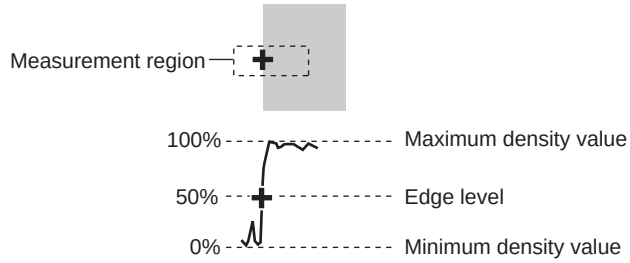
   The settings will be registered and the screen in (1.) will return.

Edge Level

Set a density change level between 0 and 100 that will indicate the edge. Normally, the default setting of 50% will be fine.

The edge is normally detected as follows:

1. The density distribution of the whole measurement region is calculated.
2. The density difference between the lowest and highest density value becomes 100%.
3. The point where the edge level density change is detected becomes the edge.



Noise Level

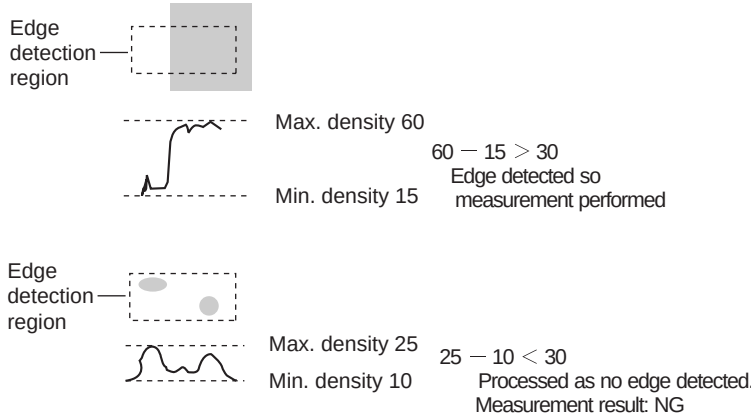
Set a noise level between 0 and 255 to assist the determination of edges. The maximum density and minimum density within the edge detection area is calculated and if the difference between the two values is less than the noise level, then the Controller determines that there is no edge. Normally the default setting of 20 is sufficient. Adjust this to a higher value, however, if noise is causing false edges to be detected.

(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

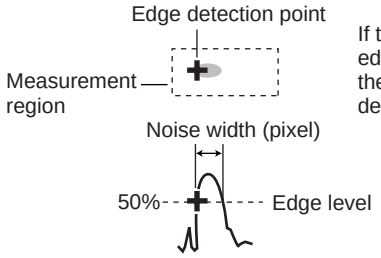


Noise Width

Set the noise width between 0 and 255 to evaluate noise.

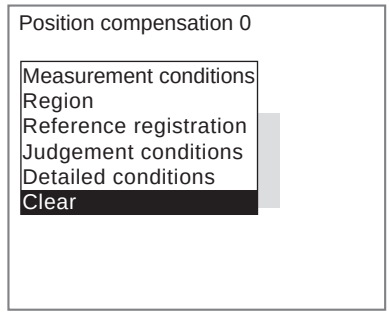
If the density distribution from the position where the edge was first detected falls to below the edge level within the noise width range, the detected point is judged as noise. Normally the default noise width setting of 0 is sufficient. If noise is causing incorrect detection, make this value higher.

Example

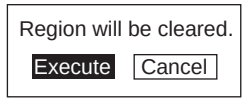


Clearing Settings

1. Select ***Clear***.

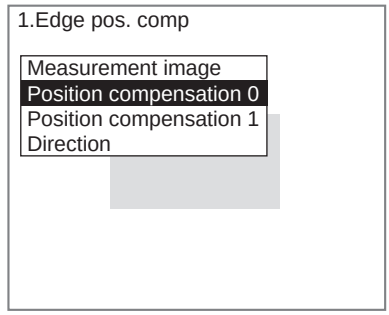


A confirmation message will be displayed.



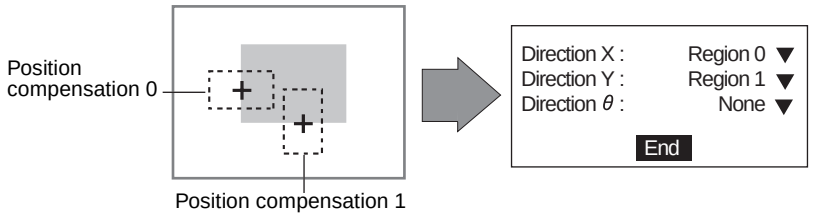
2. Select ***Execute***.

The settings will be cleared and the initial screen for edge position compensation will return.

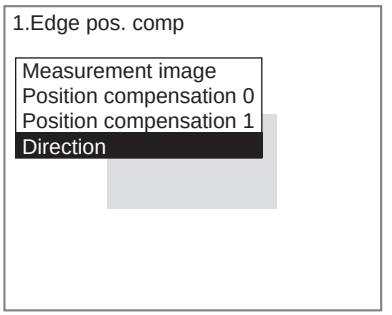


2-7-3 Setting Displacement Direction

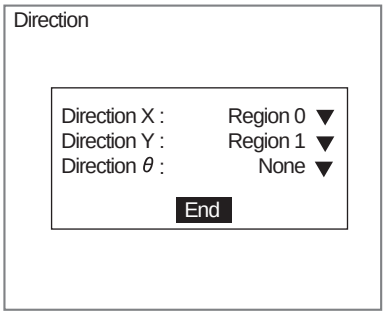
The direction function is used to select which region's measurement results will be used as the basis for position displacement compensation in the X, Y, and θ (rotation) directions.



1. Select ***Direction***.



The Direction Settings Screen will be displayed.



2. Set the conditions.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

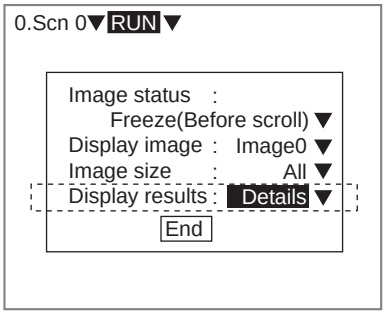
2-7-4 Measurement Screens

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

This section describes what kind of information can be displayed for edge position displacement compensation.

SeeAlso Refer to *SECTION 3 Monitor Mode and Run Mode* for details on Monitor and Run modes.

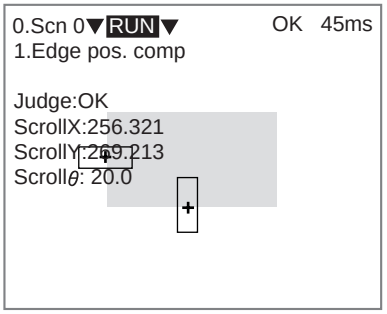
CHECK Press the **SHIFT+ESC** Keys on the Run Screen to access the following screen and change ***Display results*** to ***Details***.



Use the **Up** or **Down** Key to change to the unit for which edge position compensation is set and the following detailed screens will be displayed.

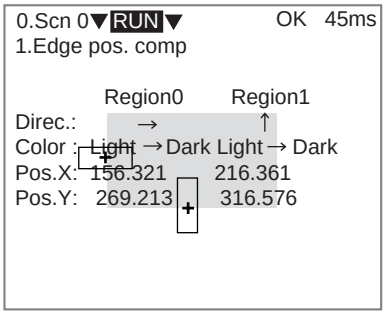
Use the **SHIFT+Right** or **Left** Keys to switch in order between the three screens.

Scroll Amount



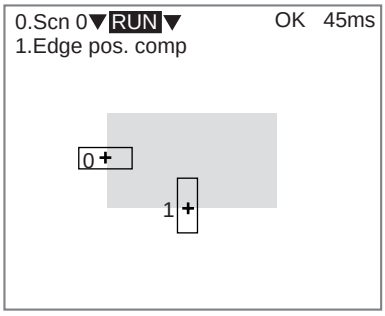
Detailed Display

The measurement values for each region will be displayed.



Position Display

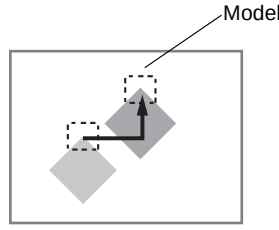
Only the region will be displayed.



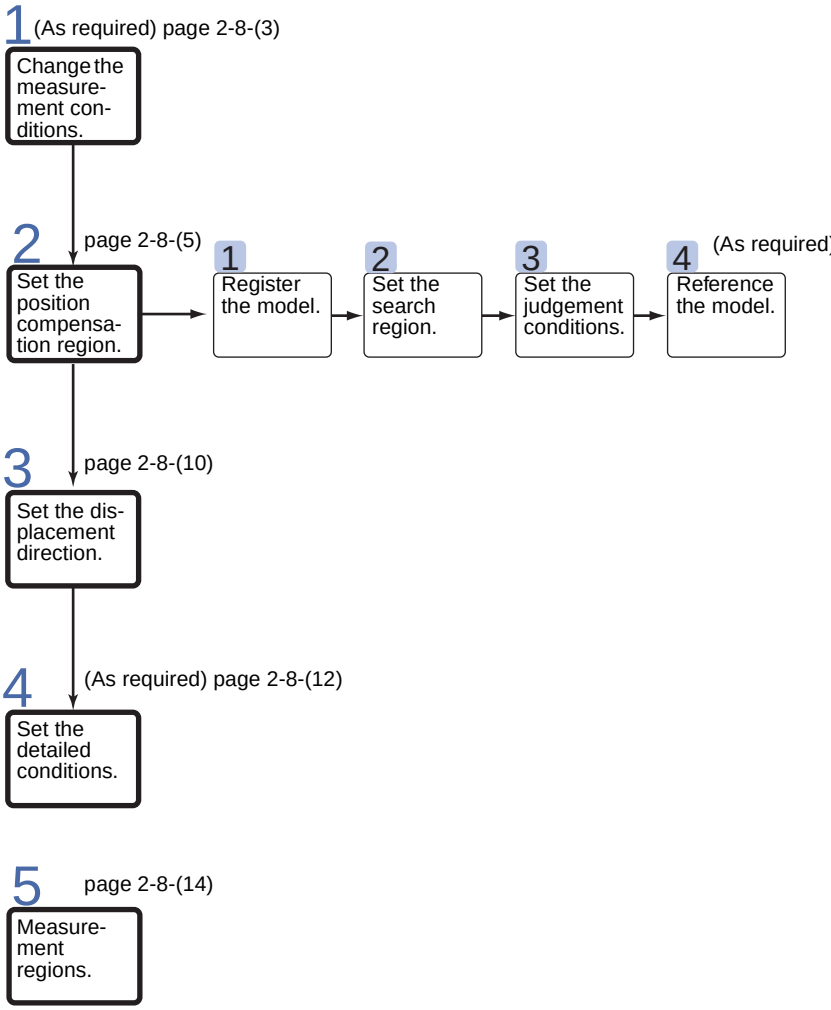
2-8 Model Position Compensation

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 on measurement objects on an angle.



Operational Flow



CHECK Model Position Compensation uses the image stored at Image 0 as the measurement image; there is no menu for selecting the measurement image.

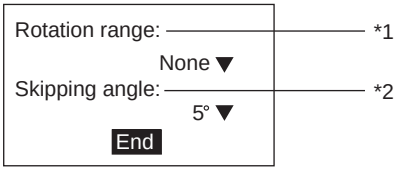
The result of the position displacement compensation (scrolling) is executed for both Image 0 and Image 1.

2-8-1 Changing Measurement Conditions

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

The searches using a model that rotates in skipping angle (*2) increments within the rotation range (*1).

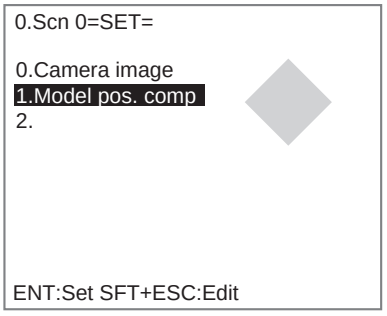
SeeAlso Refer to page 2-8-(12) for information on search processing.



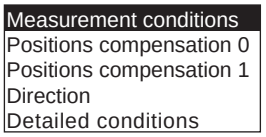
Setting item	Selections	Details	
Rotation range	None* ± 5° ± 15° ± 30° ± 45° 0 ± 15°, 180 ± 15° 0 ± 30°, 180 ± 30° All angles	Select the range for model rotation.	Example: Rotation range: ± 30°, Skipping angle: 15° Creates a model that rotates 15° at a time between −30° and 30°. (Coordinate system: Left-hand)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

The asterisk (*) indicates the default setting.

1. Select ***Model pos. comp.***

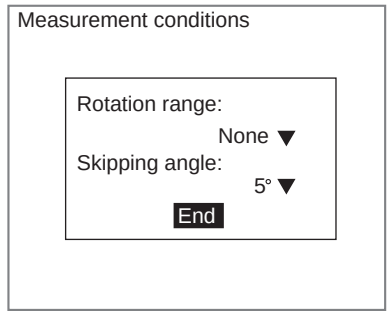


The initial screen for model position compensation will be displayed.



2. Select ***Measurement conditions***.

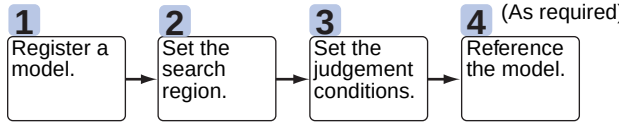
The Measurement Conditions Settings Screen will be displayed.



3. Set the conditions.
4. Select ***End***.
   The settings will be registered and the screen in (2.) will return.

2-8-2 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.



2-8-2-1 STEP 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.

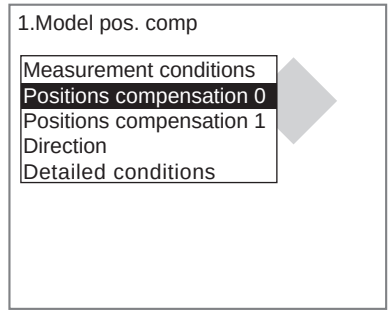
CHECK The size of the model that can be registered depends on the search verification setting under *Detailed conditions*.

No search verification (default): 15 × 9 to 70 × 66 pixels

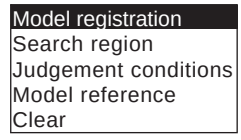
With search verification: No limit

To register large models, change the detailed conditions before registering the model. Refer to page 2-8-(12).

1. Select ***Position compensation 0*** or ***Position compensation 1***.

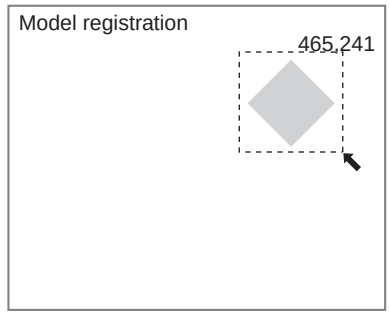


The setting selections will be displayed.



2. Select ***Model registration***.

The Model Registration Screen will be displayed.

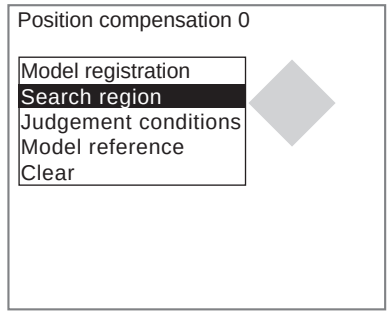


3. Draw a box to show the region that the model can be registered.
   The settings will be registered and the screen in (1.) will return.

2-8-2-2 STEP 2: Setting the Search Region

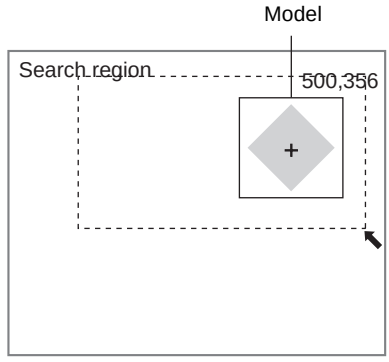
Set the region in which the model is to be searched for.

1. Select ***Search region***.



An arrow cursor will appear.

The model will be displayed in solid lines.



2. Draw a box-shaped search region.
   The search region will be set and the screen in (1.) will return.

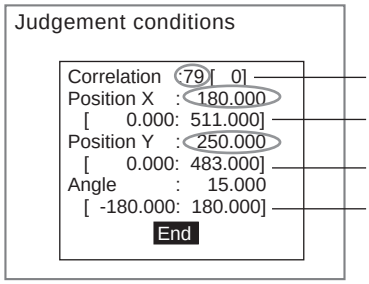
2-8-2-3 STEP 3: Setting Judgement Conditions

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

CHECK Position Compensation Judgement Results and Scrolling

OK: Scroll will be performed.

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



Range for an OK judgement.

Correlation range (OK if above this value) (0 to 100)

Range of movement of the measurement object in the X direction (-9,999.999 to 9,999.999)

Range of movement of the measurement object in the Y direction (-9,999.999 to 9,999.999)

Angle range for measurement object (-360.000 to 360.000) (The measurement value, however, is output in the range of -180° to 180°.)

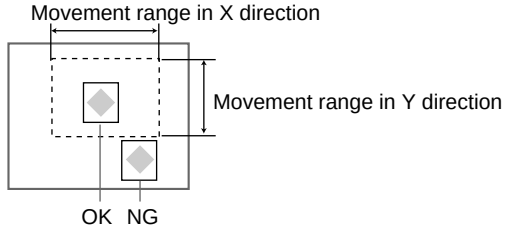
: The measurement results for the displayed image
Use these values as references in setting the upper and lower limits.

CHECK Correlation

When OK condition for correlation is 60:

Correlation:	96	55	50	65
Judgement:	OK	NG	NG	OK

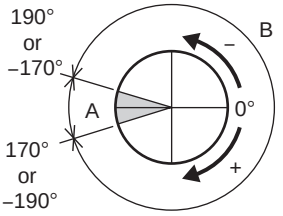
CHECK Position X and Position Y



CHECK Angle

Two values between -360° and 360° can be set. The value on the right, however, must be higher than the value on the left. (Default: -180° to 180°)

Example: For OK judgements in the A region (Right-hand coordinate system)



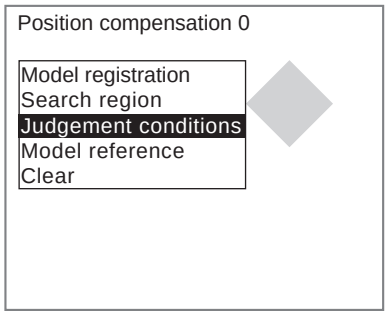
Angle :[170: 190] ○ OK
[–190: –170] ○ OK
(Give the same result.)

[170: –170] × The value on the right is smaller.

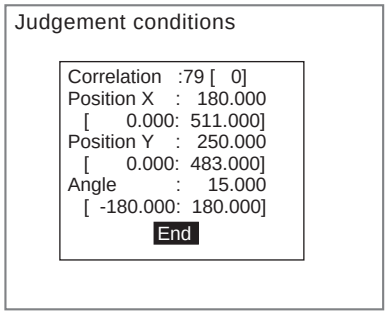
[–170: 170] × Setting within the B range.

The measurement value is output between -180° and 180°, so a measurement value of 190° becomes -170°.

1. Select ***Judgement conditions***.



The Judgement Conditions Settings Screen will be displayed.



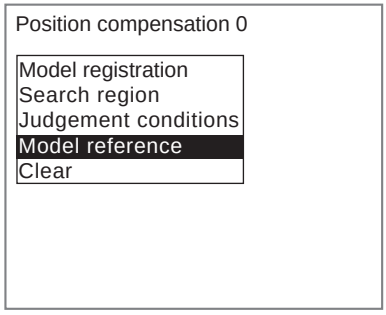
2. Make the settings.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

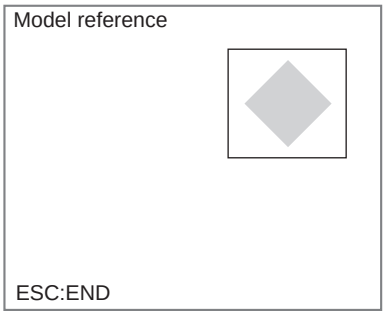
2-8-2-4 Referencing Models

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

1. Select ***Model reference.***



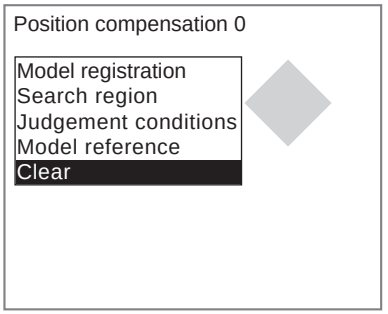
The image that is registered as the model will be displayed.



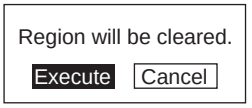
2. Press the **ESC** Key.
   The screen in (1.) will return.

Clearing Regions

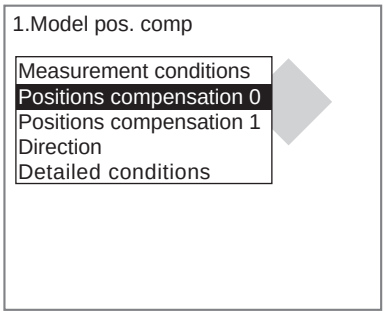
1. Select ***Clear***.



A confirmation message will be displayed.



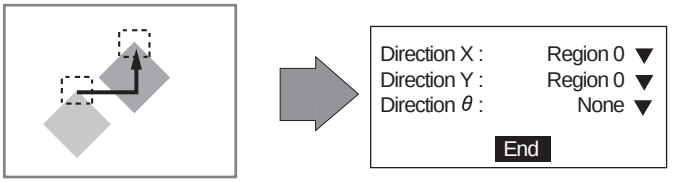
2. Select ***Execute***.
   The region will be cleared and the initial model position compensation screen will return.



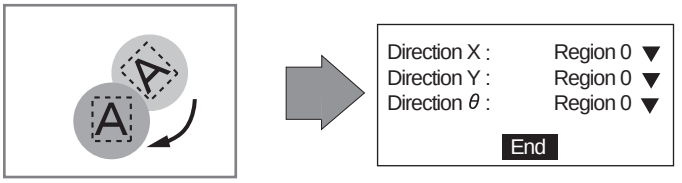
2-8-3 Setting Displacement Direction

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.

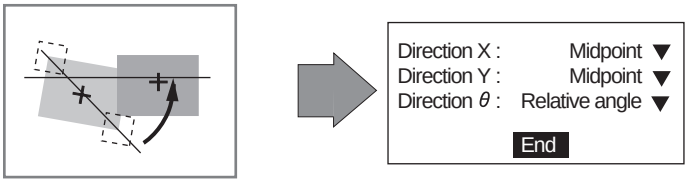
Measurement Objects Not On An Angle (Example: When Only Region 0 Is Set)



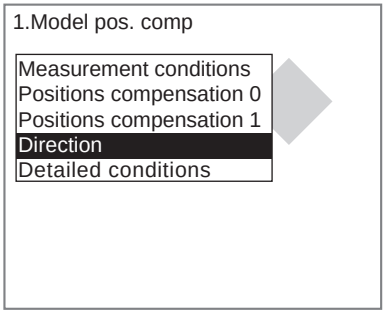
Measurement Objects On An Angle (Example: When Only Region 0 Is Set)



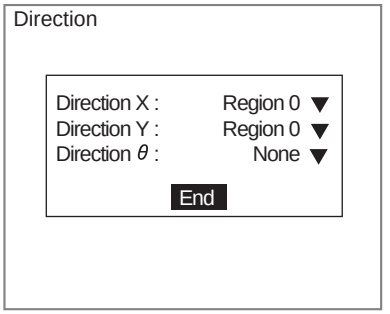
For Precision Position Compensation Using Measurement Object Angles (Example: When Region 0 and Region 1 Are Set)



1. Select ***Direction***.



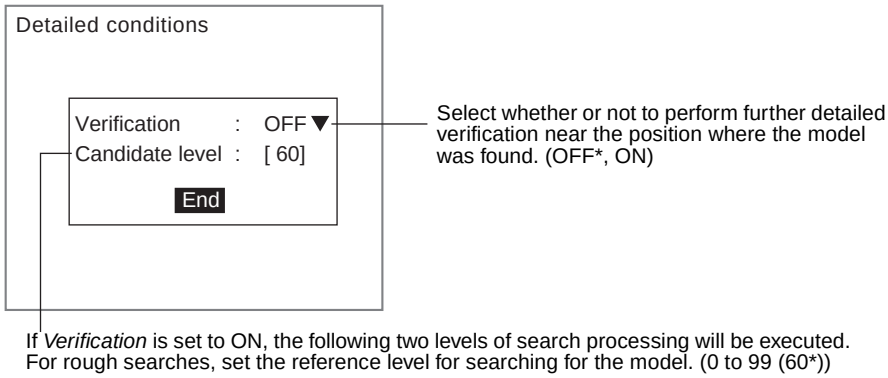
The Direction Settings Screen will be displayed.



2. Set the conditions.
3. Select ***End***.
   The settings will be registered and the screen in (1.) will return.

2-8-4 Setting Detailed Conditions

Change the detailed conditions if the detection of the registered model is unstable. Once the settings have been changed, check that actual measurement is performed correctly.

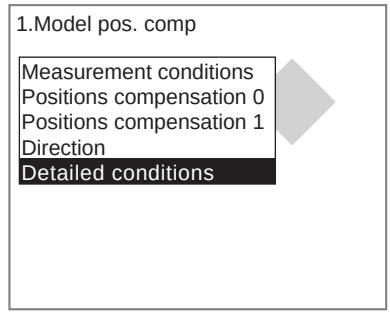


CHECK The size of the model that can be registered depends on whether or not search verification is selected.

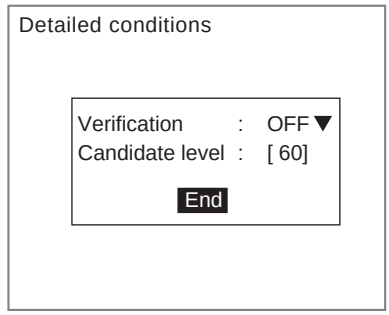
No search verification (default):15 × 9 to 70 × 66 pixels

With search verification:No limit

1. Select ***Detailed conditions***.



The Detailed Conditions Settings Screen will be displayed.



2. Set the conditions.
3. Select ***End***.
   The settings will be registered and the screen in (1.) will return.

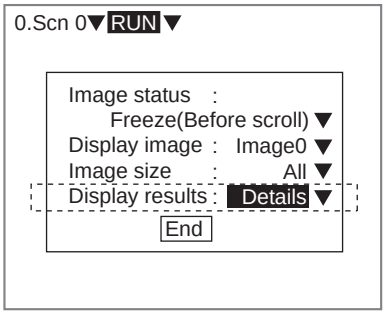
2-8-5 Measurement Screens

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

This section describes what kind of information can be displayed for model position compensation.

SeeAlso Refer to *SECTION 3 Monitor Mode and Run Mode* for details on Monitor and Run modes.

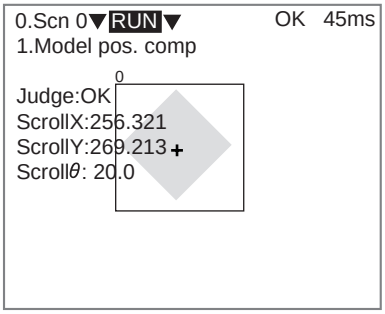
CHECK Press the **SHIFT+ESC** Keys on the Run Screen to access the following screen and change ***Display results*** to ***Details.***



Use the **Up** or **Down** Key to change to the unit for which model position compensation is set and the following detailed screens will be displayed.

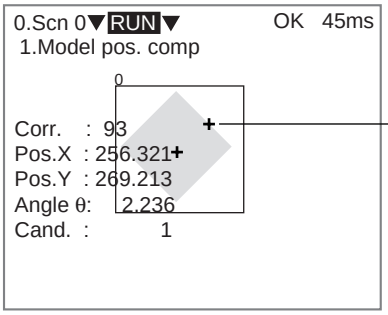
Use the **SHIFT+Right** or **Left** Keys to switch in order between the three screens.

Scroll Amount



Detailed Display

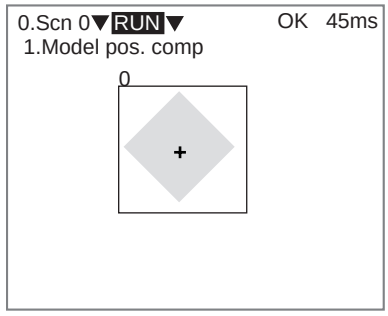
The measurement values for each region will be displayed.



Position above candidate level. Displayed only when search verification set to ON.

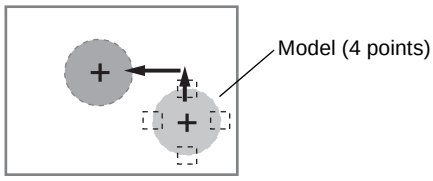
Position Display

Only the region will be displayed.

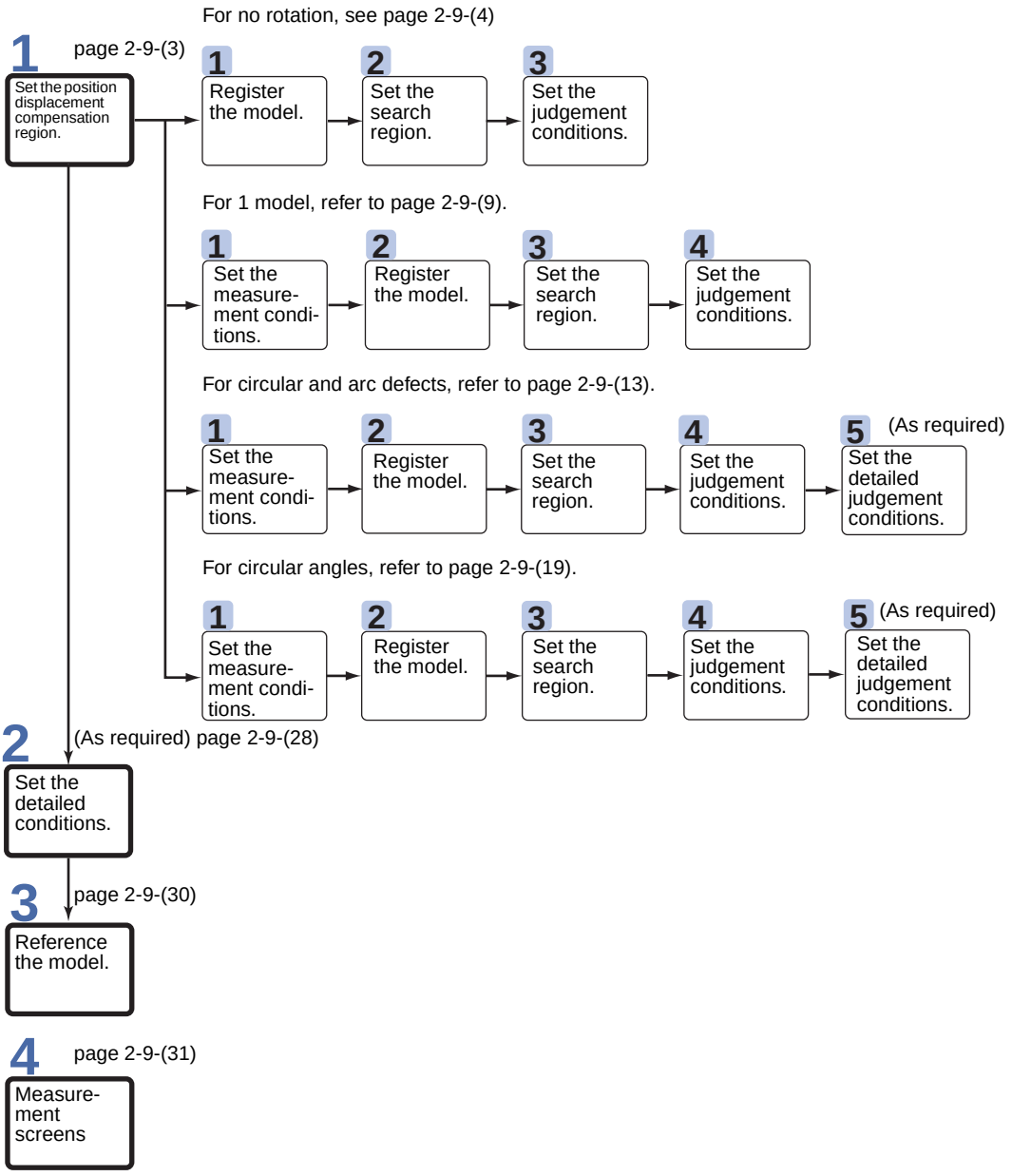


2-9 Circle Position Compensation

The Circle Position Compensation processing item is useful for circular measurement objects (workpieces). Four points on the circumference of the circle are registered as the model, the position displacement of the measurement object is found using this model, and position compensation is performed. Position compensation can be performed even if the measurement object is at an angle.



Operational Flow

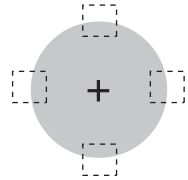
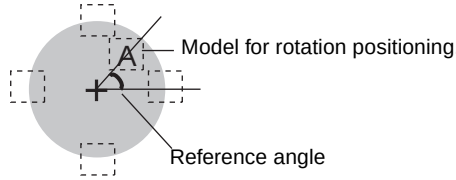
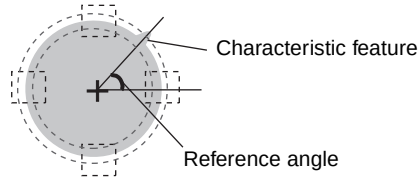
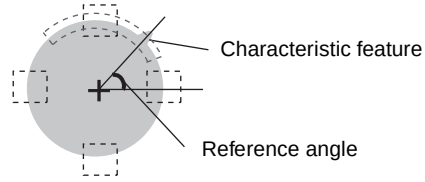
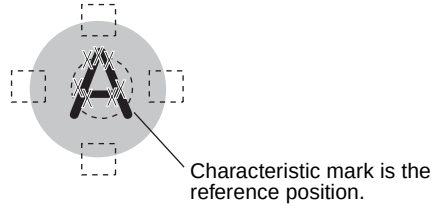


CHECK Circle position compensation uses the image stored at Image 0 as the measurement image; there is no menu for selecting the measurement image.

The results of the position displacement compensation (scrolling) are executed for both Image 0 and Image 1.

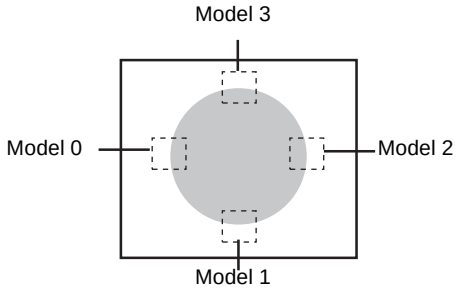
2-9-1 Setting Position Displacement Compensation Regions

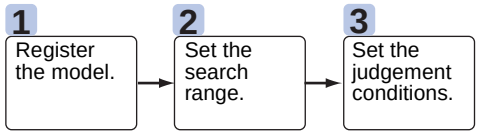
There are five methods available for circle position compensation.

Method	Details
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. 
1 model	Registers a characteristic feature of the measurement object for rotation positioning, which enables position compensation in the rotation direction. 
Defect (circle)	Detects a characteristic feature on the circumference using defect algorithms, which also enables position compensation in the rotation direction to be performed. The circumference (360°) will be the search region for defects. 
Defect (arc)	Detects a characteristic feature on the circumference using defect algorithms, which also enables position compensation in the rotation direction to be performed. The angle range to search for defects can be specified. 
Circular angle	Another circle is drawn, in addition to the circle for external positioning. A characteristic feature on the circumference of the drawn circle is used to perform position compensation in the rotation direction. 

2-9-1-1 Not Rotate

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

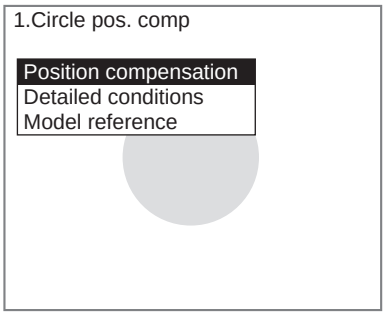




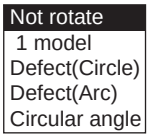
STEP 1: Registering Models

Register four points on the circumference as the model.

1. Select ***Position compensation***.



A list of compensation modes will be displayed.

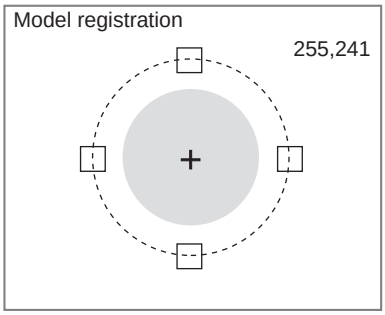


2. Select ***Not rotate***.

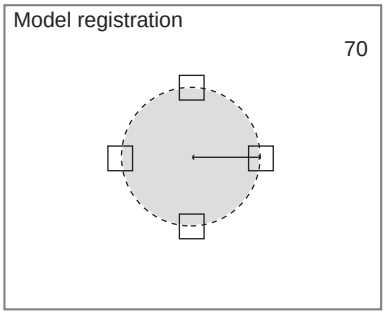
   The initial screen for Not Rotate Mode will be displayed.

3. Select ***Model registration***.

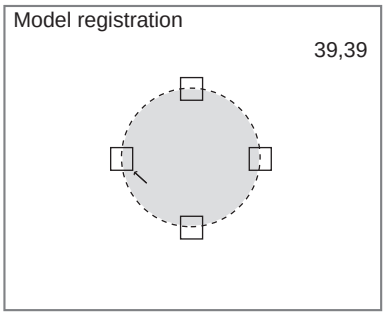
The Model Registration Screen will be displayed.



4. Specify the coordinates for the center of the circle.
   Up/Down/Left/Right Keys: Move the display cursor.
5. Press the **ENT** Key.
   The screen for specifying the radius will be displayed.

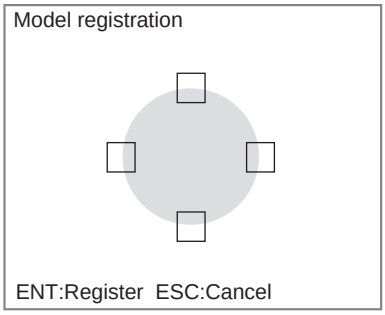


6. Specify the size of the circle.
   Left Key: Decreases the size.
   Right Key: Increases the size.
7. Press the **ENT** Key.
   The screen for registering the size of the model will be displayed.



8. 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.

9. Press the **ENT** Key.
   A confirmation screen will be displayed.

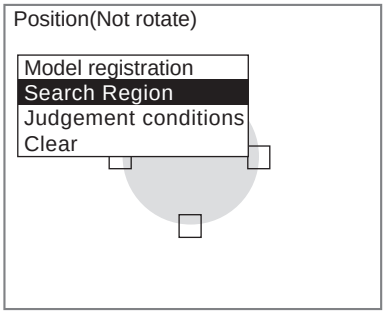


10. Check that an appropriate position has been registered as the model.
11. Press the **ENT** Key.
    The settings will be registered and the screen in (2.) will return.

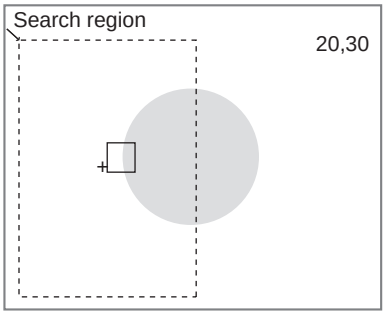
STEP 2: Setting Search Regions

Set the search region for each model.

1. Select ***Search region***.



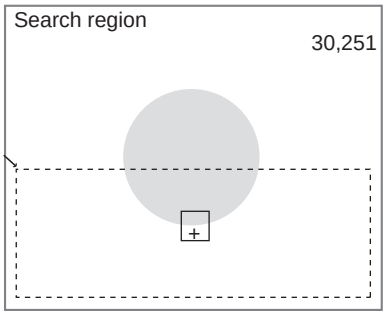
The Search Region Settings Screen for model 0 will be displayed.



2. Draw a box to indicate the search region.

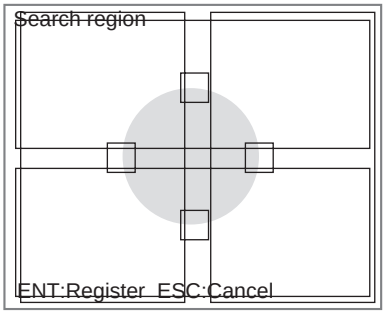
CHECK Boxes are the only figure that can be drawn.

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



3. 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.



4. Press the **ENT** Key.

   The settings will be registered and the screen in (1.) will return.

STEP 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.

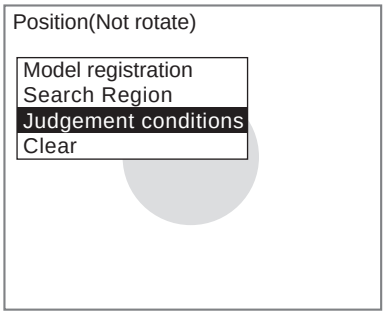
Set the range between 0 and 100, with 100 for objects that perfectly match the model. If the correlation is equal to or above the judgement condition set here, the judgement result will be OK.

CHECK Position Compensation Judgement Results and Scrolling

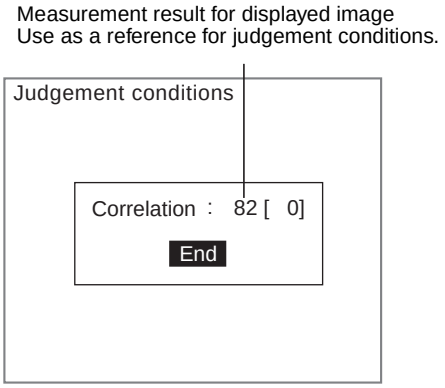
OK: Scroll will be performed.

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

1. Select ***Judgement conditions.***



The Judgement Conditions Settings Screen will be displayed.



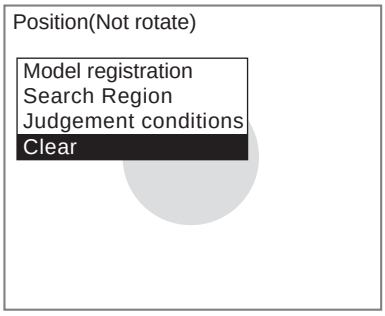
2. Change the setting.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

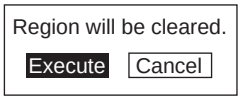
Changing to Other Modes (Clearing Settings)

The settings must be cleared before changing to other modes.

1. Select ***Clear***.

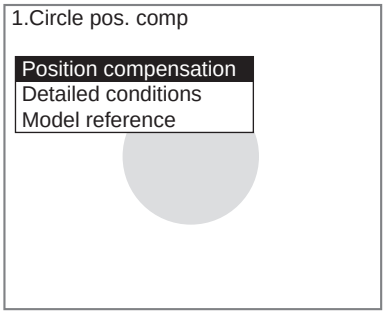


A confirmation message will be displayed.



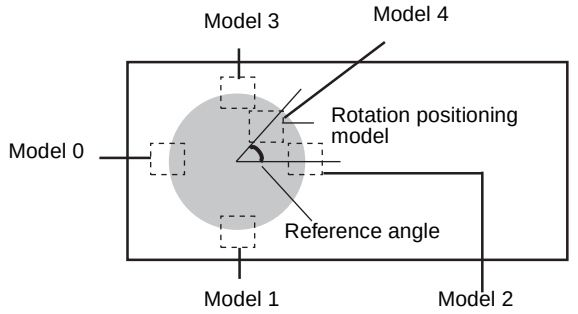
2. Select ***Execute***.

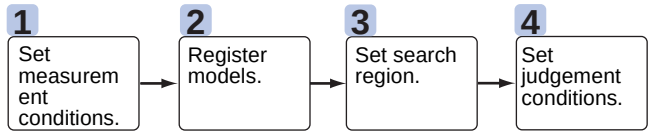
   The settings will be cleared and the initial screen for circle position compensation will be displayed.



2-9-1-2 1 Model

Position displacement compensation can be performed in the rotation direction by registering a characteristic feature as the rotation positioning model.

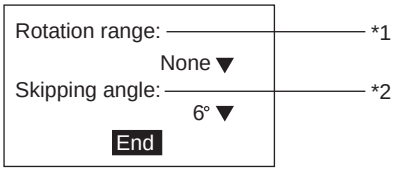




Setting Measurement Conditions

Set the conditions for searching for the rotation positioning model.

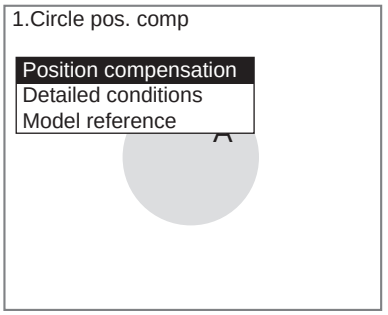
A search is performed using a model that rotates in skipping angle (*2) increments within the rotation range (*1).



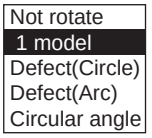
Setting item	Selections	Details	
Rotation range	None* ± 5° ± 15° ± 30° ± 45° 0 ± 15°, 180 ± 15° 0 ± 30°, 180 ± 30° All angles	Select the range for model rotation.	Example: Rotation range: ± 30°, Skipping angle: 15° Creates a model that rotates 15° at a time between −30° and 30°. (Coordinate system: Left-hand)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

The asterisk (*) indicates the default setting.

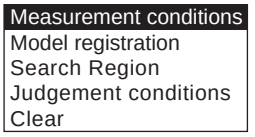
1. Select ***Position compensation***.



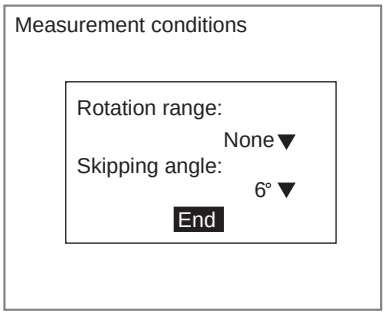
A list of compensation modes will be displayed.



2. Select ***1 model***.
   The initial screen for 1 model will be displayed.



3. Select ***Measurement conditions***.
   The Measurement Conditions Settings Screen will be displayed.

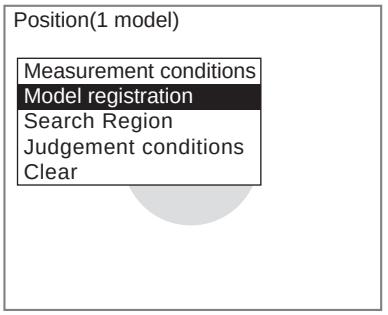


4. Set the conditions.
5. Select ***End***.
   The settings will be registered and the screen in (2.) will return.

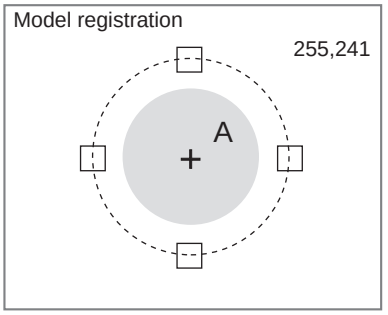
STEP 2: Registering Models

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

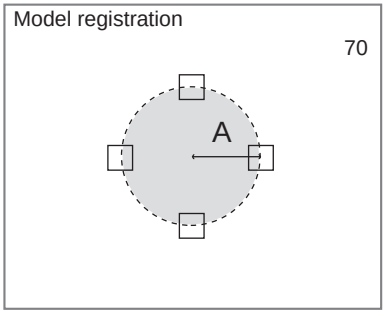
1. Select ***Model registration***.



The Model Registration Screen will be displayed.

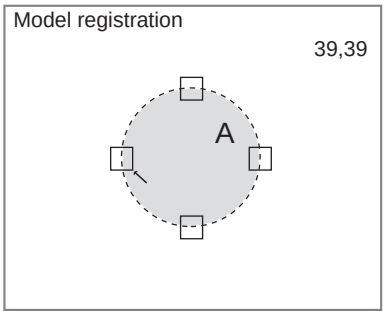


2. Specify the center position of the circle.
   Up/Down/Left/Right Keys: Move the cursor.
3. Press the **ENT** Key.
   The screen for setting the radius will be displayed.



4. Specify the size of the circle.
   Left Key: Decreases the size.
   Right Key: Increases the size.
5. Press the **ENT** Key.

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



6. Adjust the size of the model.

   Right Key: Increases the size horizontally.

   Left Key: Decreases the size horizontally.

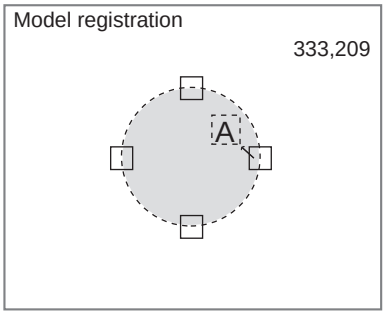
   Down Key: Increases the size vertically.

   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.

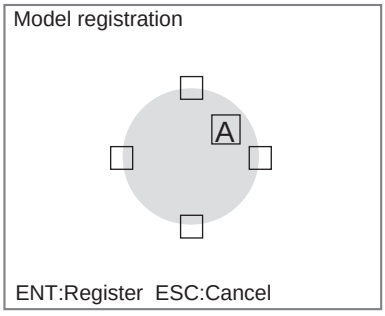
7. Press the **ENT** Key.

   The registration frame for model 4 will be displayed.



8. Enclose the rotation positioning mark.

   A confirmation screen will be displayed.



9. Check that an appropriate position has been registered as the model.
10. Press the **ENT** Key.

    The settings will be registered and the screen in (1.) will return.

STEP 3: Setting Search Regions

Set the search region for each model.

The settings method is the same as for *Not Rotate*. Refer to page 2-9-(6).

STEP 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.

CHECK Position Compensation Judgement Results and Scrolling

OK: Scroll will be performed.

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

The settings method is the same as for *Not Rotate*. Refer to page 2-9-(7).

Changing to Other Modes (Clearing Settings)

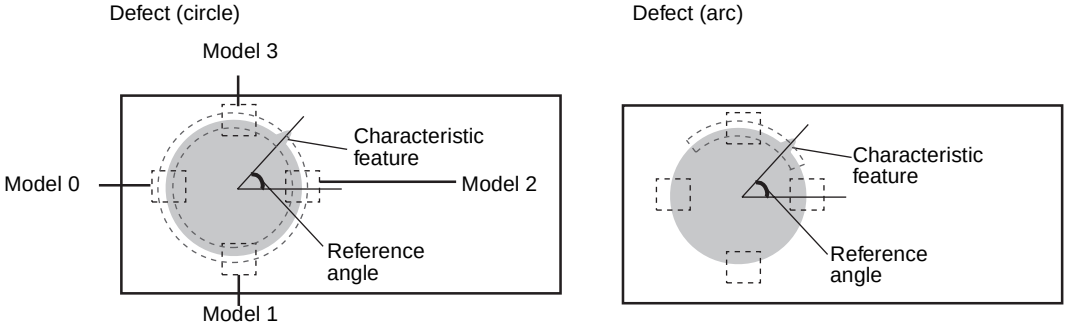
The settings must be cleared before changing to another mode.

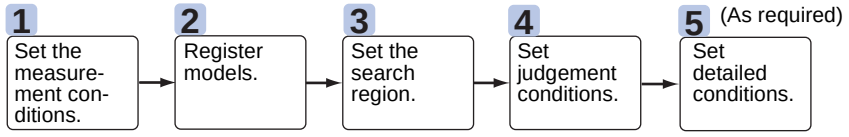
The settings method is the same as for *Not Rotate*. Refer to page 2-9-(8).

2-9-1-3 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 algorythms.

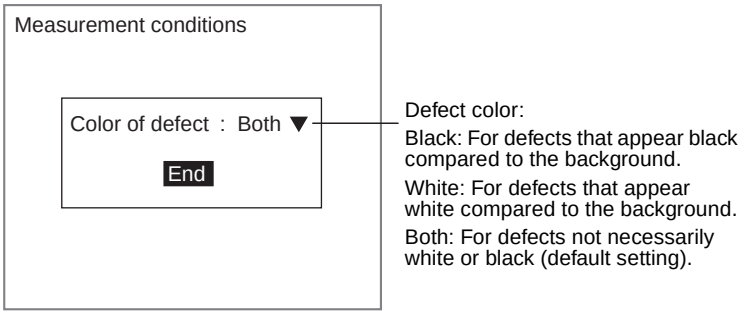
The difference between defect (circle) and defect (arc) is the search region. For circles, the circumference (360°) is searched and for arcs, an angle range is specified.



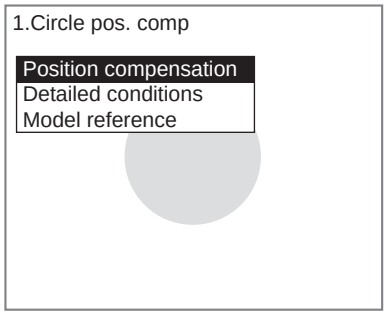


STEP 1: Setting Measurement Conditions

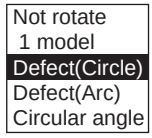
Select the color of the rotation positioning tag (the section to be detected as a defect).



1. Select ***Position compensation***.

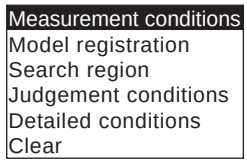


A list of compensation modes will be displayed.



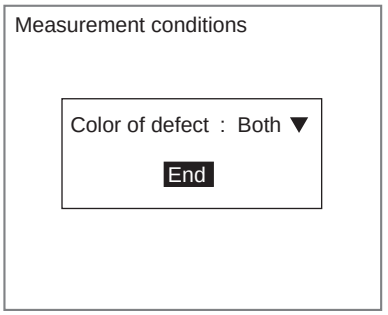
2. Select ***Defect (Circle)*** or ***Defect (Arc)***.

   The initial screen for defects will be displayed.



3. Select ***Measurement conditions***.

The Measurement Conditions Settings Screen will be displayed.



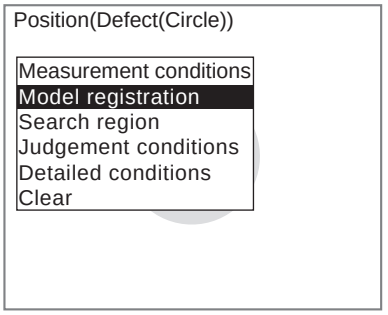
4. Select the defect color.
5. Select ***End***.

   The settings will be registered and the screen in (2.) will return.

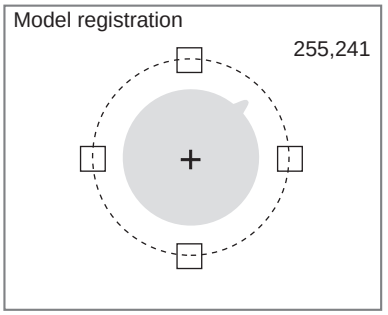
STEP 2: Registering Models

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

1. Select ***Model registration***.



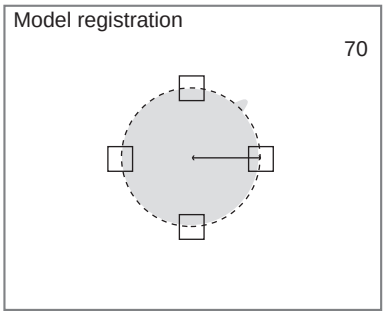
The Model Registration Screen will be displayed.



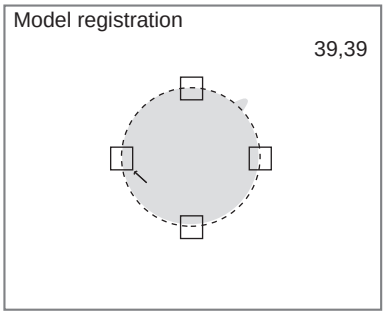
2. Specify the coordinates for the center of the circle.

   Up/Down/Left/Right Keys: Move the display cursor.
3. Press the **ENT** Key.

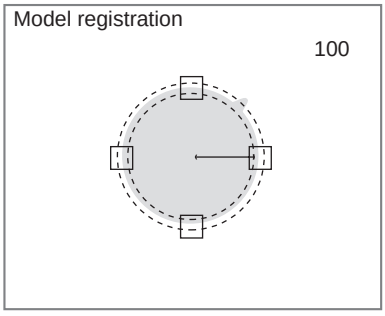
The screen for specifying the radius will be displayed.



4. Specify the size of the circle.
   Left Key: Decreases the size.
   Right Key: Increases the size.
5. Press the **ENT** Key.
   The screen for registering the size of the model will be displayed.



6. 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.
7. Press the **ENT** Key.
   A settings screen for the rotation positioning range will be displayed.



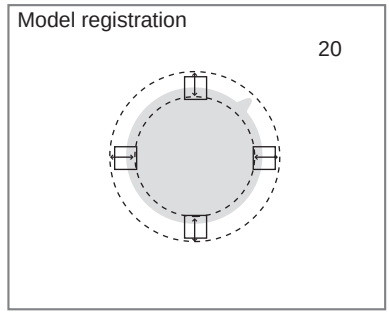
8. Specify the size of the circle.

   Left Key: Decreases the size.

   Right Key: Increases the size.

9. Press the **ENT** Key.

   The screen for registering the width will be displayed.



10. Specify the width.

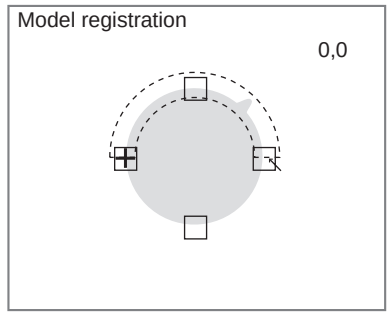
    Right/Up Keys: Increase the width.

    Left/Down Keys: Decrease the width.

11. Press the **ENT** Key.

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

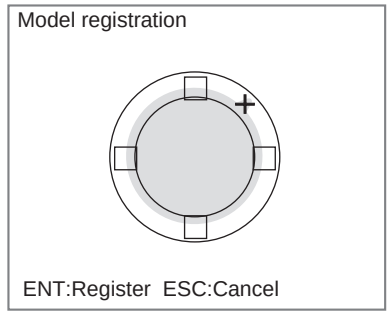
    If *Defect (Circle)* has been selected, move to (13.).



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

    A confirmation screen will be displayed.

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



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

14. Press the **ENT** Key.

    The settings will be registered and the screen in (1.) will return.

STEP 3: Setting Search Regions

Set the search region for each model.

The settings method is the same as for *Not Rotate*. Refer to page 2-9-(6).

STEP 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.

CHECK Position Compensation Judgement Results and Scrolling

OK: Scroll will be performed.

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

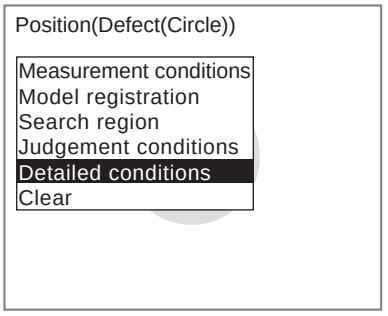
The settings method is the same as for *Not Rotate*. Refer to page 2-9-(7).

STEP 5: Setting Detailed Conditions

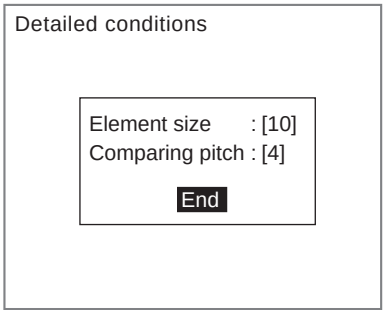
Adjust the detailed conditions if detection of the rotation positioning tag is unstable.

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

1. Select ***Detailed conditions***.



The Detailed Conditions Settings Screen will be displayed.



2. Set the detailed conditions.

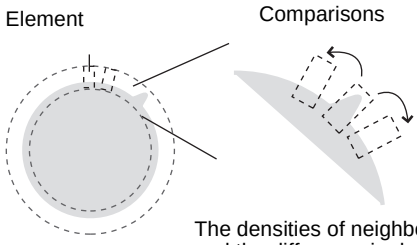
   Refer to the page 2-9-(19) for details.

3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

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.

Element size (4 to 80) (Default: 10)

Comparing pitch (1 to 6) (Default: 4)

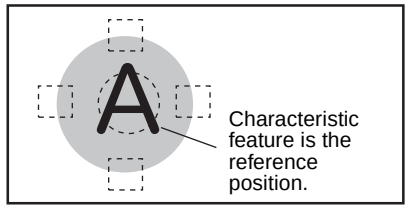
Changing to Other Modes (Clearing Settings)

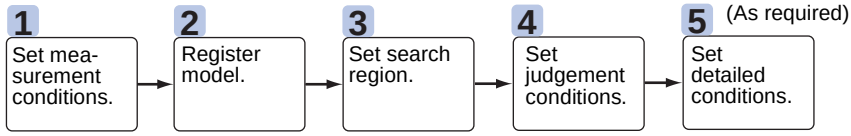
The settings must be cleared before changing to another mode.

The settings method is the same as for *Not Rotate*. Refer to page 2-9-(8).

2-9-1-4 Circular Angles

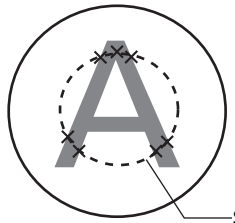
Another circle is drawn in addition to the circle for external positioning. A characteristic feature on the circumference of the new circle can be used for position compensation in the rotation direction.



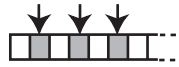
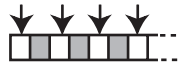


STEP 1: Setting Measurement Conditions

Select the degree of the characteristic feature in the point extractions to use for comparison.

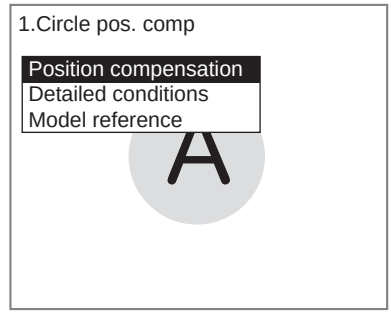


Set the conditions for detecting the feature on the circumference.

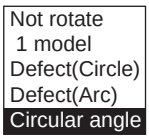
Mode	Details
Black *	Uses the low density (black) points. 
White	Uses the high density (white) points. 
Black defect	Compares the density with surrounding pixels and uses the point with the largest difference (where the density decreases suddenly). 
White defect	Compares the density with surrounding 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).

The asterisk (*) indicates the default setting.

1. Select ***Position compensation***.

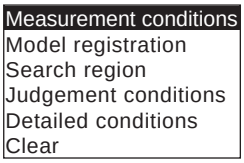


A list of compensation modes will be displayed.



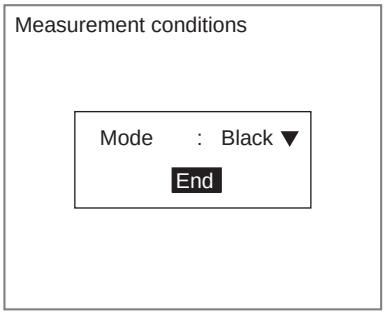
2. Select ***Circular angle***.

   The initial screen for circular angles will be displayed.



3. Select ***Measurement conditions***.

   The Measurement Conditions Settings Screen will be displayed.

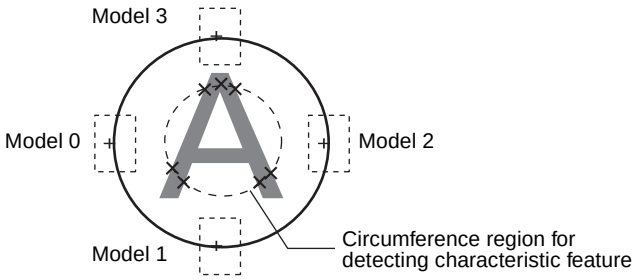


4. Select the mode.
5. Select ***End***.

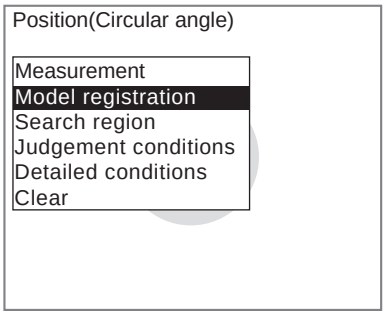
   The settings will be registered and the screen in (2.) will return.

STEP 2: Registering Models

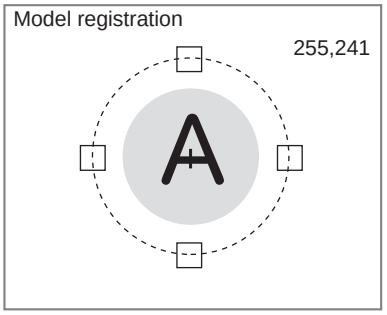
Register 4 points on the circumference and a circle for detecting the characteristic feature.



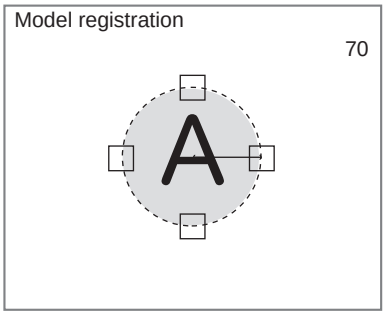
1. Select ***Model registration***.



The Model Registration Screen will be displayed.



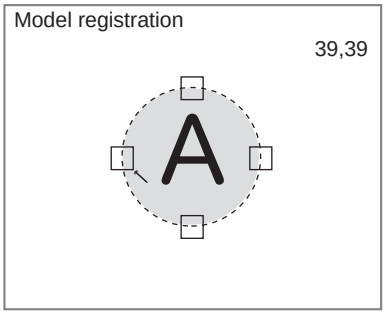
2. Specify the coordinates for the center of the circle.
   Up/Down/Left/Right Keys: Move the display cursor.
3. Press the **ENT** Key.
   The screen for specifying the radius will be displayed.



4. Specify the size of the circle.
   Left Key: Decreases the size.
   Right Key: Increases the size.

5. Press the **ENT** Key.

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



6. Adjust the size of the model.

   Right Key: Increases the size horizontally.

   Left Key: Decreases the size horizontally.

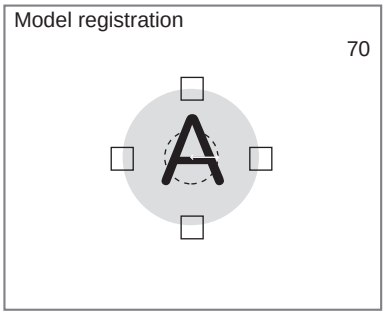
   Down Key: Increases the size vertically.

   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.

7. Press the **ENT** Key.

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



8. Specify the size of the circle.

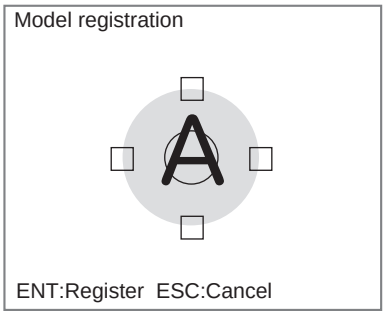
   Right Key: Increases the size.

   Left Key: Decreases the size.

9. 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.

A confirmation screen will be displayed.



10. Check that an appropriate position has been registered as the model.
11. Press the **ENT** Key.

    The settings will be registered and the screen in (1.) will return.

STEP 3: Setting Search Regions

Set the search region for each model.

The settings method is the same as for *Not Rotate*. Refer to page 2-9-(6).

STEP 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.

CHECK Position Compensation Judgement Results and Scrolling

OK: Scroll will be performed.

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

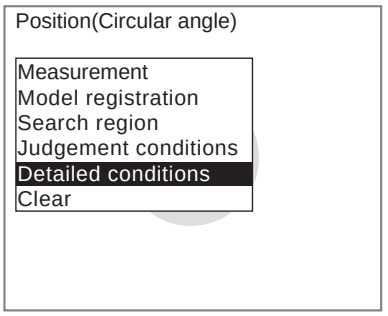
The settings method is the same as for *Not Rotate*. Refer to page 2-9-(7).

STEP 5: Setting Detailed Conditions

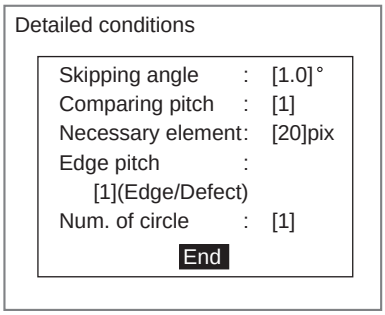
Adjust the detailed conditions if detection of the rotation positioning tag is unstable.

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

1. Select ***Detailed conditions***.



The Detailed Conditions Settings Screen will be displayed.



2. Change the settings.
   Refer to page 2-9-(25) for details.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

Skipping Angle

Set the angle to skip between point extractions.

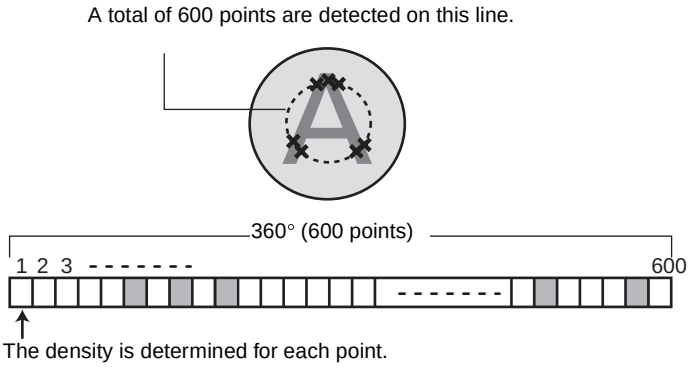
The density of all points on the circumference corresponding to the skipping angle will be measured. The most suitable value for the radius of the circle that was drawn will be set automatically.

The larger the setting, the fewer points will be extracted. This will increase processing speed, but decrease detection and rotation accuracy. (0.4 to 2.0 (1.0*))

The asterisk (*) indicates the default setting.

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.

Example for Skipping Angles of 0.6°



Comparing Pitch

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. (1 to 9 (1*))

Example:Mode: Black defect
Skipping angle: 60 (0.6°)
Comparing pitch: 2

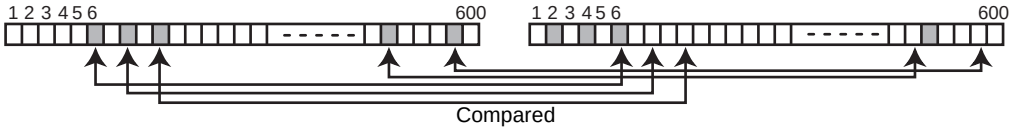
The characteristic points (here, black points) on the reference image are compared to those on the input image shifting two points at a time.

Reference image

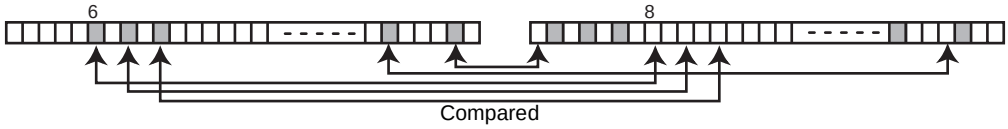
Input image

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

Reference Image Characteristic Points **Input Image Characteristic Points**



The points are moved by two and then compared again.



Necessary Elements

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. (1 to 99 (20*))

Mode	Details
Black	Registered points in order from the lowest density until the set number of points is reached.
White	Registered points in order from the highest density until the set number of points is reached.
Black defect White defect Edge	Registered points in order from the point with the highest density difference from the surrounding pixels until the set number of points is reached.

Edge Pitch

The edge pitch setting is enabled only when black defect, white defect, or edge are selected as the mode under *Measurement conditions*.

Set the pitch to obtain the density difference. (1 to 9 (1*))

Example:Mode: Black defect,
Edge pitch: 2

Compares the density with a point two pixels away.

Number of Circles

Select 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.

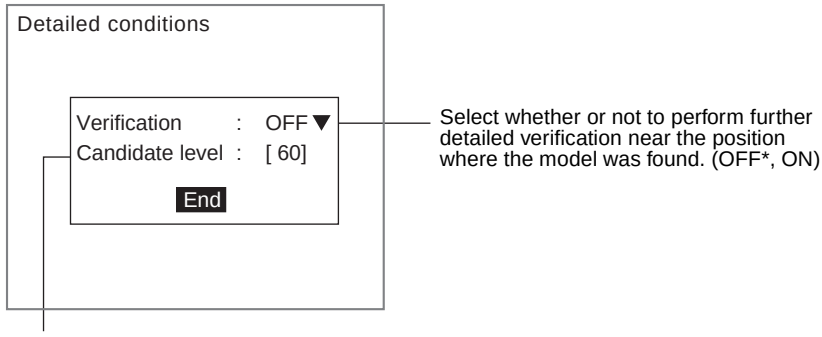
Changing to Other Modes (Clearing Settings)

The settings must be cleared before changing to another mode.

The settings method is the same as for *Not Rotate*. Refer to page 2-9-(8).

2-9-2 Setting Detailed Conditions

Change the detailed conditions if detection of the registered model is unstable.



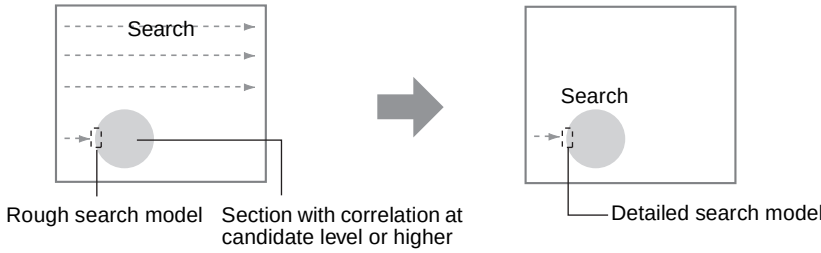
If *Verification* is set to ON, the following two levels of search processing will be executed. For rough searches, set the reference level for searching for the model. (0 to 99 (60*))

1. Rough search

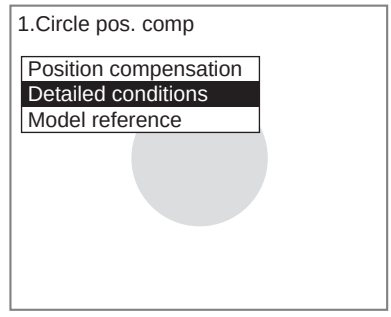
Uses a rough search model to search for an image with a correlation at the candidate level or higher.

2. Detailed search

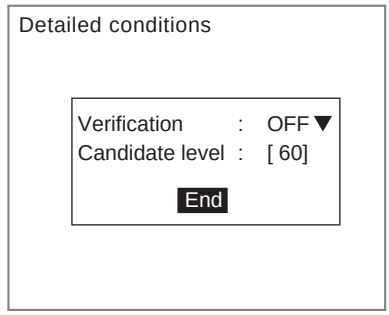
Measures again using the detailed search model to compare to the images surrounding the section at the candidate level or higher.



1. Select ***Detailed conditions***.



The Detailed Conditions Settings Screen will be displayed.

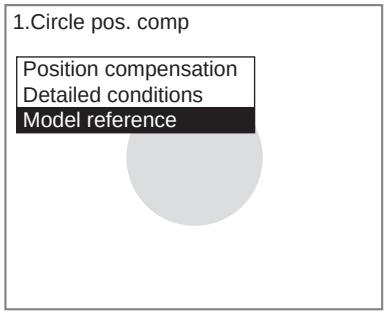


2. Make the settings.
3. Select ***End***.
   The settings will be registered and the screen in (1.) will return.

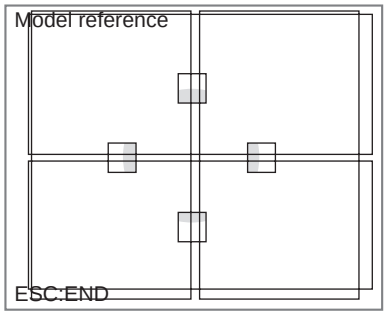
2-9-3 Referencing Models

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

1. Select ***Model reference.***



The images registered as models will be displayed.



2. Press the **ESC** Key.

   The screen in (1.) will return.

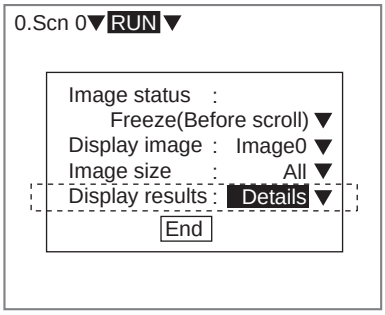
2-9-4 Measurement Screens

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

This section describes what kind of information can be displayed for Circle Position Compensation.

SeeAlso Refer to *SECTION 3 Monitor Mode and Run Mode* for details on Monitor and Run modes.

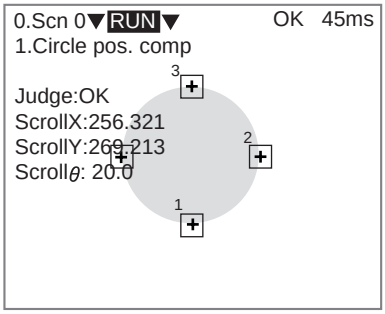
CHECK Press the **SHIFT+ESC** Keys on the Run Screen to access the following screen and change ***Display results*** to ***Details***.



Use the **Up** or **Down** Key to change to the unit for which circle position compensation is set and the following detailed screens will be displayed.

Use the **SHIFT+Right** or **Left** Keys to switch in order between the three screens.

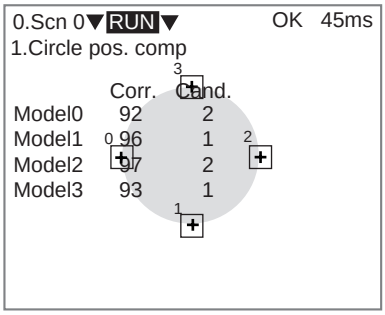
Scroll Amount



Detailed Display

The correlation values for each model will be displayed.

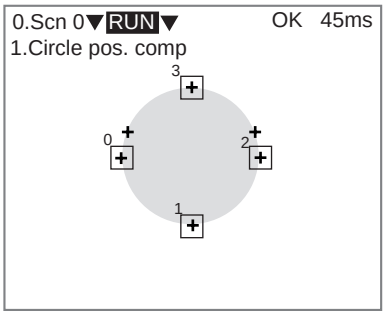
If search verification is set to ON, the number of points detected as candidates will be displayed.



Position Display

Only the model frame will be displayed.

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

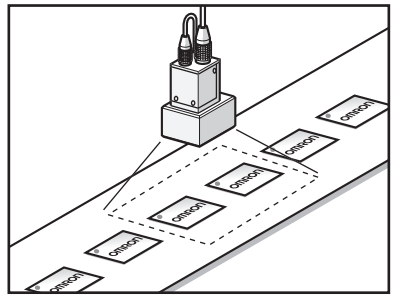


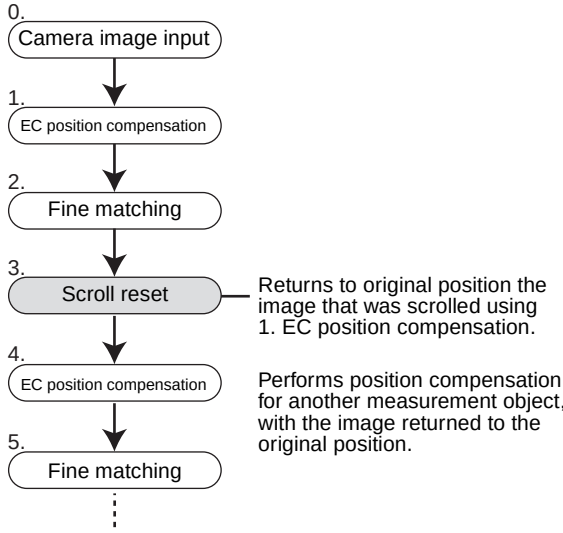
2-10 Reset Scroll

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).

This processing item is added to the flowchart but no condition settings or other operations are required.

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



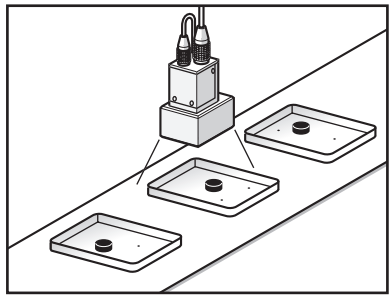


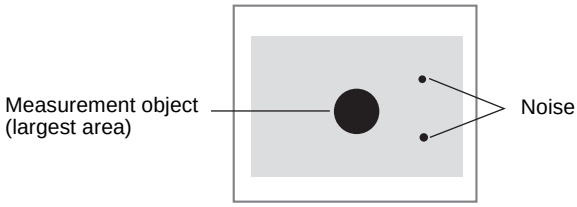
CHECK The scroll is reset for all Camera image input processing items, including Camera Image and Switch Camera.

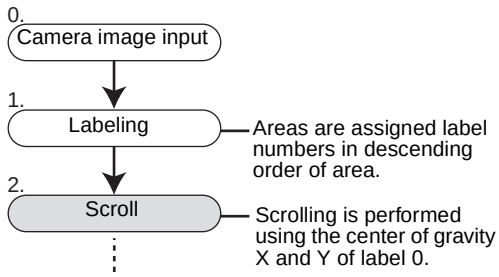
2-11 Scroll

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.

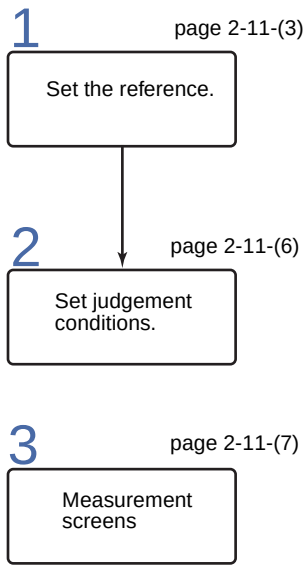
Example: Position Compensation without Being Affected by Noise.





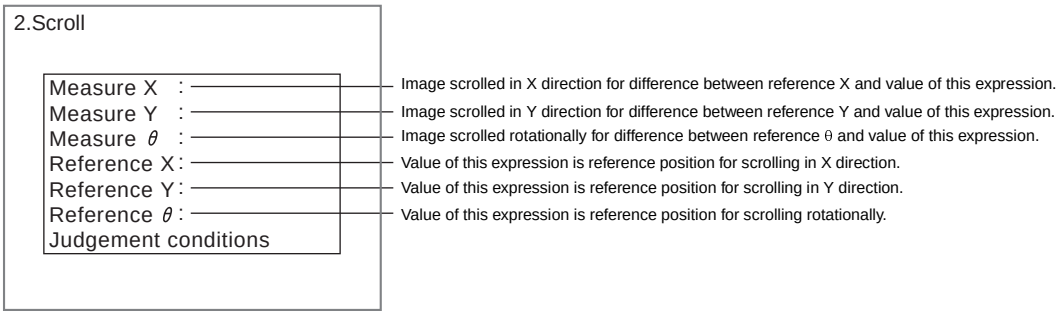


Operational Flow

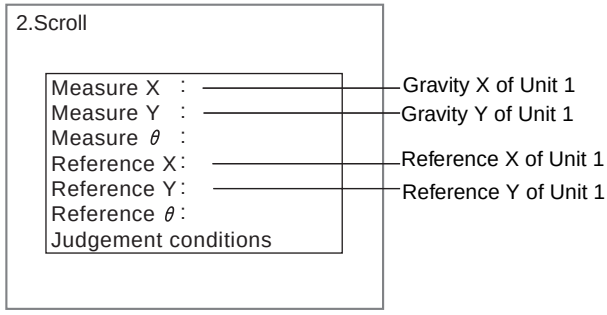


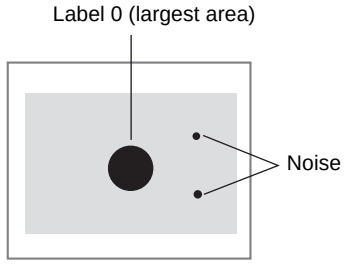
2-11-1 Setting the Reference

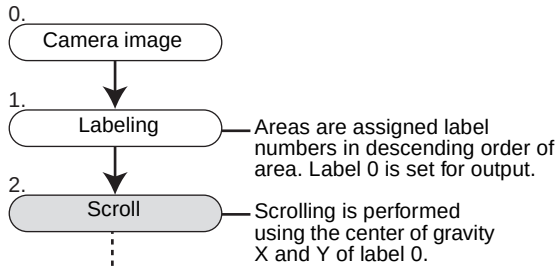
Set expressions to specify the units and measured values to be used as the reference for scrolling.



Example: Scrolling Using Labeling in Unit 1 as the Reference

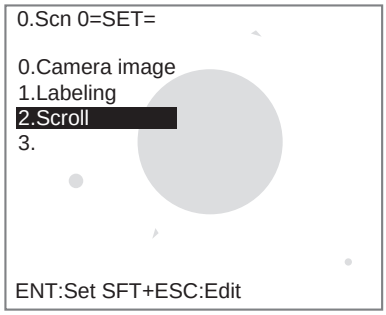




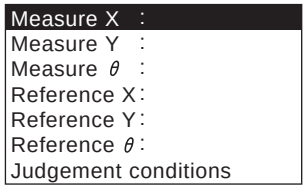


The following example shows the procedure for using “measure X” for scrolling. This procedure can be adapted for setting expressions for other items.

1. Select ***Scroll.***

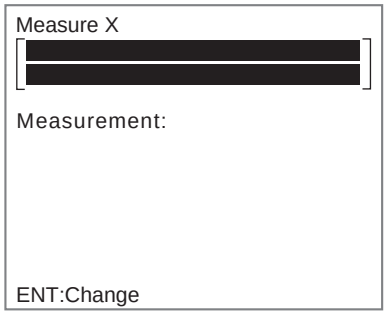


The initial screen for scrolling will be displayed.



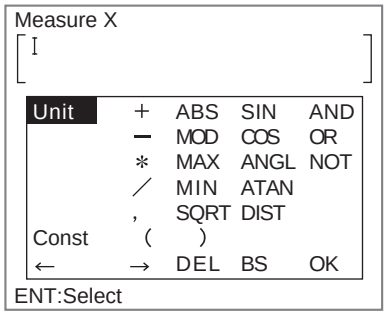
2. Select ***Measure X.***

A screen to input the expression will be displayed.



3. Place the cursor inside the square brackets for the expression and press the **ENT** Key.

A list of expression items will be displayed.

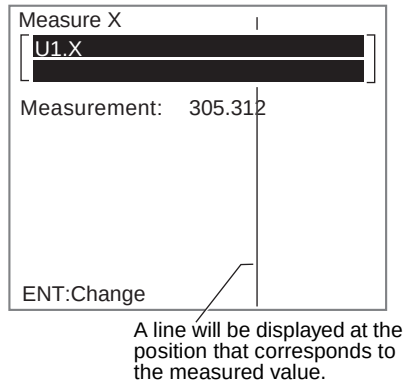


4. Select the items to be set in the expression.

SeeAlso Refer to *2-29 Calculation.*

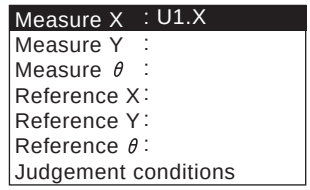
5. Once the expression has been set, select ***OK***.

The expression will be saved and the screen in (2.) will return.



6. Press the **Esc** Key.

   The expression will be saved and the screen in (1.) will return.



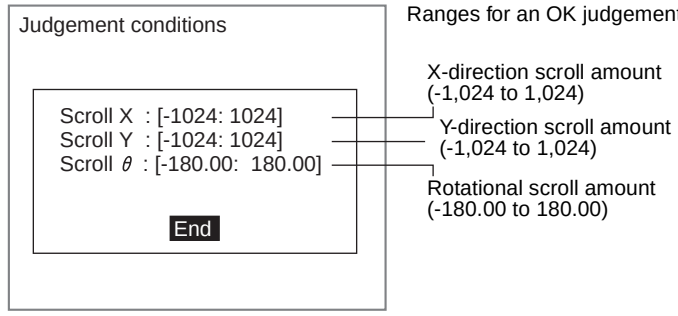
2-11-2 Setting Judgement Conditions

Judgement conditions are set for the scroll amount.

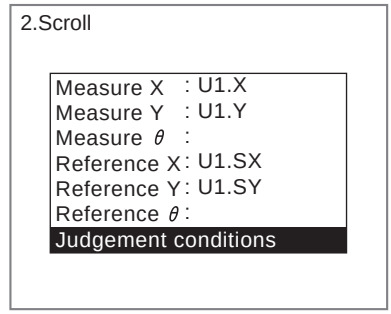
CHECK Scroll Judgement Results and Scrolling

OK: Image is scrolled.

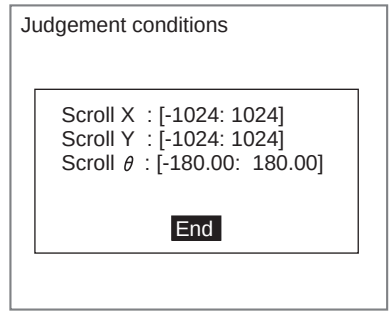
NG: Image is not scrolled and the overall judgement will be NG regardless of measurement results.



1. Select ***Judgement conditions.***



The setting screen for judgement conditions will be displayed.



2. Set the conditions.

   Select ***End.***

   The settings will be registered and the screen in (1.) will return.

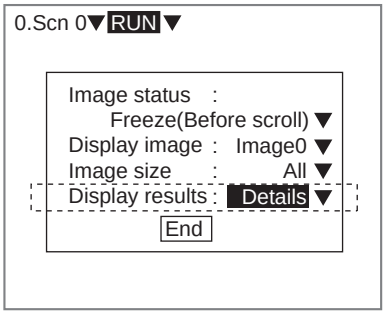
2-11-3 Measurement Screens

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

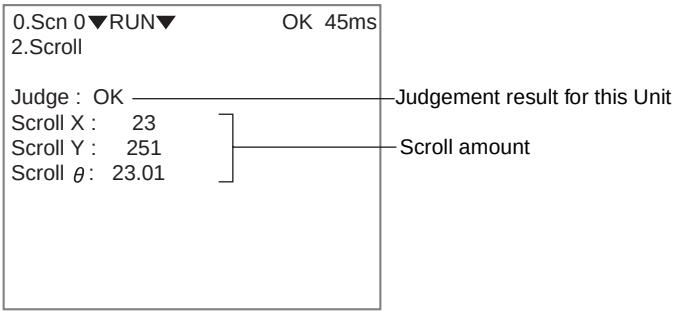
This section describes what kind of information can be displayed for scrolling.

SeeAlso Refer to *SECTION 3 Monitor Mode and Run Mode* for details on Monitor and Run modes.

CHECK 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 the Scroll processing item is set and the following detailed screens will be displayed.

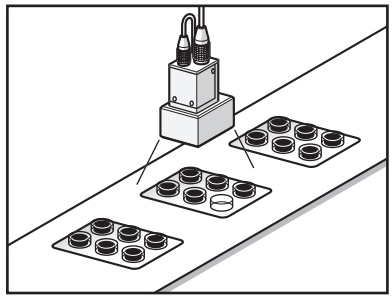


2-12 Detecting Binary Defects

The 256-gradation images read by the Camera are converted into binary black-and-white images and measurement is performed on the white pixels.

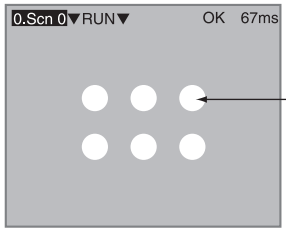
The size (area), position (center of gravity), and orientation (angle) of the measurement object can be detected.

Example: Detecting the Presence of Tablets



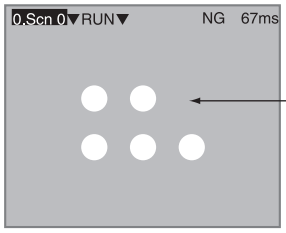
The image is converted into binary.

OK product



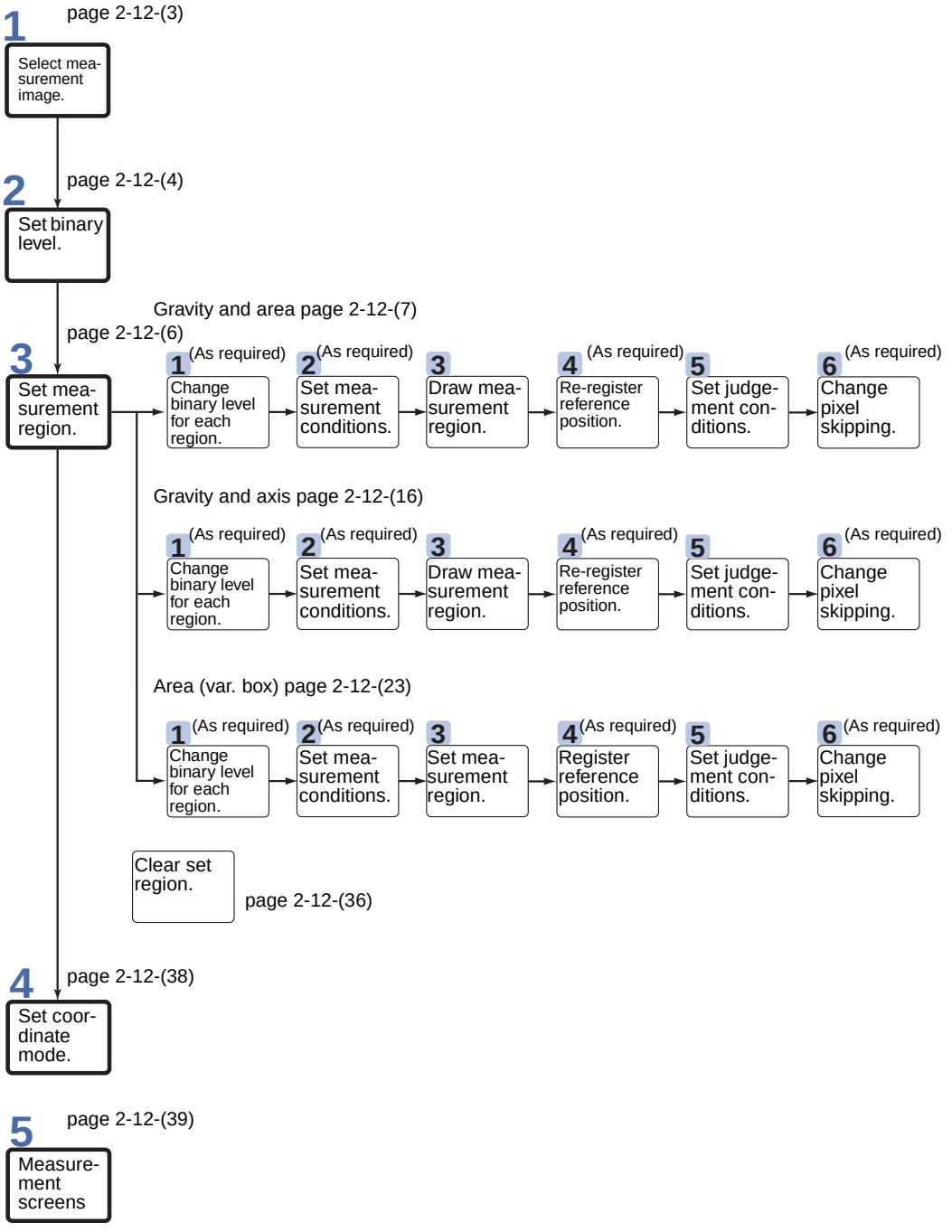
The image is converted into binary, showing the tablets in white.

NG product



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

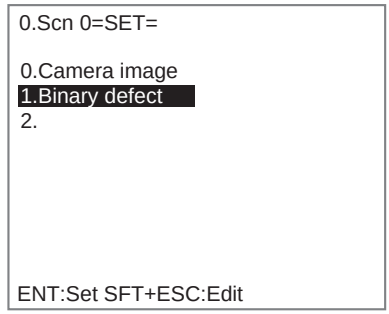
Operational Flow



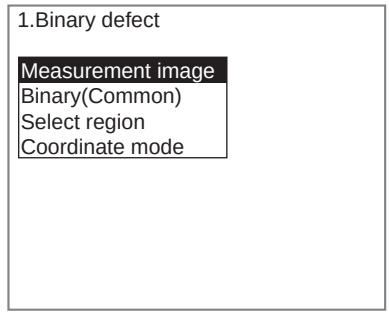
2-12-1 Selecting Measurement Images

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

1. Select ***Binary defect***.



The initial screen for binary defects will be displayed.



2. Select ***Measurement image***.

   The selections will be displayed.

3. Select which image will be used for measurement, the image stored at Image 0 or the image stored at Image 1.
4. Press the **ENT** Key.

   The settings will be registered and the screen in (1.) will return.

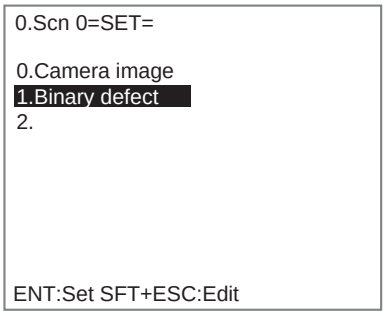
2-12-2 Setting the Binary Level

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

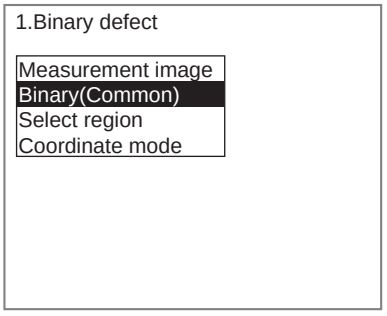
The binary level set here is used for all of the measurement regions.

CHECK The binary levels can be set for each measurement region.

1. Select ***Binary defect***.

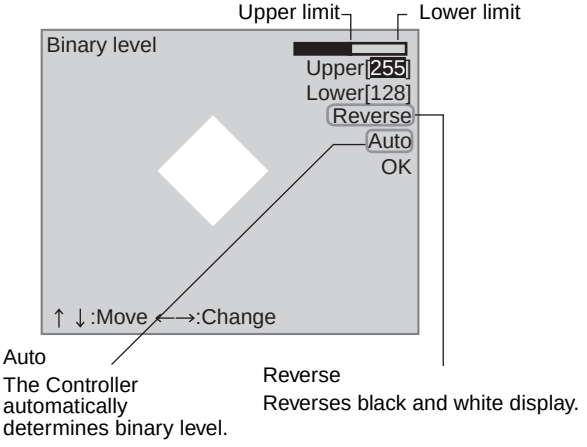


The setting selections will be displayed.



2. Select ***Binary (Common)***.

The settings screen for binary levels will be displayed.

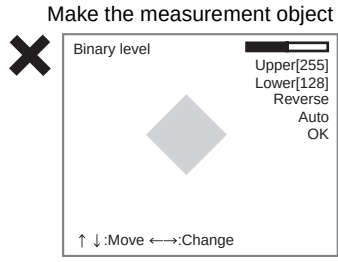


3. Move the cursor to the upper limit and use the **Left** and **Right** Keys to change the value.

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 10 times faster.
Up and Down Keys:	Switches between setting items.

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

CHECK Set the upper and lower limits to make the measurement object white.



5. Select ***OK***.

   The settings will be registered and the screen in (1.) will return.

CHECK It is also possible to set the binary level so that measurement is performed only for an intermediate density range.

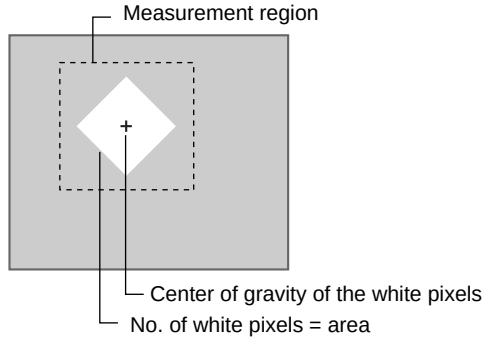
2-12-3 Setting Measurement Regions

Up to eight measurement regions can be set.

There are three measurement methods for binary defect detection: Gravity and area, gravity and axis, and area (variable box). Different measurement methods can be set for each region. Select the measurement method suitable for the objects to be inspected.

Gravity and Area

Use a gravity and area measurement to find the size and position (center of gravity) of a measurement object.



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.

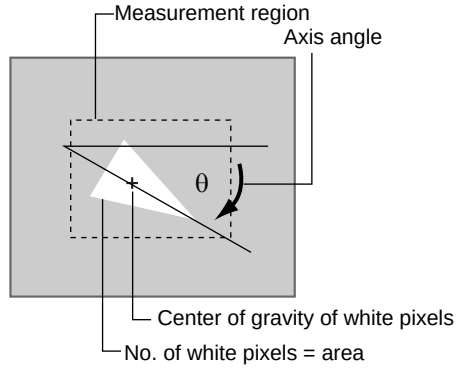
CHECK If the number of white pixels is the same, the measurement result will be OK even if the shape of the measurement object is different. Use pattern detection to distinguish between measurement object shapes.

CHECK Use an area (var. box) measurement for measurement objects with varying measurement region sizes or positions.

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.



Axis Angle

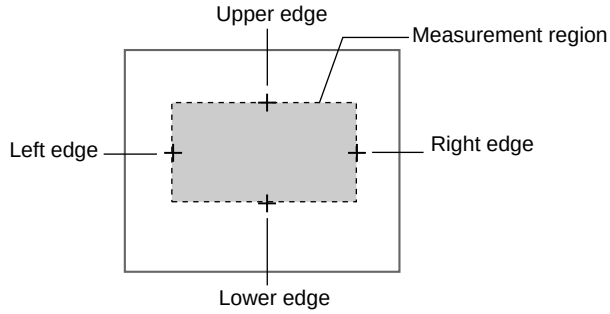
The axis angle is the angle of the major axis of an ellipse that is diagrammatically equivalent to the area occupied by the white pixels.

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.

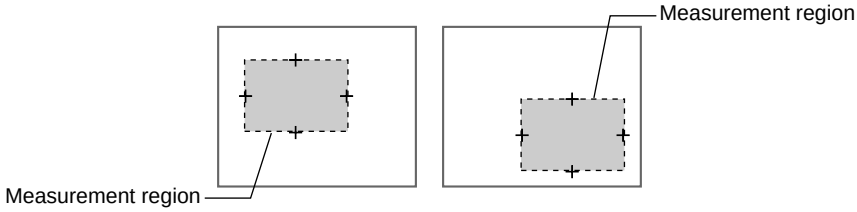
Area (Var. Box)

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 measurement region will be on the inside of the edges that were found.



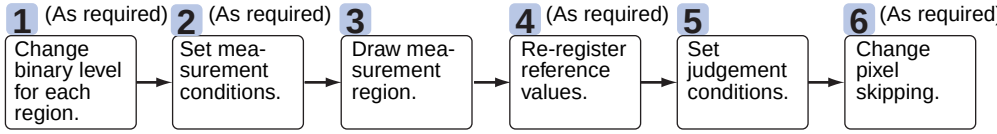
With the edges detected, the Controller can determine where the measurement object is. Even if the size and position of the measurement object changes, the Controller can move the measurement region appropriately.



Once the edges have been found, the image is converted to a binary image and the area and center of gravity of the measurement region are found.

2-12-3-1 Gravity and Area

Density images taken by the Camera are converted to binary images, made up of black and white pixels. The size (area) and position (center of gravity) of the area occupied by the white pixels are measured. Refer to page 2-12-(6).



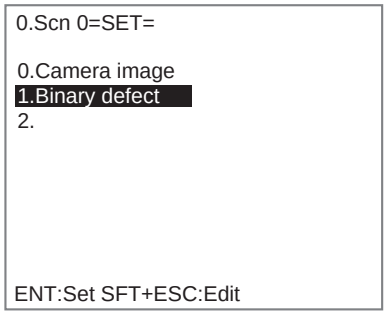
STEP 1: Changing Binary Level for Each Region

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

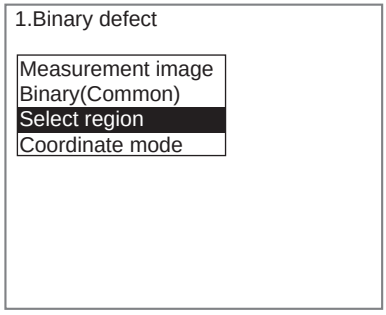
Set the level for converting 256-gradation images into binary images. Measurements are performed for the white pixels. Therefore, make the settings so that the measurement object is white.

CHECK 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.

1. Select ***Binary defect***.

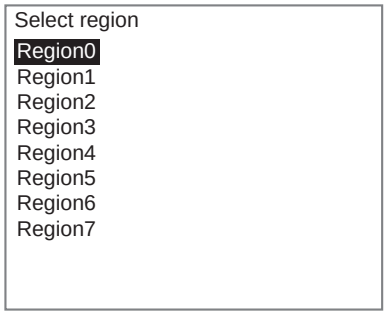


The setting selections will be displayed.



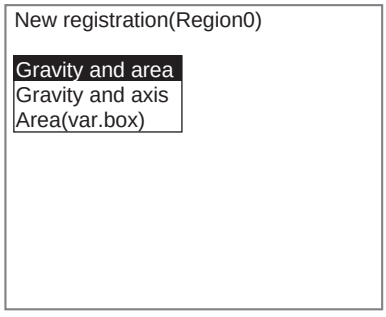
2. Select ***Select region.***

The region numbers will be displayed.



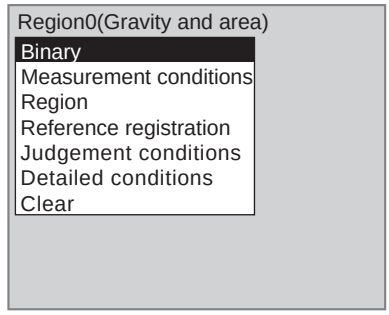
3. Select the region number.

A list of measurement methods will be displayed.



4. Select ***Gravity and area***.

   The initial Gravity and Area Screen will be displayed.



5. Select ***Binary***.

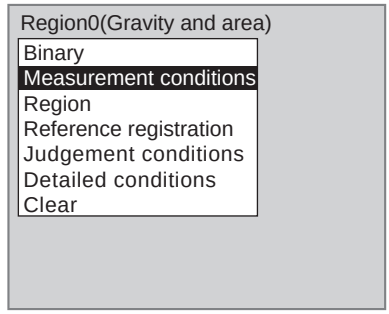
   The Binary Levels Settings Screen will be displayed.

   The rest of the procedure is the same as outlined under *2-12-2 Setting the Binary Level.*

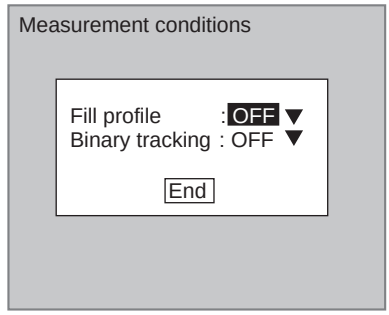
STEP 2: Setting Measurement Conditions

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.

1. Select ***Measurement conditions***.



   The Measurement Conditions Settings Screen will be displayed.



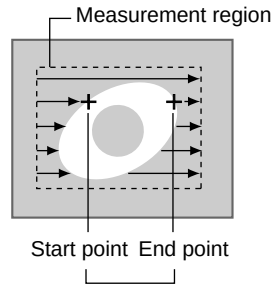
2. Select ***ON*** or ***OFF***.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

Fill Profile Function

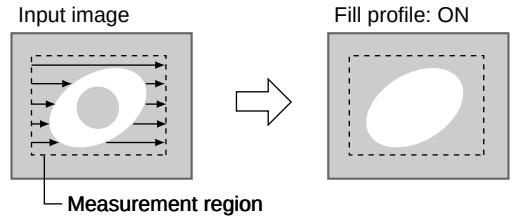
The fill profile function is set when the exterior of the measurement object is being measured.

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.

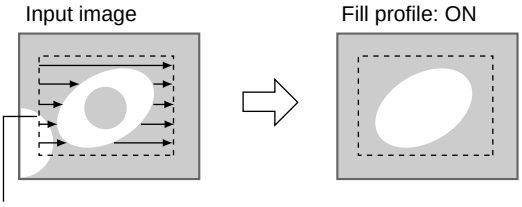


This area will be measured as white pixels.

Example



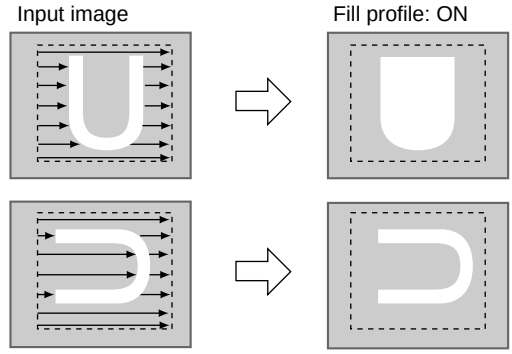
When a White-pixel Section Encroaches on the Measurement Region



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

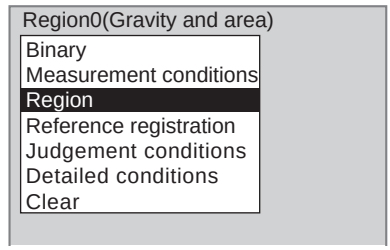
Set the binary tracking function when the variations in measurement object color or other factors prevent correct measurement with stable binary levels. If the binary tracking function is set to ON, the Controller will automatically adjust the binary levels in line with the brightness of the input image.

STEP 3: Drawing Measurement Regions

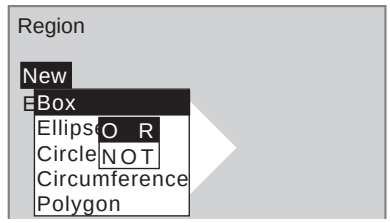
When a measurement region is drawn, measurement is performed for the displayed image and the results are registered as the reference values (area and center of gravity).

CHECK Regions 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.

1. Select ***Region***.

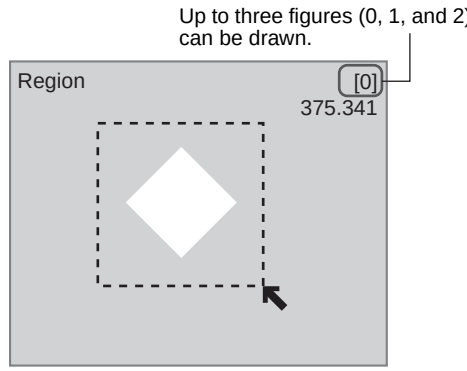


The Region Settings Screen will be displayed.



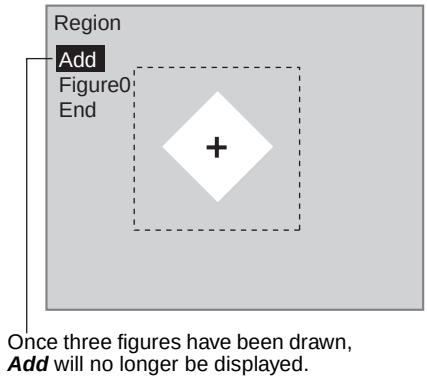
2. Select ***New***.
3. Select the desired figure.
4. Select the desired drawing mode (***OR***/***NOT***).

An arrow cursor will appear.



5. Draw the region with the selected figure.

   The figure will be registered.

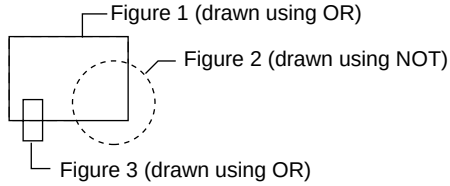


6. If additional figures are to be drawn, select ***Add***.
7. Repeat steps 3 to 5 as necessary to create the desired shape.
8. After drawing is completed, select ***End.***

   The measurement region will be registered and the screen in (1.) will return.

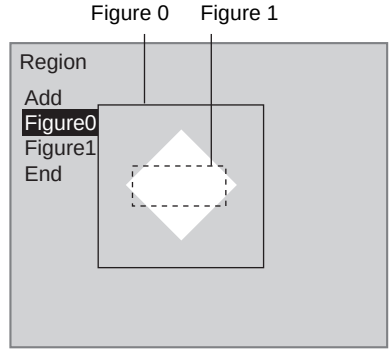
   The center of gravity (marked by an arrow cursor) and the measurement region will be displayed.

CHECK Figures drawn using OR mode are displayed with solid lines and figures drawn using NOT mode are displayed with dotted lines.



Correcting or Clearing Figures

1. In the screen for step 5 above, select the figure to be changed or cleared using the **Up** and **Down** Keys and press the **ENT** Key.



   The selections will be displayed.

2. Select either ***Correct*** or ***Clear*** and press the **ENT** Key.

   If ***Correct*** is selected, the cursor will be displayed. Correct the size and position of the figure as desired.

   If ***Clear*** is selected, the selected figure will be cleared.

STEP 4: Re-registering Reference Values

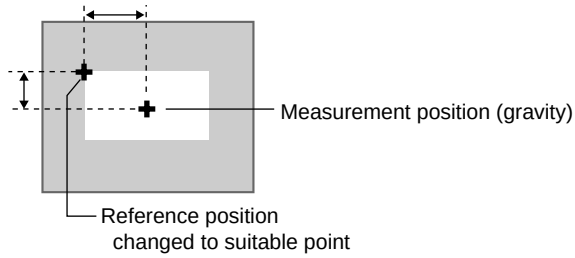
This operation is performed when only the reference values are to be re-registered.

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 Reference positions can also be changed, facilitating the following application.

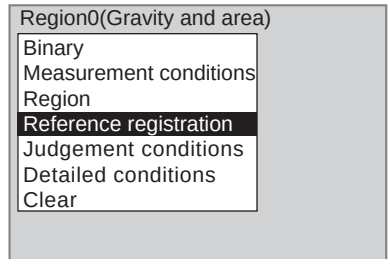
Inspecting Positions from a Specified Point

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.

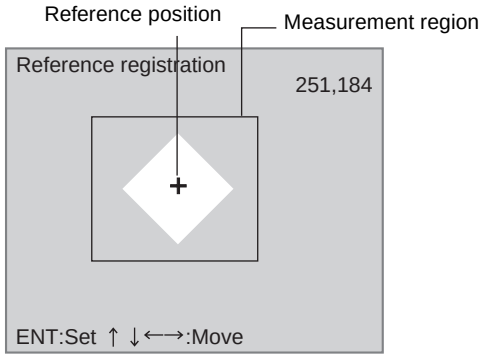


CHECK When the measurement region is changed, the reference values return to the default settings.

1. Select ***Reference registration***.



A cursor will appear at the position of the center of gravity.

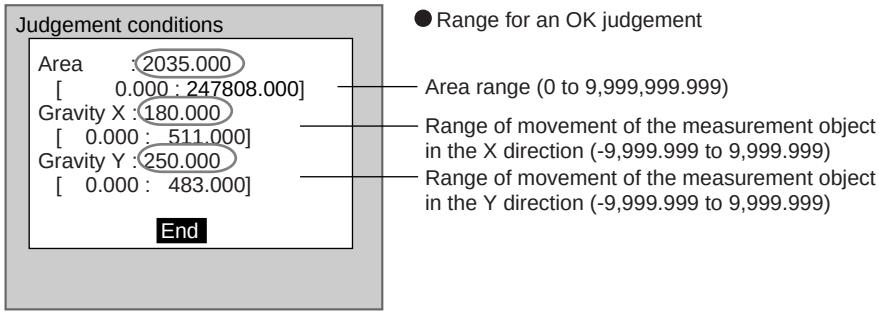


2. To change the position, use the **Up**/**Down** and **Right**/**Left** Keys to move the cursor.
3. Press the **ENT** Key.

   The setting will be registered and the screen in (1.) will return.

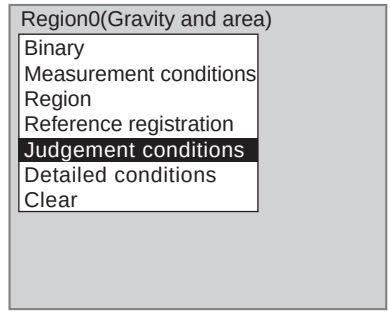
STEP 5: Setting the Judgement Conditions

Make settings for the area and center of gravity.

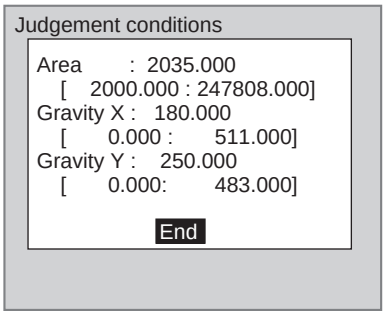


○: Measurement results for the displayed image
Use these values as a reference for setting upper and lower limits.

1. Select ***Judgement conditions***.



The Judgement Conditions Settings Screen will be displayed.



2. Change the settings.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

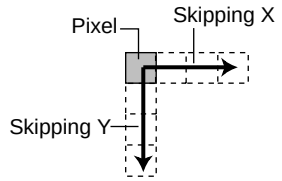
STEP 6: Changing Pixel Skipping

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.

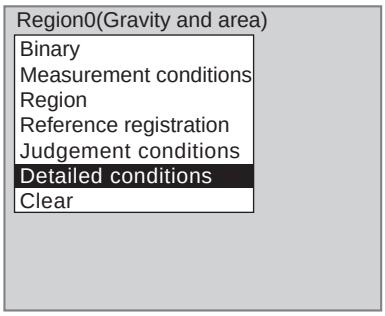
Once the skipping setting has been changed, perform a measurement and confirm that measurement can be performed correctly.

Skipping X and Skipping Y

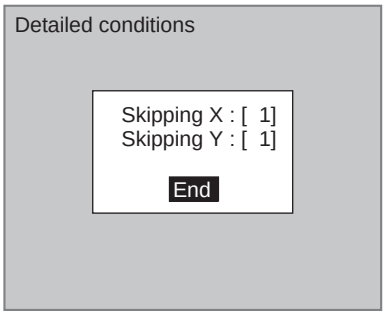
Set how many pixels to skip in the measurement region during measurement. The default setting is 1, which means that all of the measurement region will be measured.



1. Select ***Detailed conditions***.



The Detailed Conditions Settings Screen will be displayed.



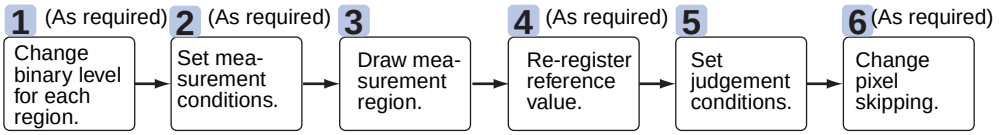
2. Set the number of pixels to skip.
3. Select ***End***.

   The setting will be registered and the screen in (1.) will return.

2-12-3-2 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.

SeeAlso Refer to page 2-12-(6).



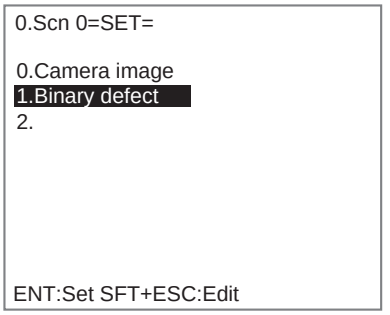
STEP 1: Changing Binary Level for Each Region

Use this function to change the binary level settings for each region.

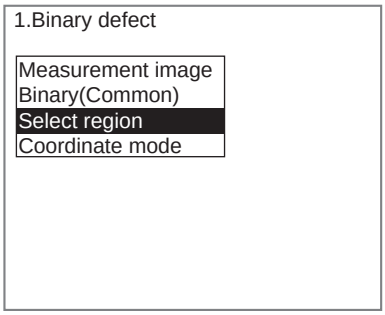
Set the level for converting 256-gradation images into binary images. Measurements are performed for the white pixels. Therefore, make the settings so that the measurement object is white.

CHECK 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.

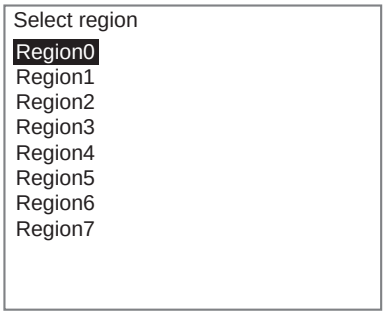
1. Select ***Binary defect***.



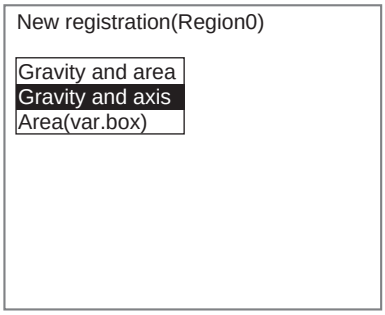
The Binary Defect Settings Screen will be displayed.



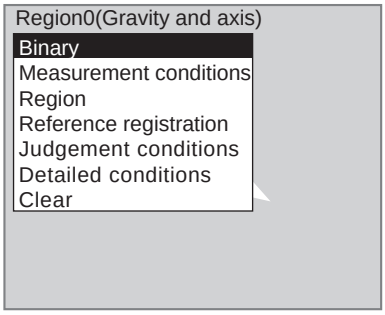
2. Select ***Select region***.
   A list of region numbers will be displayed.



3. Select the region number.
   The selection of measurement methods will be displayed.



4. Select ***Gravity and axis***.
   The initial Gravity and Axis Screen will be displayed.



5. Select ***Binary***.

   The Binary Levels Settings Screen will be displayed.

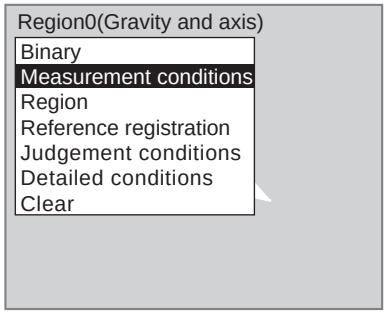
   The rest of the procedure is the same as outlined under *2-12-2 Setting the Binary Level.*

SeeAlso Refer to page 2-12-(4).

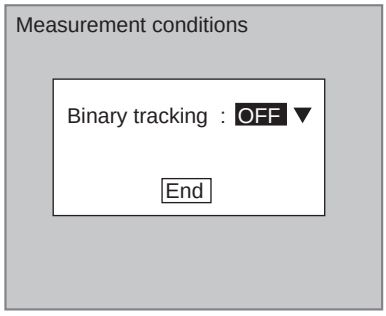
STEP 2: Setting Measurement Conditions

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

1. Select ***Measurement conditions***.



   The Measurement Conditions Settings Screen will be displayed.



2. Select either ***ON*** or ***OFF***.
3. Select ***End***.

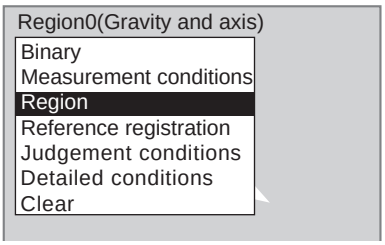
   The settings will be registered and the screen in (1.) will return.

STEP 3: Drawing Measurement Regions

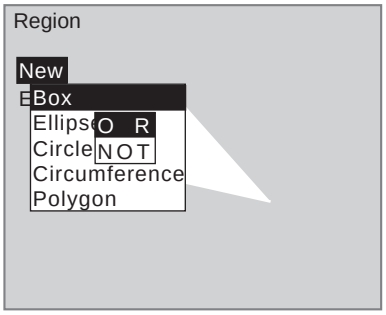
When a measurement region is drawn, measurement is performed for the displayed image and the results are registered as the reference values (area, center of gravity, and axis).

CHECK Regions 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.

1. Select ***Region***.

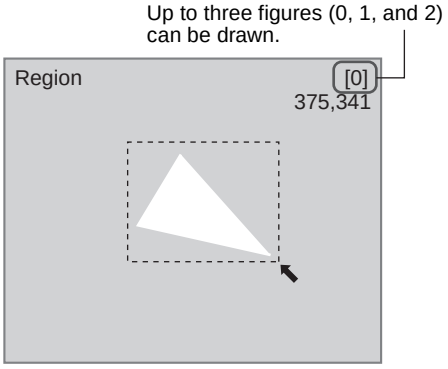


The Region Settings Screen will be displayed.



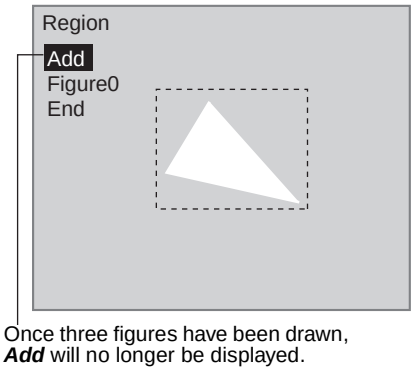
2. Select ***New***.
3. Select the desired figure.
4. Select the desired drawing mode (***OR***/***NOT***).

   An arrow cursor will appear.



5. Draw the region with the selected figure.

The figure will be registered.

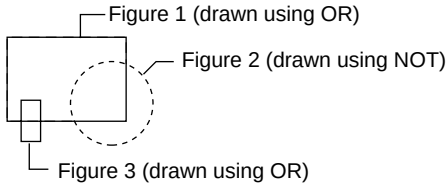


6. If additional figures are to be drawn, select ***Add***.
7. Repeat steps 3 to 5 as necessary to create the desired shape.
8. After drawing is completed, select ***End.***

   The measurement region will be registered and the screen in (1.) will return.

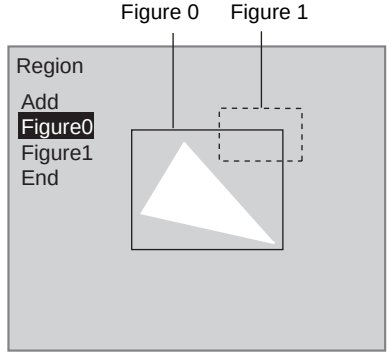
   The center of gravity (marked by an arrow cursor) and the measurement region will be displayed.

CHECK Figures drawn using OR mode are displayed with solid lines and figures drawn using NOT mode are displayed with dotted lines.



Correcting or Clearing Figures

1. In the screen for step 5 above, select the figure to be changed or cleared using the **Up** and **Down** Keys and press the **ENT** Key.



The figure for the figure number selected using the cursor will be displayed with solid lines. The selections ***Correct*** and ***Clear*** will be displayed.

2. Select either ***Correct*** or ***Clear*** and press the **ENT** Key.

   If ***Correct*** is selected, the cursor will be displayed. Correct the size and position of the figure as desired.

   If ***Clear*** is selected, the selected figure will be cleared.

STEP 4: Re-registering Reference Values

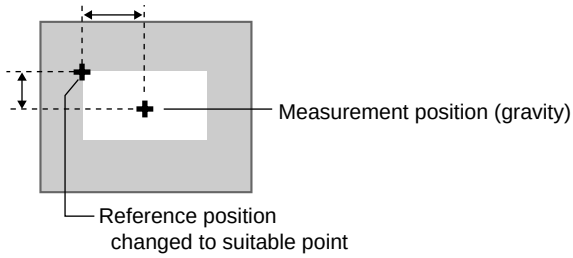
This operation is performed when only the reference values are to be re-registered.

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 values can be changed to enable the following function.

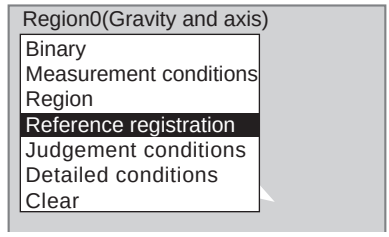
Inspecting Positions from a Specified Point

Once the reference values (area, center of gravity, and axis) 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.

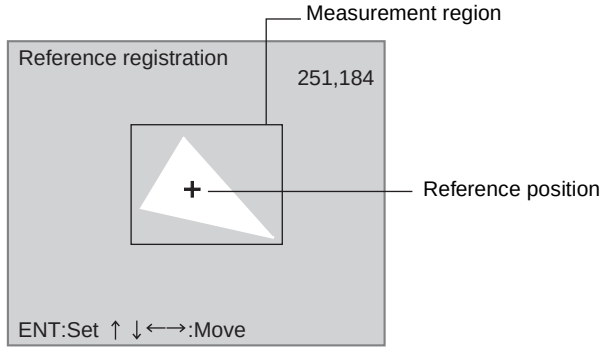


CHECK When the measurement region is changed, the reference values return to the default settings.

1. Select ***Reference registration***.



A cursor will appear at the position of the center of gravity.

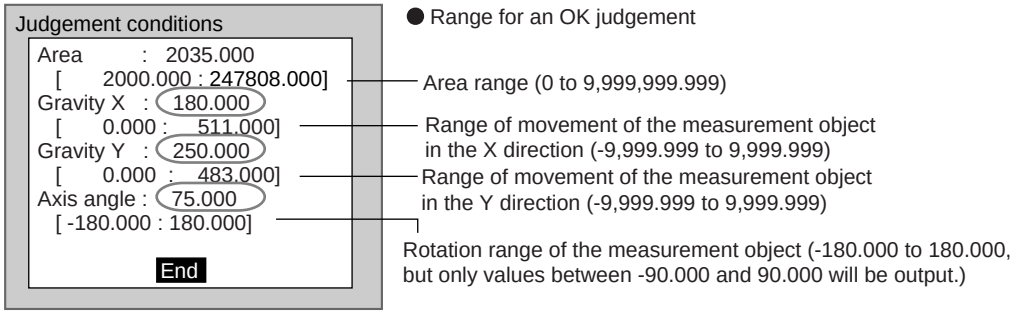


2. To change the position, use the **Up**/**Down** and **Right**/**Left** Keys to move the cursor.
3. Press the **ENT** Key.

   The setting will be registered and the screen in (1.) will return.

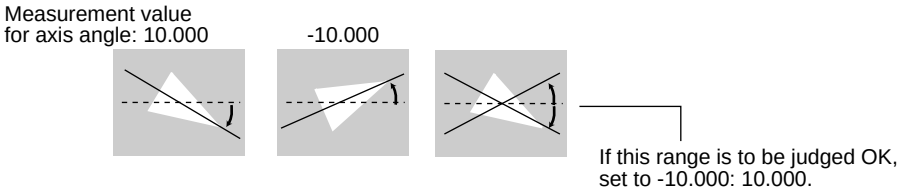
STEP 5: Setting the Judgement Conditions

Make settings for the area, center of gravity, and axis.

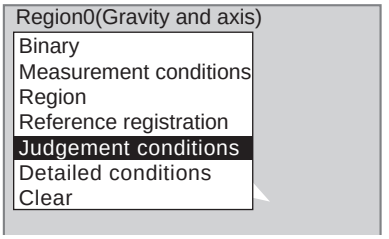


○: Measurement results for the displayed image
Use these values as a reference for setting upper and lower limits.

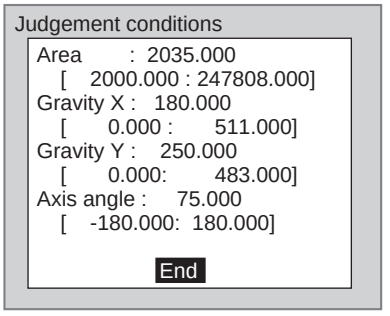
Axis Angle



1. Select ***Judgement conditions***.



The Judgement Conditions Settings Screen will be displayed.



2. Change the settings.
3. Select ***End***.

The settings will be registered and the screen in (1.) will return.

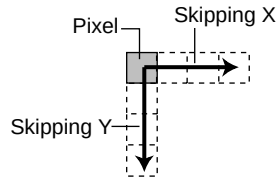
STEP 6: Changing Pixel Skipping

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.

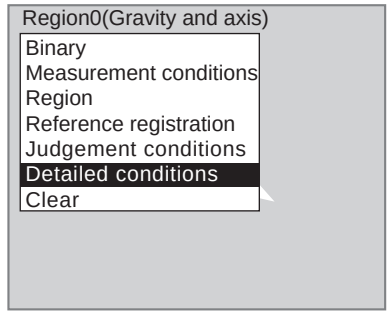
Once the skipping setting has been changed, perform a measurement and confirm that measurement can be performed correctly.

Skipping X and Skipping Y

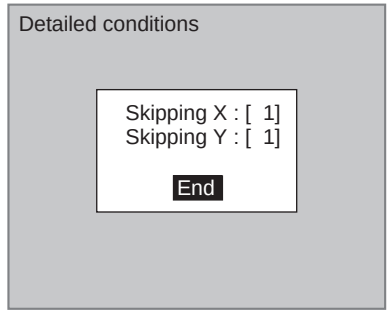
Set how many pixels to skip in the measurement region during measurement. The default setting is 1, which means that all of the measurement region will be measured.



1. Select ***Detailed conditions***.



The Detailed Conditions Settings Screen will be displayed.



2. Set the number of pixels to skip.
3. Select ***End***.

   The setting will be registered and the screen in (1.) will return.

2-12-3-3 Area (Variable Box)

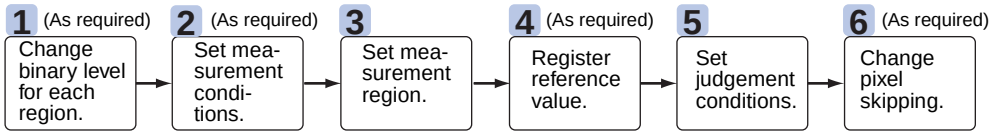
The area (variable box) measurement method measures the area and center of gravity while following the measurement region to suit measurement objects with inconsistent sizes and positions.

First, the upper, lower, left, and right edges of the measurement object are located. 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.

Once the edges have been located, the image is converted to binary and the area and center of gravity of the measurement region is measured.

SeeAlso Refer to page 2-12-(7).



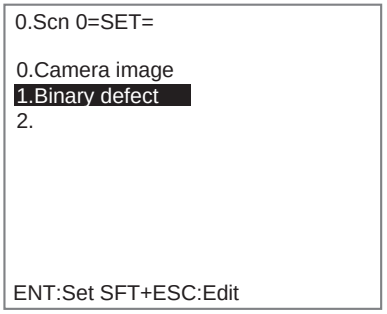
STEP 1: Changing Binary Level for Each Region

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

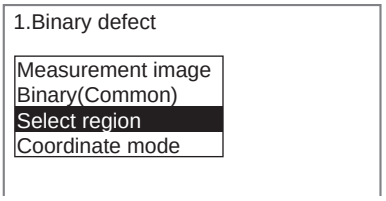
Set the level for converting 256-gradation images into binary images. Measurements are performed for the white pixels. Therefore, make the settings so that the measurement object is white.

CHECK 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.

1. Select ***Binary defect***.

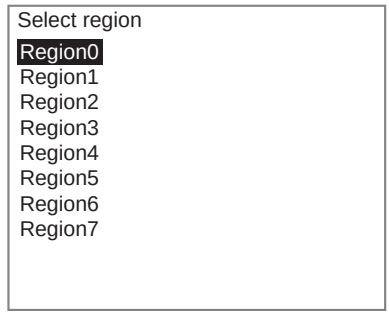


The setting selections will be displayed.



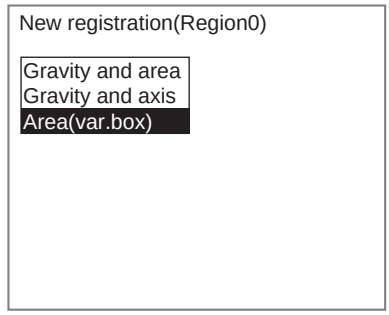
2. Select ***Select region***.

A list of region numbers will be displayed.



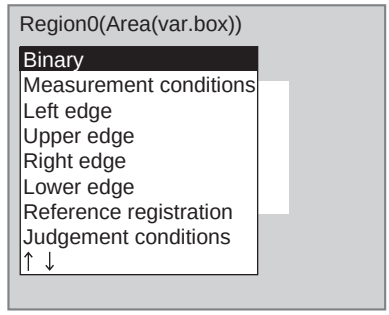
3. Select the region number.

   The selection of measurement methods will be displayed.



4. Select ***Area (var. box)***.

   The initial Area Var. Box Screen will be displayed.



5. Select ***Binary***.

   The Binary Levels Settings Screen will be displayed.

   The rest of the procedure is the same as outlined under *2-12-2 Setting the Binary Level.*

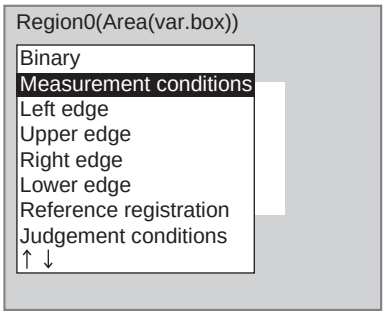
SeeAlso Refer to page 2-12-(4).

STEP 2: Setting Measurement Conditions

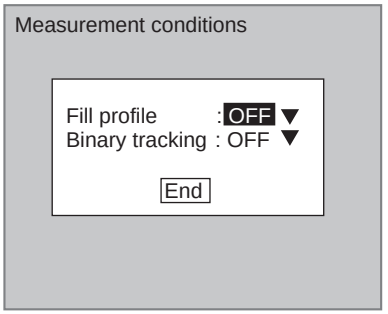
Set measurement conditions to measure the exterior of a measurement object or to make the binary levels track the brightness of the measurement image. The default for all settings is OFF.

SeeAlso Refer to page 2-12-(10) for information on the fill profile and binary tracking functions.

1. Select ***Measurement conditions***.



The Measurement Conditions Settings Screen will be displayed.

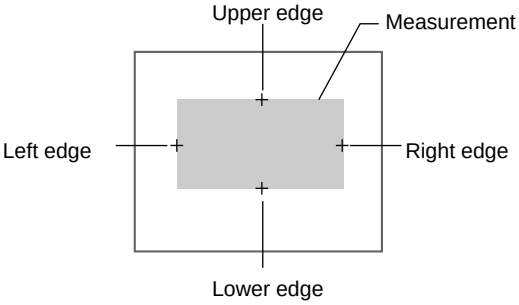


2. Select ***ON*** or ***OFF***.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

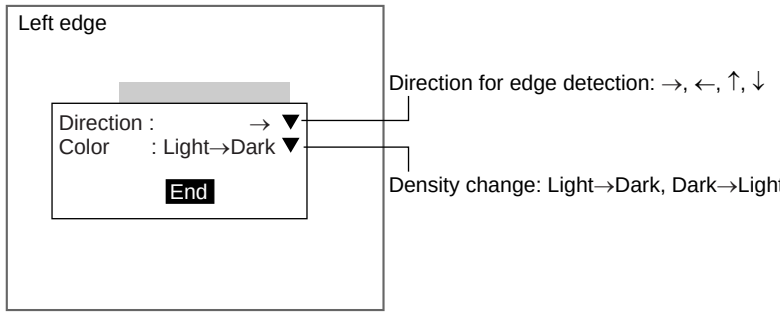
STEP 3: Drawing the Measurement Region

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.



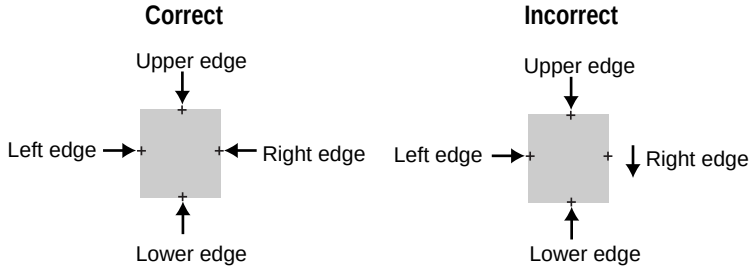
When one of the edges is selected, the settings for the conditions for the selected edge will be displayed. In this example, the settings for the left edge will be explained. Make adjustments as necessary when setting conditions for the upper, lower, and right edges.

1. Set the edge detection conditions.
   Set the direction for the edge search and the density changes.

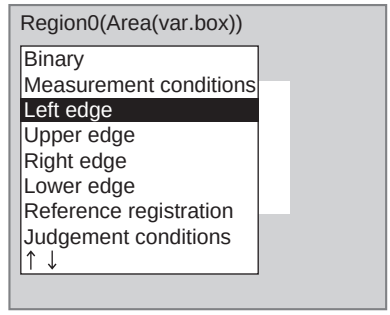


CHECK Combining Edge Detection Directions

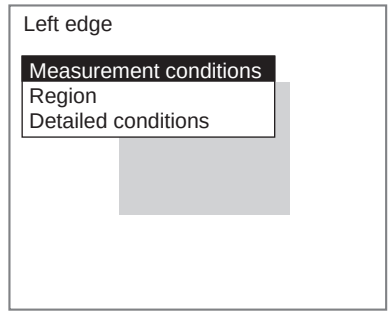
Set a combination of upper, lower, right, and left edge detection directions that surround the area to be measured.



a) Select ***Left edge***.

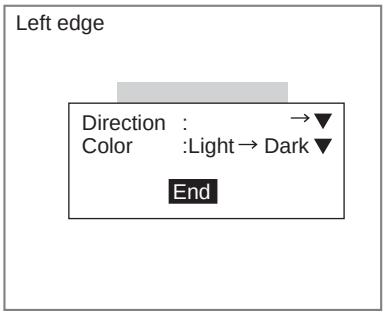


The initial screen for the left edge will be displayed.



b) Select ***Measurement conditions***.

The Measurement Conditions Settings Screen will be displayed.

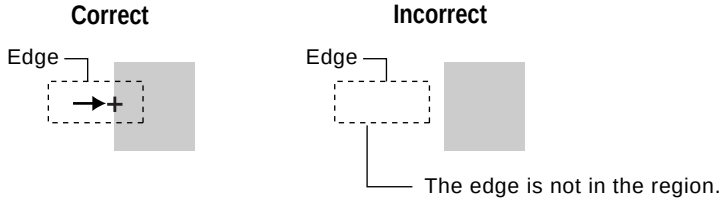


c) Select the detection conditions for the left edge.

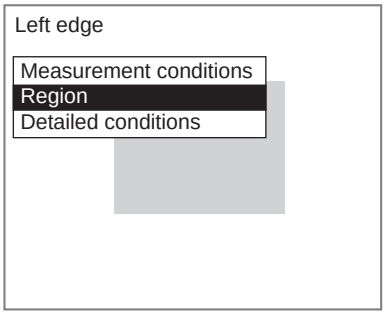
d) Select ***End***.

The settings will be registered and the screen in (1.) will return.

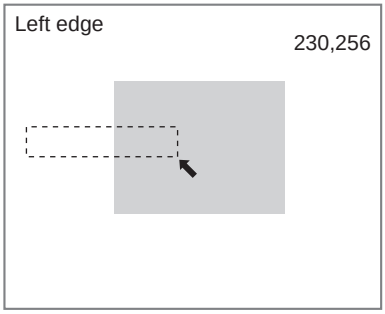
2. Drawing the Edge Detection Region
Draw a region that includes the edge.



a) Select ***Region***.



The Region Settings Screen will be displayed.



b) Draw a box-shaped region.

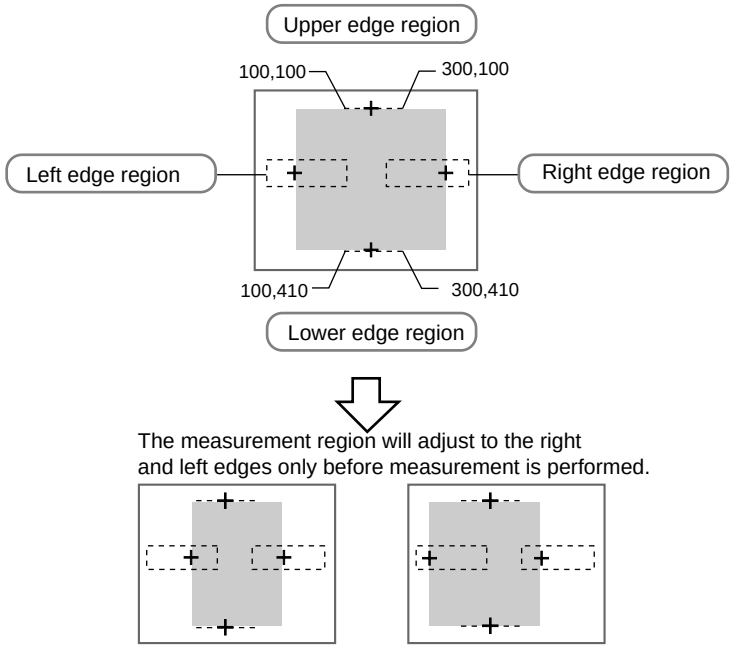
CHECK The only figure that can be drawn is a box.

When the bottom right coordinates are specified, the region will be set and the screen in (a) will return.

CHECK Use the following procedure to fix the region.

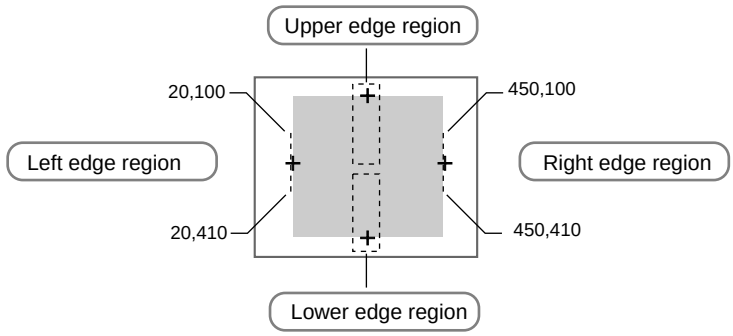
Measurement Objects with Variable Widths Only

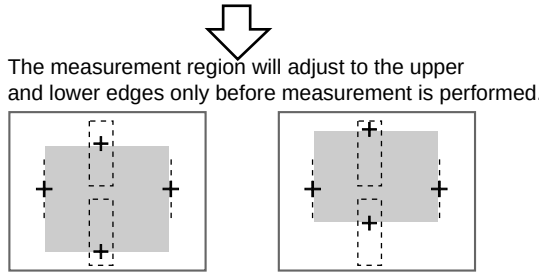
Draw the edge detection region so that the measurement region Y coordinates will remain the same for both the upper and lower edges. The upper and lower edges will always have these edge points.



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. The left and right edges will always have these edge points.

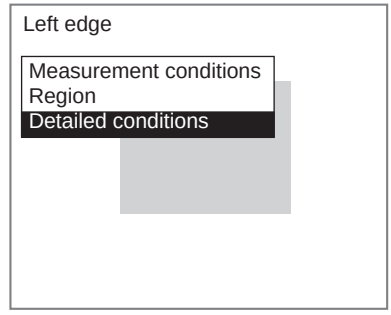




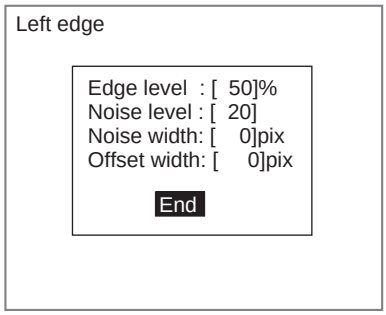
3. Changing Detailed Conditions as Required

   Change the detailed conditions when the measurement results are unstable. Change and set the edge level, noise level, noise width, and offset width as required. (Normally, these four 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.

   a) Select ***Detailed conditions***.



The Detailed Conditions Settings Screen will be displayed.



b) Move the cursor to the condition to be changed and change the setting.

c) Select ***End***.

The settings will be registered and the screen in (a) will return.

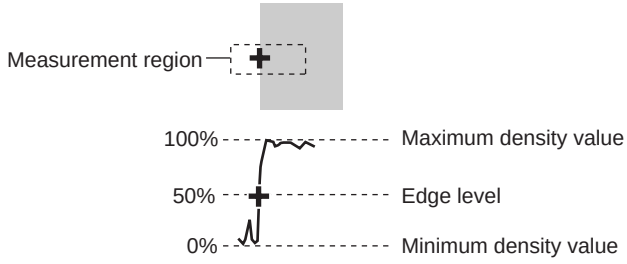
Press the **ESC** Key to return to the initial screen for Area (var. box).

Edge Level

Set a density change level between 0 and 100 that will indicate the edge. Normally, the default setting of 50% will be fine.

The edge is normally detected as follows:

1. The density distribution of the whole measurement region is calculated.
2. The density difference between the lowest and highest density value becomes 100%.
3. The point where the edge level density change is detected becomes the edge.



Noise Level

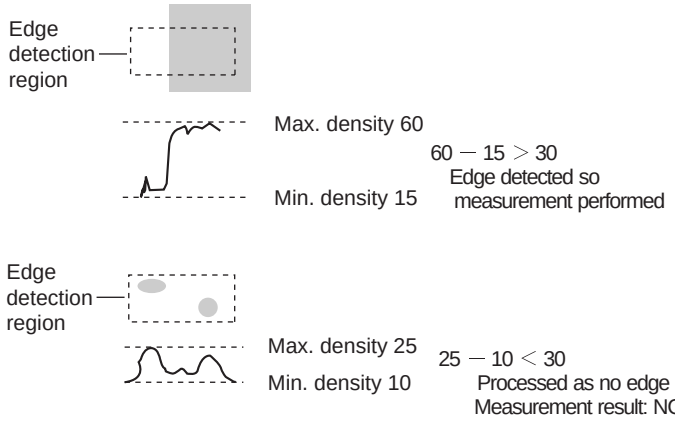
Set a noise level between 0 and 255 to assist the determination of edges. The maximum density and minimum density within the edge detection area is calculated and if the difference between the two values is less than the noise level, then the Controller determines that there is no edge. Normally the default setting of 20 is sufficient. Adjust this to a higher value, however, if noise is causing false edges to be detected.

(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

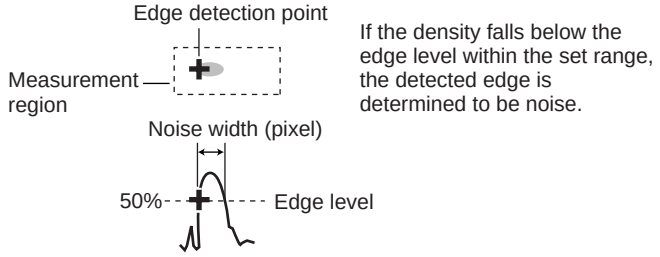


Noise Width

Set the noise width between 0 and 255 to evaluate 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. Normally the default noise width setting of 0 is sufficient. If noise is causing incorrect detection, make this value higher.

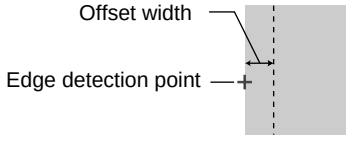
Example



Offset Width

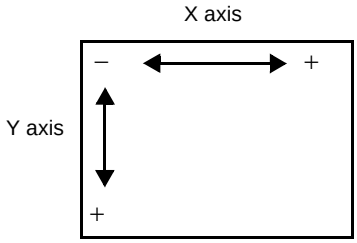
Set the adjustment width (in pixel units) for the detected edge position. Set a value between -511 and 511.

The default setting is 0, which means measurement will start from position where the edge is detected.



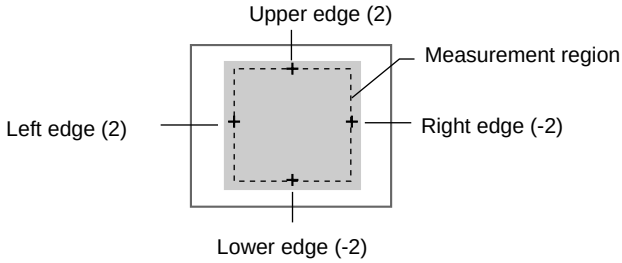
Left and right edges: Set the offset width on the X axis.

Upper and lower edges: Set the offset width on the Y axis.



Example: To Measure from 2 Pixel-widths Inside the Edge Detection Point

The value inside the brackets is the offset width.



CHECK The display cursor, which indicates the edge detection point, will also appear at the set offset width position.

STEP 4: Registering Reference Values

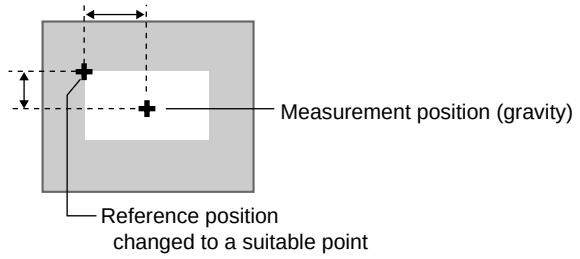
When detecting differences from an acceptable product, reference values must be registered. Place the acceptable product in the correct position and register the reference values.

The area and center of gravity are registered for the reference values.

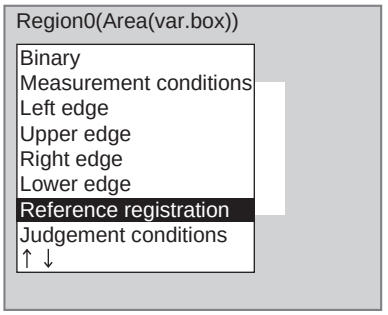
CHECK The reference values can be changed to enable the following function.

Inspecting Positions from a Specified Point

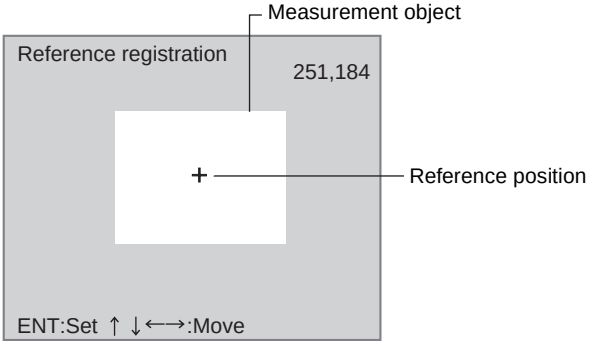
Once the reference values (area and center of gravity) have been obtained for the image currently displayed, the reference position is changed to an suitable point. Position inspection can be performed by calculating the difference between this reference position and the measurement position.



1. Select ***Reference registration***.



A cursor will appear at the position of the center of gravity.

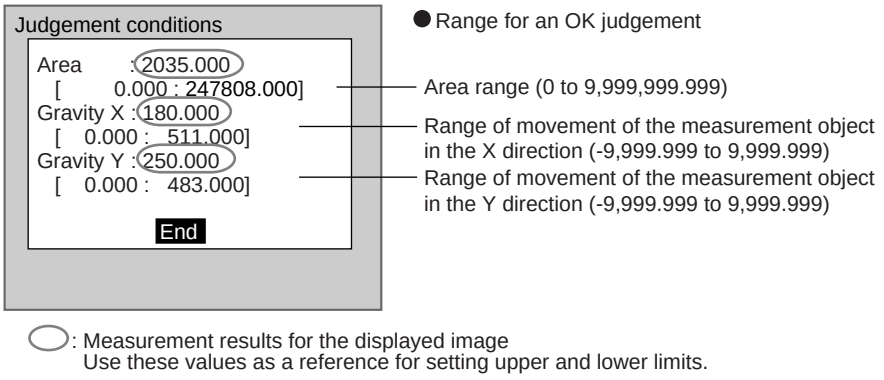


2. To change the position, use the **Up**/**Down** and **Right**/**Left** Keys to move the cursor.
3. Press the **ENT** Key.

   The setting will be registered and the screen in (1.) will return.

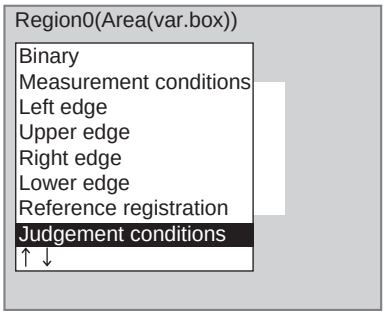
STEP 5: Setting the Judgement Conditions

Make settings for the area and center of gravity.

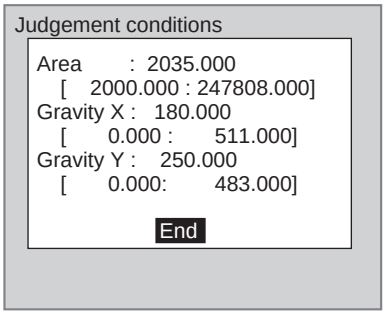


○: Measurement results for the displayed image
Use these values as a reference for setting upper and lower limits.

1. Select ***Judgement conditions***.



The Judgement Conditions Settings Screen will be displayed.



2. Change the settings.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

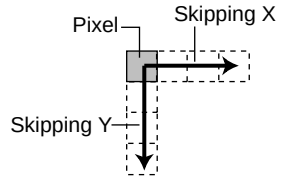
STEP 6: Changing Pixel Skipping

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.

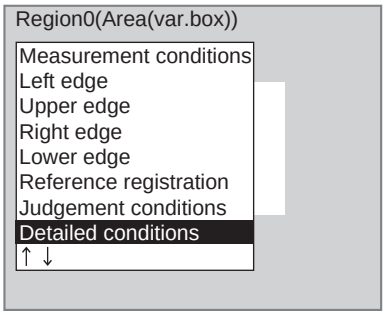
Once the skipping setting has been changed, perform a measurement and confirm that measurement can be performed correctly.

Skipping X and Skipping Y

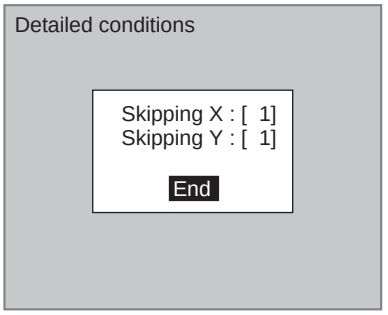
Set how many pixels to skip in the measurement region during measurement. The default setting is 1, which means that all of the measurement region will be measured.



1. Select ***Detailed conditions***.



The Detailed Conditions Settings Screen will be displayed.

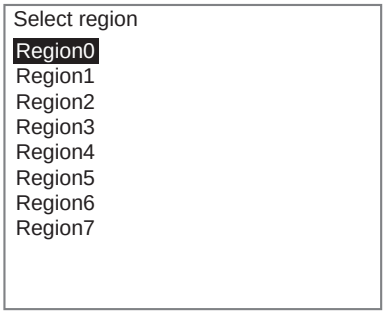


2. Set the number of pixels to skip.
3. Select ***End***.
   The setting will be registered and the screen in (1.) will return.

2-12-3-4 Clearing Set Regions

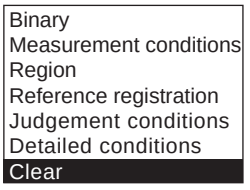
The clear operation is performed separately for each region.

1. Select the number of the region to be cleared.



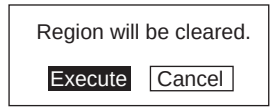
A list of selections will be displayed.

Example: For gravity and area measurement regions



2. Select ***Clear***.

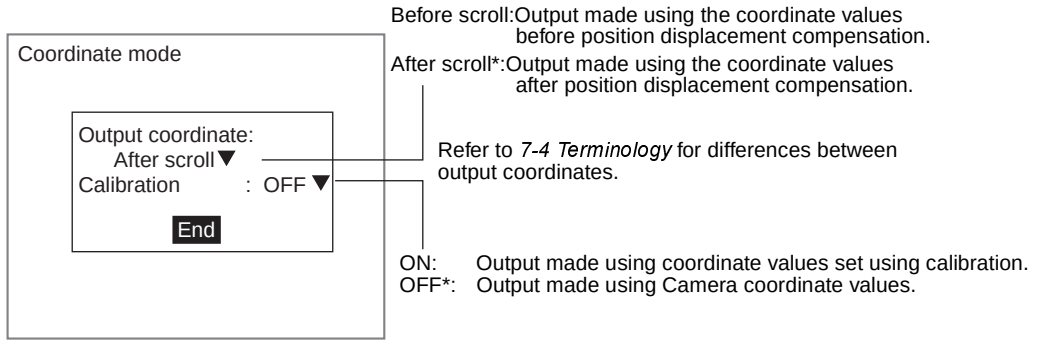
A confirmation message will be displayed.



3. Select ***Execute***.
   The region will be cleared and the screen in (1.) will return.

2-12-4 Setting the Coordinate Mode

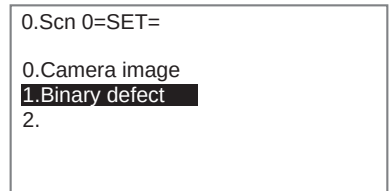
Select the type of coordinate values.



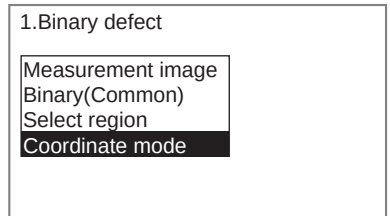
The asterisk (*) indicates the default setting.

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.

1. Select ***Binary defect***.

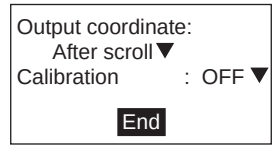


The setting selections will be displayed.



2. Select ***Coordinate mode***.

   The Coordinate Mode Settings Screen will be displayed.



3. Make the settings for each item.
4. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

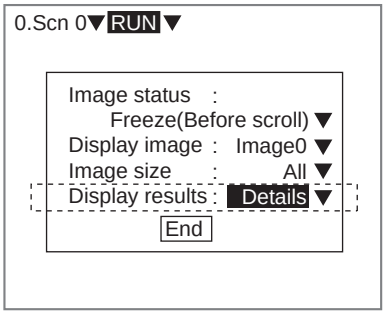
2-12-5 Measurement Screens

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

This section describes what kind of information can be displayed for binary defect detection.

SeeAlso Refer to *SECTION 3 Monitor Mode and Run Mode* for details on Monitor and Run modes.

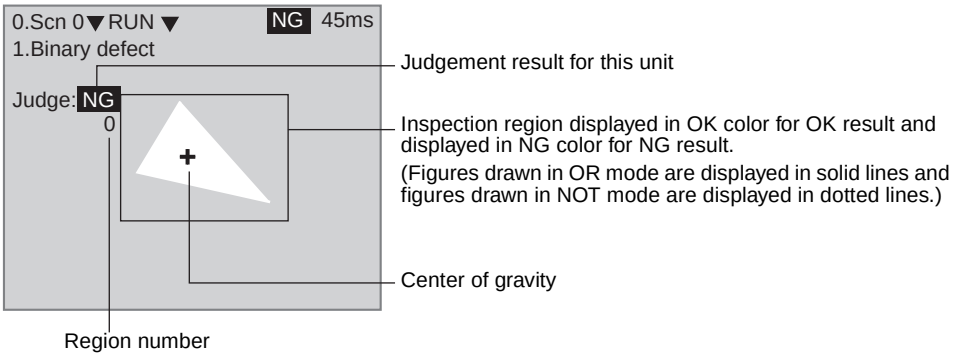
CHECK Press the **SHIFT+ESC** Keys on the Run Screen to access the following screen and change ***Display results*** to ***Details.***



Use the **Up** or **Down** Key to change to the unit for which binary defect detection is set and the following detailed screens will be displayed.

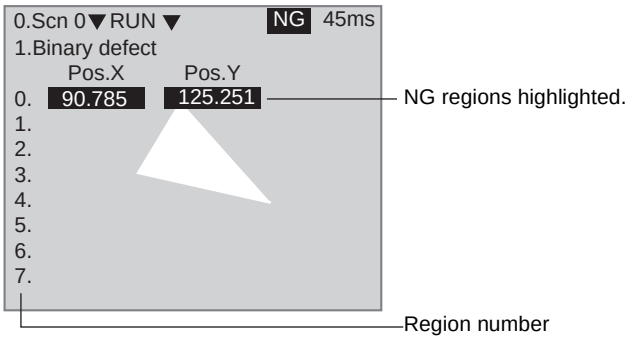
Use the **SHIFT+Right** or **Left** Keys to switch in order between the four screens.

Judgement Result



List of Positions

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

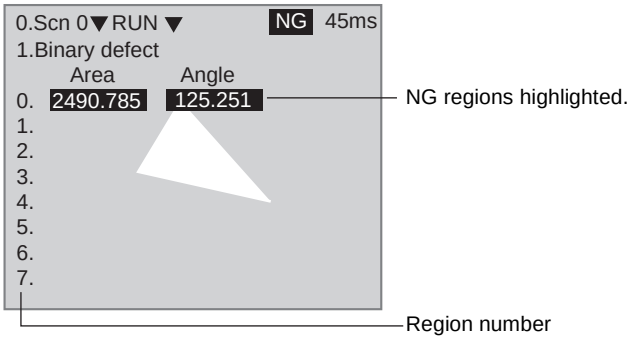


CHECK If the font size is set to small, the list of positions and area and axis screens will be listed.

If the font size is set to normal, these two screens will be displayed consecutively.

Area and Axis

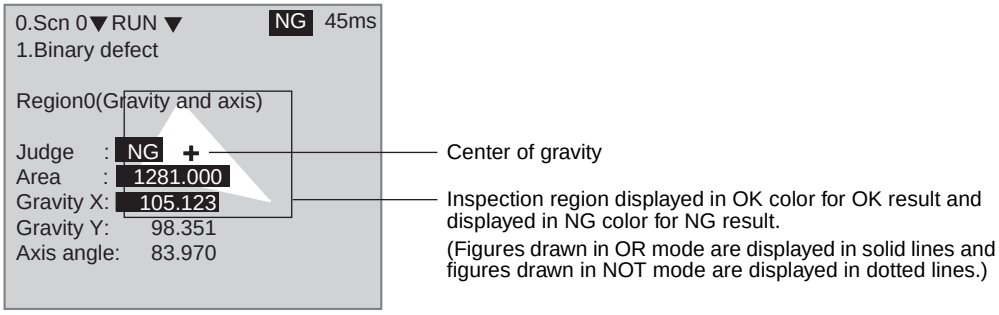
A list of the area and axis for each region is displayed.



Individual Region Display

More detailed measurement results are displayed for each region.

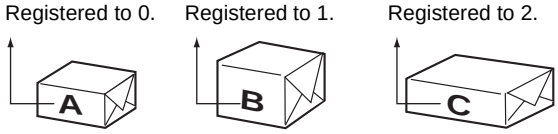
Press the **SHIFT+ Right** or **Left** Keys to display the set regions in order.



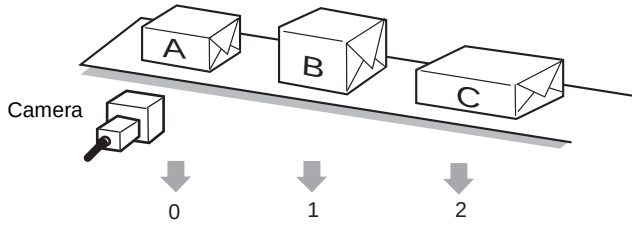
2-13 Classification

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.

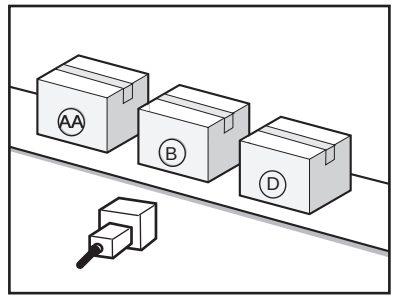


The number of the model that is most similar to the input image is output. If this data is retrieved by an external device, the products can be classified at the next stage of the process. If there is no model that matches the image, the output will be NG (-1).

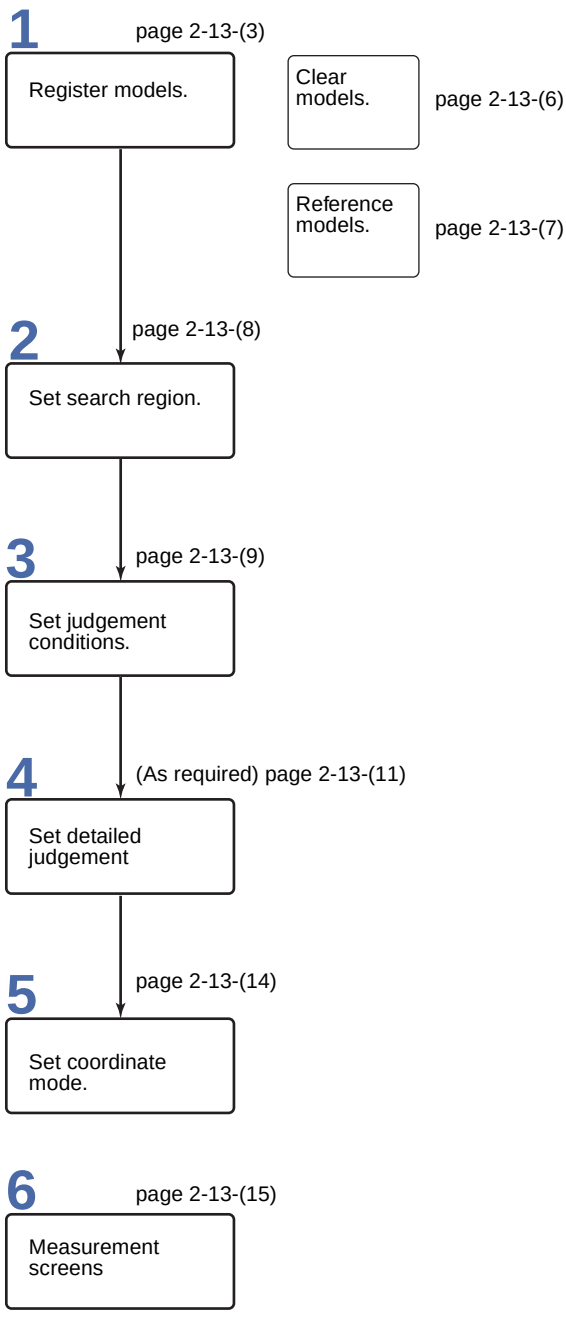


The number of the most similar model is output.

Example: Distinguishing between Grades of Mandarin Boxes



Operational Flow



CHECK The Classification processing item uses the image stored at Image 0 as the measurement image; there is no menu for selecting the measurement image.

2-13-1 Registering Models

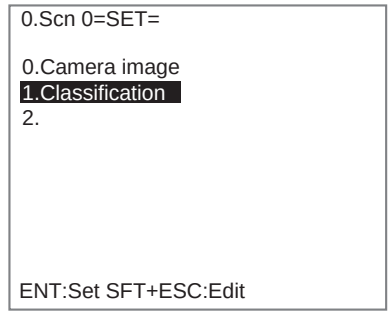
A section that will serve as the classification reference is registered as the model. Up to 36 versions of a model can be registered with index numbers 0 to 35.

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 of the model is registered as the search coordinates.

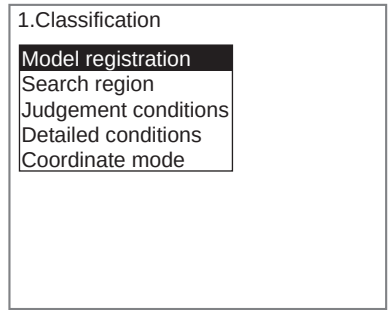
CHECK Models can be created by combining up to 3 different figures. Regions with difficult shapes can be drawn and sections not to be measured can be left out of the model region by combining different figures.

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*. Refer to page 2-13-(12) for information on auxiliary models.

1. Select ***Classification***.



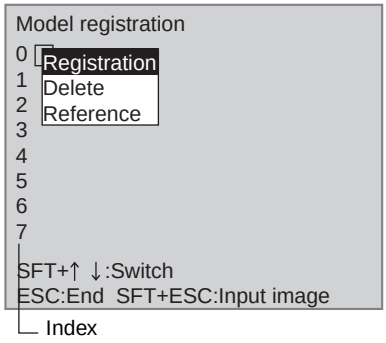
The settings selections will be displayed.



2. Select ***Model registration***.

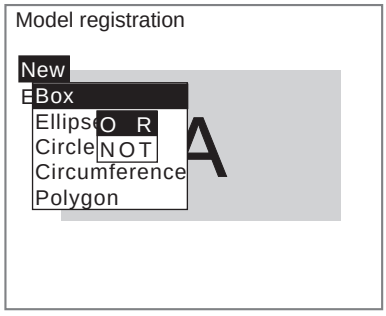
   The Model Registration Screen for index numbers 0 to 7 will be displayed.

   Use the **SHIFT**+**Up**/**Down** Keys to switch the index number.



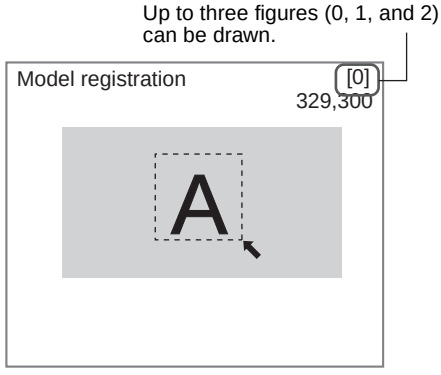
3. Move the cursor to the index number for the model to be registered and press the **ENT** Key. In this example, index 0 will be used.
4. Select ***Registration***.

   The selections will be displayed.

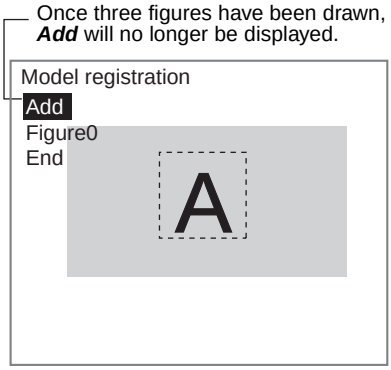


5. Select ***New***.
6. Select the desired figure.
7. Select the desired drawing mode (***OR***/***NOT***).

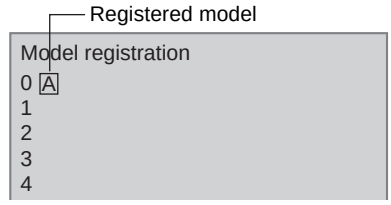
   An arrow cursor will appear.



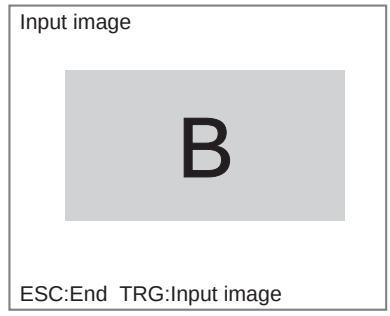
8. Draw the region to be registered as the model with the selected figure.
   The figure will be registered.



9. If additional figures are to be drawn, select ***Add***.
10. Repeat steps 6 to 8 as necessary to create the desired shape.
11. After drawing is completed, select ***End.***
    The model will be registered.
    The registered model is displayed as a thumbnail.

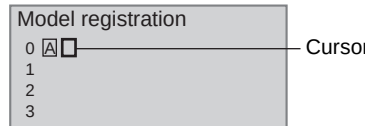


12. To register the next model, change the measurement object and press the **SHIFT**+**ESC** Keys.
    The Input Image Screen will be displayed.



13. Press the **TRIG** Key to refresh the image.
14. Press the **ESC** Key.
    The screen in (11.) will return.
15. Repeat steps 3 to 11 to register further models.

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

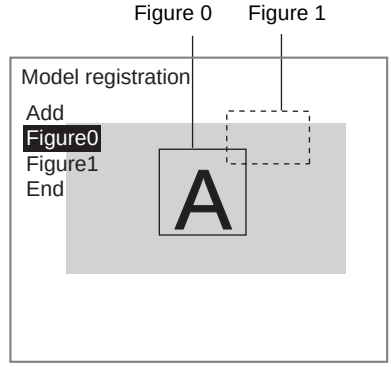


16. When all models have been registered, press the **ESC** Key.

    The settings will be registered and the screen in (1.) will return.

Correcting or Clearing Figures

1. In the screen for step 8 above, select the figure to be changed or cleared using the **Up** and **Down** Keys and press the **ENT** Key.



The figure for the figure number selected using the cursor will be displayed with solid lines. The selections ***Correct*** and ***Clear*** will be displayed.

2. Select either ***Correct*** or ***Clear*** and press the **ENT** Key.

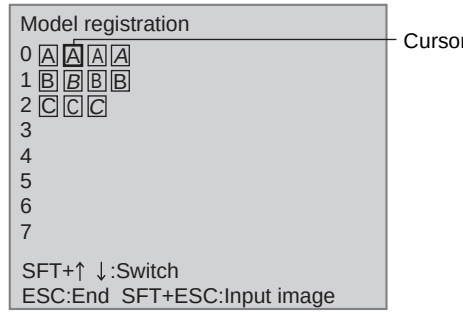
   If ***Correct*** is selected, the cursor will be displayed. Correct the size and position of the figure as desired.

   If ***Clear*** is selected, the selected figure will be cleared.

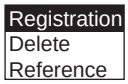
2-13-1-1 Deleting Models

Use this operation to delete registered models.

1. Select the model to be deleted from among the thumbnails and press the **ENT** Key.

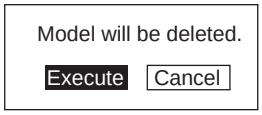


A list of operations will be displayed.



2. Select ***Delete*** and press the **ENT** Key.

   A confirmation message will be displayed.



3. Select ***Execute***.

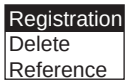
   The model will be deleted and the screen in (1.) will return.

2-13-1-2 Referencing Models

Use this operation to confirm registered models.

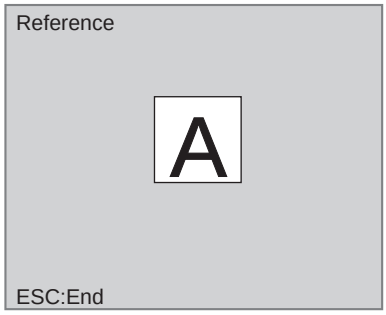
1. Select the model to be checked from among the thumbnails and press the **ENT** Key.

   A list of operations will be displayed.



2. Select ***Reference***.

   The model will be displayed at the position where registered.



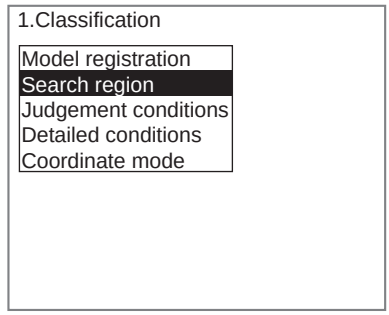
3. Press the **ESC** Key to exit this screen.

   The screen in (1.) will return.

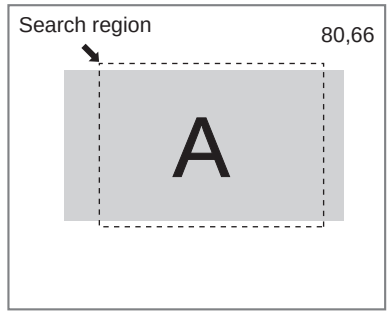
2-13-2 Setting Search Regions

Set the region for searching for the model. The whole area of the input image can be searched; however, accuracy can be increased by limiting the search region.

1. Select ***Search region***.



An arrow cursor will appear.

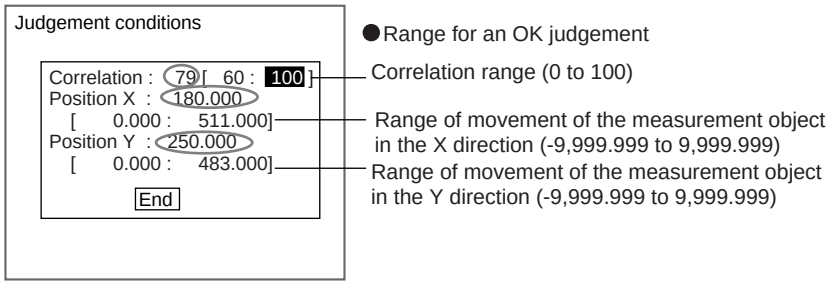


2. Draw a box-shaped search region.

When the bottom right coordinates are specified, the region will be set, and the screen in (1.) will return.

2-13-3 Setting Judgement Conditions

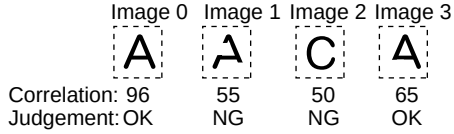
Set the judgement conditions for the correlation between the measurement object and the models and the position (X, Y) where the object was detected.



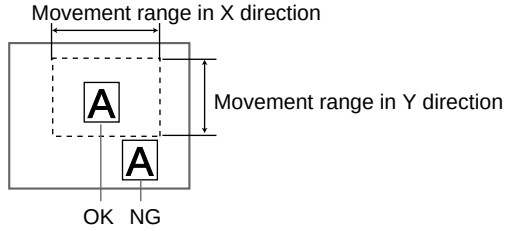
○: Measurement results for the displayed image
Use these values as a reference for setting upper and lower limits.

CHECK Correlation

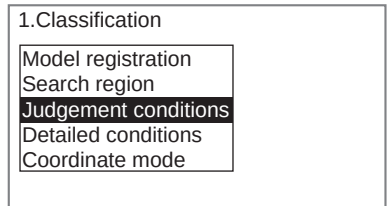
When OK condition for correlation is set between 60 and 100:



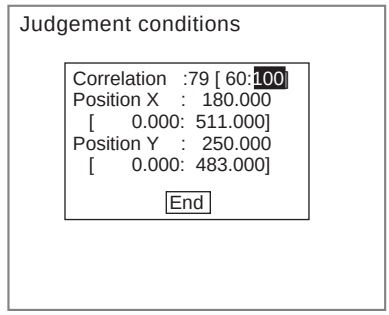
CHECK Position X and Position Y



1. Select ***Judgement conditions***.



The Judgement Conditions Settings Screen will be displayed.



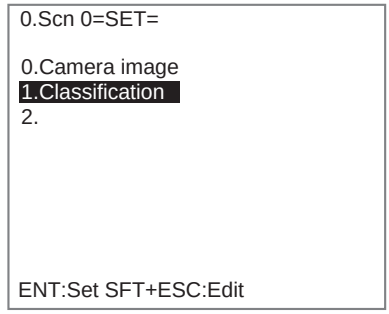
2. Make the settings.
3. Select ***End***.
   The settings will be registered and the screen in (1.) will return.

2-13-4 Changing Detailed Conditions

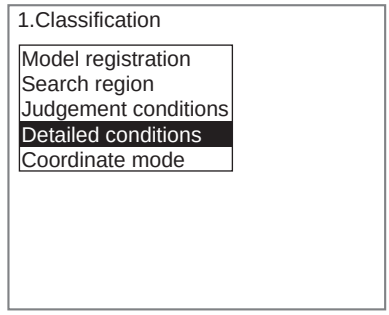
Use this operation to change the search-related settings. Change the conditions if the measurement results are unstable. Normally, however, the default settings are sufficient.

After the settings have been changed, check that actual measurement is performed correctly.

1. Select ***Classification***.

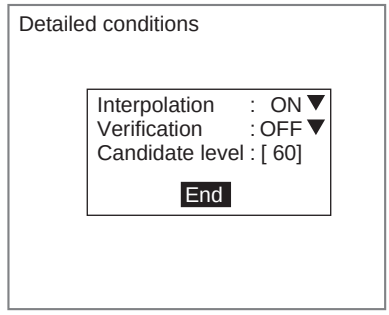


A list of settings selections will be displayed.



2. Select ***Detailed conditions***.

The Detailed Conditions Settings Screen will be displayed.



3. Change the settings.
4. Select ***End***.

The settings will be registered and the screen in (1.) will return.

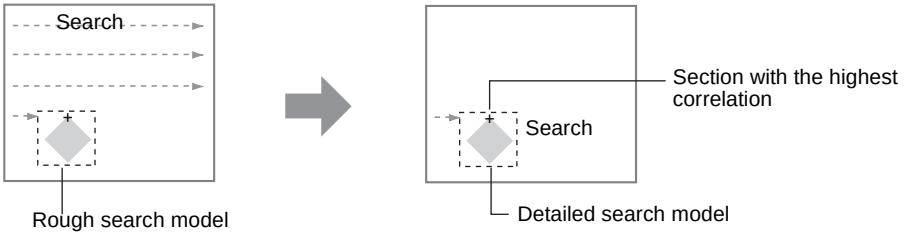
CHECK The Controller performs the following 2-stage processing internally.

Rough Search

Searches all of the measurement region using a rough search model.

Detailed Search

Measures again using the detailed search model to compare to the images surrounding the section with the highest correlation.



Interpolation Mode

When 2 or more models are registered to in the same index, set whether or not to search using an auxiliary model.

Selection	Meaning
ON*	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.

The asterisk (*) indicates the default setting.

HELP 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

Note Indicates the number of models when interpolation mode is set to ON.

Search Verification and Candidate Levels

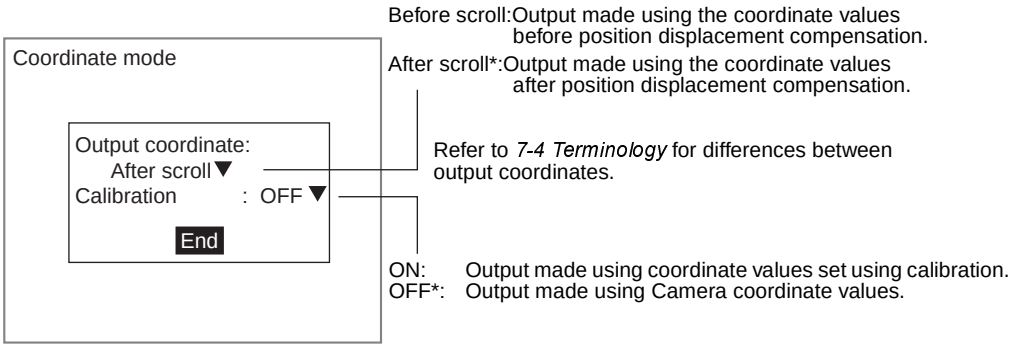
Select whether or not to perform detailed searches on models at the candidate level or higher. If model searches are unstable, set search verification to ON and adjust the candidate level.

Setting item	Selection/ Setting range	Details
Search verification	OFF*	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 (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 search verification is set to ON.

The asterisk (*) indicates the default setting.

2-13-5 Setting the Coordinate Mode

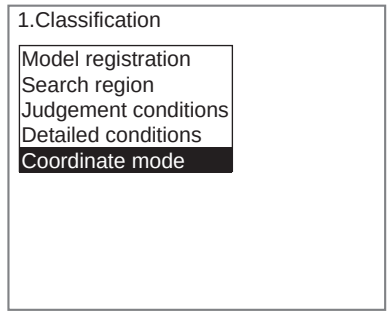
Select the type of coordinate values.



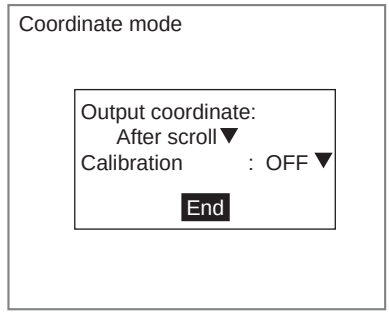
The asterisk (*) indicates the default setting.

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.

1. Select ***Coordinate mode***.



The Coordinate Mode Settings Screen will be displayed.



2. Make the settings for each item.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

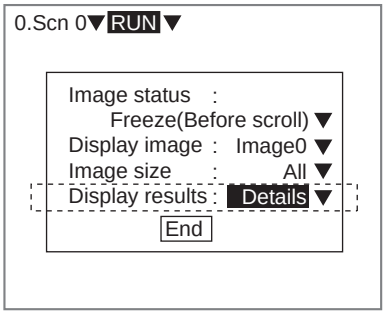
2-13-6 Measurement Screens

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

This section describes what kind of information can be displayed for classification.

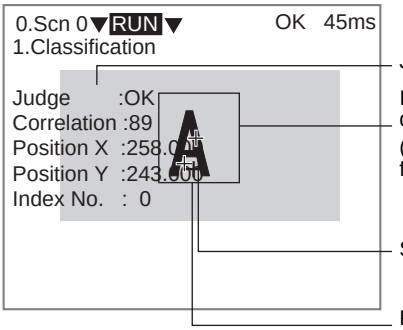
SeeAlso Refer to *SECTION 3 Monitor Mode and Run Mode* for details on Monitor and Run modes.

CHECK 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 classification is set and the following detailed screen will be displayed.

Judgement Result



Judgement result for this unit

Inspection region displayed in OK color for OK result and displayed in NG color for NG result.
(Figures drawn in OR mode are displayed in solid lines and figures drawn in NOT mode are displayed in dotted lines.)

Search coordinates

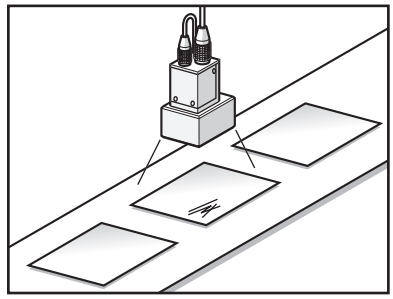
Position at candidate level or above
(Enabled only when search verification set to ON.)

2-14 Density Defects

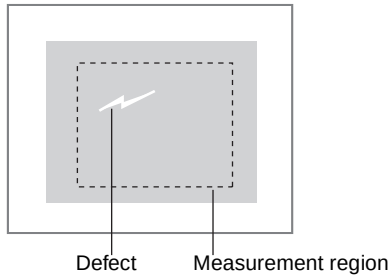
The Density Defect processing item is used to inspect measurement objects using differences in density (brightness) in the measurement region.

This processing item is suitable for external inspections for defects or dirt on unbuttoned measurement objects and defects or burrs on parts.

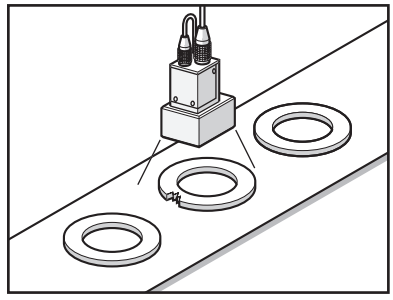
Example 1: Checking for Stains on Sheets



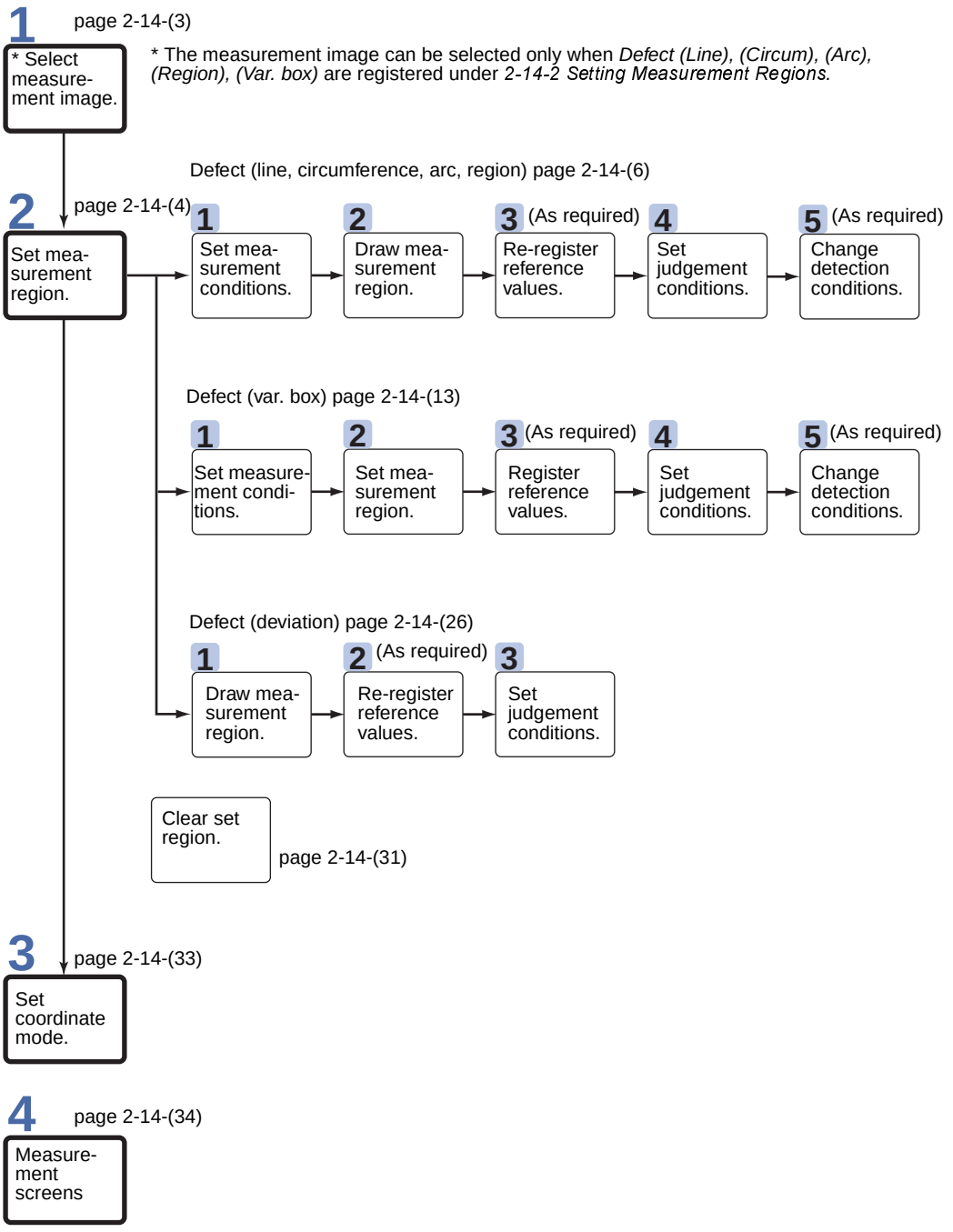
Defect found using density changes within measurement region.



Example 2: Inspecting for Defects or Burrs in O Rings



Operational Flow

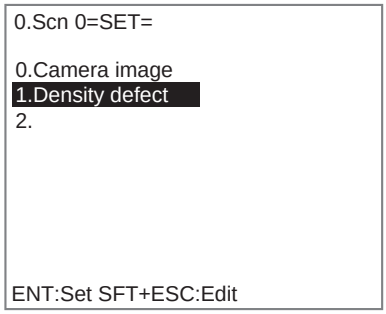


2-14-1 Selecting Measurement Images

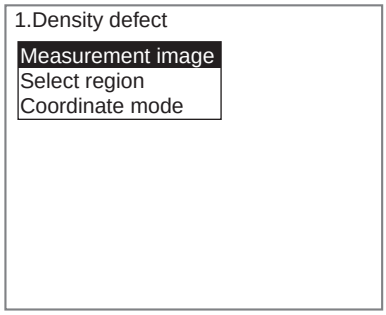
When Defect (Line), (Circum), (Arc), (Region), (Var. box) is set for the inspection region, select which image will be used for measurement, the image stored at Image 0 or the image stored at Image 1.

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.

1. Select ***Density defect***.



The initial Density Defect Screen will be displayed.



2. Select ***Measurement image***.

   The selections will be displayed.

3. Select ***Image 0*** or ***Image 1*** to use either of the images stored at these locations for measurement.
4. Press the **ENT** Key.

   The settings will be registered and the screen in (1.) will return.

2-14-2 Setting Measurement Regions

Up to 8 regions can be set.

There are 6 measurement methods for density defect inspections and different methods can be set for each region. Select the best method for the inspection.

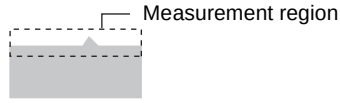
Defect (Line, Circumference, Arc, Region)

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.

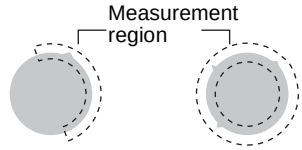
Line

Select line searches when inspecting for chips or burrs on a measurement object.



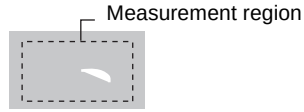
Circumference and Arc

Use circumference or arc searches when inspecting for chips or burrs on a circular measurement object.



Region

Select region when inspecting the whole measurement object for defects or blemishes. 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.

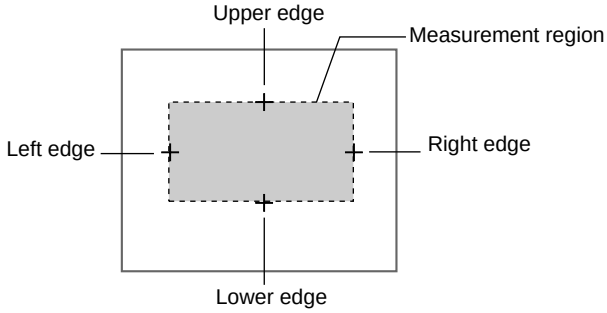
The inspection is performed using changes in density and any pattern or mark in the measurement region will be detected as a surface defect. Use the Fine Matching inspection item to inspect regions with patterns or marks.

CHECK Use the Defect (Var. Box) processing item for measurement objects with varying measurement region sizes or positions.

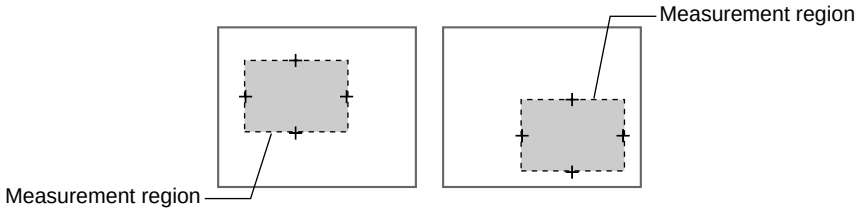
Defect (Variable Box)

Use the Defect (Var. Box) processing item to adjust the measurement region (a box) for measurement objects with varying sizes or positions to inspect for defects.

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.



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.



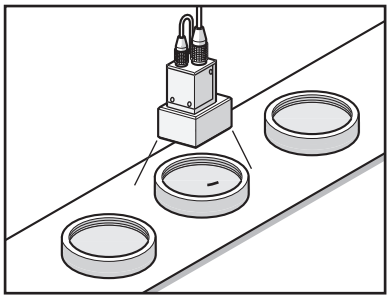
Defect (Deviation)

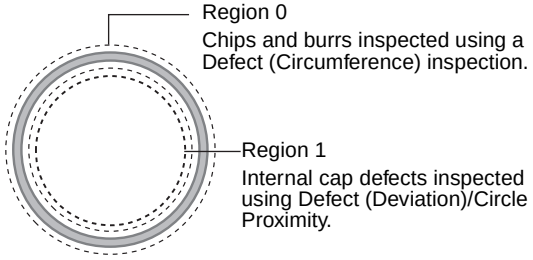
Use a Defect (Deviation) measurement to quickly measure multiple regions.

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

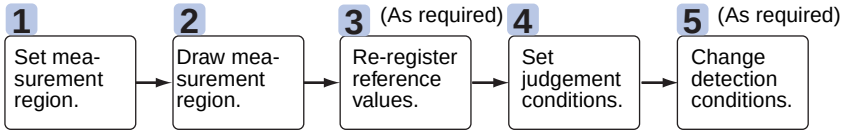
Chips and burrs on caps are measured using a Defect (Circumference) inspection and defects are measured using Defect (Deviation)/Circle Proximity.





2-14-2-1 Defect (Line, Circumference, Arc, and Region)

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).



STEP 1: Setting Measurement Conditions

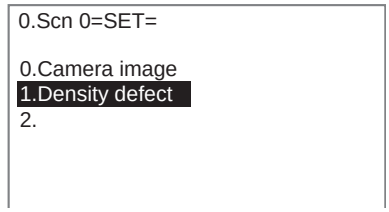
The Controller detects defect positions using density variations in the measurement region.

Set the conditions for calculating density variations in measurement regions.

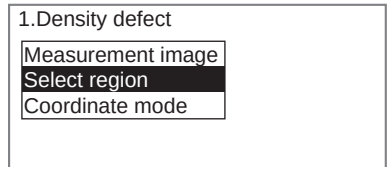
Setting item	Selections	Details
Large defect inspections	ON* OFF	Set to ON when inspecting for large defects (defects, blemishes, chips, burrs).
Small defect inspections	ON* OFF	Set to ON when inspecting for small defects (defects, blemishes, chips, burrs). Inspection of small defects will be more stable than if the large defect inspection setting is used.
Small defect color	White Black Both*	Select the color of the defect to be inspected. This setting is enabled only when small defect inspection is set to ON.
Density	ON* OFF	Set to ON to measure for the existence of a measurement object.

The asterisk (*) indicates the default setting.

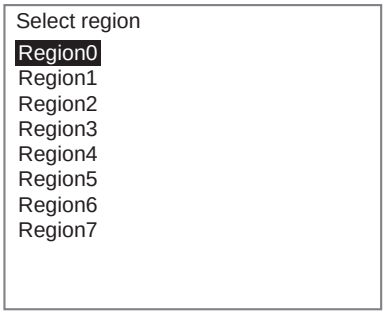
1. Select ***Density defect***.



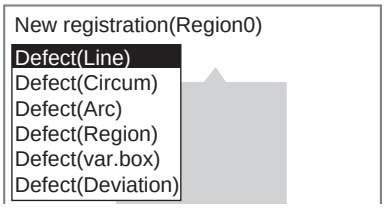
The setting selections will be displayed.



2. Select ***Select region***.
   A list of region numbers will be displayed.



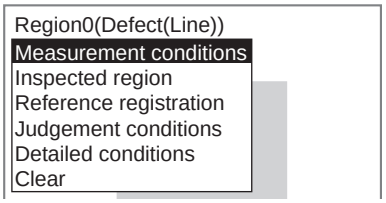
3. Select the region number.
   A list of measurement methods will be displayed.



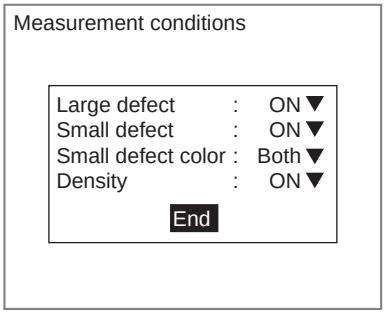
4. Select the measurement method.
   In this example, ***Defect (line***) will be selected.

SeeAlso Refer to page 2-14-(4) for a guide on selecting figures.

The initial Defect (Line) Screen will be displayed.



5. Select ***Measurement conditions***.
   The Measurement Conditions Settings Screen will be displayed.



6. Make the settings.
7. Select ***End***.
   The settings will be registered and the screen in (4.) will return.

STEP 2: Drawing Measurement Regions

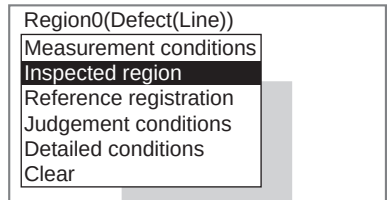
Draw a figure in the section to be inspected.

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.

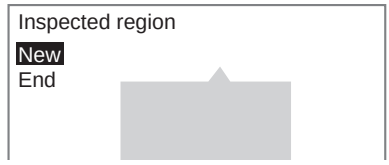
CHECK Position detection can be performed using algorithms for detecting defects.

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.

1. Select ***Inspected region***.

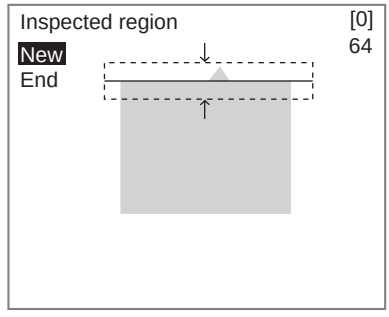


The Inspected Region Settings Screen will be displayed.



2. Select ***New***.

A display cursor will appear.



3. 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.

4. Select ***End***.

The settings will be registered and the screen in (1.) will return.

The measurement region and the positions where defects were located will be displayed. The defects will be indicated by a display cursor.

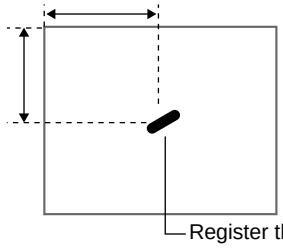
STEP 3: Re-registering Reference Values

Position detection can also be 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 both large and small defects were found). If this function is used, however, the reference value alone can be re-registered based on the currently displayed image.

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

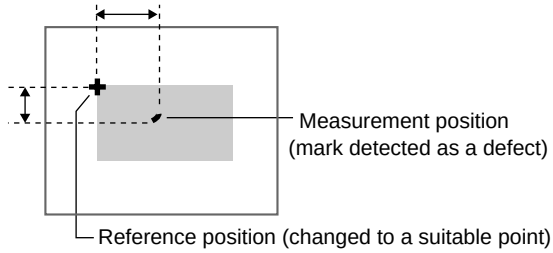
Display a measurement object in the correct position, detect a mark, and register that position as the reference position.



CHECK The reference value can be changed to enable the following function.

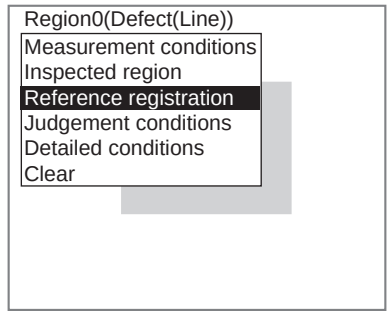
Inspecting Positions from a Specified Point

Once a mark has been detected in 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.

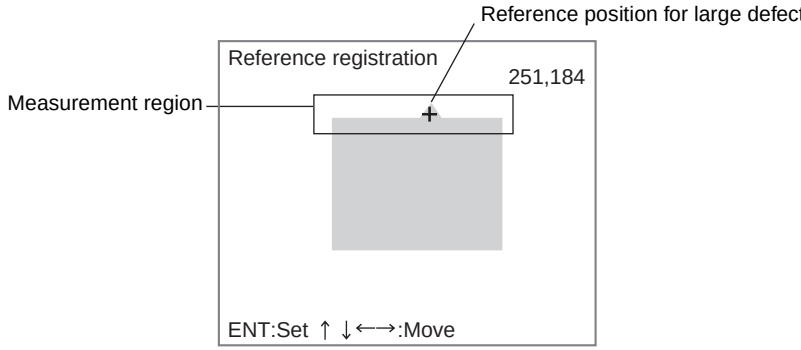


CHECK If the measurement region is changed, the reference values return to the default setting.

1. Select ***Reference registration***.

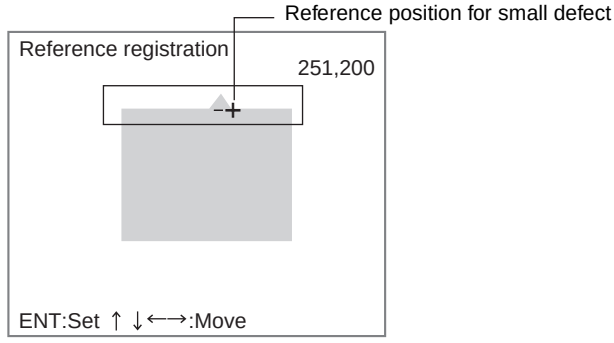


A display cursor will appear at the position where a large defect was found.



2. Use the **Up/Down/Left/Right** Keys to move the cursor to change the reference position.
3. Press the **ENT** Key.

   A display cursor will appear at the position where a small defect was found.

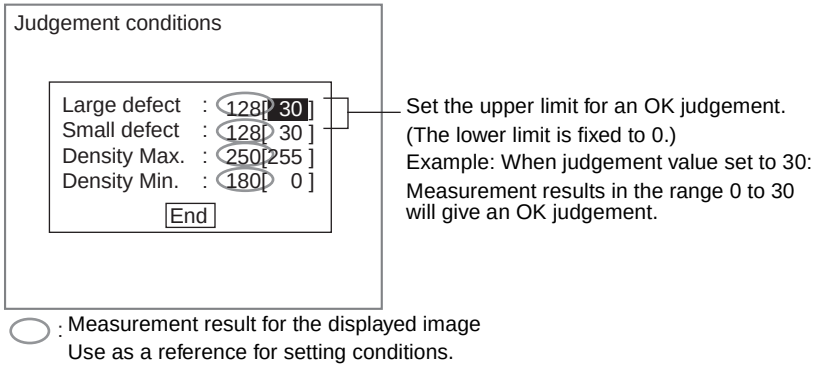


4. Use the **Up/Down/Left/Right** Keys to move the cursor to change the reference position and Press the **ENT** Key.

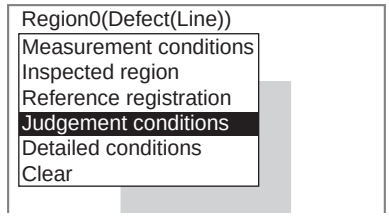
The settings will be registered and the screen in (1.) will return.

STEP 4: Setting Judgement Conditions

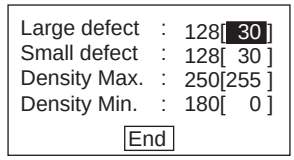
Set the conditions for determining defects. Set a value between 0 and 255 as the OK judgement value for the measurement conditions set in step 1. The defect value will be higher the clearer the defect. Measure several samples and set the judgement conditions while referring to the measurement results.



1. Select ***Judgement conditions***.



The Judgement Conditions Setting Screen will be displayed.



2. Make the settings.
3. Select ***End***.

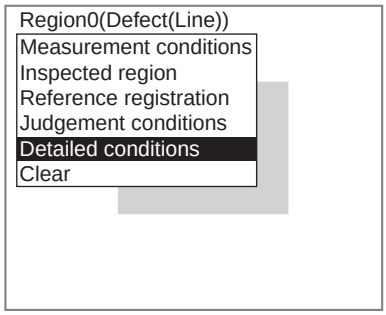
   The settings will be registered and the screen in (1.) will return.

STEP 5: Changing Detection Conditions

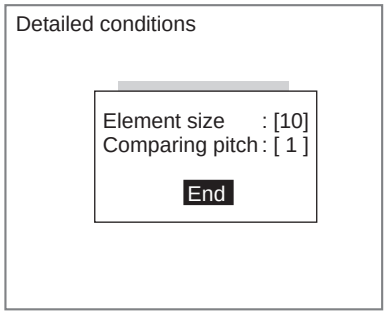
To shorten measurement processing time, change the conditions for detecting defects. The greater the element size and comparing pitch, the shorter the processing time. However, the accuracy of the measurement will decrease.

Once the element size or comparing pitch setting has been changed, perform measurements to check that they can be performed correctly.

1. Select ***Detailed conditions***.



The Detailed Conditions Settings Screen will be displayed.



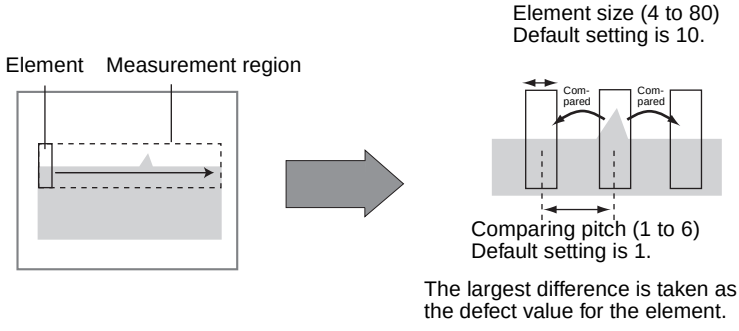
2. Set the element size and comparing pitch.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

CHECK Method for Judging 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)

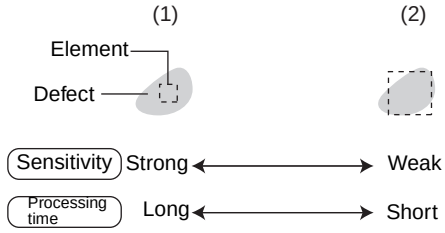


HELP Element Size

Determine the element size according to the size of the defect to be detected. Detection will be more sensitive (and the processing time longer) if the

element size is reduced and less sensitive (and the processing time shorter) if the element size is increased.

Example

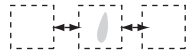


If density that is not part of the defect is included in the calculations as shown in (2), the differences with areas that are not part of the defect will be reduced. In other words, the more the background is included in the element, the weaker the sensitivity will be.

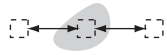
HELP Comparing Pitch

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.



CHECK Differences That Depend on the Shape of the Region

Shape of region	Element size	Comparing direction
Line, circumference, or arc defects	Element size Depends on measurement region size	Left, right
Region defects	Element size Element size	Up, down, left, right

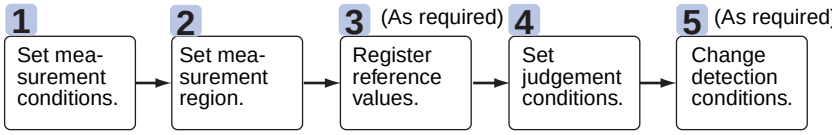
2-14-2-2 Defect (Variable Box)

The Defect (Variable Box) measurement method measures defects while adapting the measurement region to suit measurement objects with inconsistent sizes and positions.

First, the upper, lower, left, and right edges of the measurement object are located. The area within the edges becomes the measurement region.The location of the measurement object can be determined using the edge detec-

tion points so the measurement region can be adapted to suit if the size or position of the measurement object changes.

SeeAlso Refer to page 2-14-(4).

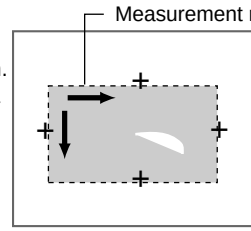
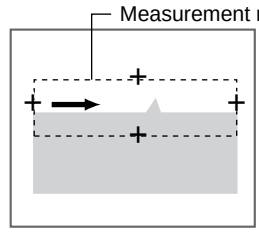
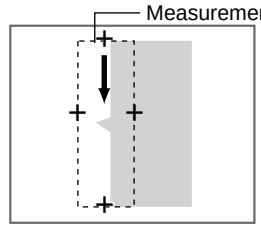


STEP 1: Setting Measurement Conditions

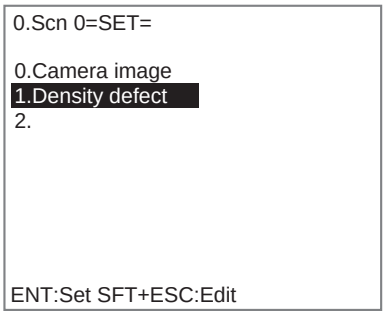
Set the conditions for calculating density changes in measurement regions.

The settings are the same as for Defect (Line, Circum, Arc, and Region), except for the measurement direction.

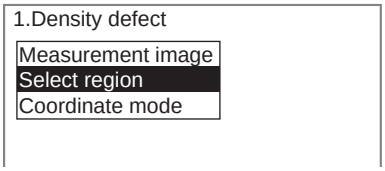
SeeAlso Refer to page 2-14-(6).

Measurement direction	Application
Box	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. Refer to page 2-14-(19). 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. Refer to page 2-14-(20). Calculates the variation in density in the Y direction. 

1. Select ***Density defect***.

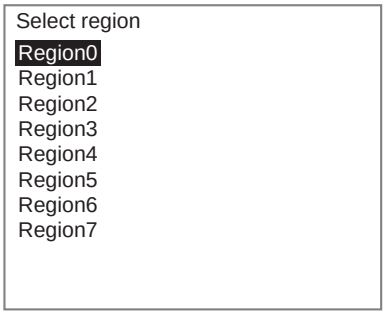


The settings selections will be displayed.



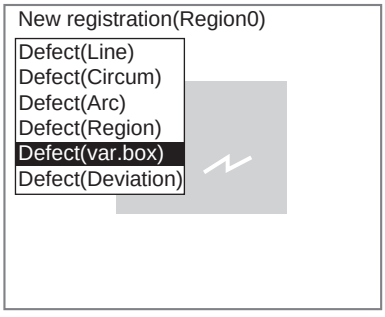
2. Select ***Select region***.

A list of regions will be displayed.



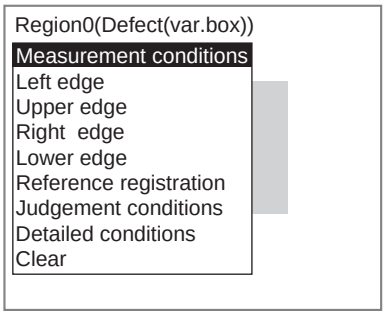
3. Select the region number.

A list of measurement methods will be displayed.



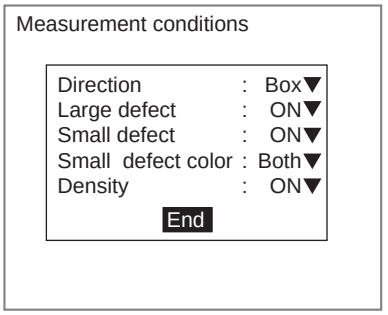
4. Select ***Defect (var. box)***.

The initial Defect (var. box) screen will be displayed.



5. Select ***Measurement conditions***.

   The Measurement Conditions Settings Screen will be displayed.

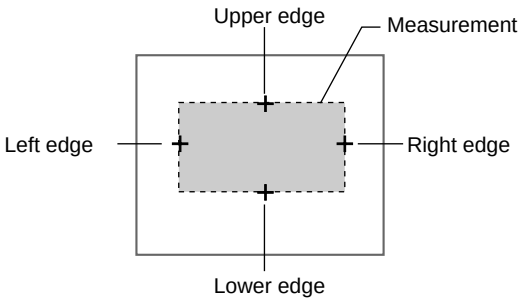


6. Make the settings.
7. Select ***End***.

   The settings will be registered and the screen in (4.) will return.

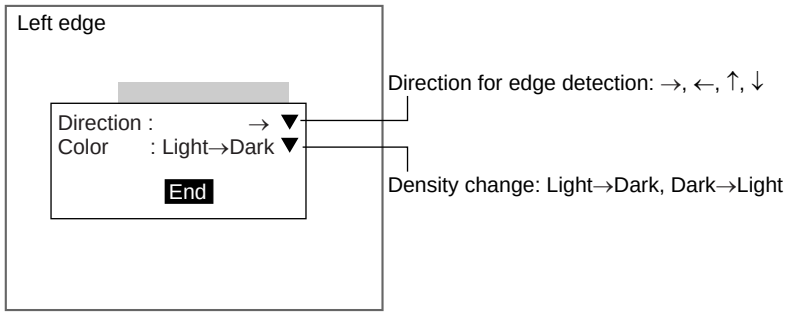
STEP 2: Drawing the Measurement Region

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.

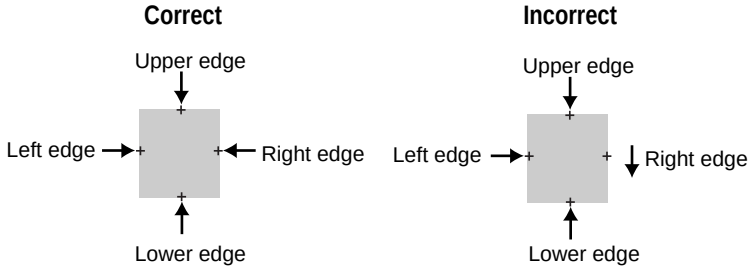


When one of the edges is selected, the settings for the conditions for the selected edge will be displayed. In this example, the settings for the left edge will be explained. Make adjustments as necessary when setting conditions for the upper, lower, and right edges.

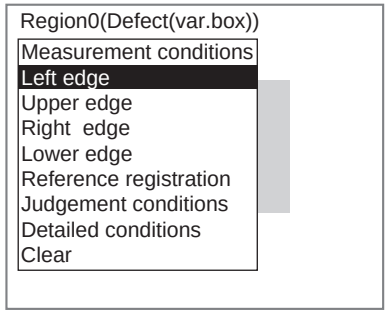
1. Set the edge detection conditions.
   Set the direction for the edge search and the density changes.



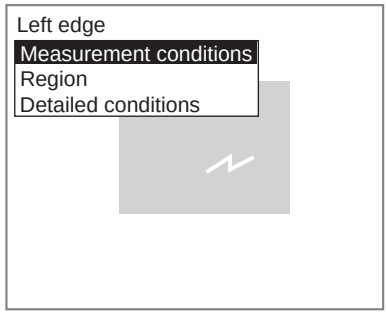
CHECK Combining Edge Detection Directions
Set a combination of upper, lower, right, and left edge detection directions that surround the area to be measured.



a) Select ***Left edge***.

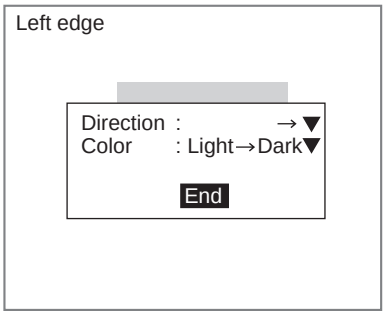


The initial setting screen for the left edge will be displayed.



b) Select ***Measurement conditions***.

The Measurement Conditions Settings Screen will be displayed.

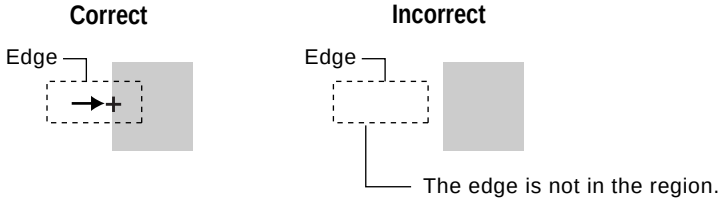


c) Select the detection conditions for the left edge.

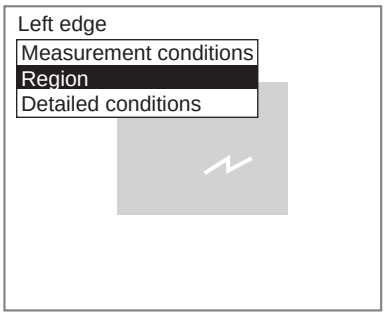
d) Select ***End***.

The settings will be registered and the screen in (a) will return.

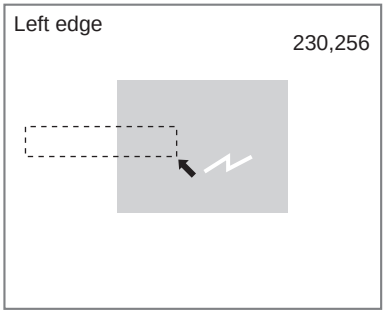
2. Drawing the Edge Detection Region
Draw a region that includes the edge.



a) Select ***Region***.



The Region Settings Screen will be displayed.



b) Draw a box-shaped region.

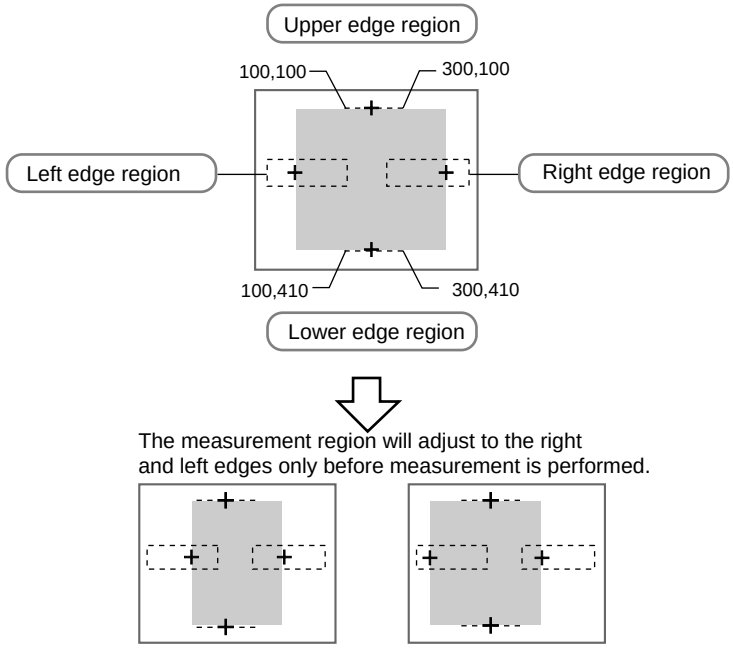
CHECK The only figure that can be drawn is a box.

When the bottom right coordinates are specified, the region will be set, and the screen in (a) will return.

CHECK Use the following procedure to fix the measurement region.

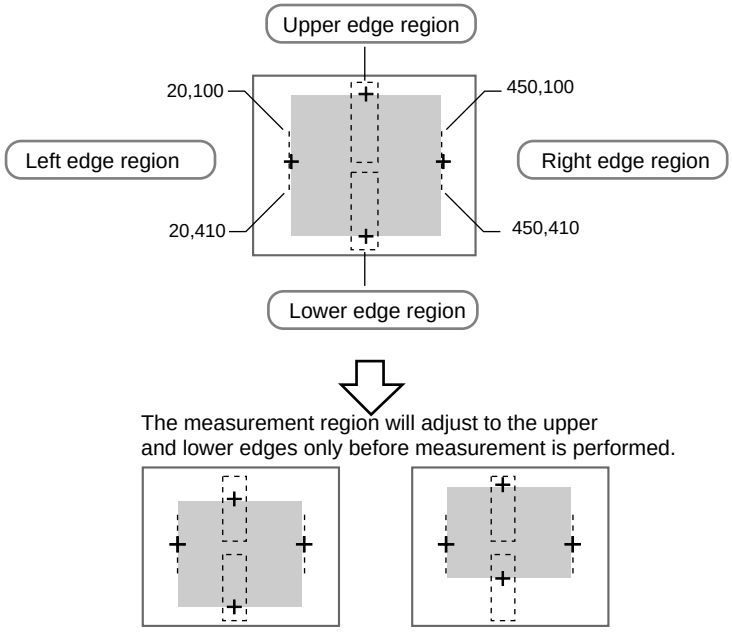
- To measure defects in measurement objects with variable widths only:

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



- To measure defects in measurement objects with variable heights only:

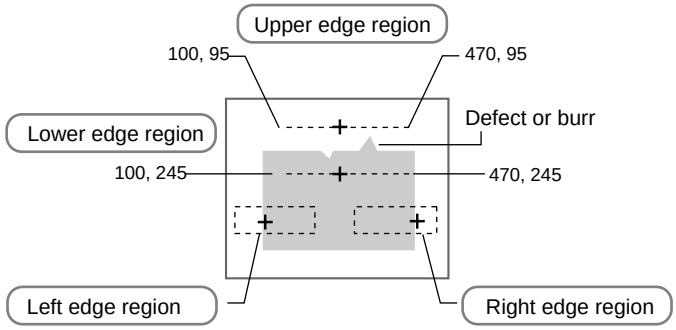
  Draw the edge detection region so that the measurement region X coordinates will remain the same for both the left and right edges. The left and right edges will always have these edge points.



- 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.

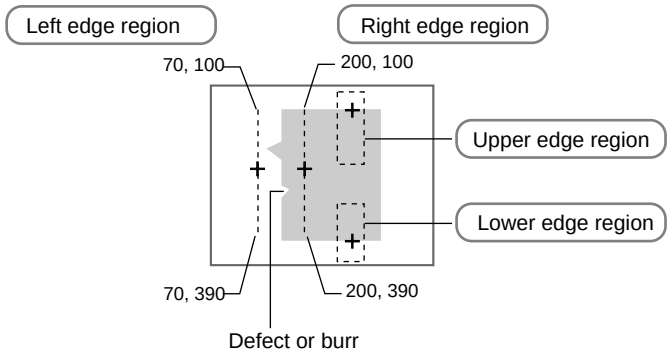
Note Specify *X line* under *Measurement conditions/measurement direction*.



- To Measure Defects and Burrs in the Left Section of Measurement Regions with Variable Heights Only:

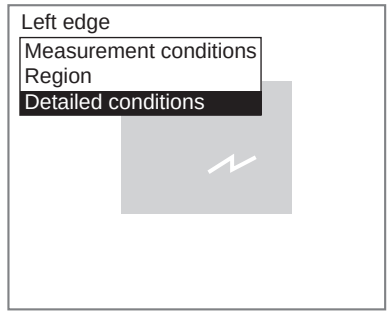
  Draw the edge detection region so that the measurement region X coordinates will remain the same for both the left and right edges. The left and right edges will always have these edge points.

Note Specify *Y line* under *Measurement conditions/measurement direction*.

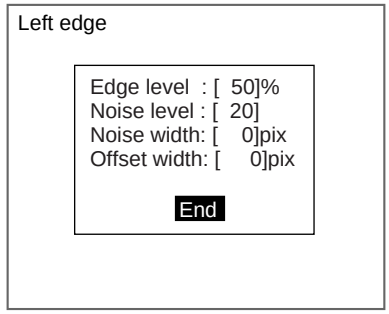


3. Changing Detailed Conditions as Required
Change the detailed conditions when the measurement results are unstable. (Normally, these conditions can be left on the default settings.) After changing the settings, perform an object measurement to check that measurement can still be performed correctly.

a) Select ***Detailed conditions***.



The Detailed Conditions Settings Screen will be displayed.



b) Move the cursor to the condition to be changed and change the setting.

c) Select ***End***.

The settings will be registered and the screen in (a) will return.

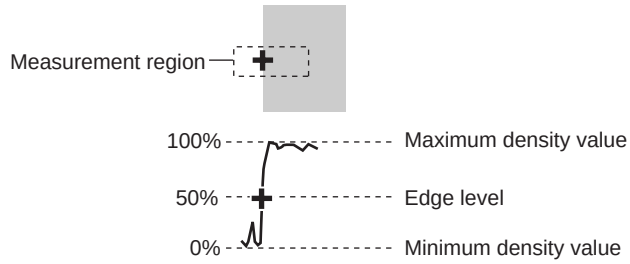
Press the **ESC** Key to return to the initial screen for Defect (var. box).

Edge Level

Set a density change level between 0 and 100 that will indicate the edge. Normally, the default setting of 50% will be fine.

The edge is normally detected as follows:

1. The density distribution of the whole measurement region is calculated.
2. The density difference between the lowest and highest density value becomes 100%.
3. The point where the edge level density change is detected becomes the edge.



Noise Level

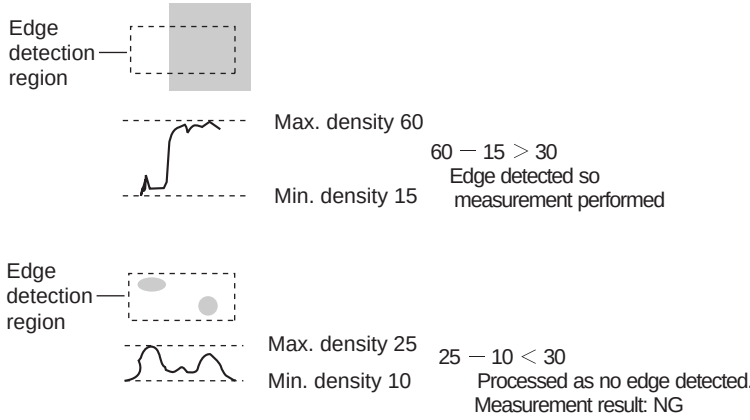
Set a noise level between 0 and 255 to assist the determination of edges. The maximum density and minimum density within the edge detection area is calculated and if the difference between the two values is less than the noise level, then the Controller determines that there is no edge. Normally the default setting of 20 is sufficient. Adjust this to a higher value, however, if noise is causing false edges to be detected.

(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

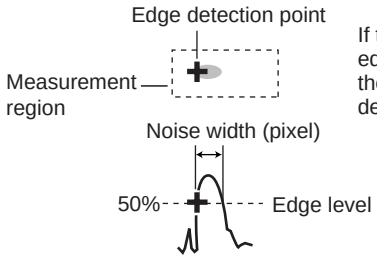


Noise Width

Set the noise width between 0 and 255 to evaluate 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. Normally the default noise width setting of 0 is sufficient. If noise is causing incorrect detection, make this value higher.

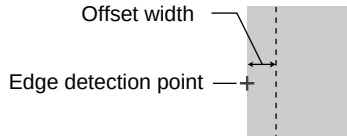
Example



Offset Width

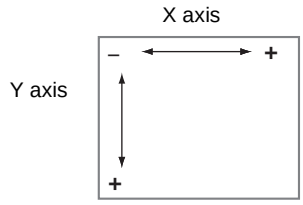
Set the adjustment width (in pixel units) for the detected edge position. Set a value between -511 and 511.

The default setting is 0, which means measurement will start from position where the edge is detected.



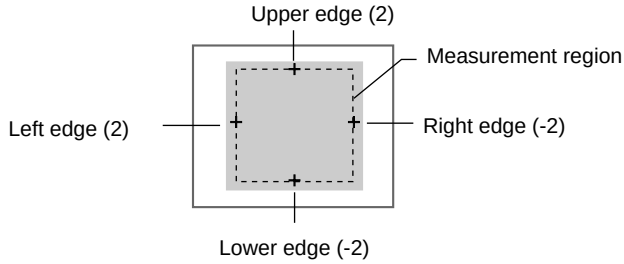
Left and right edges: Set the offset width on the X axis.

Upper and lower edges: Set the offset width on the Y axis.



Example: To Measure from 2 Pixel-widths Inside the Edge Detection Point

The value inside the brackets is the offset width.



CHECK The display cursor, which indicates the edge detection point, will also appear at the set offset width position.

STEP 3: Registering Reference Values

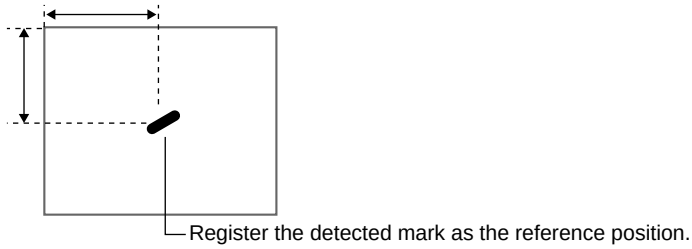
Position detection can also be performed using algorithms for detecting defects. Register the reference values when performing position detection. The following reference values must be registered:

The X and Y coordinates of the position found as 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

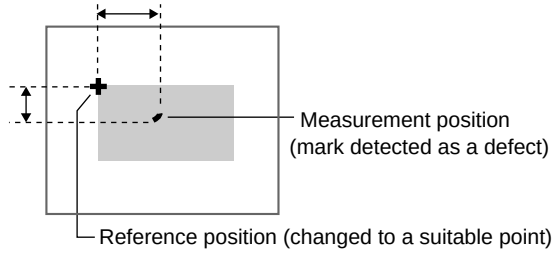
Display a measurement object in the correct position, detect a mark, and register that position as the reference position.



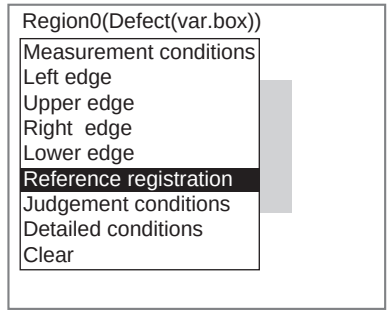
CHECK The reference value can be changed to enable the following function.

Inspecting Positions from a Specified Point

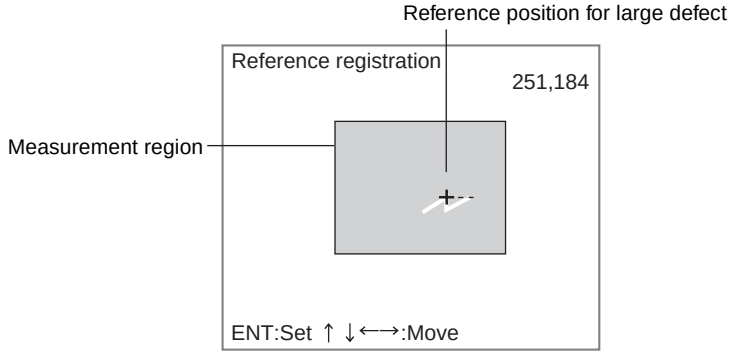
Once a mark has been detected in the image currently displayed, the reference position is changed to an suitable point. Position inspection can be performed by calculating the difference between this reference position and the measurement position.



1. Select ***Reference registration***.

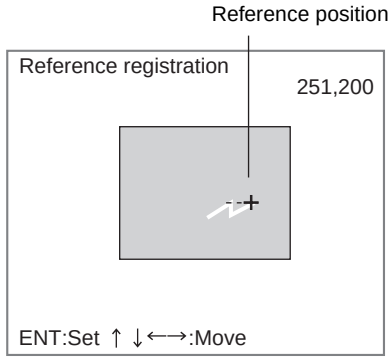


A display cursor will appear at the position where a large defect was found.



2. Use the **Up/Down/Left/Right** Keys to move the cursor to change the reference position.
3. Press the **ENT** Key.

   A display cursor will appear at the position where a small defect was found.

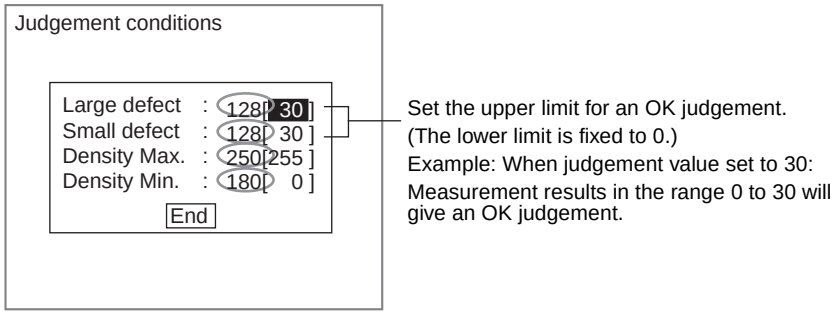


4. Use the **Up/Down/Left/Right** Keys to move the cursor to change the reference position as for large defects and Press the **ENT** Key.

   The settings will be registered and the screen in (1.) will return.

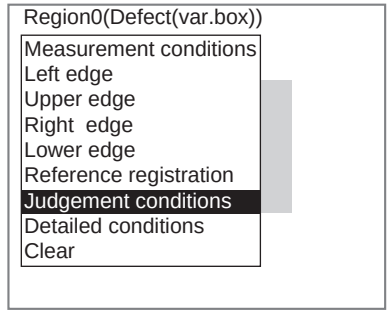
STEP 4: Setting Judgement Conditions

Set the conditions for determining defects. Set a value between 0 and 255 as the OK judgement value. Measure several samples and set the judgement conditions while referring to the measurement results.

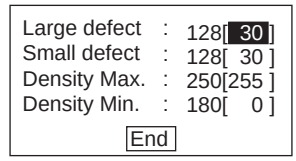


: Measurement result for the displayed image
Use as a reference for setting conditions.

1. Select ***Judgement conditions***.



The Judgement Conditions Settings Screen will be displayed.



2. Change the settings.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

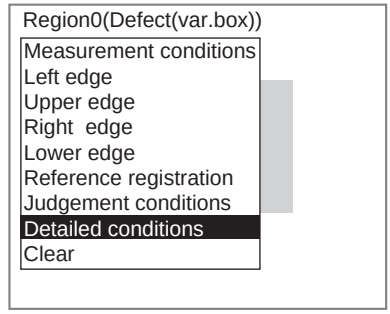
STEP 5: Changing Detection Conditions

To shorten measurement processing time, change the conditions for detecting defects. The greater the element size and comparing pitch, the shorter the processing time. However, the accuracy of the measurement will decrease.

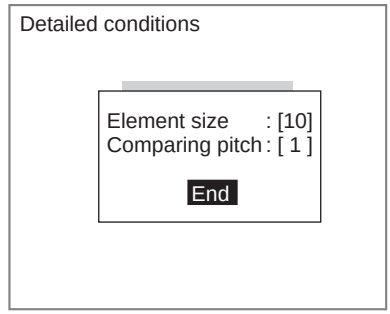
Once the element size or comparing pitch setting has been changed, perform measurements to check that they can be performed correctly.

SeeAlso Refer to *Element Size* and *Comparing Pitch* on page 2-14-(12).

1. Select ***Detailed conditions***.



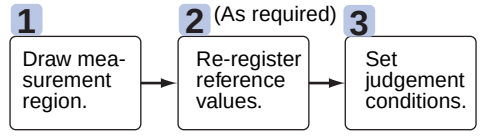
The Detailed Conditions Settings Screen will be displayed.



2. Set the element size and comparing pitch.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

2-14-2-3 Defect (Deviation)



STEP 1: Drawing Measurement Regions

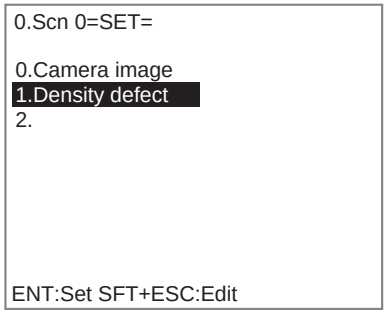
Draw a figure in the section to be inspected.

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.

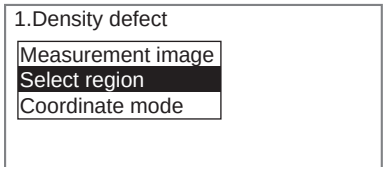
CHECK Position detection can be also performed using algorithms for detecting defects.

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.

1. Select ***Density defect***.

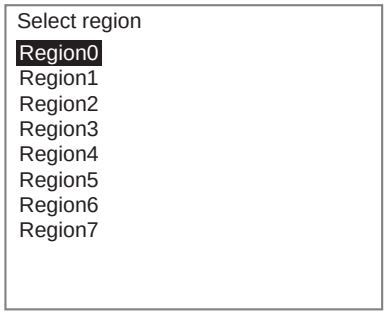


The settings selections will be displayed.



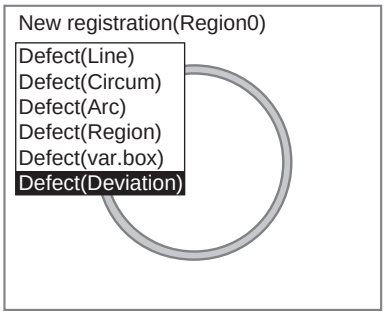
2. Select ***Select region***.

A list of region numbers will be displayed.

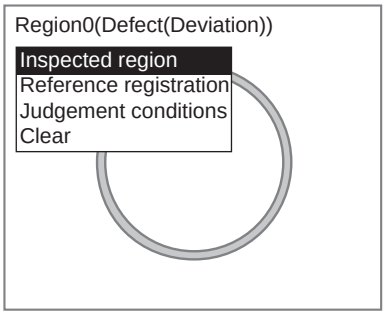


3. Select the region number.

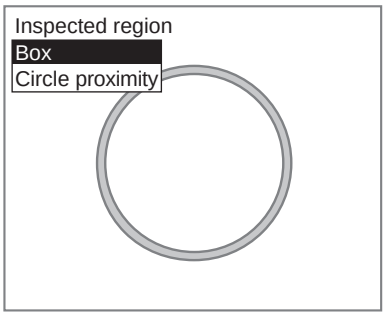
A list of measurement methods will be displayed.



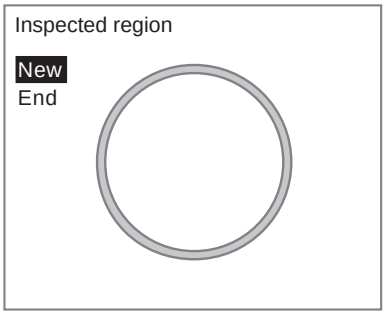
4. Select ***Defect (Deviation)***.
   The initial Defect (Deviation) Screen will be displayed.



5. Select ***Inspected region***.
   The selections will be displayed.

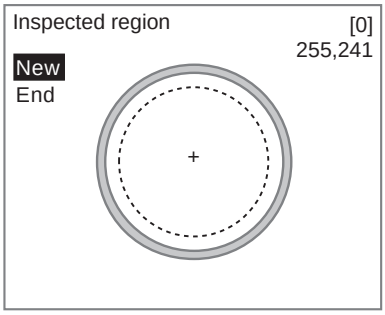


6. Select ***Box*** or ***Circle proximity***.
   In this example, *Circle proximity* is selected.
   The Inspected Region Settings Screen will be displayed.



7. Select ***New***.

   A display cursor will appear.



8. Draw a figure in the region to be measured.
9. Select ***End***.

   The settings will be registered and the screen in (4.) will return.

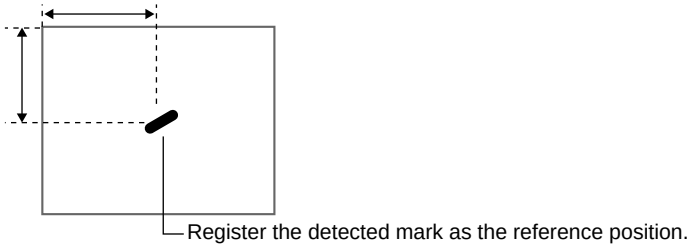
   The measurement region and the positions where defects were located will be displayed. The defects will be indicated by a display cursor.

STEP 2: Re-registering Reference Values

Position detection can also be 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). If this function is used, however, the reference value alone can be re-registered based on the currently displayed image.

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.

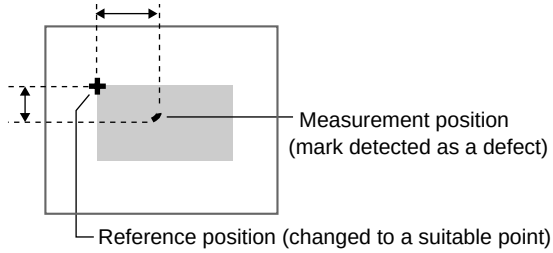


CHECK The reference value can be changed to enable the following function.

Inspecting Positions from a Specified Point

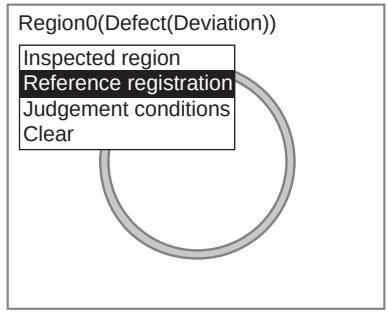
Once a mark has been detected in the image currently displayed, the reference position is changed to an suitable point. Position inspection can be per-

formed by calculating the difference between this reference position and the measurement position.

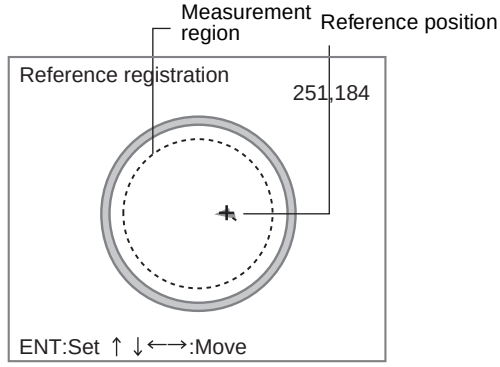


CHECK If the measurement region is changed, the reference values return to the default setting.

1. Select ***Reference registration***.



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.

   The setting will be registered and the screen in (1.) will return.

STEP 3: Setting Judgement Conditions

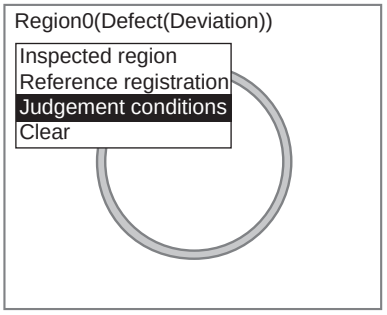
The Controller uses the density deviation of each element in the measurement region to determine if a defect exists. Set a deviation value between 0 and 127 for an OK judgement.

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.

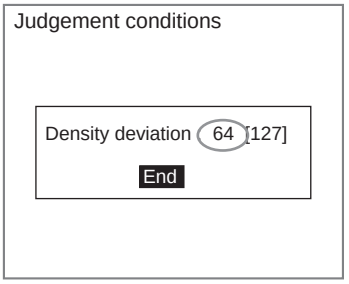
Measure several samples and use those measurement results as a reference for setting the judgement conditions.

SeeAlso Refer to page 2-14-(12) for information on elements.

1. Select ***Judgement conditions***.



The Judgement Conditions Settings Screen will be displayed.



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

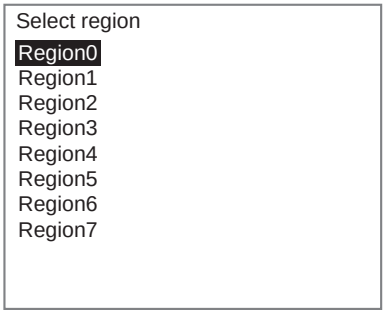
2. Set a density deviation value.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

2-14-2-4 Clearing Set Regions

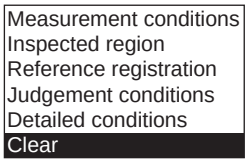
The clear operation is performed separately for each region.

1. Select the number of the region to be cleared.

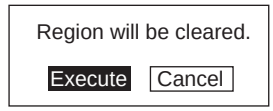


A list of selections will be displayed.

Example: Clearing region for Defect (line) measurement



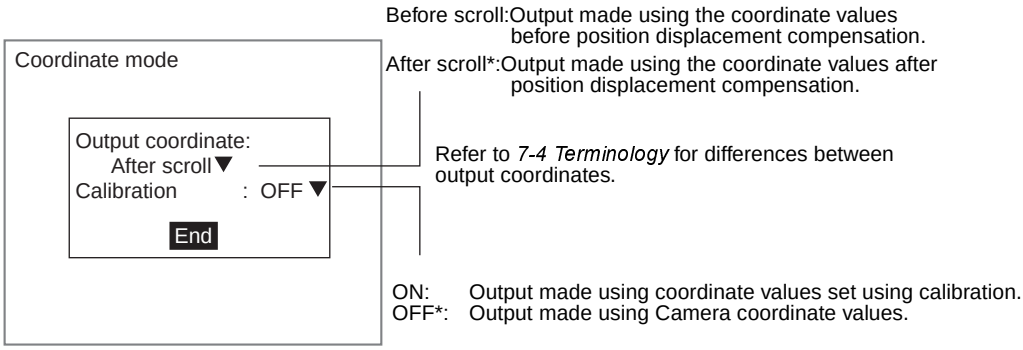
2. Select ***Clear***.
   A confirmation message will be displayed.



3. Select ***Execute***.
   The region will be cleared and the screen in (1.) will return.

2-14-3 Setting the Coordinate Mode

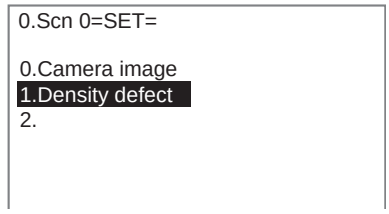
Select the type of coordinate values.



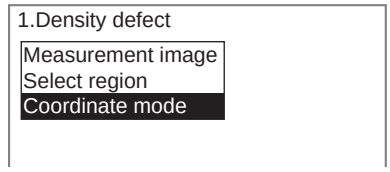
The asterisk (*) indicates the default setting.

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.

1. Select ***Density defect***.

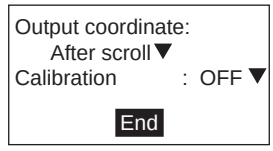


The settings selections will be displayed.



2. Select ***Coordinate mode***.

   The Coordinate Mode Settings Screen will be displayed.



3. Make the settings for each item.
4. Select ***End***.

   The settings will be registered and the screen in (2.) will return.

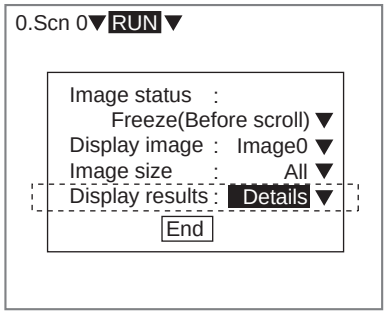
2-14-4 Measurement Screens

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

This section describes what kind of information can be displayed for density defect inspections.

SeeAlso Refer to *SECTION 3 Monitor Mode and Run Mode* for details on Monitor and Run modes.

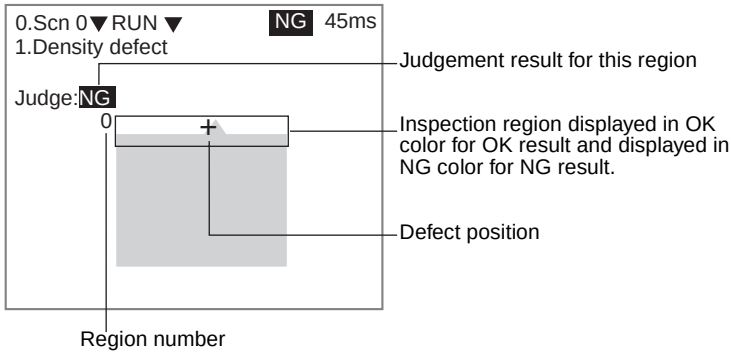
CHECK Press the **SHIFT+ESC** Keys on the Run Screen to access the following screen and change ***Display results*** to ***Details***.



Use the **Up** or **Down** Key to change to the unit for which density defect inspection is set and the following detailed screens will be displayed.

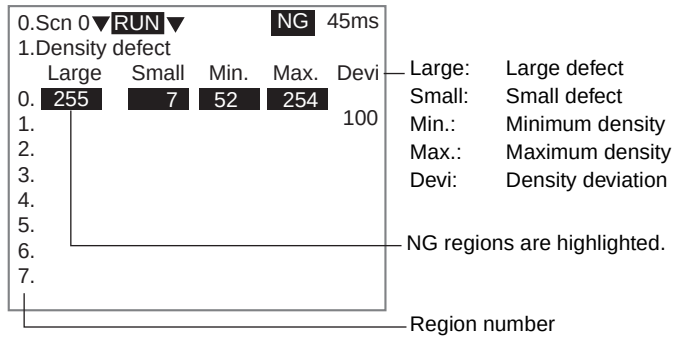
Use the **SHIFT+Right** or **Left** Keys to switch in order between the two screens.

Measurement Region and Position Display



Numeric Display

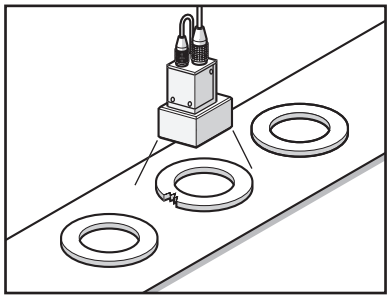
The measurement values for each region are displayed in a list.



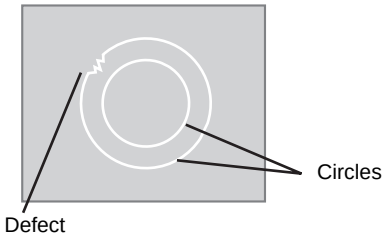
2-15 EC Defect

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



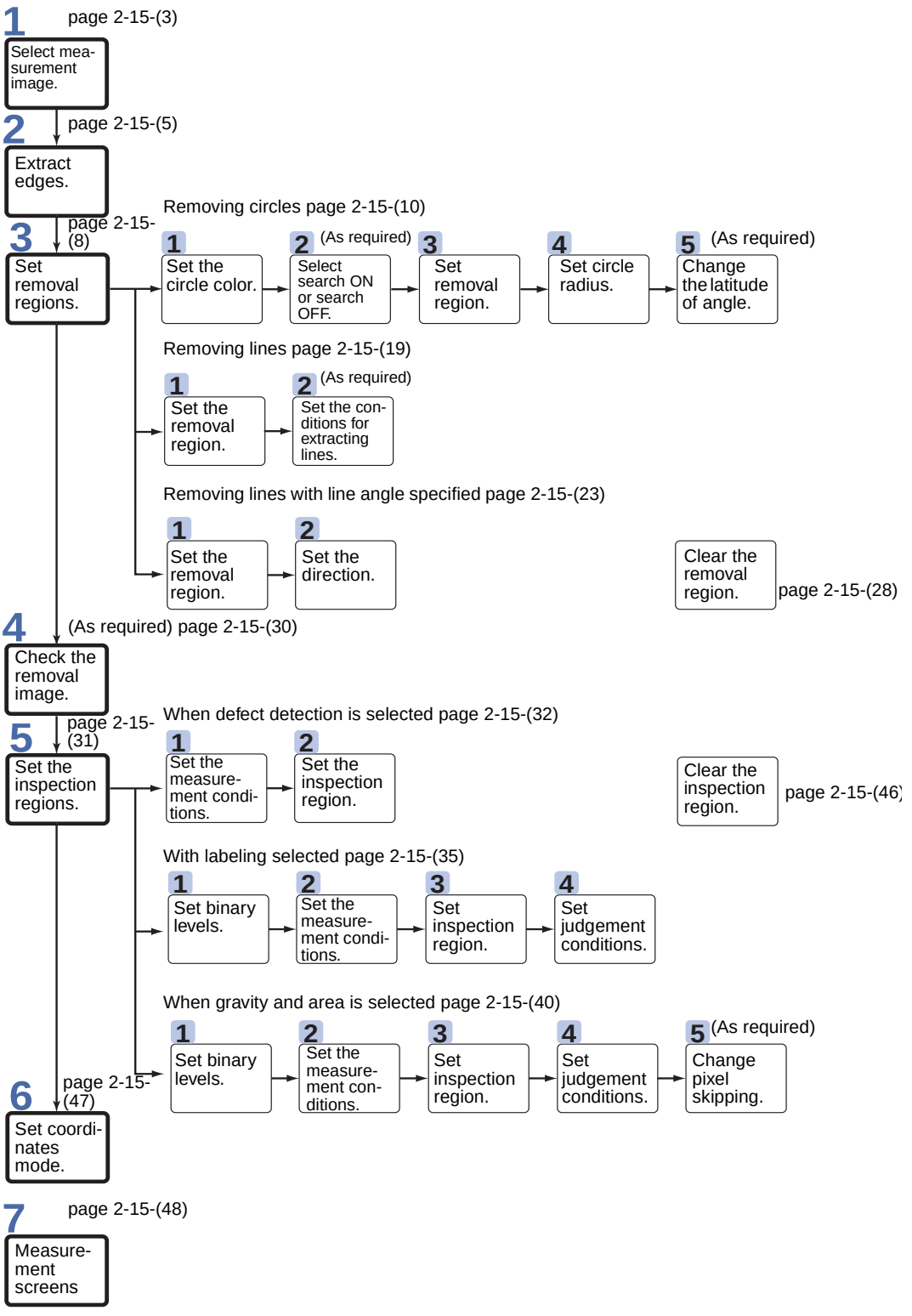
Edge-extracted image



These images are recognized as circles, even if they are slightly out of shape.

HELP Refer to *7-4 Terminology* for information on echo codes (EC).

Operational Flow

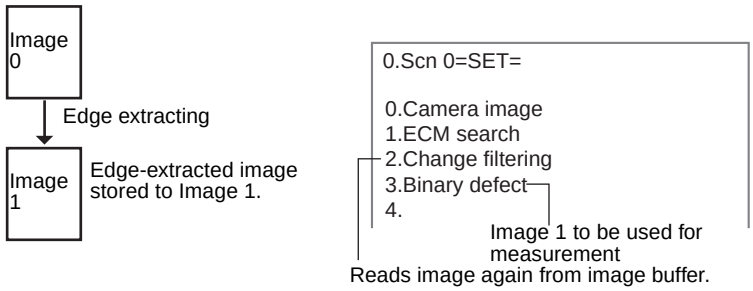


2-15-1 Selecting Measurement Images

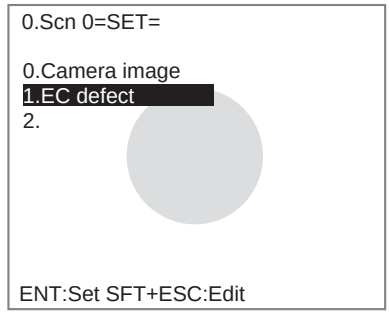
This section describes how to select the image stored at either Image 0 or Image 1 as the image for measurement.

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 defect inspection was set. Then store the image stored in the image buffer to Image 0 or Image 1.

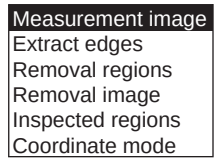
When Image 0 Is Selected as Measurement Image



1. Select ***EC defect***.

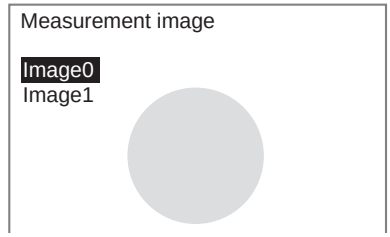


The initial screen for EC defect inspection will be displayed.



2. Select ***Measurement Image***.

   The selections will be displayed.



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

4. Press the **ENT** Key.
   The settings will be registered and the screen in (1.) will return.

2-15-2 Extracting Edges

EC defect inspection is performed for images for which the edges have been extracted.

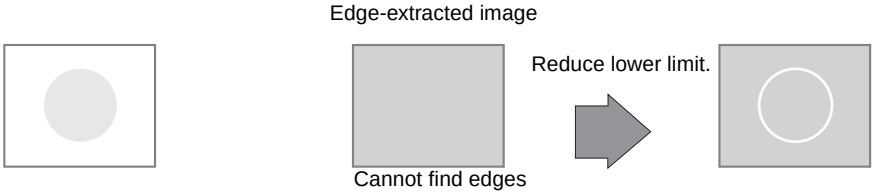
Adjust the upper and lower levels for edge extracting if there is low contrast between the measurement object and the background and to remove noise.

Upper and Lower Limits

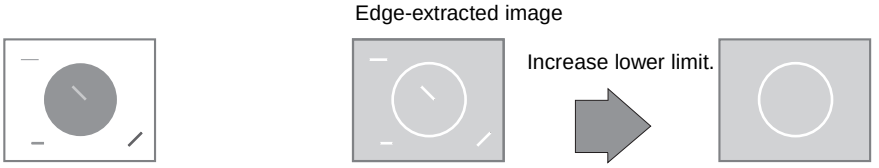
Set the level to which the background will be cut from the edge-extracted image. The levels can be set between 10 and 255 (default 100:255).

Areas with a density above the lower limit will become the edge of the measurement object. Refer to the following examples and adjust the upper and lower limits.

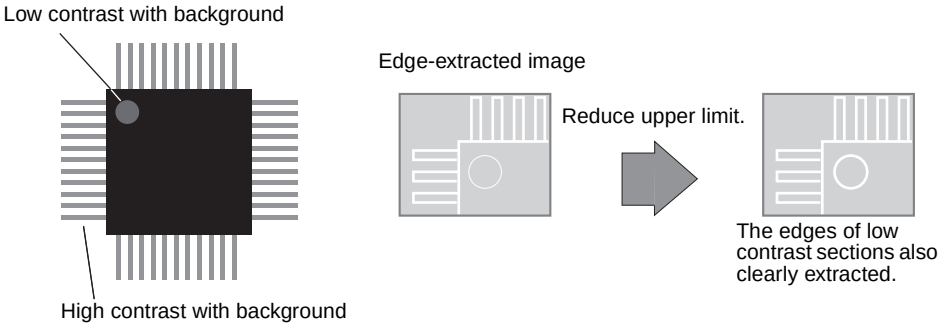
Example: Cannot Find Edges Due to Low Contrast



Example: To Remove Noise



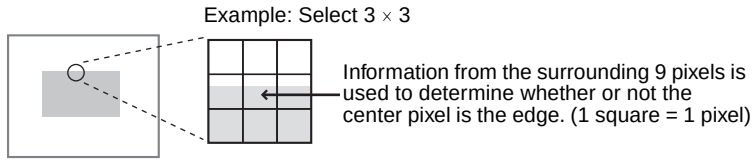
Example: Other Edges Clearly Extracted But Cannot Find Desired Mark Edge with Stability



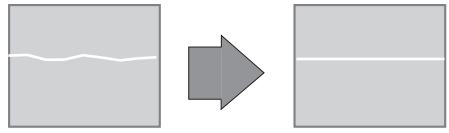
Mask Size

The mask size function is used when searching for edges to judge edges using peripheral information. Select how much peripheral pixel information to use. The selections are 5 × 5 (default) or 3 × 3.

CHECK This setting will be enabled only if *Frame/Field* under *Camera image* is set to *Frame*. If set to *Field*, the effect will remain the same as if 5 × 5 is selected even if 3 × 3 is selected.



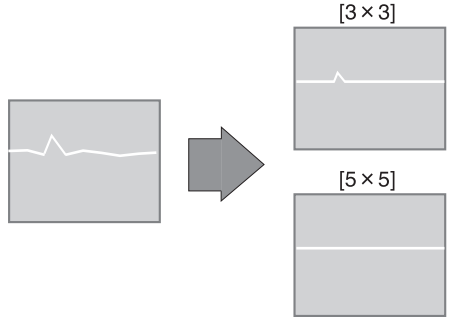
The greater the mask size, the more the variations in surrounding pixels can be absorbed. Select 5 × 5 to ignore uneven edges.



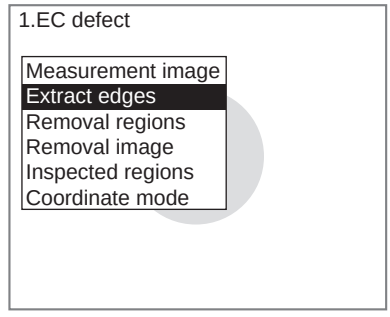
CHECK This function is even more effective if smoothing is used.

SeeAlso Refer to *2-1 Inputting Camera Images* and *2-4 Filtering Again* (where smoothing can be set to be executed twice).

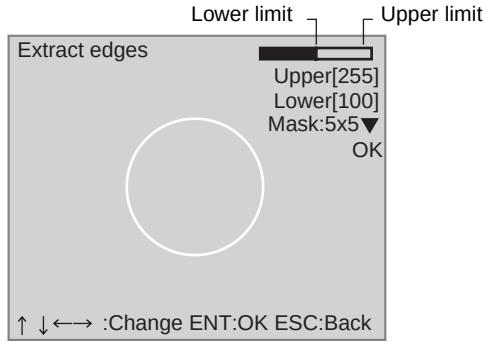
Select 3 × 3 to detect small defects or burrs. If 5 × 5 is selected, the edges might be absorbed as uneven edges and defects may not be detected.



1. Select ***Extract edges***.



The screen for setting edge extracting levels will be displayed.

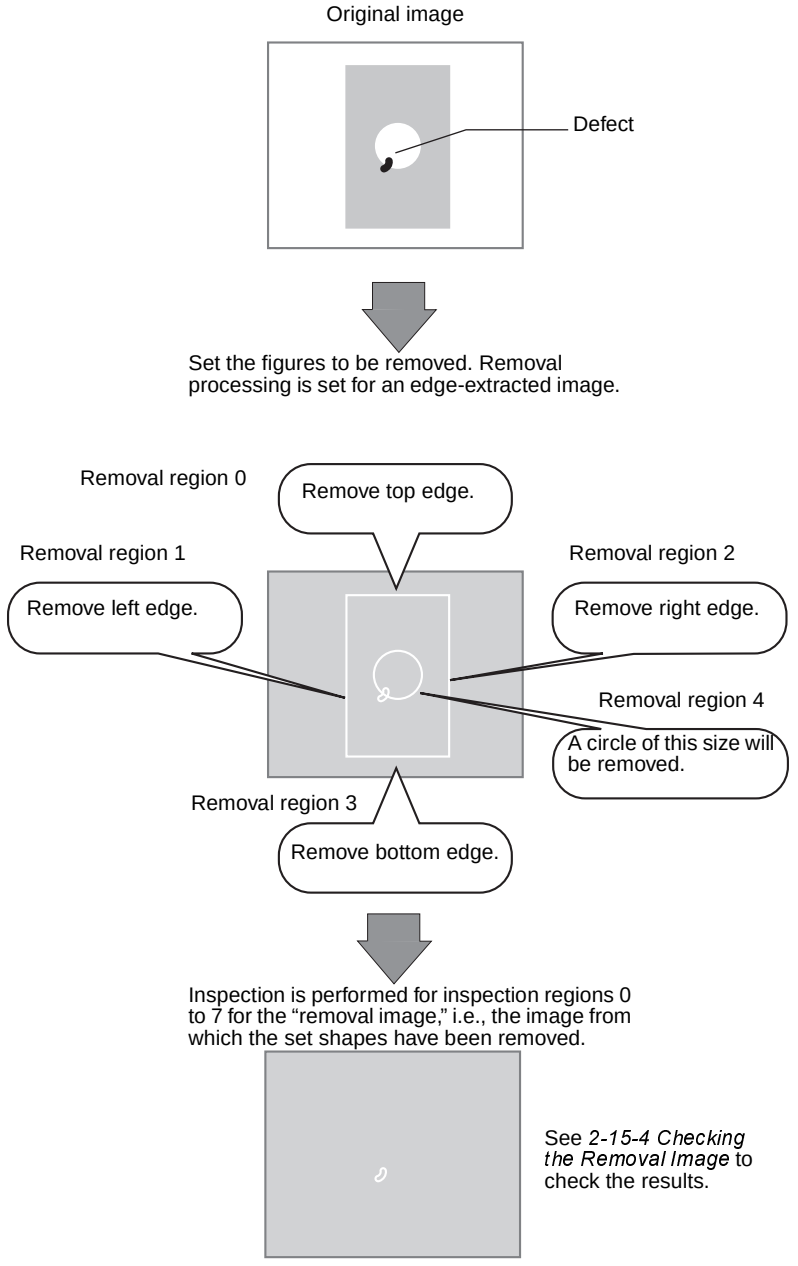


2. Set the upper and lower limits.
   Right Key: Increases the lowest digit by one.
   SHIFT+Right Keys: Increases the value 10 times faster.
   Left Key: Decreases the lowest digit by one.
   SHIFT+Left Keys: Decreases the value 10 times faster.
   Up and Down Keys: Switches between setting items.
3. Select the mask size.
4. Press the **ENT** Key.
   The settings will be registered and the screen in (1.) will return.

2-15-3 Setting Removal Regions

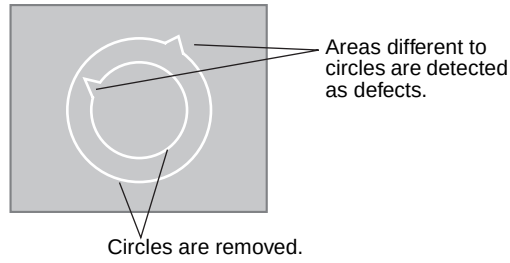
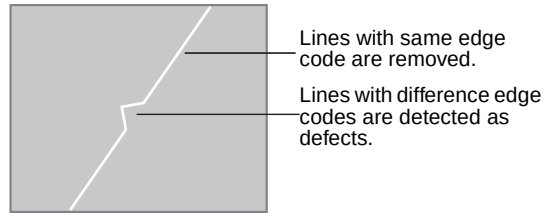
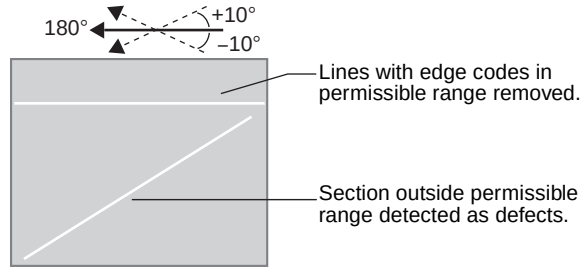
Set the figures to be removed. The figures can be chosen separately for each region.

The inspection target can be limited to the defect if the outline of the measurement object or other regions are set to be removed.



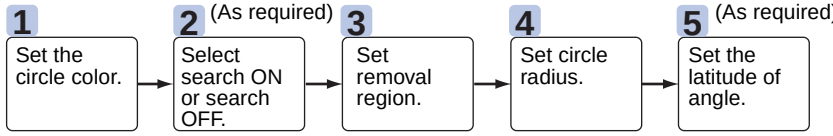
The following 3 types of figures can be set for removal.

Up to 8 regions can be set and figures can be chosen separately for each region.

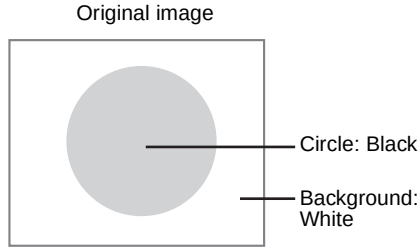
Figure	Details
Circle	Removes only circles of the specified size from the edge-extracted image. With EC algorithms, removal processing is not affected if the shape of the circles differs slightly. 
Line	Lines with the most common edge code (direction) are removed from the edge-extracted image. 
Oriented line	The line direction and the permissible range are set and only lines within the permissible range are removed from the edge-extracted image. Example: Removing straight lines at 180° ±10° 

2-15-3-1 Removing Circles

Circles are detected using edge codes. To remove circles of a different size, set the removal region for each size.



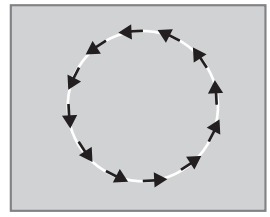
HELP Circle Extracting Algorithms Using Edge Codes



1. An edge code image is found.

   Edge codes indicate the edge directions (arrows in the diagram).

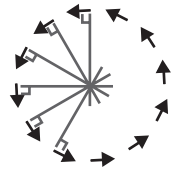
   If the circle is white and the background is black, the arrows will be in the opposite direction.



2. The center of the circle is found.

   The center of the circle is calculated using the points of intersection from lines running at right angles to the left of the direction indicated by the edge code.

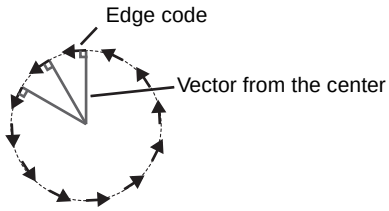
   The center of the circle is determined by using the most common point of intersection from the edge codes. This means that the approximate center of a circle can be found even if the shape is not a perfect circle, e.g., an ellipse or a circle with a defect.



3. Edge points on the circumference are found.

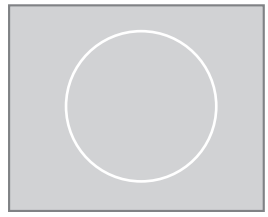
   Points that fulfill the following two conditions are detected as edge points.

   - The point is within a fixed distance range from the center.
   - The edge code is at 90° from a vector from the center.



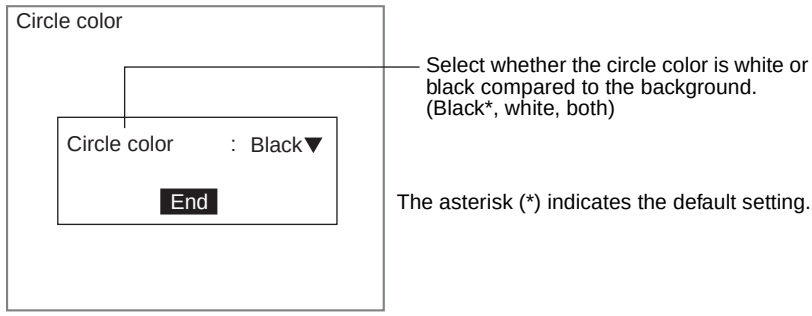
4. The points detected as edges on the circumference are removed.

Figure That Was Removed

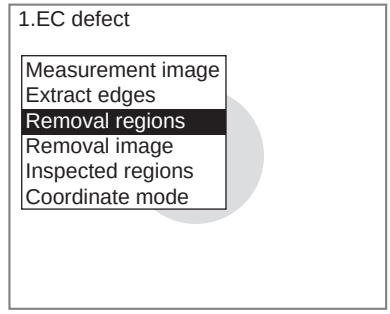


STEP 1: Setting the Circle Color

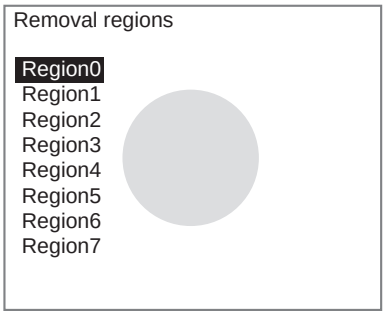
Set the color of the circle to be removed.



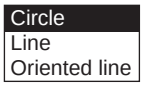
1. Select ***Removal regions***.



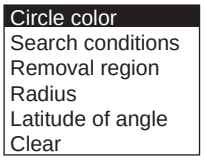
A list of regions will be displayed.



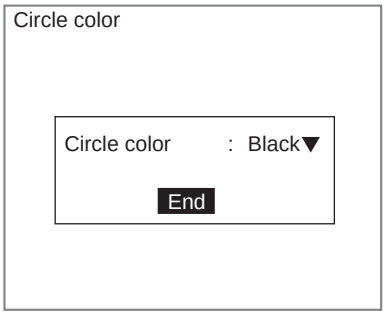
2. Select the number of the region to be removed.
   A list of figures will be displayed.



3. Select ***Circle***.
   The initial screen for circle removal regions will be displayed.



4. Select ***Circle color***.
   The initial Removal Conditions Settings Screen will be displayed.



5. Set the circle color.
6. Select ***End***.
   The settings will be registered and the screen in (3.) will return.

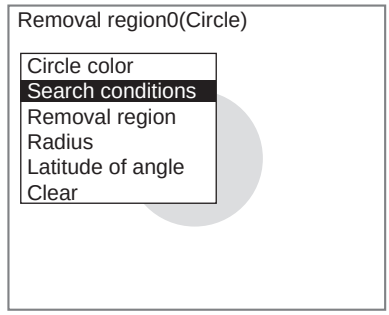
STEP 2: Selecting Search ON or Search OFF

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 and removed from the removal region.

Set the circle search to OFF (default) 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. If circle search is set to OFF, specify the center position of the circle under *Radius*.

SeeAlso Refer to *STEP 4: Setting the Radius of the Circle* on page 2-15-(16) for information on setting the radius.

1. Select ***Search conditions***.

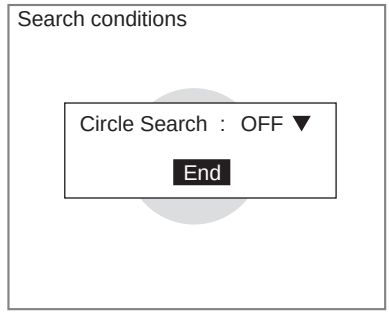


The Search Conditions Settings Screen will be displayed.

2. Select whether or not to execute a circle search.

ON: Execute

OFF: Not execute



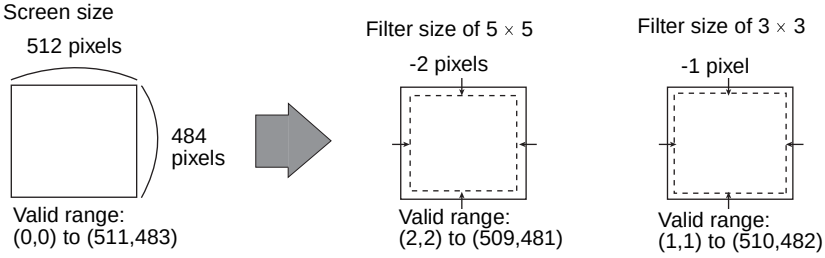
3. Select ***End***.

The settings will be registered and the screen in (1.) will return.

STEP 3: Setting Removal Regions

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.



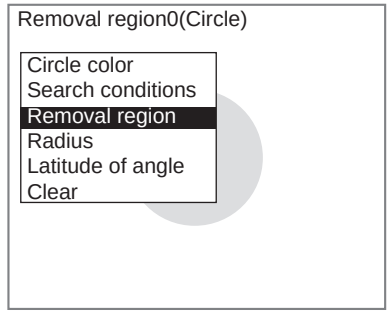
Each time the image is filtered, the range of inaccurate pixels will be increased further. For example, if filtering is performed twice, the valid range will be reduced as follows:

Filter size of 5 × 5: -2 pixels × 3 = -6 pixels

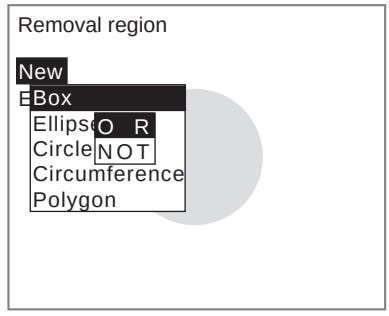
Filter size of 3 × 3: -1 pixel × 3 = -3 pixels

(Filtering is also performed once in edge extraction, so filtering is actually performed a total of three times.)

1. Select ***Removal region***.

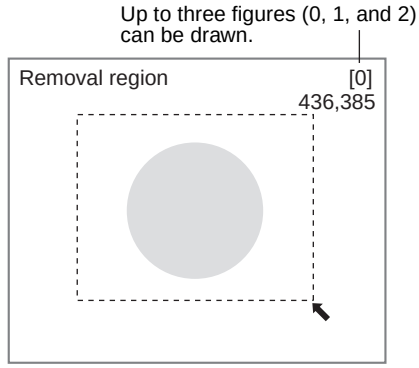


The Removal Region Settings Screen will be displayed.



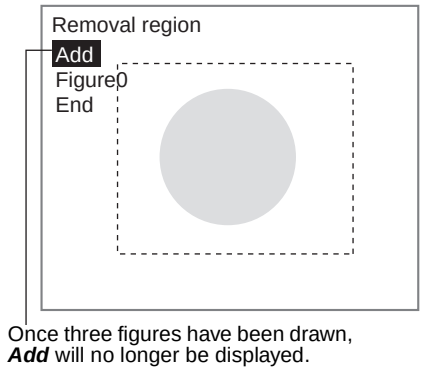
2. Select ***New***.
3. Select the desired figure.
4. Select the desired drawing mode (***OR***/***NOT***).

   An arrow cursor will appear.



5. Draw the figure in the circle removal region.

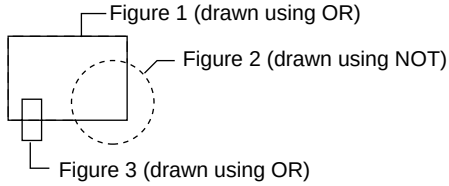
The figure will be registered.



6. If additional figures are to be drawn, select ***Add***.
7. Repeat steps 3 to 5 as necessary to create the desired shape.
8. After drawing is completed, select ***End.***

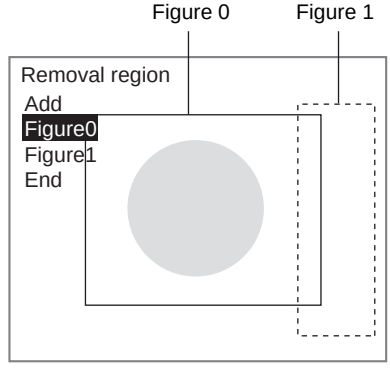
   The measurement region will be registered and the screen in (1.) will return.

CHECK Figures drawn using OR mode are displayed with solid lines and figures drawn using NOT mode are displayed with dotted lines.



Correcting or Clearing Figures

1. In the screen for step 5 above, select the figure to be changed or cleared using the **Up** and **Down** Keys and press the **ENT** Key.



   The figure for the figure number selected using the cursor will be displayed with solid lines. The selections ***Correct*** and ***Clear*** will be displayed.

2. Select either ***Correct*** or ***Clear*** and press the **ENT** Key.

   If ***Correct*** is selected, the cursor will be displayed. Correct the size and position of the figure as desired.

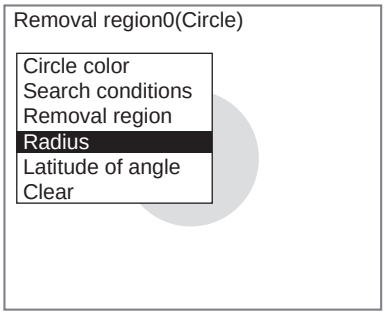
If ***Clear*** is selected, the selected figure will be cleared.

STEP 4: Setting the Radius of the Circle

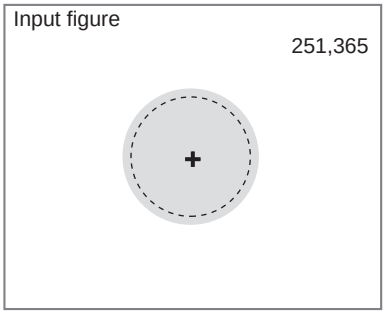
Set the radius and the permissible radius range for the circle to be removed.

If the circle search is set to OFF, the center of the circle will be the position specified here.

1. Select ***Radius***.



The Input Figure Screen will be displayed.

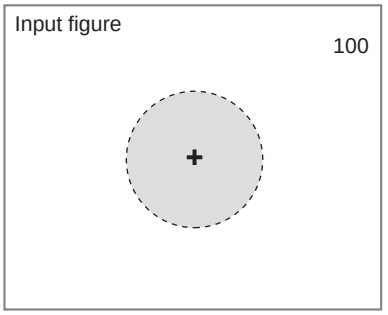


2. Specify the center of the circle.

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

   ENT Key: Confirms the setting.

   The Radius Settings Screen will be displayed.



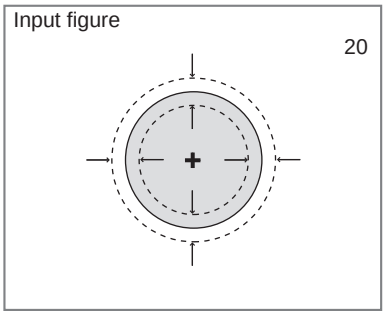
3. Set the radius of the circle.

   Up/Right Keys: Increase the radius.

   Down/Left Keys: Decrease the radius.

   ENT Key: Confirms the setting.

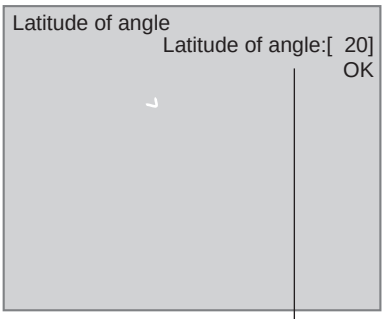
The screen for setting the permissible radius range will be displayed.



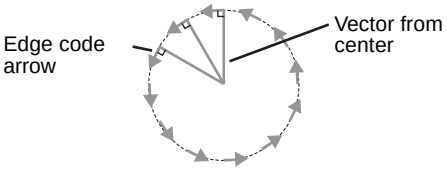
4. Set the permissible radius range.
   Up/Right Keys: Increase the radius.
   Down/Left Keys: Decrease the radius.
   ENT Key: Confirms the setting.
   The settings will be registered and the screen in (1.) will return.

STEP 5: Changing the Latitude of the Angles

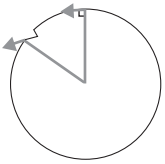
If circles are deformed, interfering with removal or causing removal of incorrect elements, the latitude of the angles of the edge codes judged to be a circle can be changed. The latitude can be set between 0 and 99 (default: 20).



The latitude of angle is set for the 90° angle between the edge code arrow and a vector from the center of the circle. (0 to 99, default: 20) If, for example, the latitude is set to 15°, points at 75° to 105° will be judged to be edge points on the circumference.

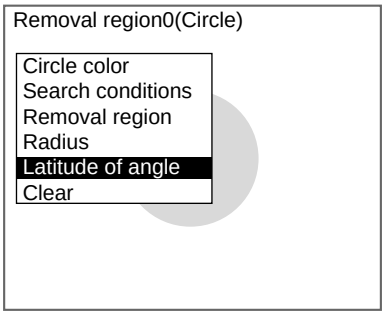


As shown below, the angle of the edge code changes when there is an irregularity on the circumference of the circle.

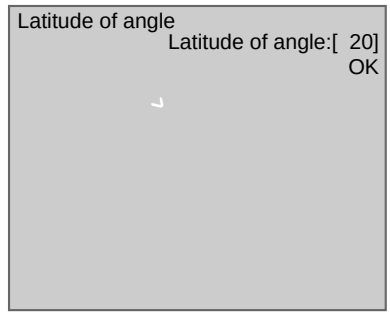


Set the latitude of angle to remove circles that are not required.

1. Select ***Latitude of angle.***



The setting screen will be displayed.



2. Set the latitude of angle to remove circles that are not required.

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.

SeeAlso See *2-15-2 Extracting Edges*.

- Set smoothing for filtering the image.

SeeAlso See *2-1 Inputting Camera Images*:
Camera Image
Filter Again (To perform smoothing twice)

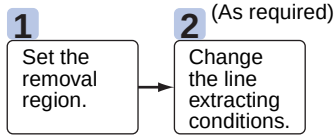
3. Select ***OK***.

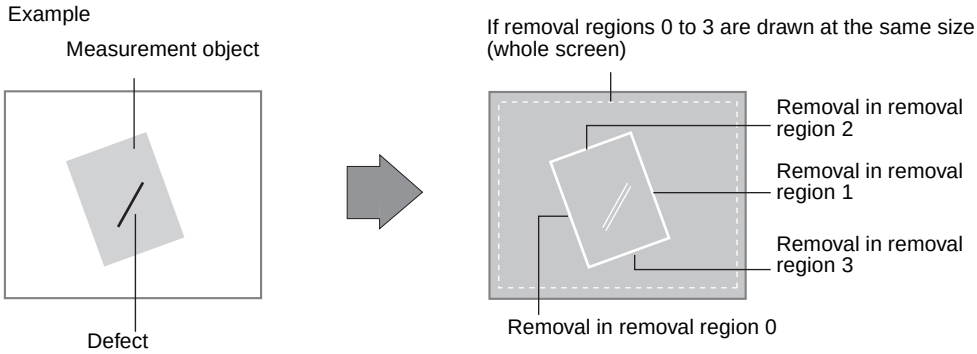
The settings will be registered and the screen in (1.) will return.

2-15-3-2 Removing Lines

Lines are detected using edge codes.

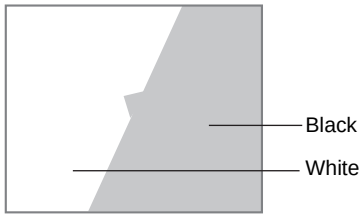
The lines with the most common edge code (direction) will be deleted from the edge-extracted image so this function can be used even if the measurement object is at a different orientation.





HELP Line Extracting Algorithm Using Edge Codes

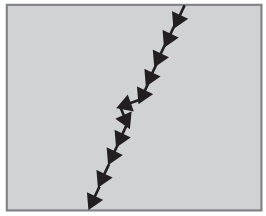
Original image



1. An edge code image is created.

   The edge codes indicate the directions of the edges (arrows in the diagram).

   If black and white are reversed, the arrows will be in the opposite direction.



2. The section with the most common edge codes is removed from the image.

Figure That Was Removed

STEP 1: Setting Removal Region

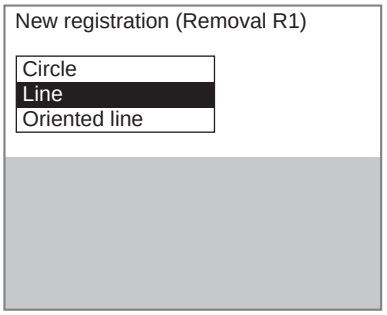
Lines that match the removal conditions will be removed from the range set here.

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 removal region.

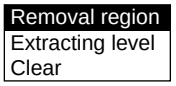
SeeAlso Refer to page 2-15-(13) under *2-15-3-1 Removing Circles*.

1. Display the figure selections using the same steps 1 to 3 as outlined under *Circle*.

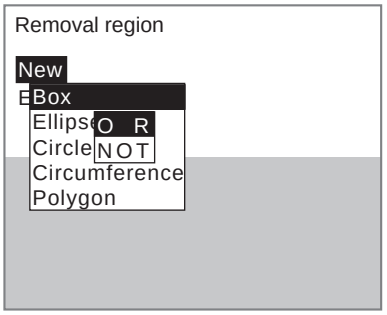
SeeAlso Refer to page 2-15-(11).



2. Select ***Line***.
   The initial screen for lines will be displayed.



3. Select ***Removal region***.
   The Removal Region Settings Screen will be displayed.



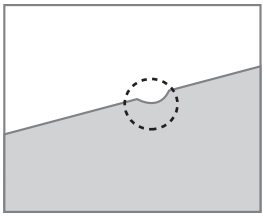
The rest of the procedure is the same as for circles.

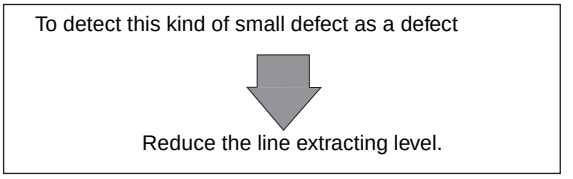
SeeAlso Refer to page 2-15-(13).

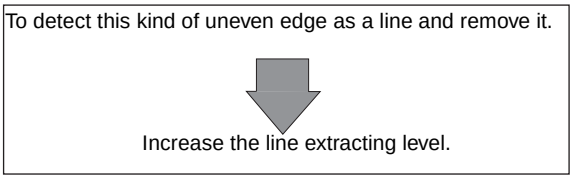
STEP 2: Changing Line Extracting Conditions

The level for line extracting can be changed. There are 5 levels, 1 to 5. The default setting is 3. Adjust the level as required.

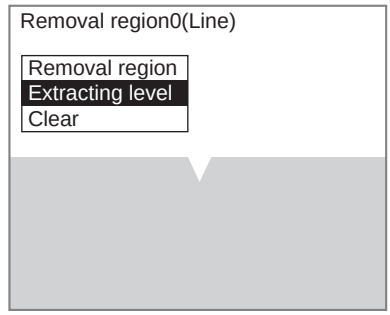
Example



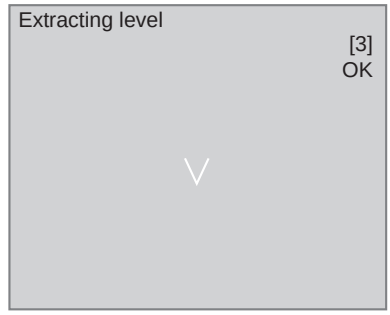




1. Select ***Extracting level***.



The setting screen will be displayed.



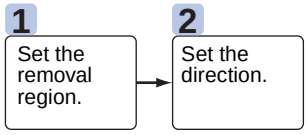
2. Set the line extracting level so that the lines that are not required are removed.
3. Select ***End***.

   The extracting level will be registered and the screen in (1.) will return.

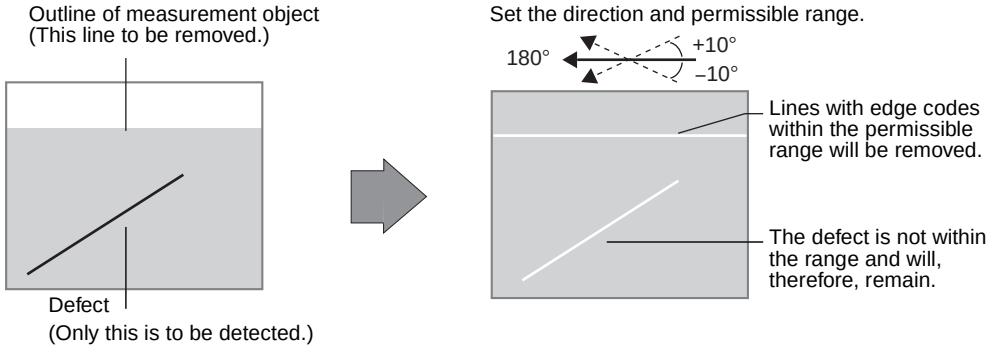
2-15-3-3 Removing Lines with Line Angle Specified

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.

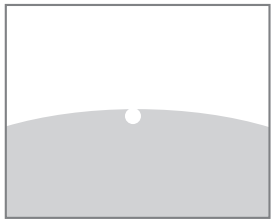


Example



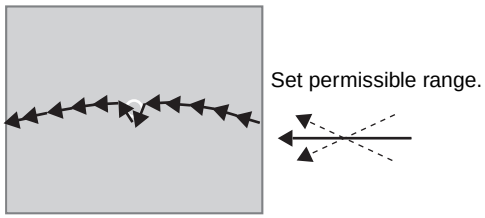
HELP Oriented Line Extracting Algorithm Using Edge Codes

Original image



1. An edge code image is created.

   Points with edge codes within the permissible range are detected as edges on the line.



2. The section detected as a line with a uniform direction is removed.

Figure That Was Removed

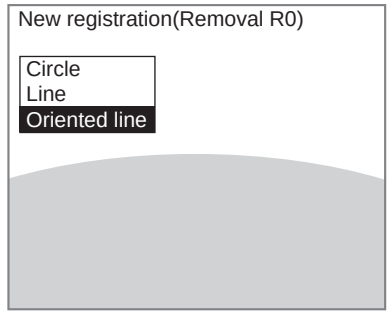
STEP 1: Setting Removal Ranges

1. Display the figure selections using the same steps 1 to 3 as outlined under *Circle*.

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.

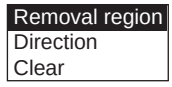
SeeAlso Refer to page 2-15-(13) under *2-15-3-1 Removing Circles*.

SeeAlso Refer to page 2-15-(11).



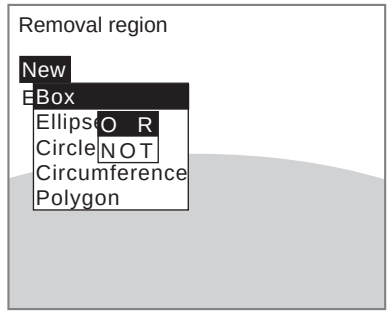
2. Select ***Oriented line***.

   The initial screen for oriented line processing will be displayed.



3. Select ***Removal region***.

   The Removal Region Settings Screen will be displayed.



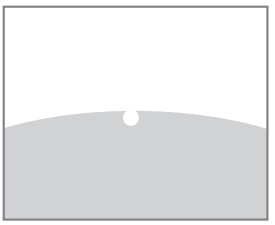
The rest of the procedure is the same as for circles.

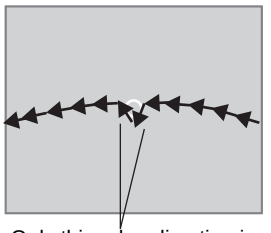
SeeAlso Refer to page 2-15-(13).

STEP 2: Setting the Direction

Set the line direction and the permissible range for oriented lines to be detected and removed.

Example



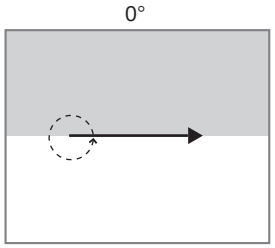


There are two methods to register the settings.

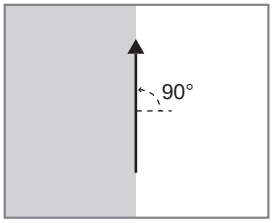
Method	Contents
Input figure	The measurement object is displayed and arrows are placed on it to set the direction and latitude of angle.
Input parameter	The direction and latitude of angle are input numerically. In the background, an image with lines removed corresponding to the angle settings is displayed.

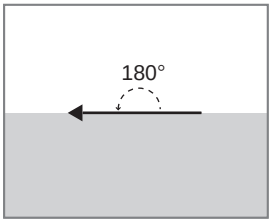
HELP Line Directions and Angles

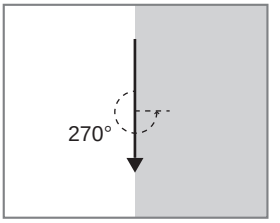
Locations where the brightness changes are detected as edges and the direction of the change in brightness is found. This is called the edge code and it indicates the direction of the line. The arrangement of black and white determines the edge code direction, and angles are calculated as shown below.



Expressed as 0° or 360°.

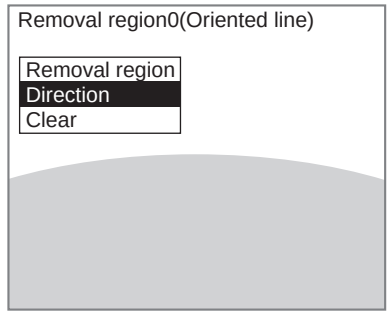




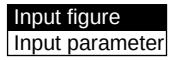


Input Figure

1. Select ***Direction***.

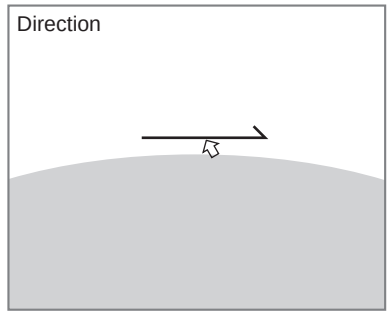


The selections for the registration method will be displayed.



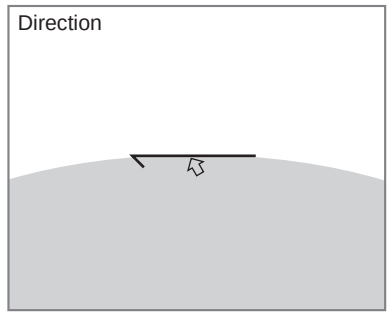
2. Select ***Input figure.***

   An arrow will appear in the center of the screen.



3. Press the **TRIG** Key.

   The arrow will point in the direction that indicates the edge code for the displayed image.

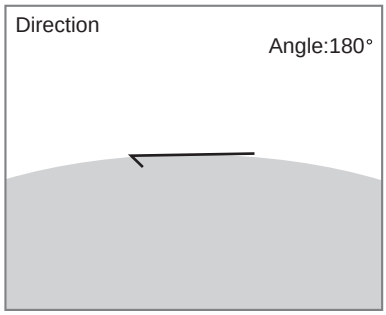


4. Move the arrow to on top of the line to be removed.

   Up/Down/Left/Right Keys: Move the line up, down, left, and right.

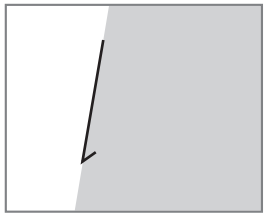
5. Press the **ENT** Key.

The screen for setting the angle of the arrow will be displayed.



6. Align the arrow with the angle of the line.
   Down/Right Keys: Move the arrow clockwise.
   Up/Left Keys: Move the arrow counterclockwise.

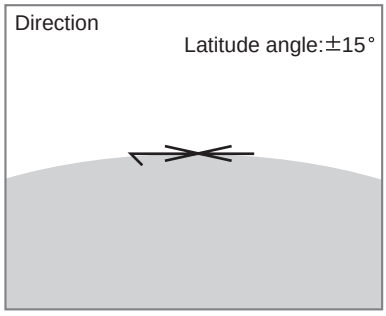
Example



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 3. Press the **TRIG** Key to return the arrow to the correct direction if the arrow direction has become unclear.

HELP Arrow directions (edge codes) and angles: See page 2-15-(27).

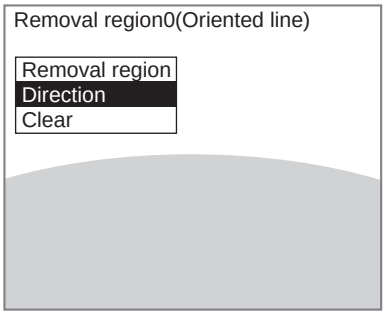
7. Press the **ENT** Key.
   The screen for setting the permissible range will be displayed.



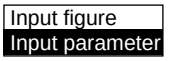
8. Set the permissible angle range. The maximum setting is ±45°.
   Up/Left Keys: Increase the range.
   Down/Right Keys: Decrease the range.
9. Press the **ENT** Key.
   The settings will be registered and the screen in (1.) will return.

Input Parameter

1. Select ***Direction***.

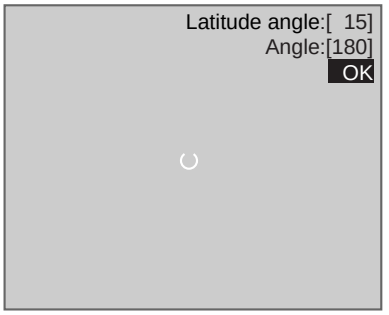


The selections for the registration method will be displayed.



2. Select ***Input parameter.***

   The setting screen will be displayed.



3. Set the parameters so that the lines that are not needed are removed.

HELP Angles: See page 2-15-(27).

CHECK The latitude of angle is set on both sizes of the angle. For example, if the angle is set to 180° and the latitude is set to 15°, lines at 165° to 195° will be removed.

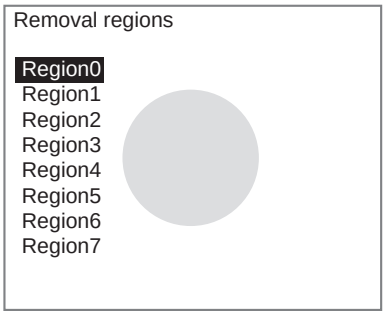
4. Select ***OK.***

   The settings will be registered and the screen in (1.) will return.

2-15-3-4 Clearing Removal Regions

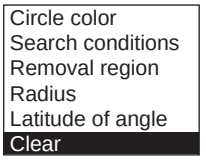
The clear operation is performed separately for each region.

1. Select the number of the region to be cleared.

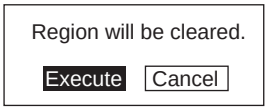


A list of setting selections will be displayed.

When removing circular regions



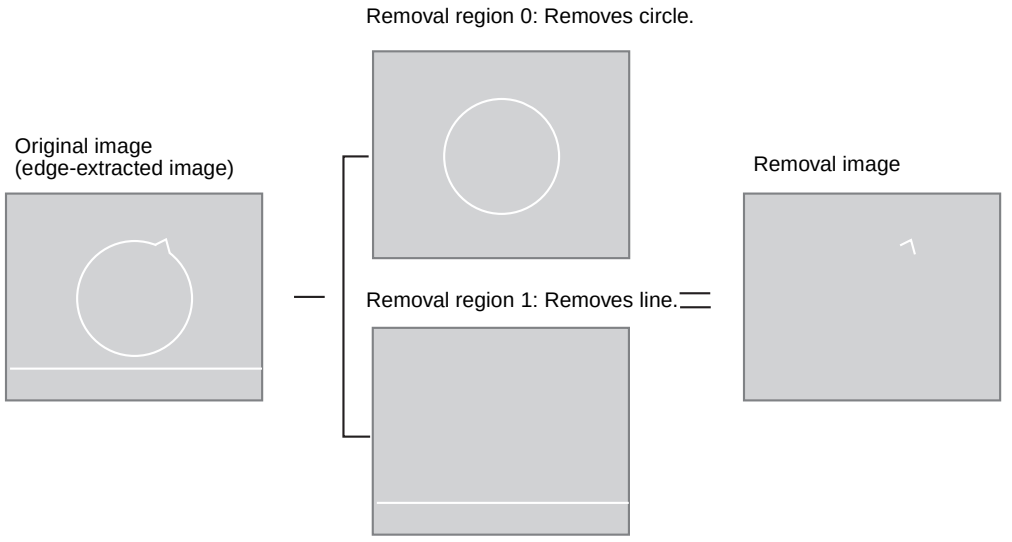
2. Select ***Clear***.
   A confirmation message will be displayed.



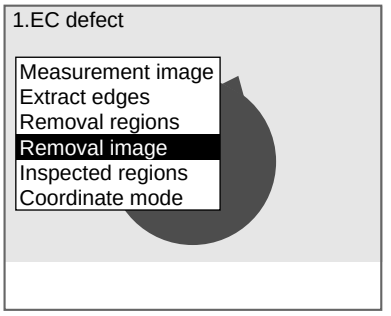
3. Select ***Execute***.
   The region will be cleared and the screen in (1.) will return.

2-15-4 Checking the Removal Image

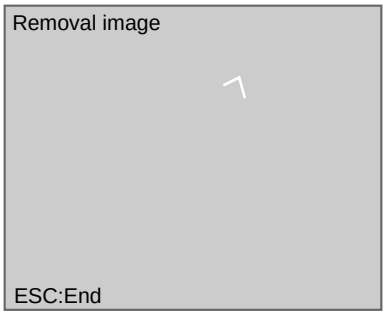
The removal image with the settings for removal regions 0 to 7 can be displayed on the screen for checking.



1. Select ***Removal image.***



The removal image will be displayed.

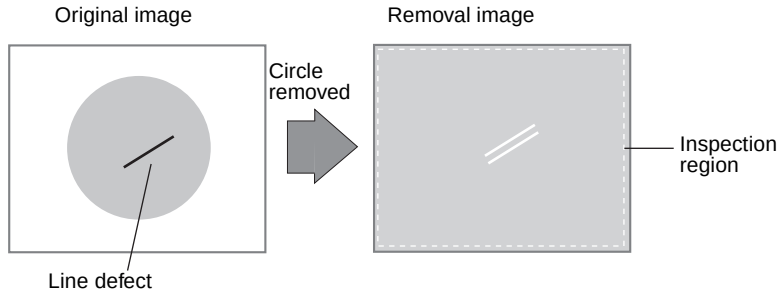
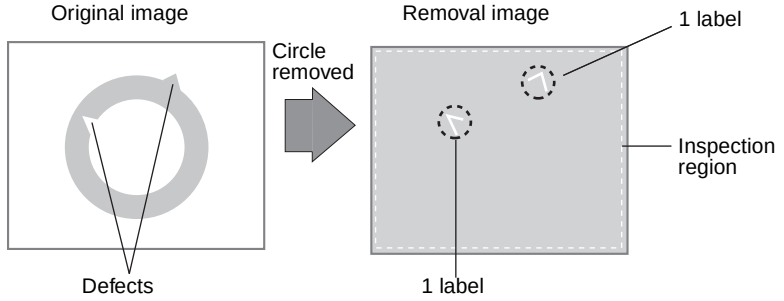
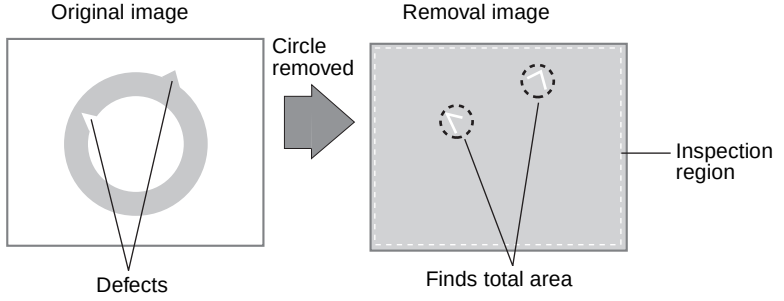


2. Press the **ESC** Key.
   The screen in (1.) will return.

2-15-5 Setting Inspection Regions

There are 3 inspection methods available for selection.

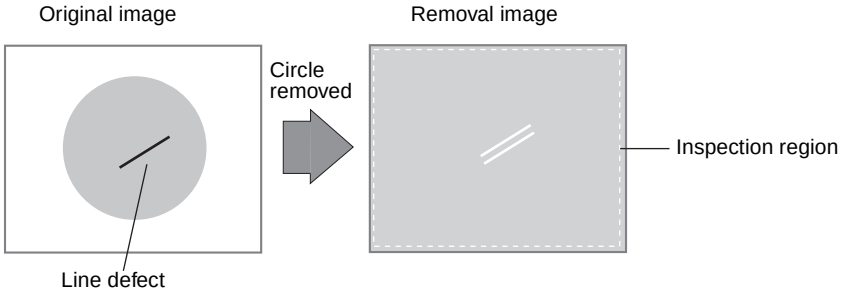
Up to 8 regions can be set and separate inspection methods can be chosen for each region.

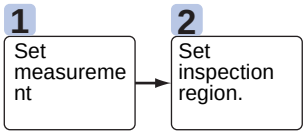
Inspection method	Details
Defect	Detects line defects for the removal image produced from the settings for removal regions 0 to 7. Only the 2 parallel lines in the edge-extracted image are detected as defects. 
Labeling	Performs labeling on the removal image produced from the settings for removal regions 0 to 7. The number of defects and the size of each defect can be found. 
Gravity and area	Performs gravity and area processing on the removal image produced from the settings for removal regions 0 to 7. The total white pixel area can be found. 

2-15-5-1 Defect

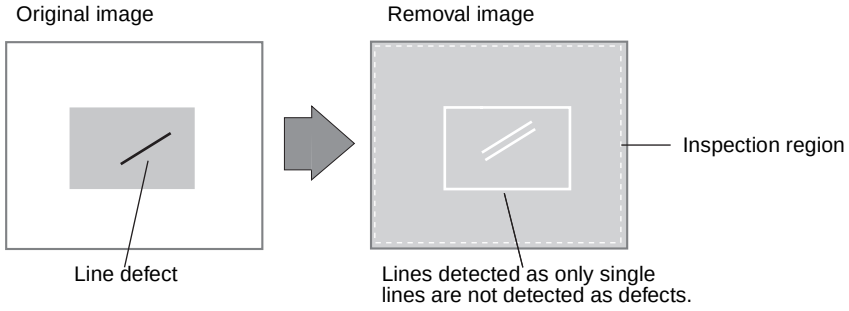
This defect inspection operation detects line defects on a removal image.

Only the 2 parallel lines in the edge-extracted image are detected as defects.



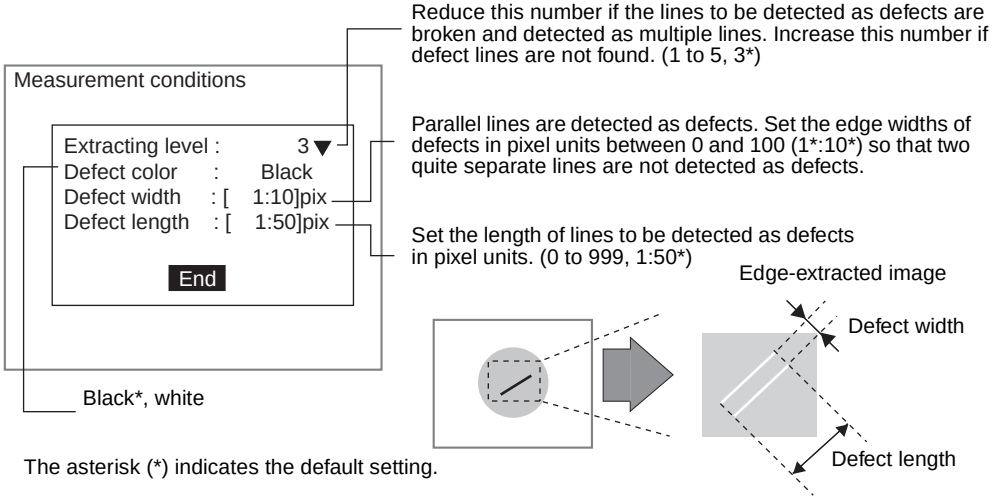


CHECK Any lines in the measurement object that are detected as only single lines, such as the exterior, are ignored. In this case, it is not necessary to set removal regions.



STEP 1: Setting Measurement Conditions

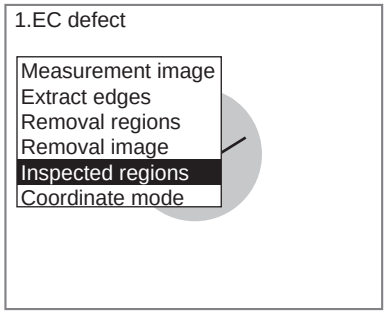
Set the conditions for detecting lines as defects.



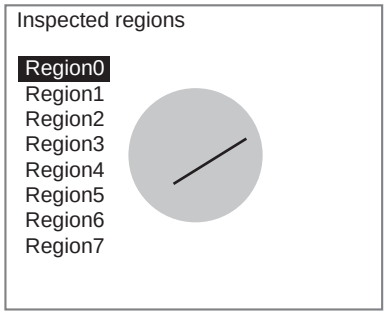
The asterisk (*) indicates the default setting.

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.

1. Select ***Inspected regions***.

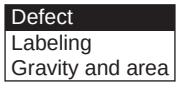


A list of inspected regions will be displayed.



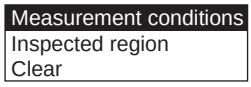
2. Select a region number.

   The measurement method selections will be displayed.



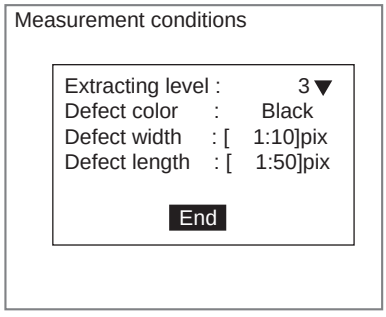
3. Select ***Defect***.

   The initial Defect Screen will be displayed.



4. Select ***Measurement conditions***.

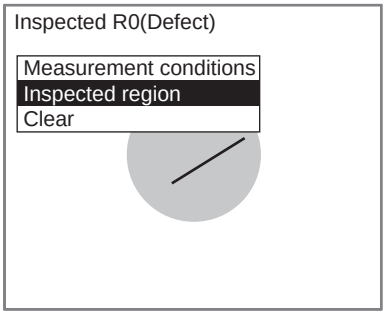
   The Measurement Conditions Settings Screen will be displayed.



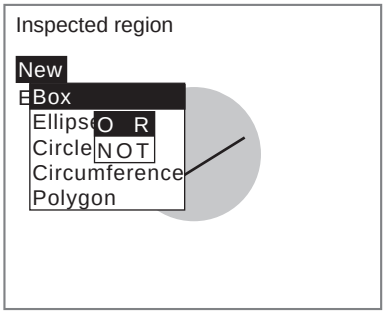
5. Make the settings for each item.
6. Select ***End***.
   The settings will be registered and the screen in (3.) will return.

STEP 2: Setting Inspected Regions

1. Select ***Inspected region***.



   The Inspected Region Settings Screen will be displayed.



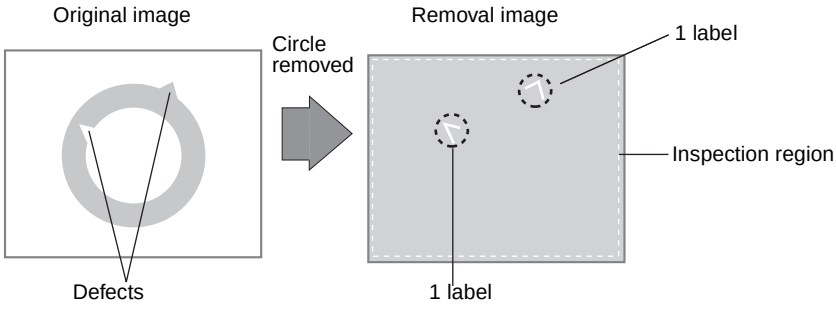
2. Set the region.
   The method for drawing the region is the same as for removal regions.

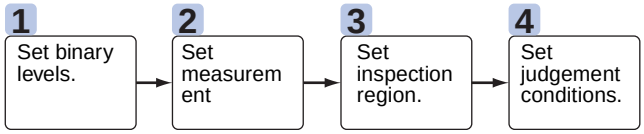
SeeAlso Refer to page 2-15-(13).

Once the region has been drawn, the screen in (1.) will return.

2-15-5-2 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.



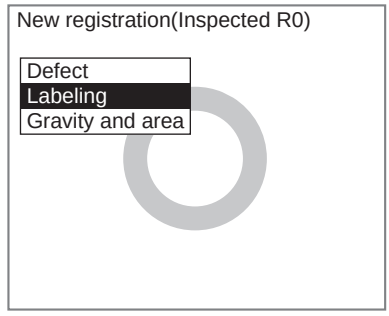


STEP 1: Setting Binary Levels

Adjust the binary levels so that the area to be measured appears as white pixels.

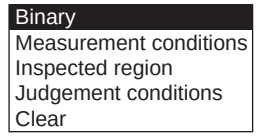
1. Display the measurement method selections using the same steps 1 to 3 as outlined under *Defect.*

SeeAlso Refer to page 2-15-(32).



2. Select ***Labeling***.

   The initial Labeling Screen will be displayed.

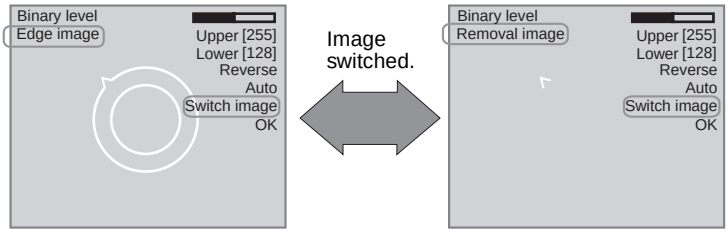


3. Select ***Binary***.

   The settings screen for binary levels will be displayed.

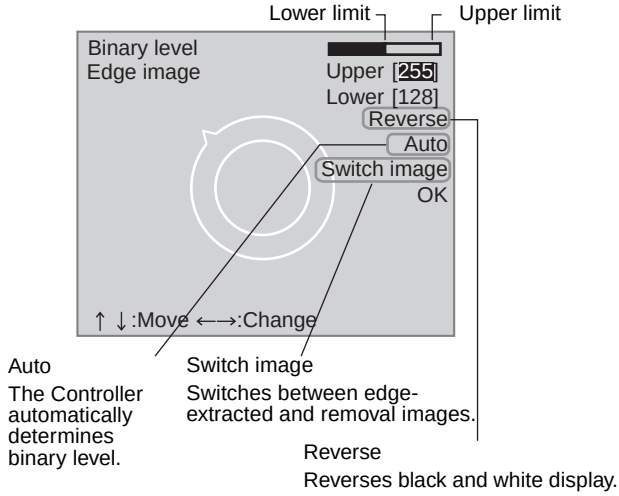
CHECK An edge-extracted image (the original image with edge extraction) is displayed. When ***Switch image*** is selected, the removal image will be

switched to. If a NG image is shown, display the removal image and adjust the binary level.



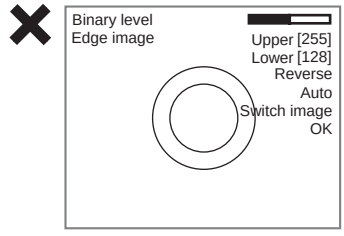
4. Move the cursor to the upper limit and press the **Left** and **Right** Keys to change the value.

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 10 times faster.
Up and Down Keys:	Switches between setting items.



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

CHECK Set the upper and lower limits to make the measurement object white.



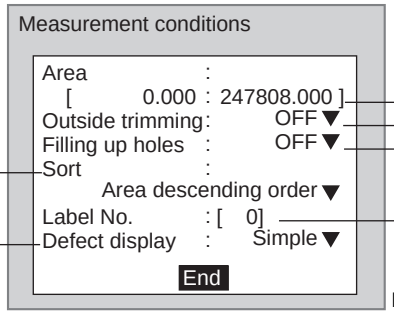
6. Select ***OK***.

   The settings will be registered and the screen in (2.) will return.

STEP 2: Setting Measurement Conditions

Set the area and sort conditions and label number for measuring labels.

Set the other conditions as required.



Area range for labels (0 to 9,999,999.999 (0*))

Output conditions for measurement value:
OFF*: Measures the binary image.
ON: Measures all pixels outside the inspected region as white pixels.

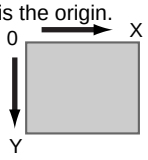
Output conditions for measurement value:
OFF*: Outputs area and center of gravity coordinates before filling holes.
ON: Outputs area and center of gravity coordinates after filling holes.

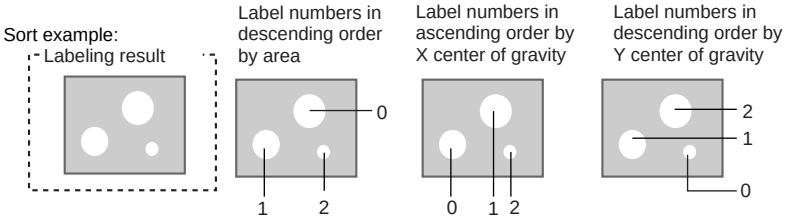
Label number (0 to 2499 (0*)) for defect evaluation.

Defect display method on measurement screen (regions displayed separately):
Simple*: A display cursor indicates defects.
Detail: Defects shown in NG color. Longer processing time required than for simple display.
Refer to page 2-15-(42).

Conditions for reassigning label numbers
Area descending order*: Sorts in descending order by area.
Area ascending: Sorts in ascending order by area.
Gravity X descending: Sorts in descending order by center of gravity X coordinate. (See note.)
Gravity X ascending: Sorts in ascending order by center of gravity X coordinate. (See note.)
Gravity Y descending: Sorts in descending order by center of gravity Y coordinate. (See note.)
Gravity Y ascending: Sorts in ascending order by center of gravity Y coordinate. (See note.)

Note When X and Y center of gravity are sorted, the upper left corner of the measurement region is the origin.

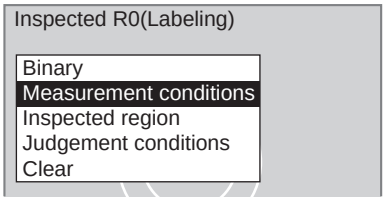




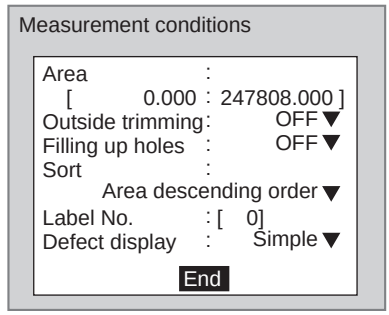
CHECK The coordinates set using calibration are not affected by labeling.

The asterisk (*) indicates the default setting.

1. Select ***Measurement conditions.***



The Measurement Conditions Settings Screen will be displayed.

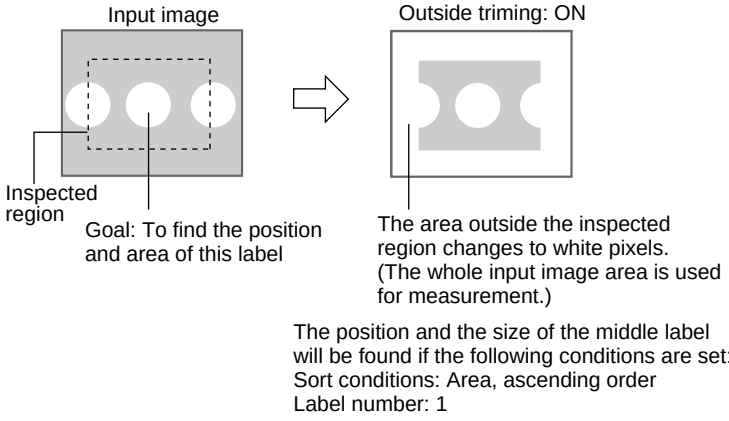


2. Change the settings.

   The settings will be registered and the screen in (1.) will return.

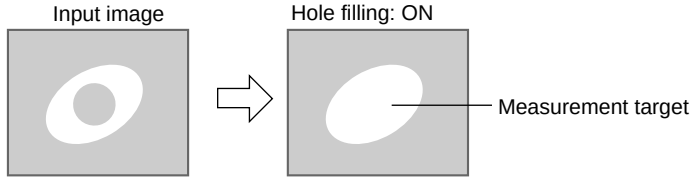
CHECK Outside Trimming

Select *Outside trimming* when there is a white-pixel area inside the inspected region that is not to be measured.



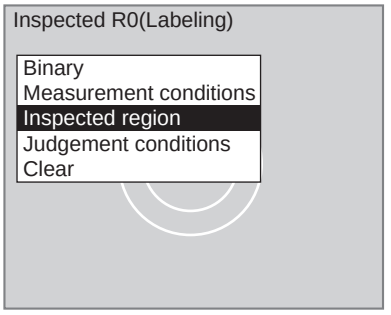
CHECK Filling Up Holes

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.

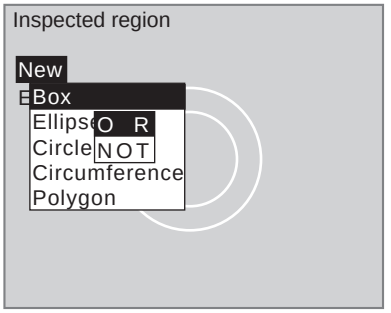


STEP 3: Setting Inspected Regions

1. Select ***Inspected region***.



The Inspected Region Settings Screen will be displayed.



2. Set the region.

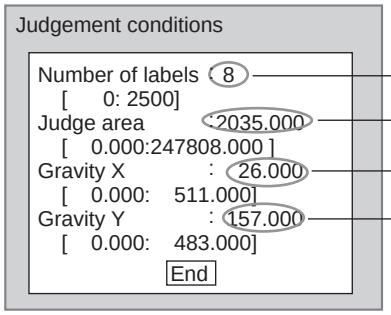
   The method for drawing the region is the same as for removal regions.

SeeAlso Refer to page 2-15-(13).

Once the region has been drawn, the screen in (1.) will return.

STEP 4: Setting Judgement Conditions

Set the ranges for the number of labels, area and center of gravity for an OK judgement.



Ranges for an OK judgement
Range for number of labels in measurement region (0 to 2,500)

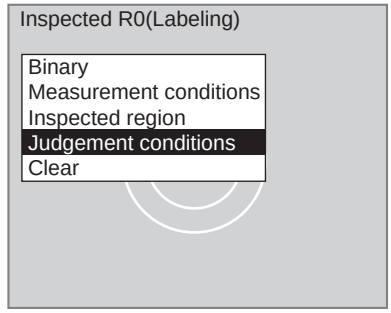
Range for specified label number area (0 to 9,999,999.999)

Range of movement in X direction for specified label number (–9,999.999 to 9,999.999)

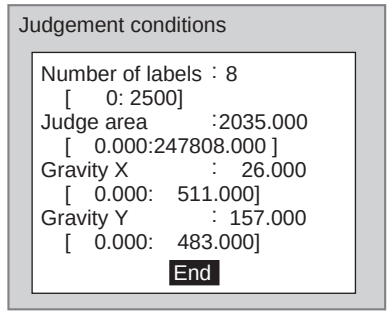
Range of movement in Y direction for specified label number (–9,999.999 to 9,999.999)

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

1. Select ***Judgement conditions***.



The Judgement Conditions Settings Screen will be displayed.

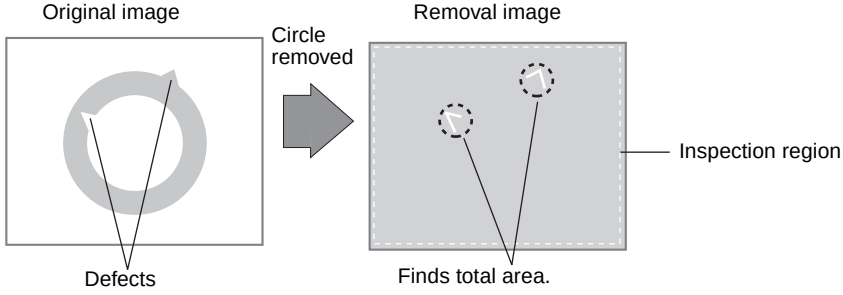


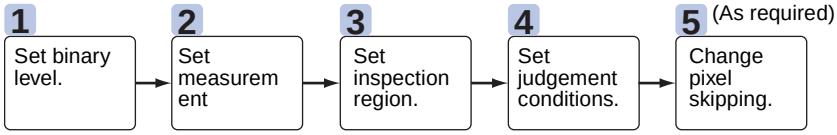
2. Make the settings for each item.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

2-15-5-3 Gravity and Area

Gravity and area processing is performed on the removal image. The total white pixel area is found and evaluated for defects.



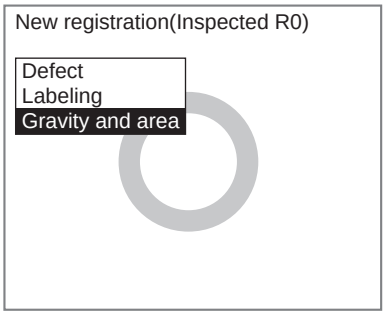


STEP 1: Setting Binary Levels

Adjust the binary levels so that the area to be measured appears as white pixels.

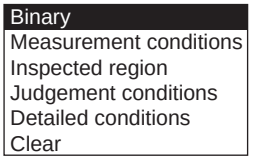
1. Display the measurement method selections using the same steps 1 to 3 as outlined under *Defect.*

SeeAlso Refer to page 2-15-(32).



2. Select ***Gravity and area***.

   The initial Gravity and Area Screen will be displayed.



3. Select ***Binary***.

   The rest of the procedure is the same as for labeling.

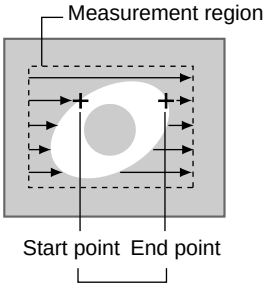
SeeAlso Refer to page 2-15-(35).

STEP 2: Setting Measurement Conditions

Set the measurement conditions if using fill profile or defect display functions.

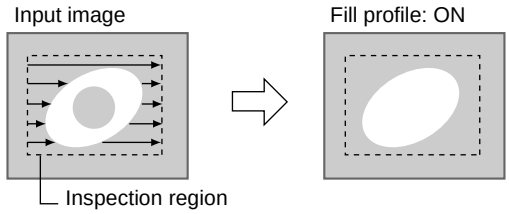
Fill Profile

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. The default setting is OFF.

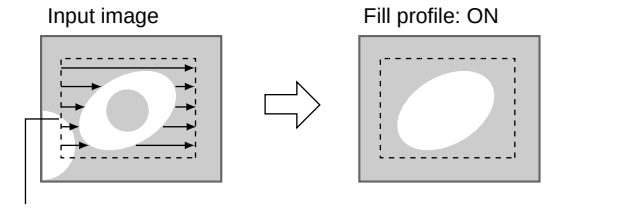


This area will be measured as white pixels.

Example

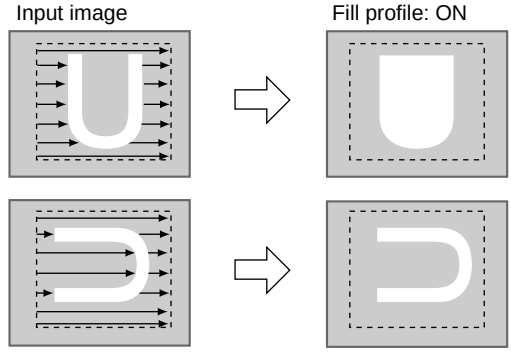


When a White-pixel Section Encroaches on the Inspected Region



Measuring Open-form Measurement Objects

The measurement result changes depending on the orientation of the measurement object.



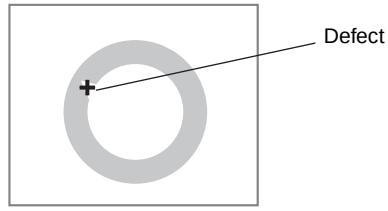
Defect Display

Select the method for displaying defects on the measurement screen (where regions are displayed separately).

SeeAlso Refer to page 2-16-(20).

Simple

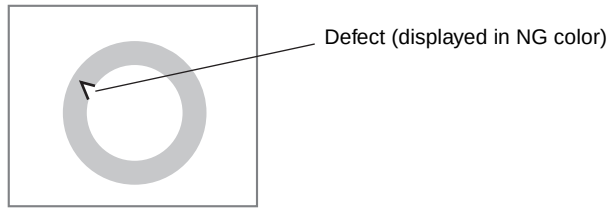
A display cursor will appear at the defect position. This is the default setting.



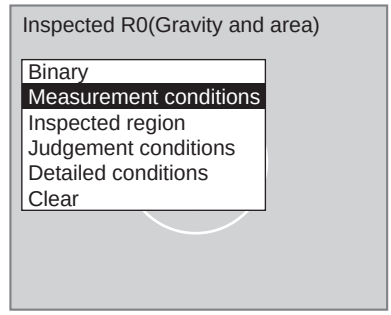
CHECK When there are defects at multiple positions, the display cursor will appear at the center of gravity of the total white pixel area and may not, therefore, appear exactly at the defect position.

Detail

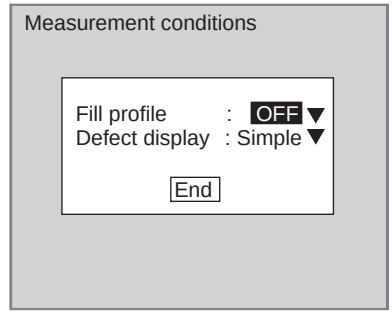
Defects will appear in the NG color. This option requires longer processing time than simple display.



1. Select ***Measurement conditions***.



The Measurement Conditions Settings Screen will be displayed.

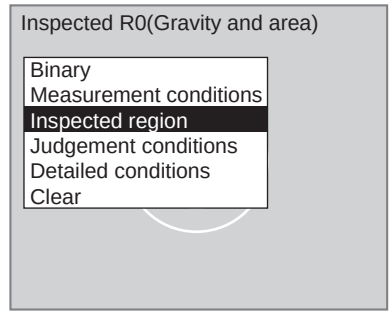


2. Make the fill profile and defect display settings.
3. Select ***End***.

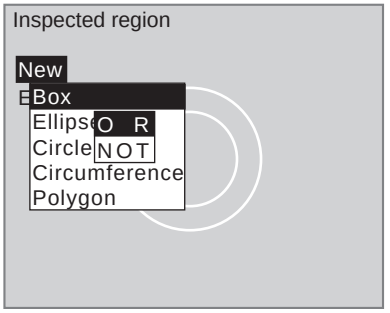
   The settings will be registered and the screen in (1.) will return.

STEP 3: Setting Inspection Regions

1. Select ***Inspected region***.



The Inspected Region Settings Screen will be displayed.



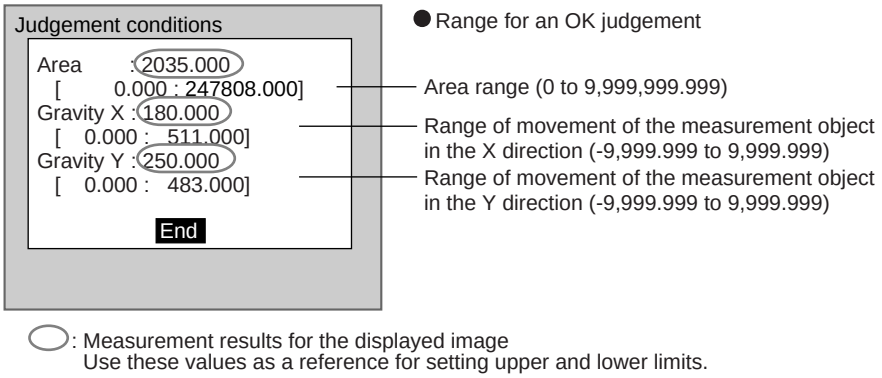
2. Set the region.
   The method for drawing the region is the same as for removal regions.

SeeAlso Refer to page 2-16-(20).

Once the region has been drawn, the screen in (1.) will return.

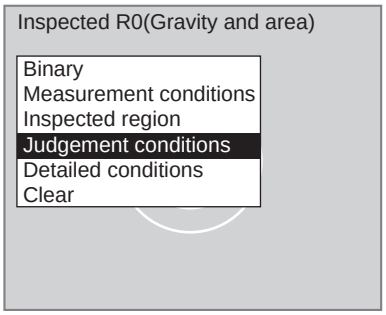
STEP 4: Setting the Judgement Conditions

Make settings for the area and center of gravity.

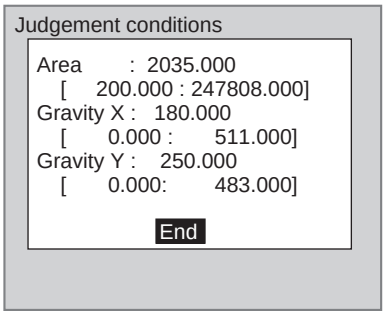


: Measurement results for the displayed image
Use these values as a reference for setting upper and lower limits.

1. Select ***Judgement conditions***.



The Judgement Conditions Settings Screen will be displayed.



2. Change the settings.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

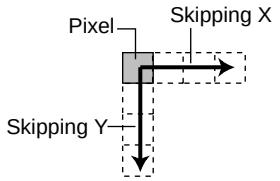
STEP 5: Changing Pixel Skipping

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.

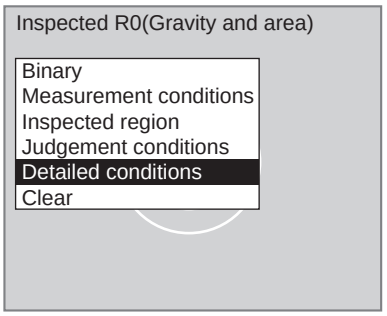
Once the skipping setting has been changed, perform a measurement and confirm that measurement can be performed correctly.

Skipping X and Skipping Y

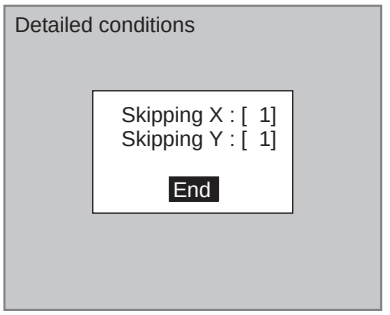
Set how many pixels to skip in the inspected region during measurement. The default setting is 1, which means that all of the measurement region will be measured.



1. Select ***Detailed conditions***.



The Detailed Conditions Settings Screen will be displayed.

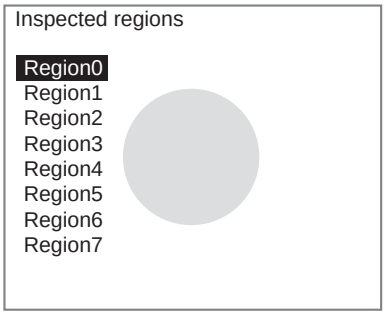


2. Set the number of pixels to skip.
3. Select ***End***.
   The setting will be registered and the screen in (1.) will return.

2-15-5-4 Clearing Inspection Regions

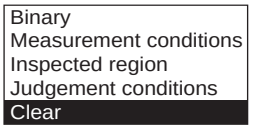
The clear operation is performed separately for each region.

1. Select the number of the region to be cleared.

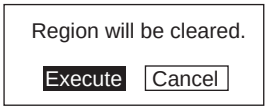


The setting selections will be displayed.

Example: For labeling inspected regions



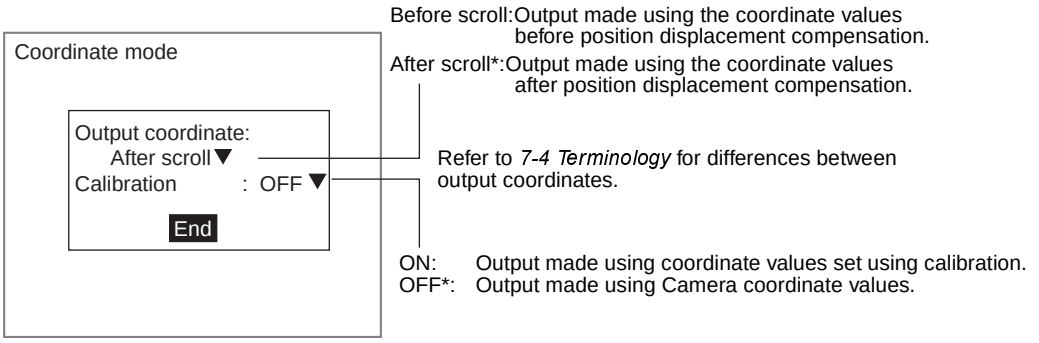
2. Select ***Clear***.
   A confirmation message will be displayed.



3. Select ***Execute***.
   The region will be cleared and the screen in (1.) will return.

2-15-6 Setting the Coordinate Mode

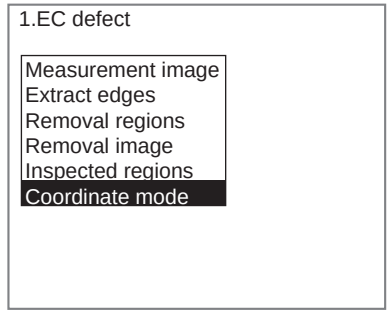
Select the type of coordinate values.



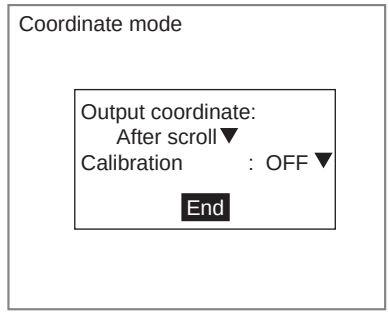
The asterisk (*) indicates the default setting.

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.

1. Select ***Coordinate mode***.



The Coordinate Mode Settings Screen will be displayed.



2. Make the settings for each item.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

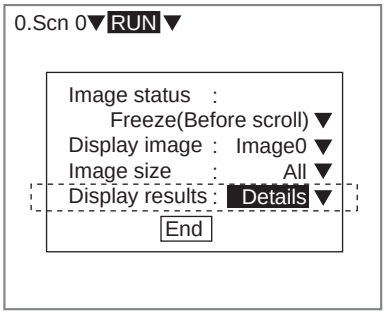
2-15-7 Measurement Screens

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

This section describes what kind of information can be displayed for EC defect inspections.

SeeAlso Refer to *SECTION 3 Monitor Mode and Run Mode* for details on Monitor and Run modes.

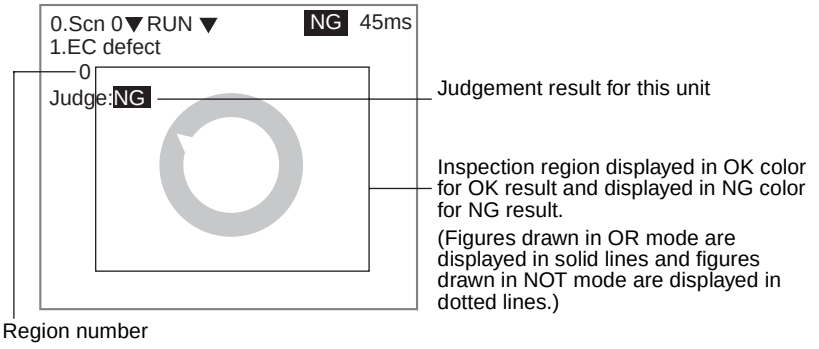
CHECK Press the **SHIFT+ESC** Keys on the Run Screen to access the following screen and change ***Display results*** to ***Details.***



Press the **Up** or **Down** Key to change to the unit for which EC defect inspection is set and the following detailed screens will be displayed.

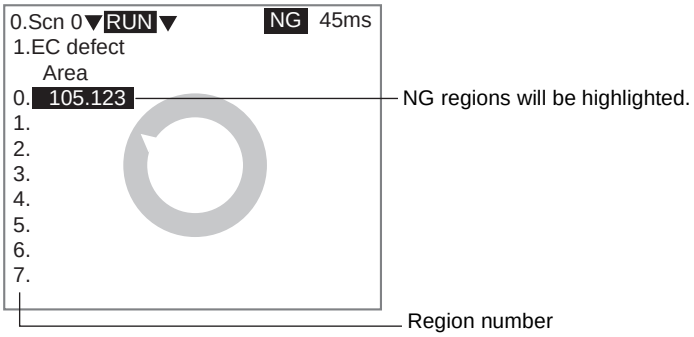
Press the **SHIFT+Right** or **Left** Keys to switch in order between the five screens.

Judgement Result



Defect Area

A list of the area of defects will be displayed for each region.

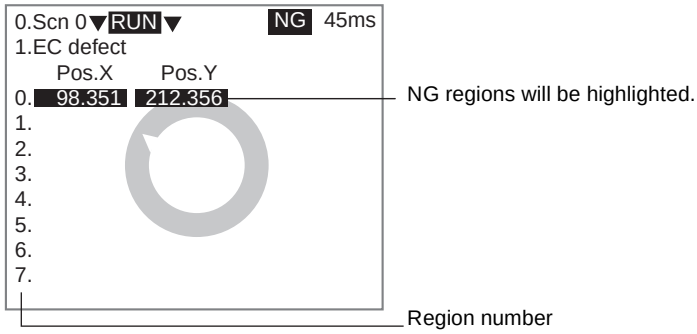


CHECK If the font size is set to small, the list of positions and defect area and defect position and defect width and length screens will be listed together.

If the font size is set to normal, the defect area, defect position, and defect width and length screens will be displayed consecutively.

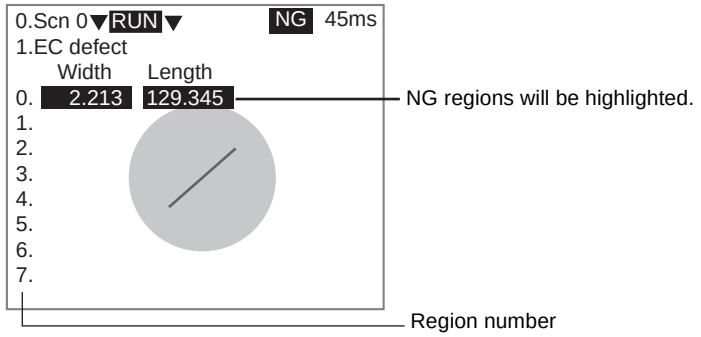
Defect Position

A list of defect positions for each region will be displayed.



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.



Individual Region Display

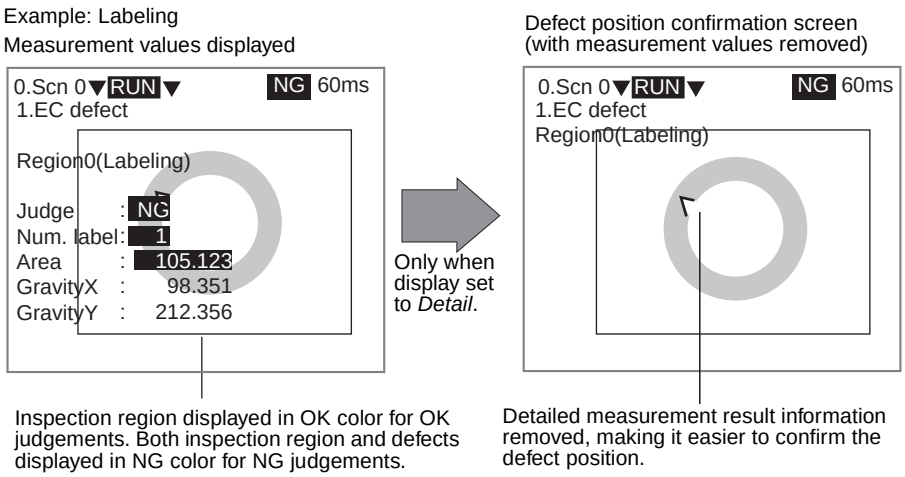
More detailed measurement results are displayed for each region.

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.

SeeAlso Refer to page 2-15-(37) and page 2-15-(42).

Defect, Labeling, and Gravity and Area

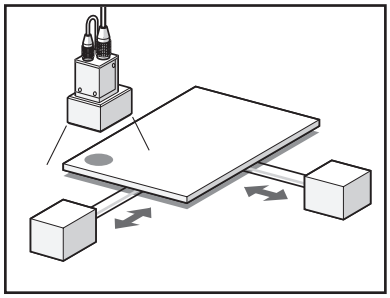


CHECK When individual region display is selected, the position of defects can be confirmed on screen but the processing time is longer than other display screens. The processing time is shown in the upper right corner of the screen.

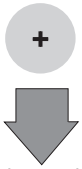
2-16 EC Positioning

The EC Positioning processing item finds positioning marks using shape information, such as “round” or “angular.” High precision positioning is possible even if the measurement object is deformed or chipped.

This processing item can also be used with low contrast images.



Positioning Marks

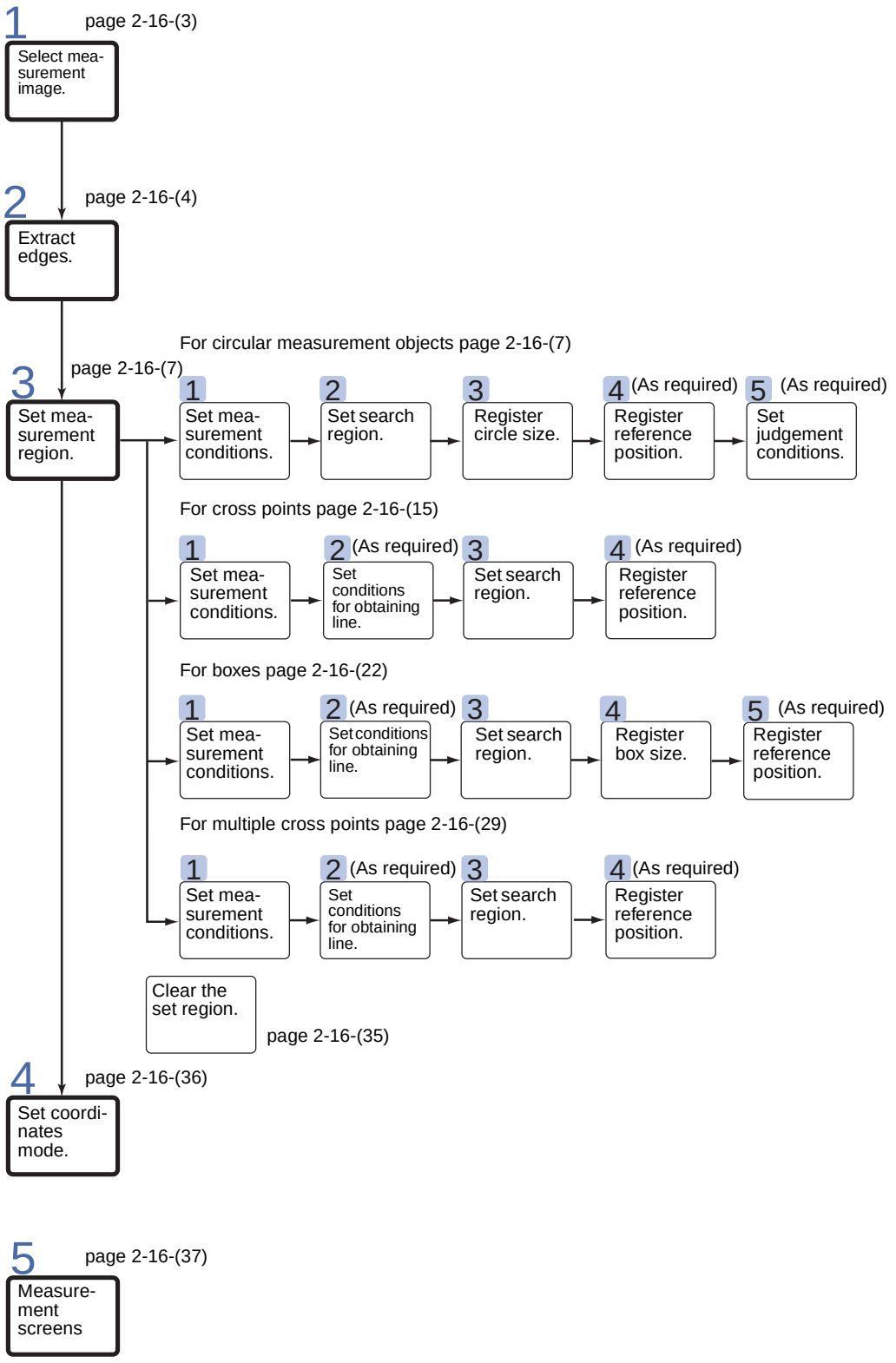


Positioning marks can be found even under the following conditions.

This function can be used for positioning of a variety of shapes.

HELP Refer to *7-4 Terminology* for information on edge codes (EC).

Operational Flow

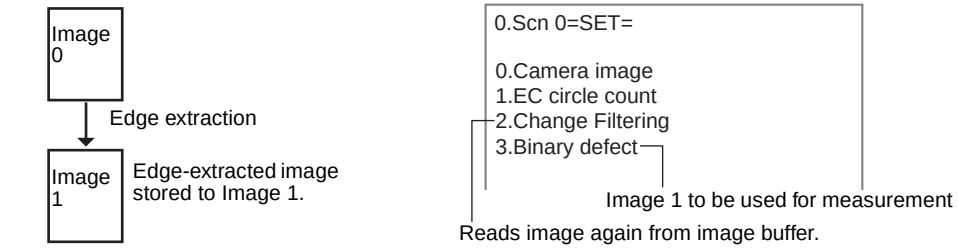


2-16-1 Selecting Measurement Images

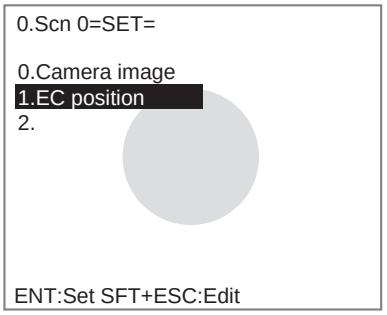
This section describes how to select an image stored at either Image 0 or Image 1 as the image for measurement.

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 position compensation was set. Then store the image stored in the image buffer to Image 0 or Image 1.

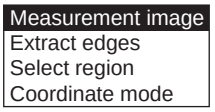
Example: When Image 0 Is Selected as Measurement Image



1. Select ***EC position***.

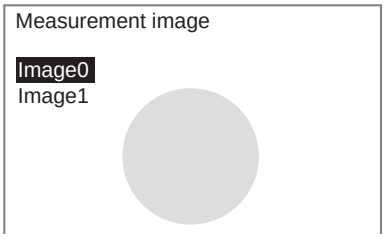


The initial EC Positioning Screen will be displayed.



2. Select ***Measurement Image***.

   The selections will be displayed.



3. Select which image will be used for measurement, the image stored at Image 0 or the image stored at Image 1.
4. Press the **ENT** Key.

   The setting will be registered and the screen in (1.) will return.

2-16-2 Extracting Edges

EC positioning is performed for images for which the edges have been extracted.

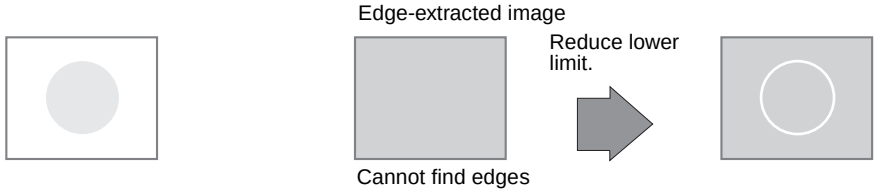
Adjust the upper and lower levels for edge extraction if there is low contrast between the measurement object and the background and to remove noise.

Upper and Lower Limits for Edge Extraction Image

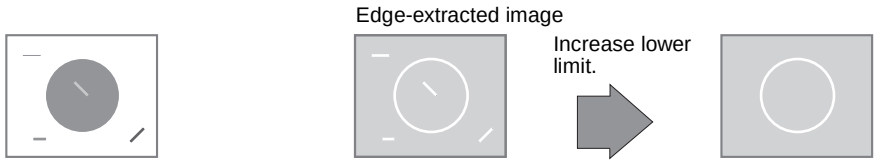
Set the level to which the background will be cut from the edge-extracted image. The levels can be set between 10 and 255 (default 100:255).

Areas with a density above the lower limit will become the edge of the measurement object. Refer to the following examples and adjust the upper and lower limits.

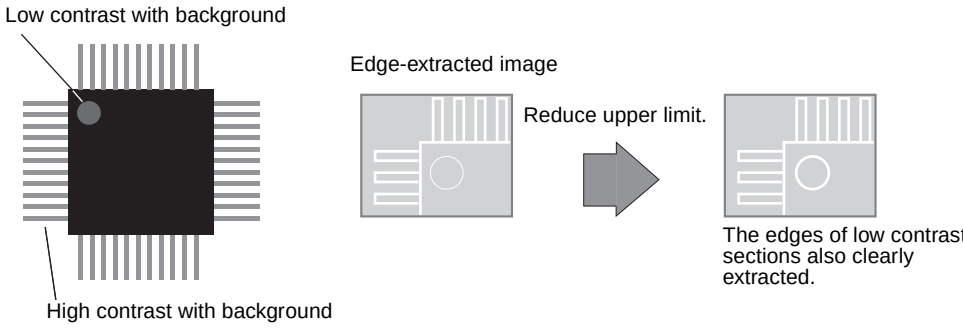
Example: Cannot Find Edges Due to Low Contrast



Example: To Remove Noise



Example: Other Edges Clearly Extracted But Cannot Find Desired Mark Edge with Stability



CHECK If the lower limit is too low, low-level noise may remain even if the image appears noise-free on the screen. If measurements are not stable, use the following methods to see if unwanted edges have been extracted and eliminate them.

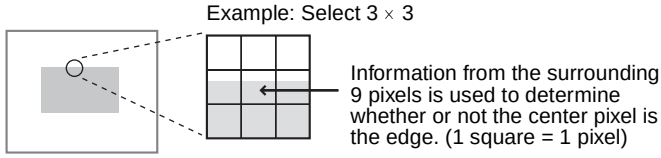
- Checking Method
  Lower the upper limit to the same value as the lower limit. If unwanted edges are displayed, then the lower limit is too low. Return the upper limit to its original value after completing this check.
- Elimination Method
  Increase the lower limit, or use smoothing or median filtering.

SeeAlso Refer to *2-1 Inputting Camera Images* and *2-4 Filtering Again* (where smoothing can be set to be executed twice).

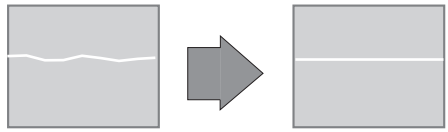
Mask Size

The mask size function is used when searching for edges to judge edges using peripheral information. Select how much peripheral pixel information to use. The selections are 5 × 5 (default) or 3 × 3.

CHECK This setting will be enabled only if *Frame/Field* under *Camera image* is set to *Frame*. If set to *Field*, the effect will remain the same as if 5 × 5 is selected even if 3 × 3 is selected.



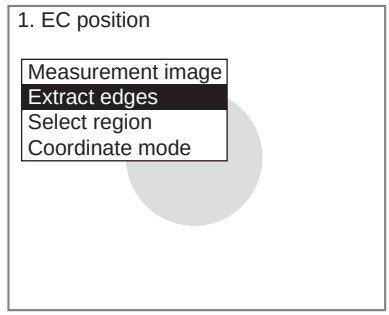
The greater the mask size, the more the variations in surrounding pixels can be absorbed. Select 5 × 5 to ignore uneven edges.



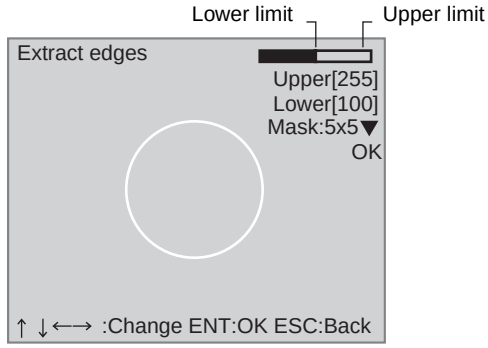
CHECK This function is even more effective if smoothing is used.

SeeAlso Refer to *2-1 Inputting Camera Images*, *2-3 Changing Filtering*, and *2-4 Filtering Again* (where smoothing can be set to be executed twice).

1. Select ***Extract edges***.



The screen for setting edge extraction levels will be displayed.



2. Set the upper and lower limits.

   Right Key: Increases the lowest digit by one.

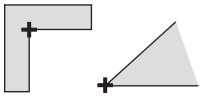
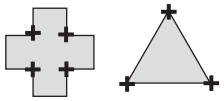
   SHIFT+Right Keys: Increases the value 10 times faster.

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

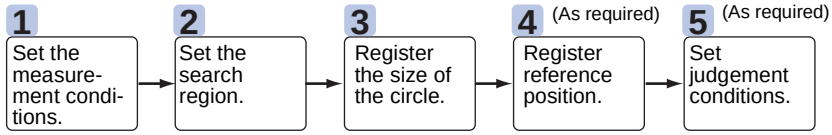
3. Select the mask size.
4. Select **OK**.
   The settings will be registered and the screen in (1.) will return.

2-16-3 Setting Measurement Regions

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.

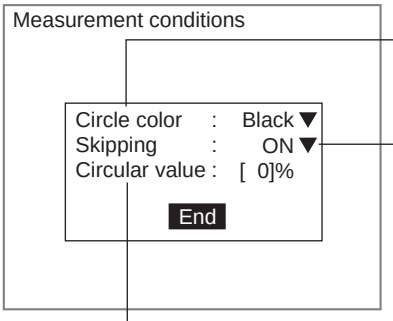
Positioning mark		Figure	Details
Circular 		Circle	Searches for a circle of a specified size and can output the position coordinates (center of the circle).
Box 		Box	Searches for a rectangle of a specified size and can output the position coordinates. The center or one of the four corners can be selected for the position coordinates.
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.
	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.

2-16-3-1 Circles



STEP 1: Setting Measurement Conditions

Set the conditions to search for the positioning mark.



Select whether the color of the circle that is the positioning mark will be white or black compared to the background.

Select “white/black” if circle color not fixed to either black or white. (Black*, white, white/black)

Select whether pixel skipping (1 pixel) will be used when searching for the circle. (ON*, OFF)

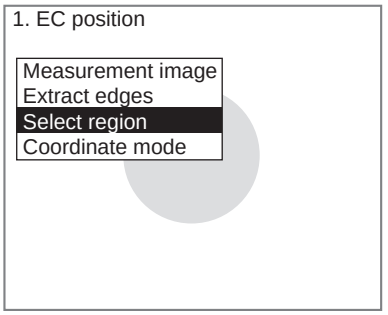
Processing is faster if pixel skipping is ON so normally it is appropriate to set pixel skipping to ON. However, if the measurement values vary, set to OFF.

Checks circle deformation. (0% to 100% (0%*))

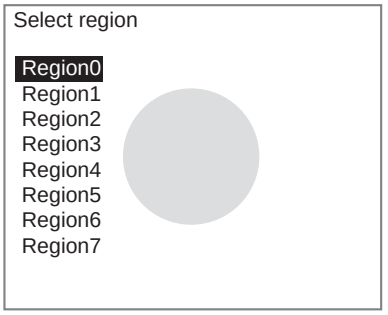
The value drops if the circle is deformed or chipped. The object is not extracted as a circle if the value is lower than the set value.

The asterisk (*) indicates the default setting.

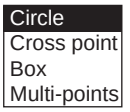
1. Select ***Select region***.



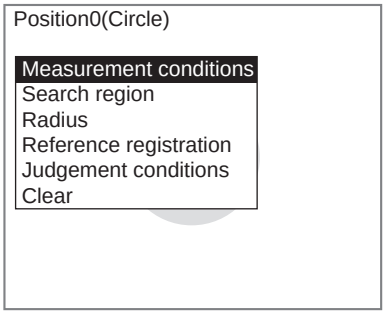
A list of regions will be displayed.



2. Select a region number.
   The figure selections will be displayed.

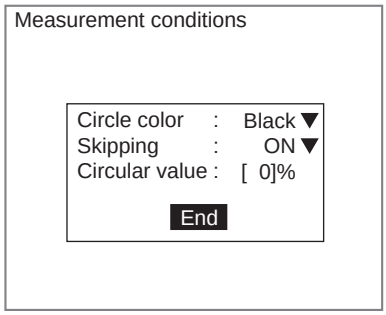


3. Select ***Circle***.
   The initial Circle Screen will be displayed.



4. Select ***Measurement conditions***.

The Measurement Conditions Settings Screen will be displayed.



5. Make the settings for each item.
6. Select ***End***.

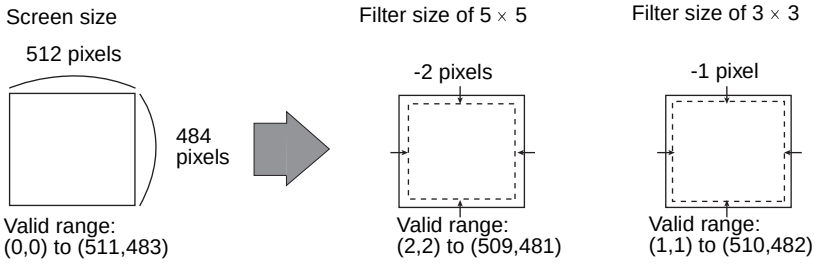
   The settings will be registered and the screen in (3.) will return.

STEP 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.

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.

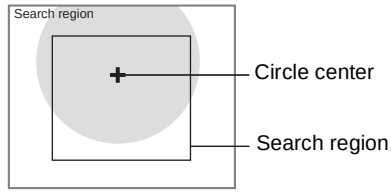


Each time the image is filtered, the range of inaccurate pixels will be increased further. For example, if filtering is performed twice, the valid range will be reduced as follows:

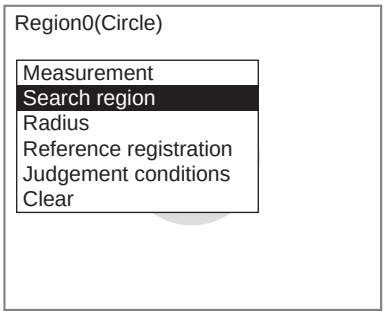
Filter size of 5 × 5: -2 pixels × 3 = -6 pixels
Filter size of 3 × 3: -1 pixel × 3 = -3 pixels

(Filtering is also performed once in edge extraction, so filtering is actually performed a total of three times.)

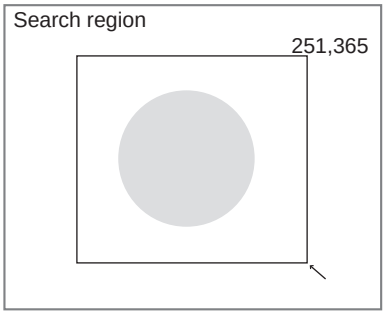
CHECK The search can be performed even if the whole circle is not within the search region, as long as the center of the circle is within the region.



1. Select ***Search region***.



The screen for drawing search regions will be displayed.



2. Draw a rectangular search region.

   Specify the upper left and lower right coordinates.

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

   ENT Key: Confirms the settings.

   When the bottom right coordinates have been set, the screen in (1.) will return.

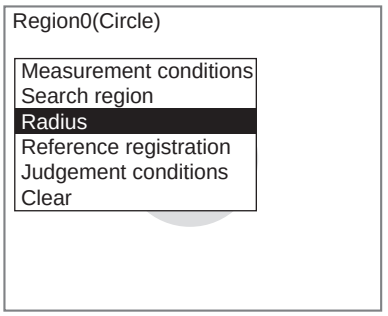
STEP 3: Registering the Size of the Circle

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

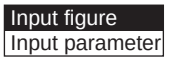
Registration method	Details
Input figure	The measurement object is displayed on the screen, a circle is drawn on the exterior edge of the object and the size of the circle is registered.
Input parameter	The radius of the circle and the permissible range are entered as parameters (in pixel units).

Inputting Figures

1. Select ***Radius***.

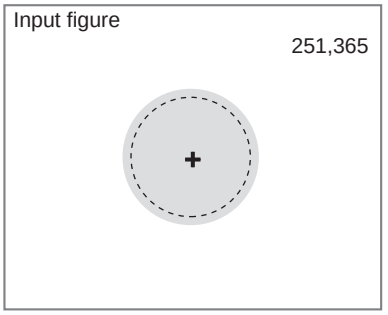


The registration selections will be displayed.



2. Select ***Input figure***.

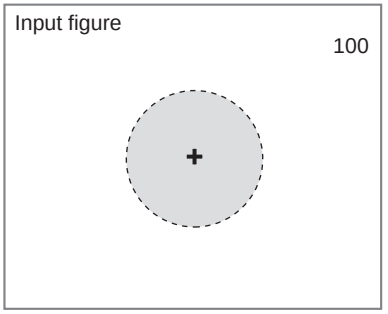
The screen for drawing figures will be displayed.



3. Specify the center position of the circle.

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

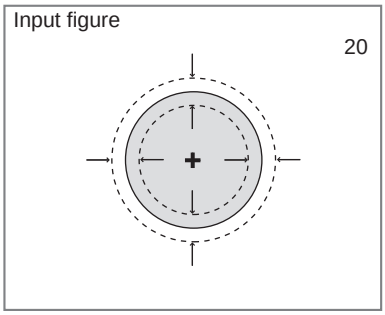
The screen for setting the radius will be displayed.



4. Specify the radius (3 to 512 pixels).

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.



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

   Up/Right Keys: Larger

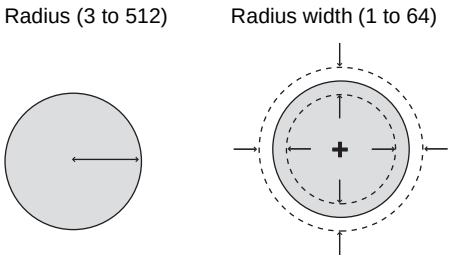
   Down/Left Keys: Smaller

   ENT Key: Confirms the setting.

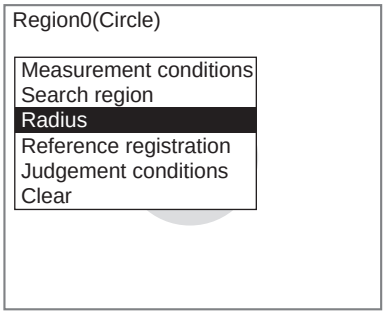
   The settings will be registered and the screen in (1.) will return.

Inputting Parameters

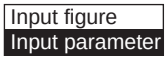
Input the parameters in pixel units for the radius and latitude of the search circle.



1. Select ***Radius***.

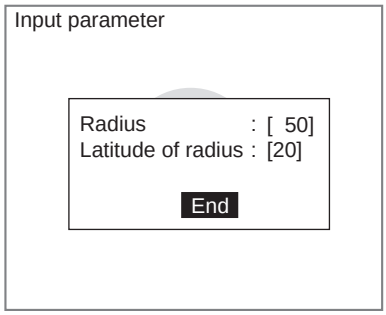


The registration selections will be displayed.



2. Select ***Input parameter***.

The Input Parameter Settings Screen will be displayed.



3. Make the settings for each item.
4. Select ***End***.

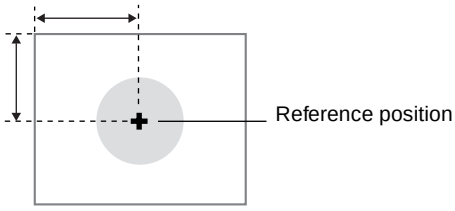
   The settings will be registered and the screen in (2.) will return.

STEP 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 using a calculation.

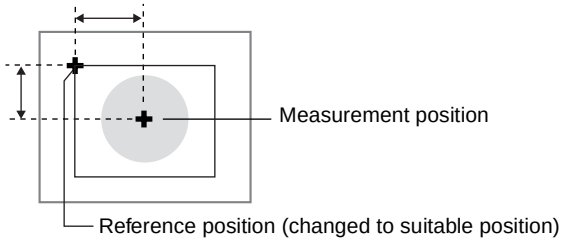
Example 1: Inspections to Detect If the Measurement Object is in the Same Position

Place the measurement object in the correct position and register that position as the reference position.

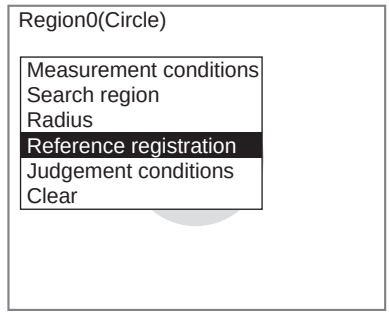


Example 2: Inspecting Position from a Specified Position

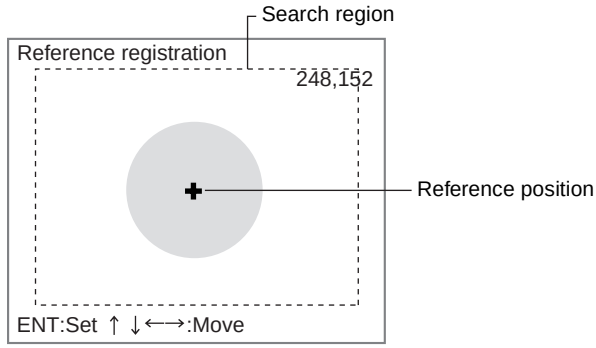
Change the reference position to a suitable position.



1. Select ***Reference registration***.



The circle will be found for the currently displayed image and a display cursor will be placed at the center of the circle.



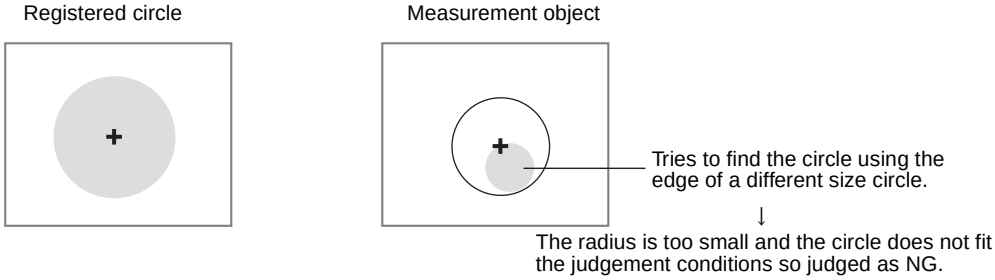
2. Press the **Up**/**Down** and **Right**/**Left** Keys to move the cursor to change the position.
3. Press the **ENT** Key to save the setting.

   The setting will be registered and the screen in (1.) will return.

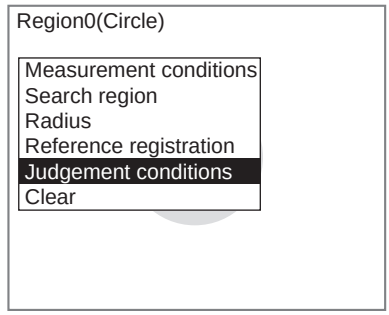
STEP 5: Setting Judgement Conditions

Set the conditions for judging whether or not a circle of the registered size has been found. Set in pixel units the radius of circles to receive an OK judgement. The setting range is 1.000 to 9,999.999. Any circles found of a different size can be judged as NG.

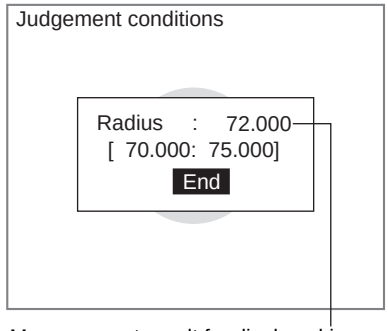
Example: Only Circles Smaller than the Registered Size Displayed on Screen



1. Select ***Judgement conditions***.



The Judgement Conditions Setting Screen will be displayed.

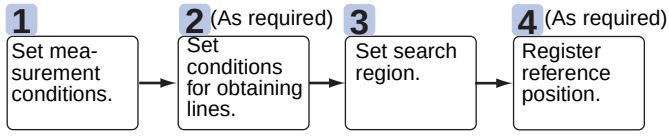


Measurement result for displayed image.
Use as a reference for upper and lower limits.

2. Set the radius range for an OK circle.
3. Select ***End***.

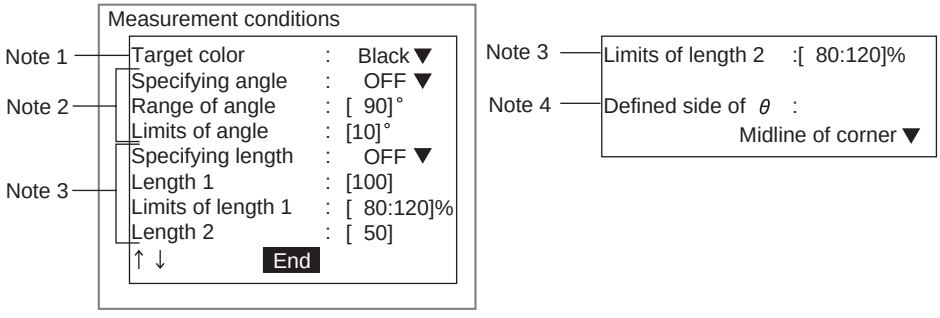
   The settings will be registered and the screen in (1.) will return.

2-16-3-2 Cross Points



STEP 1: Setting Measurement Conditions

Set the conditions for searching for the positioning mark.



Note

1. Select whether the color of the positioning mark will be white or black compared to the background. (Black*, white)

   The asterisk (*) indicates the default setting.

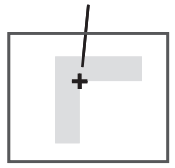
2. Angle
Use the following settings to set the angle of intersection and thus find the coordinates of only the desired intersection even though many lines exist on the screen.

Specifying angle: Set to ON.

Range of angle: Angle of the section in the target color (If the target color changes, change the angle setting too.)

Limits of angle: Set the permissible range for the angle.
Example: When the range of the angle is set to 90° and the limits of angle set to 10°, the cross point of lines that intersect at between 80° and 100° will be found.

Example: To find this intersection



Set the *Target color* to black, the *Specifying angle* to ON, and the *Range of angle* to 270°.

To find the coordinates of the cross point of lines regardless of their angle, set *Specifying angle* to OFF. The settings for the range of the angle and the limits of the angle will be ignored.

Setting item	Selection
Specifying angle	ON, OFF*
Range of angle	0 to 359
Limits of angle	0 to 99 (10*)

The asterisk (*) indicates the default setting.

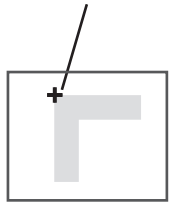
3. Length of lines
Use the following settings to set the length and thus find the coordinates of only the desired intersection even though many lines exist on the screen.

Specifying length: Set to ON.

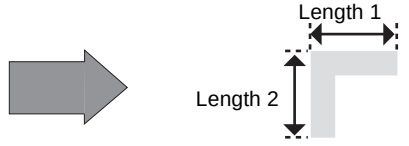
Length □: Set the line length in pixels.

Limits of length□: Set the permissible range for the length.

Example: To find this cross point



Set the *Target color* to black and the *Length 1* and *Length 2* to the lengths shown in the diagram.



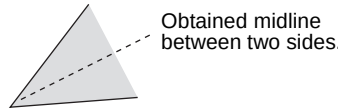
To find the coordinates of the cross point of lines regardless of their length, set *Specifying length* to OFF. The settings of the line lengths will be ignored.

Setting item	Selection
Specifying length	ON, OFF*
Length □	1 to 999
Limits of length □	1 to 200 (80:120*)

The asterisk (*) indicates the default setting.

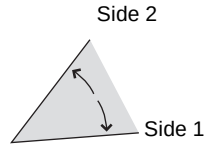
4. Only one angle (θ) will be output as the measurement results for the lines that are found. Select which position θ will be obtained.

   Midline of Corner*

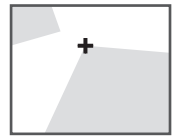


   The asterisk (*) indicates the default setting.

   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.

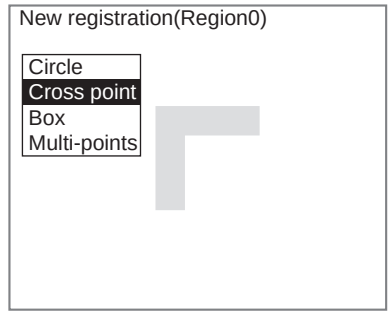


CHECK If both specifying angle and specifying length are set to OFF and there are multiple lines displayed on the screen, the cross point of the longest line and the line that crosses it will be found.



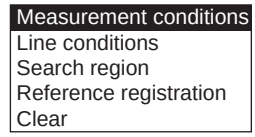
1. Display the figure selections using the same procedure as outlined in steps 1 to 3 for *Circle***.**

SeeAlso Refer to page 2-16-(25).



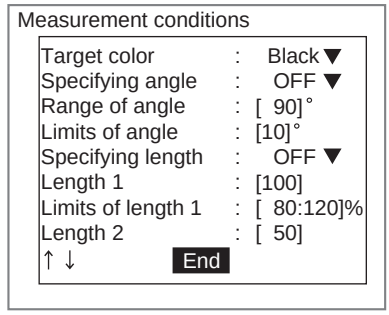
2. Select ***Cross point***.

   The settings selections will be displayed.



3. Select ***Measurement conditions***.

   The Measurement Conditions Settings Screen will be displayed.

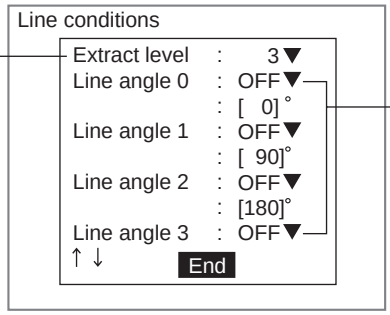


4. Make the settings for each item.
5. Select ***End***.

   The settings will be registered and the screen in (2.) will return.

STEP 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.



To extract lines regardless of the angle:
Line angle □: Set to OFF.
(Ignore the setting in square brackets on the second line.)
To extract only lines at specific angles:
Up to four angles can be specified.
Line angle □: Set to ON.
Set the angle for the lines to be detected in the square brackets on the second line.

Setting item	Selections
Line angle 0	ON, OFF*
	0 to 359 (*0)
LIne angle 1	ON, OFF*
	0 to 359 (*90)
LIne angle 2	ON, OFF*
	0 to 359 (*180)
LIne angle 3	ON, OFF*
	0 to 359 (*270)

The asterisk (*) indicates the default setting.

SeeAlso Refer to *Line Angles* on page 2-15-(1).

The level for extracting lines can be changed. There are 5 levels (1 to 5) and the default setting is 3. Refer to the following examples and adjust the level as required.

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

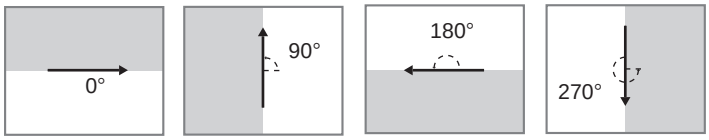
Change the extraction level to a smaller value.

When the measurement object is small and cannot be detected easily

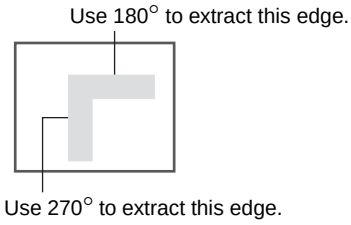
Change the extraction level to a larger value.

HELP Line Angles

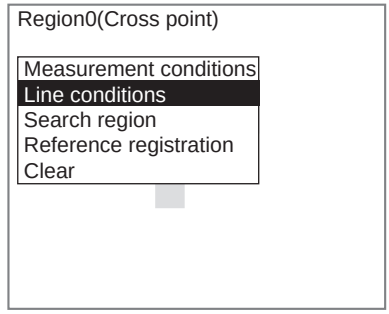
The position where the brightness changes is extracted as an edge and the direction of the change in brightness is found. This direction is called the edge code and it indicates the direction of the edge. The way in which black and white meet determines the direction of the edge code, and the angle is calculated as shown below.



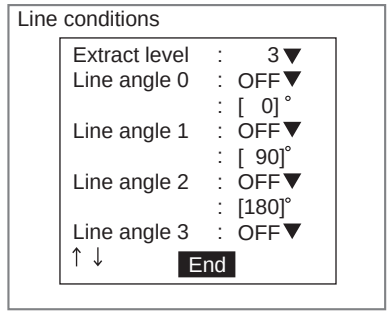
Example



1. Select ***Line conditions***.



The Line Conditions Settings Screen will be displayed.



2. Make the settings for each item.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

STEP 3: Setting the Search Region

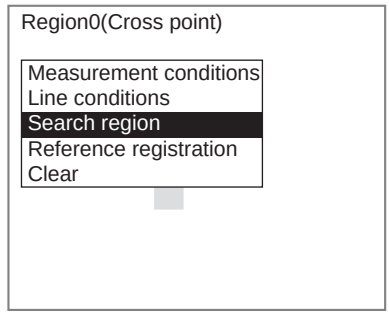
Set the region to search for the positioning mark.

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

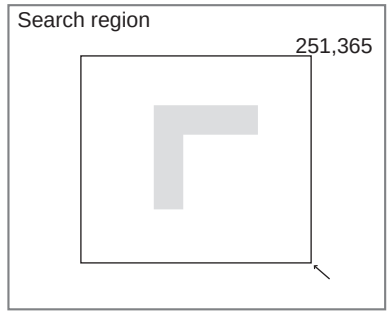
CHECK When edges are extracted, the pixels at the edges of the screen cannot be processed accurately. Do not include the outer edges of the screen when setting the search region.

SeeAlso Refer to page 2-16-(7) under *2-16-3-1 Circles*.

1. Select ***Search region***.



The screen for drawing search regions will be displayed.



2. Draw a rectangular search region.

   Specify the upper left and lower right coordinates.

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

   ENT Key: Confirms the settings.

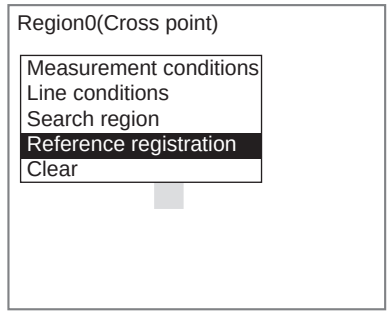
   When the bottom right coordinates have been set, the screen in (1.) will return.

STEP 4: Registering Reference Positions

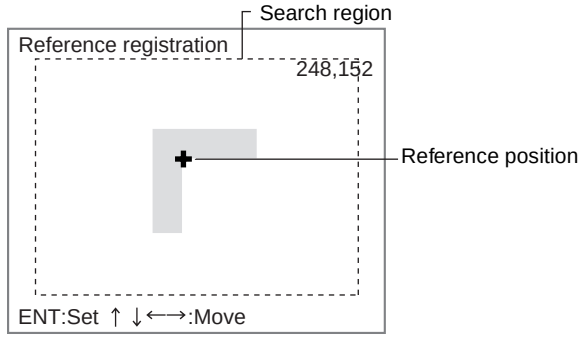
Register reference positions here to detect position displacement. Positions can be inspected if the difference between the reference position and the measurement position is obtained from a calculation.

SeeAlso Refer to *2-16-3-1 Circles* for an outline.

1. Select ***Reference registration***.



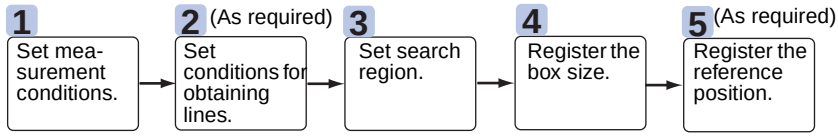
The Controller will search for the cross point in the displayed image that matches the conditions and a display cursor will appear at that position.



2. Press the **Up**/**Down** and **Right**/**Left** Keys to move the cursor to change the position.
3. Press the **ENT** Key to save the setting.

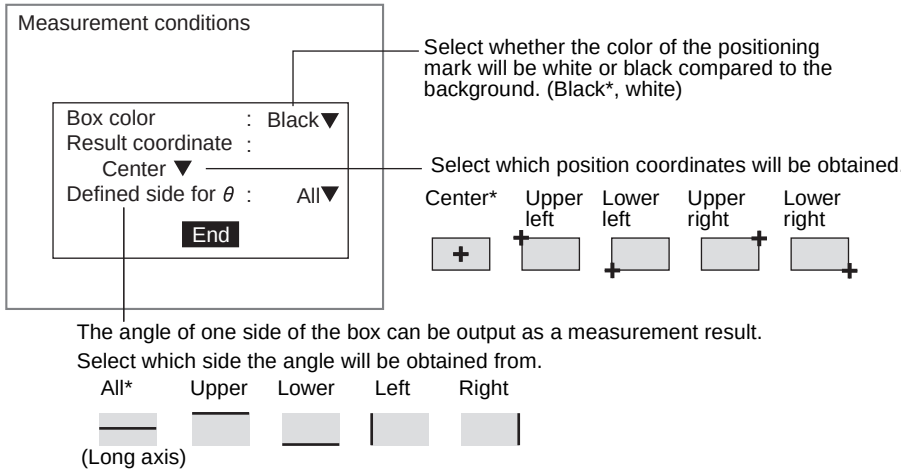
   The setting will be registered and the screen in (1.) will return.

2-16-3-3 Boxes



STEP 1: Setting Measurement Conditions

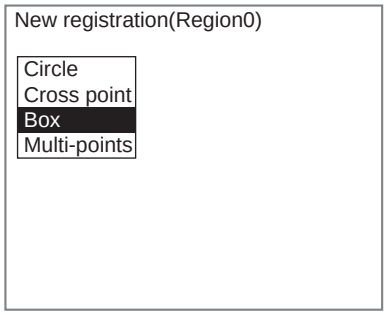
Set the conditions to search for the positioning mark.



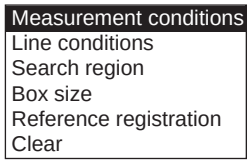
The asterisk (*) indicates the default setting.

1. Display the figure selections using the same procedure as outlined in steps 1 to 3 for *Circle*.

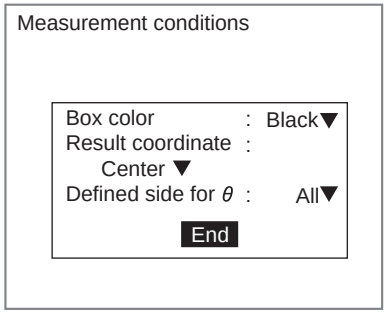
SeeAlso Refer to *2-16-3-1 Circles*.



2. Select ***Box***.
   The settings selections will be displayed.



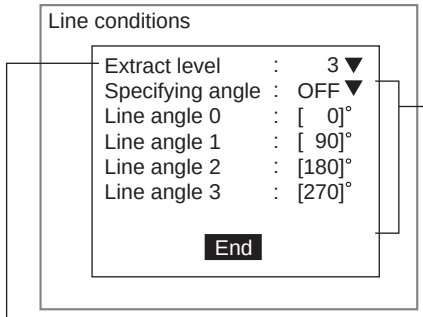
3. Select ***Measurement conditions***.
   The Measurement Conditions Settings Screen will be displayed.



4. Make the settings for each item.
5. Select ***End***.
   The settings will be registered and the screen in (2.) will return.

STEP 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.



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.

Setting item	Selections
Specifying angle	ON, OFF*
Line angle 0	0 to 359 (*0)
Line angle 1	0 to 359 (*90)
Line angle 2	0 to 359 (*180)
Line angle 3	0 to 359 (*270)

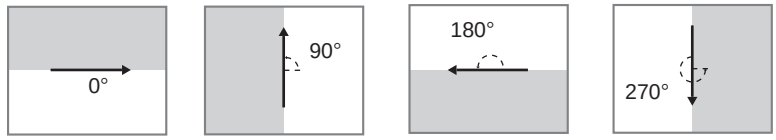
The asterisk (*) indicates the default setting.

Note: Angles cannot be specified when positioning mark may rotate.

Refer to the information about cross points for details (page 2-16-(19)).

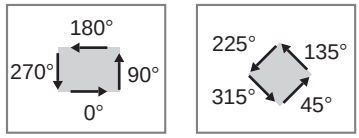
HELP Line Angles

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.

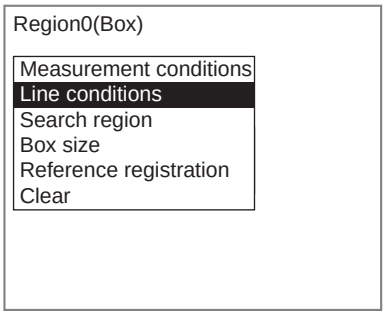


CHECK Set the angles as a combination of the four sides of the box to be found (angles 0 to 3).

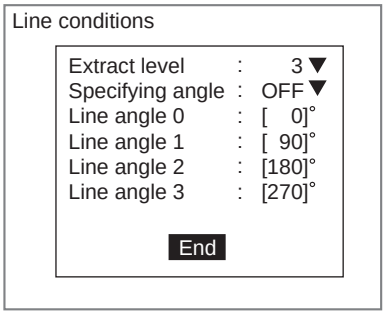
Example: The following examples are for black boxes.



1. Select ***Line conditions***.



The Line Conditions Settings Screen will be displayed.



2. Make the settings for each item.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

STEP 3: Setting Search Regions

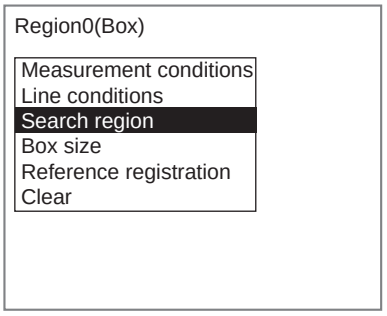
Set the region to search for the positioning mark.

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

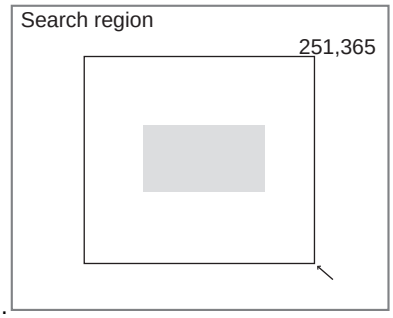
CHECK When edges are extracted, the pixels at the edges of the screen cannot be processed accurately. Do not include the outer edges of the screen when setting the search region.

SeeAlso Refer to page 2-16-(7) under *2-16-3-1 Circles*.

1. Select ***Search region***.



The screen for drawing regions will be displayed.



2. Draw a rectangular search region.

   Specify the upper left and lower right coordinates.

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

   ENT Key: Confirms the settings.

   When the bottom right coordinates have been set, the screen in (1.) will return

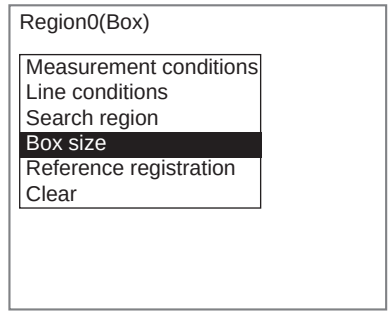
STEP 4: Registering the Size of the Box

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

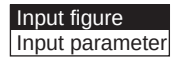
Registration method	Details
Input figure	The measurement object is displayed on the screen, a box is drawn on the exterior edge of the object and the size of the box is registered. Adjust the permissible range by inputting parameters.
Input parameter	The lengths of sides of the box and the permissible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

Inputting Figures

1. Select ***Box size***.

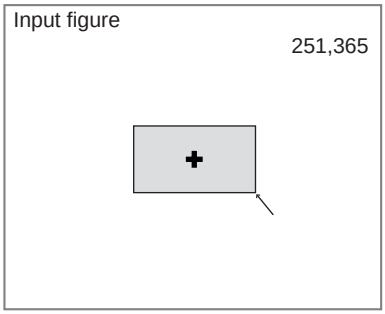


The registration methods will be displayed.



2. Select ***Input figure***.

   The Input Figure Screen will be displayed.



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

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

   ENT Key: Confirms the settings.

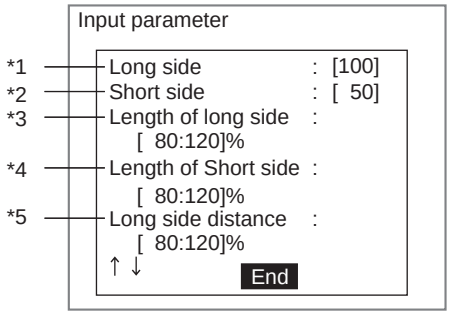
   The settings will be registered and the screen in (1.) will return.

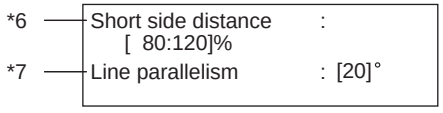
CHECK Figures can be input to make settings only for the *Long size* and *Short size* of the box. Use the parameter input screen to make permissible size range and other detailed settings.

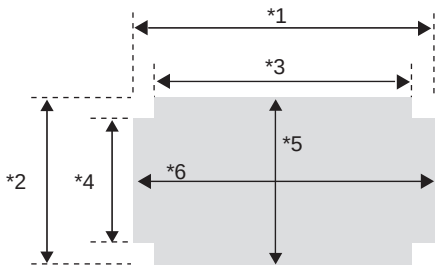
Inputting Parameters

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.







Settings ranges and Default Values*:

*1: 1 to 512

*2: 1 to 484

*3: 1 to 200 (default: 80:120)

*4: 1 to 200 (default: 80:120)

*5: 1 to 200 (default: 80:120)

*6: 1 to 200 (default: 80:120)

*7: Parallelism of long sides and short sides: 1 to 99 (default: 20)

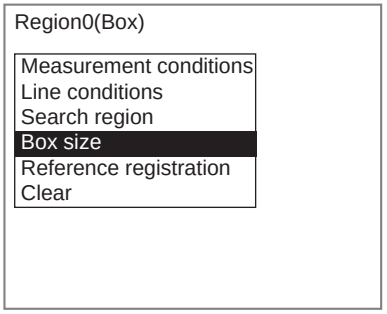
CHECK To Change Box Sizes:

- Increase the *Length of long side* and *Length of short side*.
- Increase the *Long side distance* and *Short side distance*.

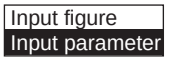
When Box Is Chipped

- Reduce the lower limit of *Length of long side* and *Length of short side*.

1. Select ***Box size***.

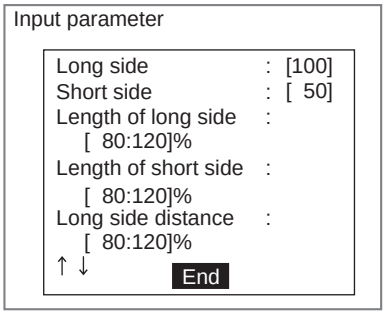


The registration methods will be displayed.



2. Select ***Input parameter.***

   The Input Parameter Settings Screen will be displayed.



3. Make the settings for each item.
4. Select ***End***.

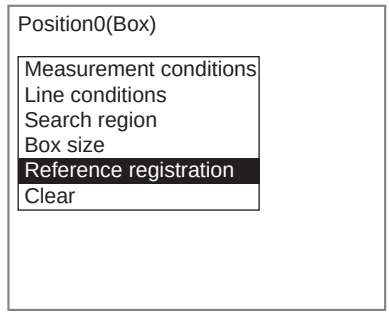
   The settings will be registered and the screen in (1.) will return.

STEP 5: Registering Reference Positions

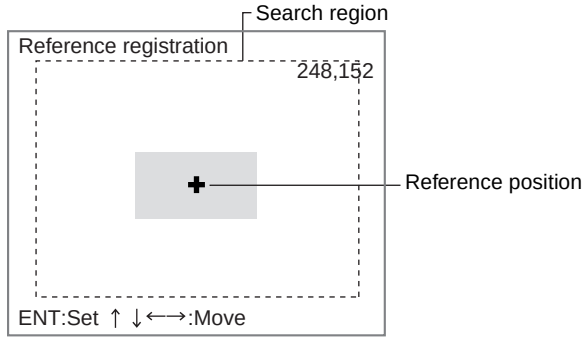
Register reference positions here to detect position displacement. Positions can be inspected if the difference between the reference position and the measurement position is obtained from a calculation.

SeeAlso Refer to *2-16-3-1 Circles* for an outline.

1. Select ***Reference registration***.



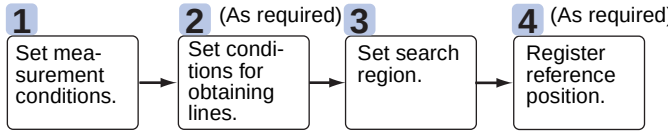
The Controller will search for the box in the displayed image and a display cursor will appear at that position.



2. Press the **Up**/**Down** and **Right**/**Left** Keys to move the cursor to change the position.
3. Press the **ENT** Key to save the setting.

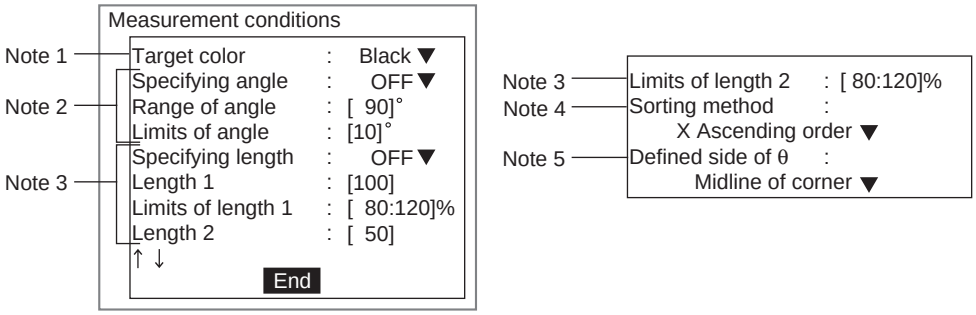
   The setting will be registered and the screen in (1.) will return.

2-16-3-4 Multi-points



STEP 1: Setting Measurement Conditions

Set the conditions for searching for the positioning mark.



Note

1. Select whether the positioning mark color will be white or black compared to the background. (Black*, white)
   The asterisk (*) indicates the default setting.

2. Angles
   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.

   Specifying angle: Set to ON.

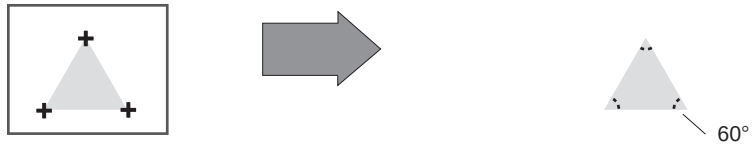
   Range of angle: Angle of the section in the target color (If the target color changes, change the angle setting too.)

   Limits of angle: Set the permissible range for the angle.
   Example: When the range of the angle is set to 90° and the limits of angle set to 10°, the cross point of lines that intersect at between 80° and 100° will be found.

   Example: When *Range of angle* set to 90° and *Limits of angle* set to 10°. The cross point of lines that intersect at 80° to 100° will be found.

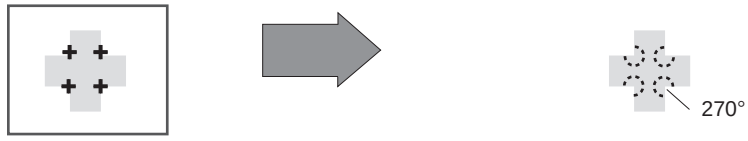
   Example: To extract the following 3 cross points

   Set the *Target color* to black, the *Specifying angle* to ON, and the *Range of angle* to 60°.

   Example: To extract the following 4 cross points

   Set the *Target color* to black, the *Specifying angle* to ON, and the *Range of angle* to 270°.

   To find the coordinates of the cross point of lines regardless of their angle, set *Specifying angle* to OFF. The settings for the range of the angle and the limits of the angle will be ignored.

Setting item	Selections
Specifying angle	ON, OFF*
Range of angle	0 to 359
Limits of angle	0 to 99 (10*)

   The asterisk (*) indicates the default setting.

3. Lengths
   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.

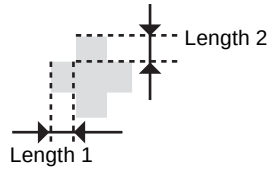
   Specifying length: Set to ON.

   Length □: Set the line length in pixels.

Limits of length□: Set the permissible range for the length.

Example: To extract the 4 cross points shown below

Set the *Length 1* and *Length 2* to the lengths for the areas indicated in the following diagram.



To find the coordinates of the cross point of lines regardless of their length, set *Specifying length* to OFF. The settings of the line lengths and the limits of the length will be ignored.

Setting item	Selections
Specifying length	ON, OFF*
Length □	1 to 999
Limits of length □	1 to 200 (80:120*)

The asterisk (*) indicates the default setting.

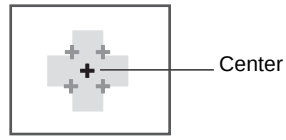
4. Select the sorting conditions for determining which cross point coordinates will be output. Up to 20 points can be obtained. The coordinates for the first point matching the selected conditions will be output. (X ascending*, X descending, Y ascending, Y descending)

   The asterisk (*) indicates the default setting.

CHECK 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.

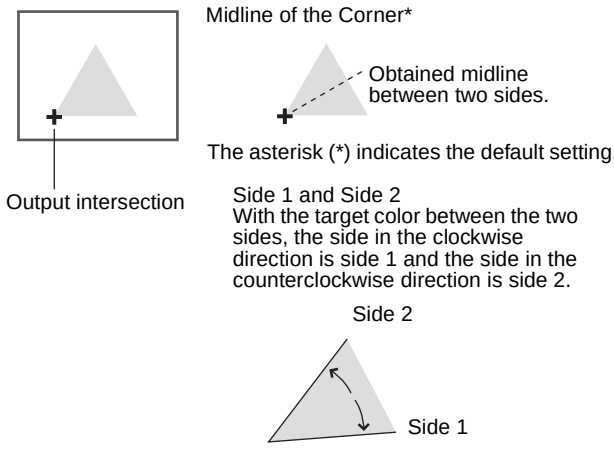
SeeAlso Refer to *2-29 Calculation*.

Example: Find the average of 4 points to output the center point.

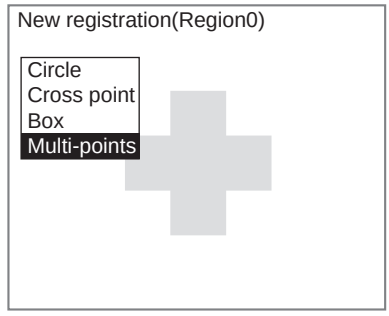


5. Only one angle (θ) will be output as the measurement results for the lines that are found. Select which position θ will be obtained. (The lines that are considered are the two lines meeting the intersection point.)

Example: To extract the cross point shown in the following diagram, set target color to black and sorting condition to X ascending order.

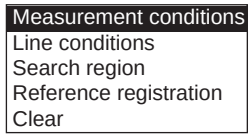


1. Display the figure selections using the same operations as outlined under steps (1.) to steps (3.) for *Circle*. Refer to page 2-16-(20).



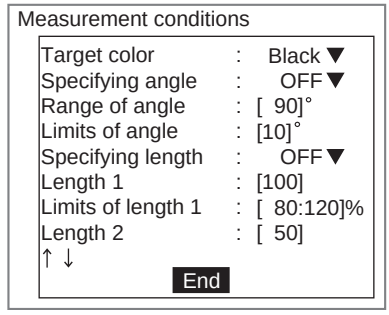
2. Select ***Multi-points***.

   The selections for setting conditions will be displayed.



3. Select ***Measurement conditions***.

   The Measurement Conditions Settings Screen will be displayed.



4. Make the settings for each item.
5. Select ***End***.

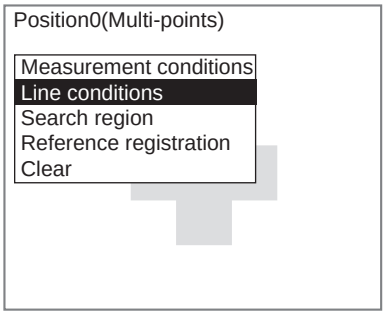
The settings will be registered and the screen in (2.) will return.

STEP 2: Setting Conditions for Obtaining Lines

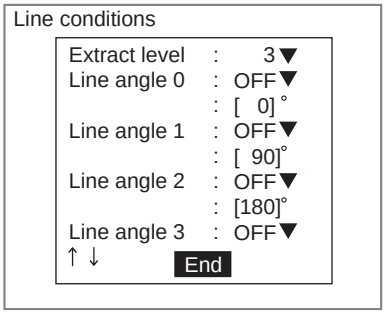
Adjust the line conditions if the lines cannot be found easily or to extract only lines of a particular angle.

Refer to *page 2-16-(19)* for an outline.

1. Select ***Line conditions***.



The Line Conditions Settings Screen will be displayed.



2. Make the settings for each item.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

STEP 3: Setting Search Region

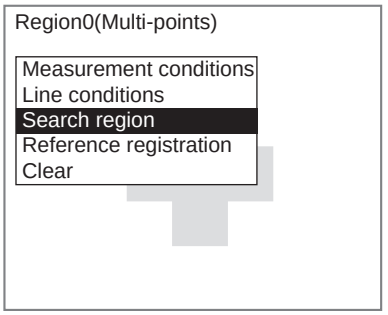
Set the region to search for the positioning mark.

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

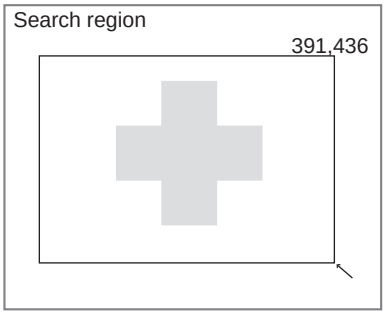
CHECK When edges are extracted, the pixels at the edges of the screen cannot be processed accurately. Do not include the outer edges of the screen when setting the search region.

SeeAlso Refer to page 2-16-(7) under *2-16-3-1 Circles*.

1. Select ***Search region***.



The screen for drawing search regions will be displayed.



2. Draw a rectangular search region.

   Specify the upper left and lower right coordinates.

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

   ENT Key: Confirms the settings.

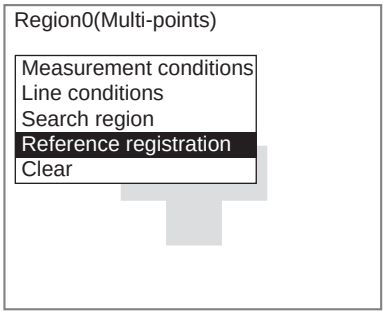
   When the bottom right coordinates have been set, the screen in (1.) will return.

STEP 4: Registering Reference Positions

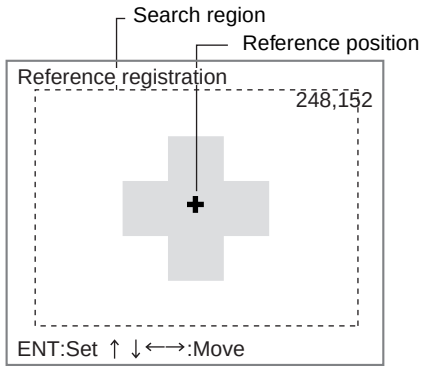
Register reference positions here to detect position displacement. Positions can be inspected if the difference between the reference position and the measurement position is obtained from a calculation.

SeeAlso Refer to *2-16-3-1 Circles* for an outline.

1. Select ***Reference registration***.



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.



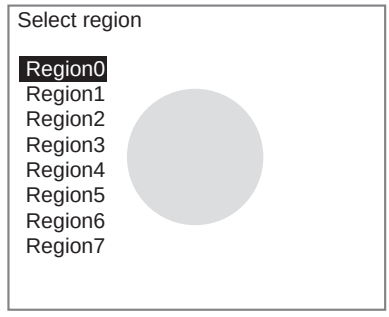
2. Press the **Up**/**Down** and **Right**/**Left** Keys to move the cursor to change the position.
3. Press the **ENT** Key to save the setting.

   The setting will be registered and the screen in (1.) will return.

Clearing Set Regions

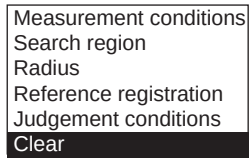
The clear operation is executed for each region.

1. Select the region number to be cleared.



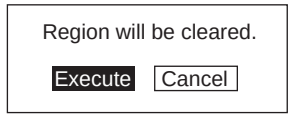
The selections will be displayed.

Example: For circles



2. Select ***Clear***.

   A confirmation message will be displayed.

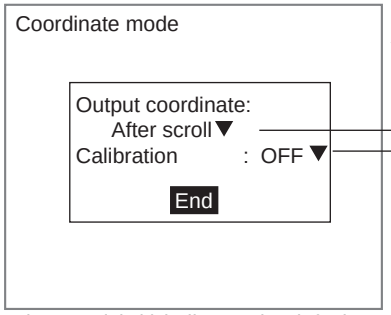


3. Select ***Execute***.

   The region will be cleared and the screen in (1.) will return.

2-16-4 Setting the Coordinate Mode

Select the type of coordinate values.



Before scroll: Output made using the coordinate values before position displacement compensation.
After scroll*: Output made using the coordinate values after position displacement compensation.

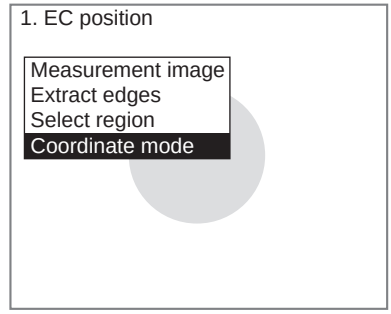
Refer to *7-4 Terminology* for differences between output coordinates.

ON: Output made using coordinate values set using calibration.
OFF*: Output made using Camera coordinate values.

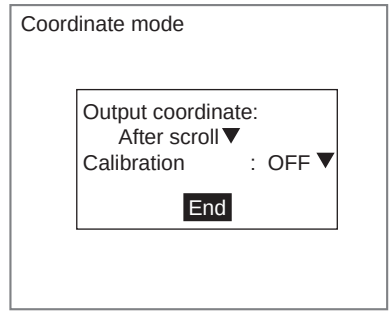
The asterisk (*) indicates the default setting.

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.

1. Select ***Coordinate mode***.



The Coordinate Mode Settings Screen will be displayed.



2. Make the settings for each item.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

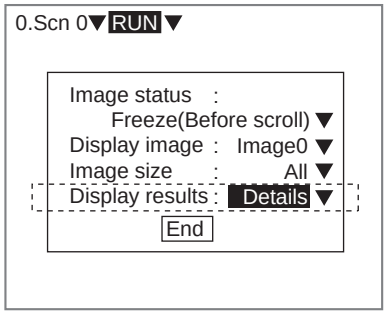
2-16-5 Measurement Screens

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

This section describes what kind of information can be displayed for EC positioning.

SeeAlso Refer to *SECTION 3 Monitor Mode and Run Mode* for details on Monitor and Run modes.

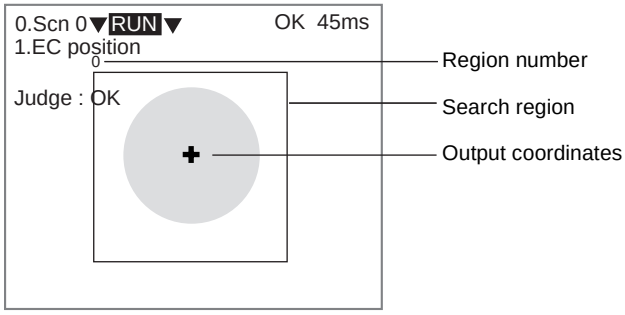
CHECK Press the **SHIFT+ESC** Keys on the Run Screen to access the following screen and change ***Display results*** to ***Details.***



Press the **Up** or **Down** Key to change to the unit for which EC positioning is set and the following detailed screens will be displayed.

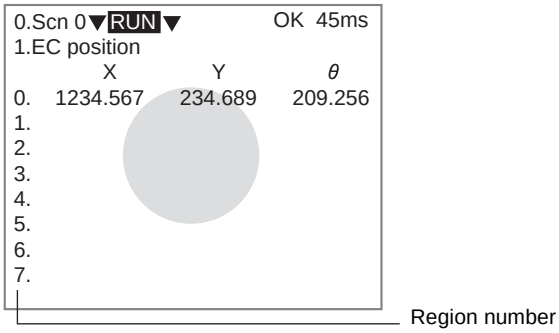
Press the **SHIFT+Right** or **Left** Keys to switch in order between the three screens.

Judgement Result



Detailed Display

The measurement values for each region will be displayed.

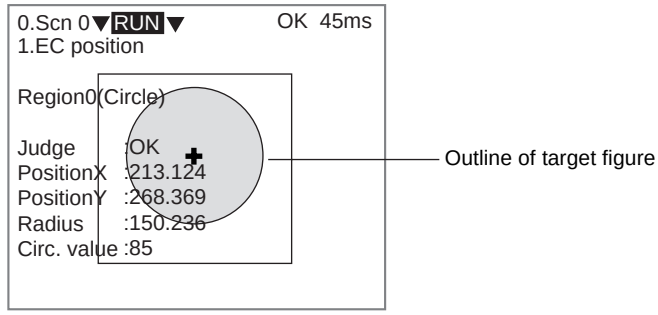


Individual Region Display

More detailed measurement results are displayed for each region.

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

- Circle

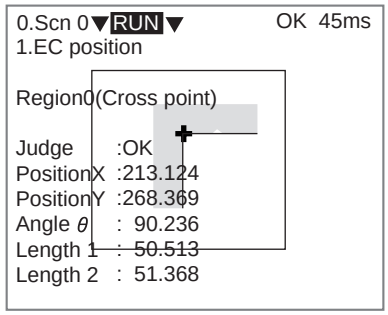


- Cross points, boxes, and multiple cross points

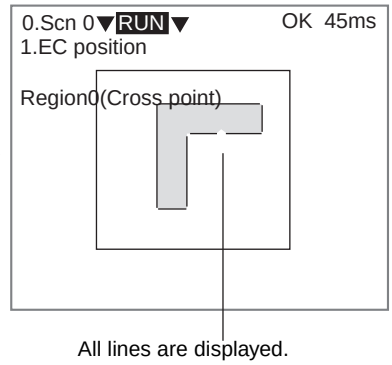
  Once the measurement values for the region have been displayed, the screen for confirming the line extraction status will be displayed.

Example: Cross points

Measurement values display



Screen for confirming extracted line status

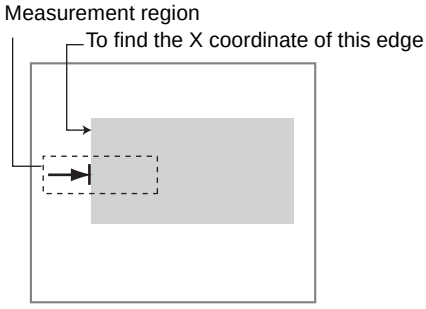


2-17 Edge Position

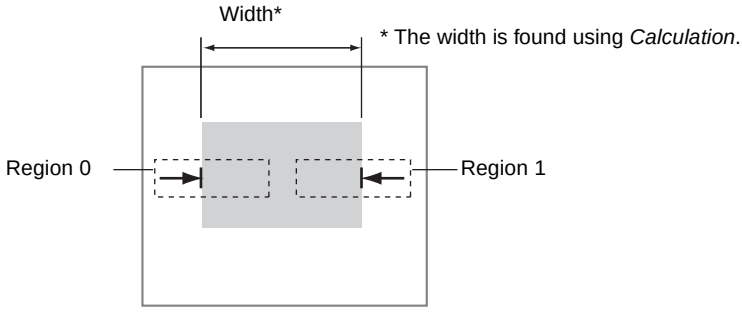
The Edge Position processing item uses the density (brightness) in the measurement region to find the position of the measurement object.

Use this processing item to find the edge coordinates or width of the measurement object.

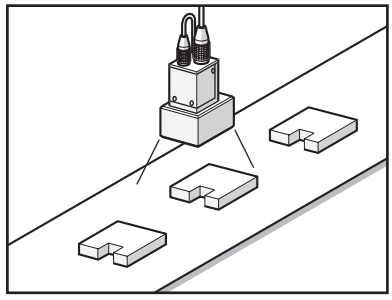
The edge is found using density changes in the measurement region.



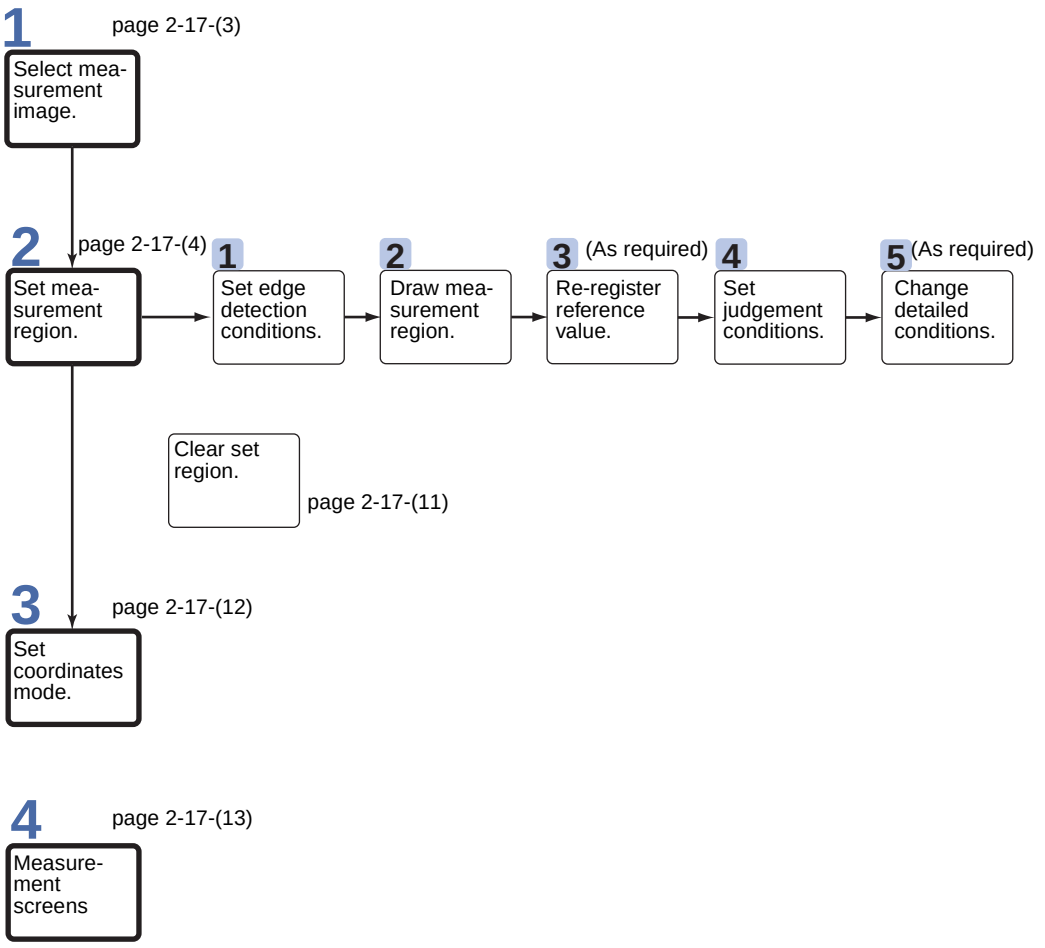
The width can be found if multiple regions are registered.



Example: Finding the size of a molded product.



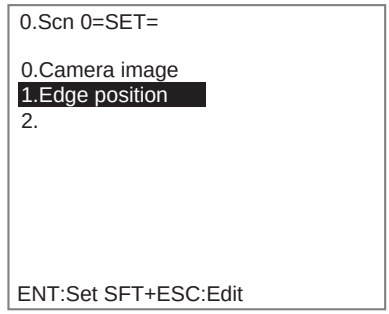
Operational Flow



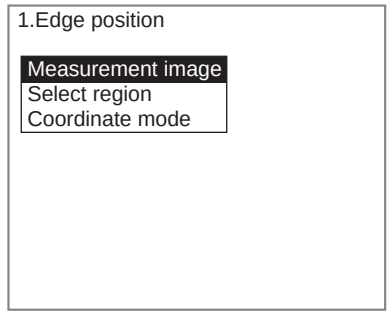
2-17-1 Selecting Measurement Images

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

1. Select ***Edge position***.



The setting selections will be displayed.



2. Select ***Measurement Image***.

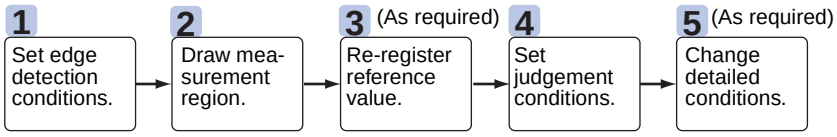
   The selections will be displayed.

3. Select which image will be used for measurement, the image stored at Image 0 or the image stored at Image 1.
4. Press the **ENT** Key.

   The settings will be registered and the screen in (1.) will return.

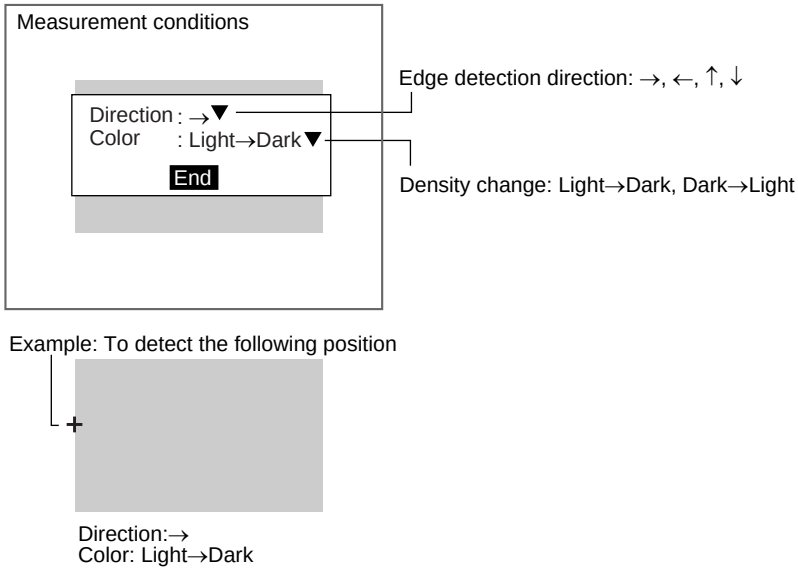
2-17-2 Setting Measurement Regions

Up to 8 regions can be set.

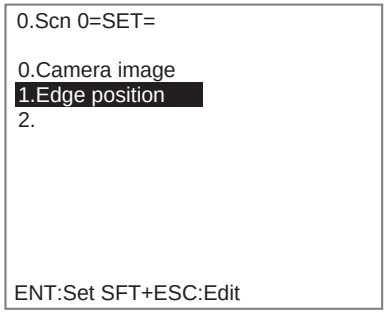


STEP 1: Setting Edge Detection Conditions

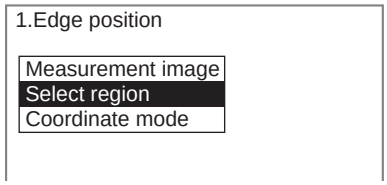
Set the direction for edge detection and the density changes.



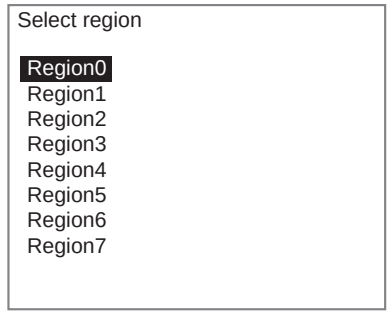
1. Select ***Edge position***.



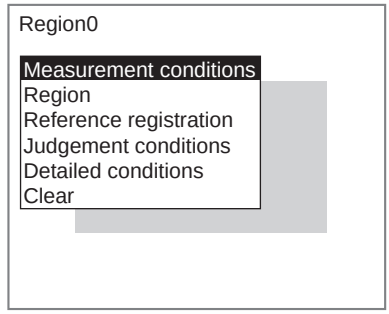
The settings selections will be displayed.



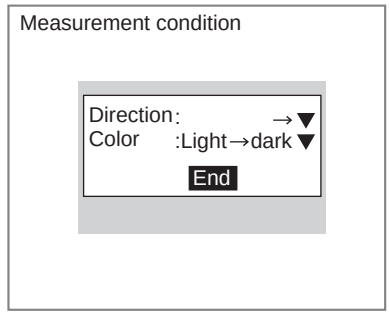
2. Select ***Select region***.
   The region numbers will be displayed.



3. Select a region number.
   The initial Edge Position Screen will be displayed.



4. Select ***Measurement conditions***.
   The Measurement Conditions Settings Screen will be displayed.



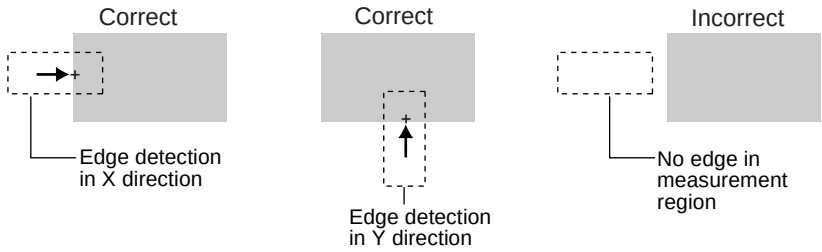
5. Select the edge detection conditions.
6. Select ***End***.
   The settings will be registered and the screen in (3.) will return.

STEP 2: Drawing Measurement Regions

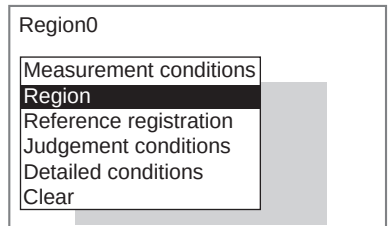
Draw a measurement region to include all the edges for detection.

When a measurement region is drawn, measurement is performed for the displayed image and the result is registered as the reference value (edge position).

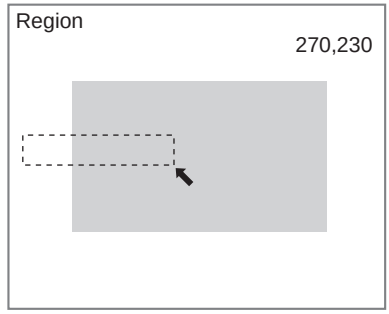
CHECK If the edge is not in the measurement region, measurement will not be possible. Make a region of a size and position that allows for movement of the range of the measurement object.



1. Select ***Region***.



The Region Settings Screen will be displayed.



2. Draw a box-shaped region.

CHECK The only figure that can be drawn is a box.

The region will be set and the screen in (1.) will return. The edge position (display cursor) and the measurement region will be displayed.

STEP 3: Re-registering Reference Values

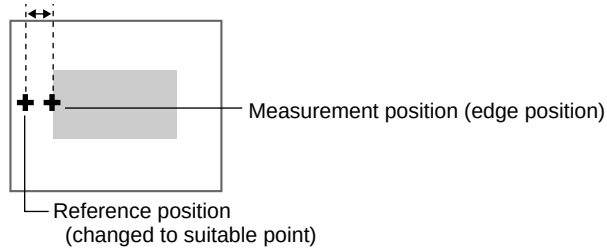
This operation is performed when only the reference value is to be re-registered.

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 position can be changed to enable the following function.

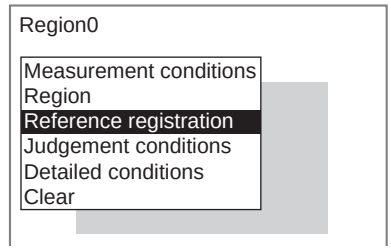
Inspecting Positions from a Specified Point

Once the reference value (edge position) has 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.

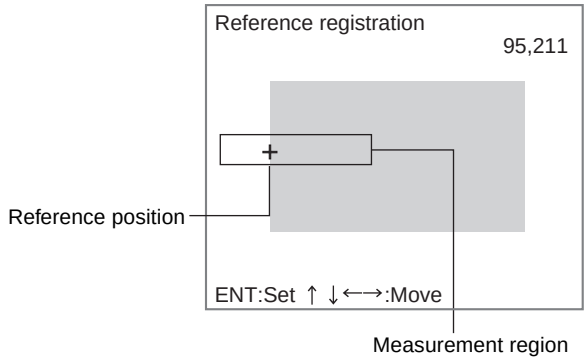


CHECK When the measurement region is changed, the reference value returns to the default setting.

1. Select ***Reference registration***.



A cursor will appear at the edge position.



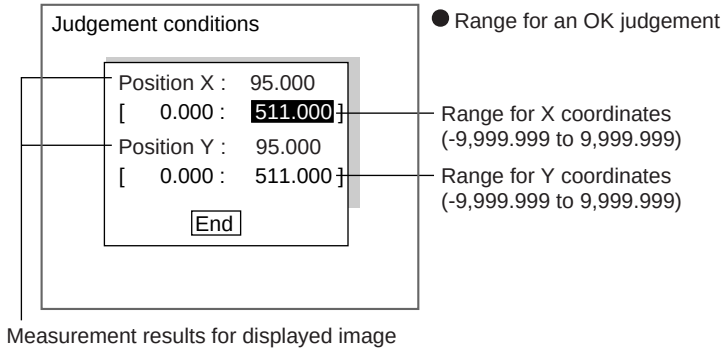
2. To change the position, use the **Up**/**Down** and **Right**/**Left** Keys to move the cursor.

3. Press the **ENT** Key.

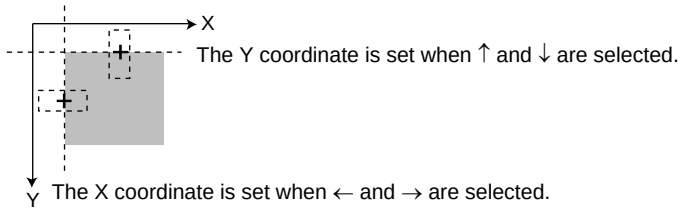
   The setting will be registered and the screen in (1.) will return.

STEP 4: Setting Judgement Conditions

Set the position ranges for an OK judgement.

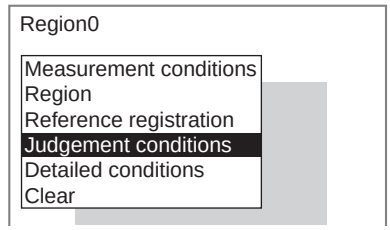


CHECK Position X and Position Y will change depending on the settings under *Measurement/Direction*.

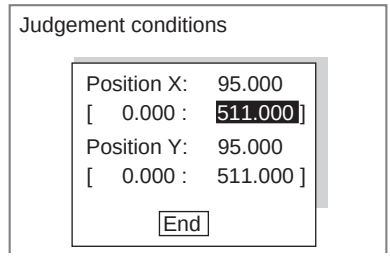


The origin and coordinate system are determined by the calibration settings.

1. Select ***Judgement conditions***.



The Judgement Conditions Settings Screen will be displayed.



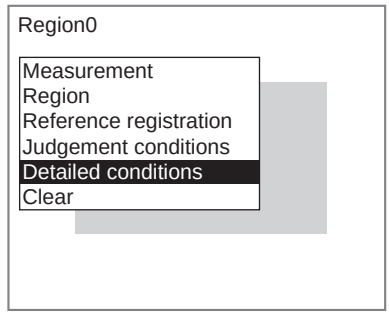
2. Change the settings.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

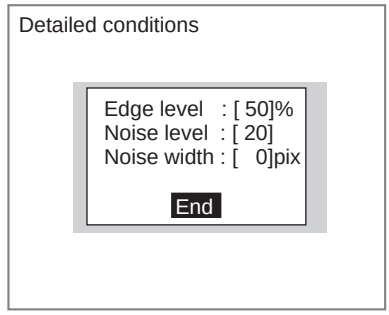
STEP 5: Changing Detailed Conditions

Change the detailed conditions when the measurement results are unstable. 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.

1. Select ***Detailed conditions***.



The Detailed Conditions Settings Screen will be displayed.



2. Change the settings.
3. Select ***End***.

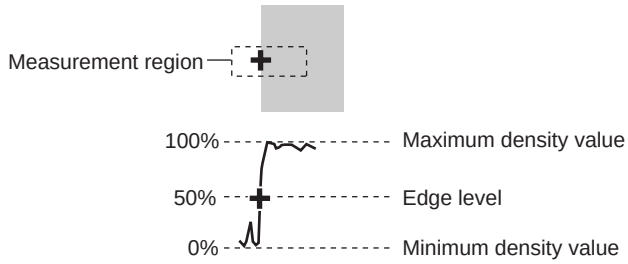
   The settings will be registered and the screen in (1.) will return.

Edge Level

Set a density change level between 0 and 100 that will indicate the edge. Normally, the default setting of 50% will be fine.

The edge is normally detected as follows:

1. The density distribution of the whole measurement region is calculated.
2. The density difference between the lowest and highest density value becomes 100%.
3. The point where the edge level density change is detected becomes the edge.



Noise Level

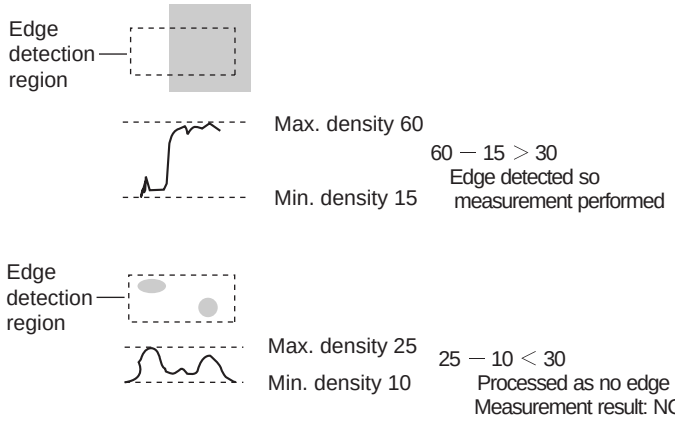
Set a noise level between 0 and 255 to assist the determination of edges. The maximum density and minimum density within the edge detection area is calculated and if the difference between the two values is less than the noise level, then the Controller determines that there is no edge. Normally the default setting of 20 is sufficient. Adjust this to a higher value, however, if noise is causing false edges to be detected.

(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

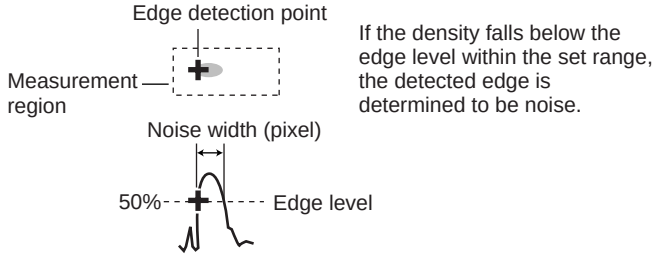


Noise Width

Set the noise width between 0 and 255 to evaluate 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. Normally the default noise width setting of 0 is sufficient. If noise is causing incorrect detection, make this value higher.

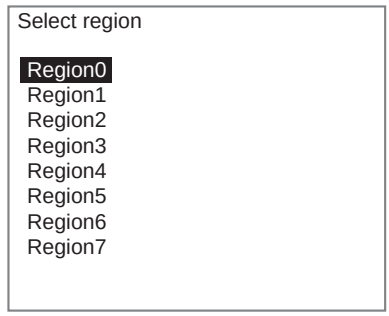
Example



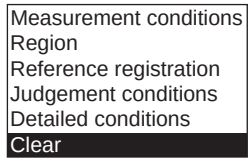
Clearing Set Regions

The clear operation is executed for each region.

1. Select the region number to be cleared.

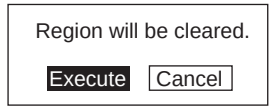


The selections will be displayed.



2. Select ***Clear***.

   A confirmation message will be displayed.

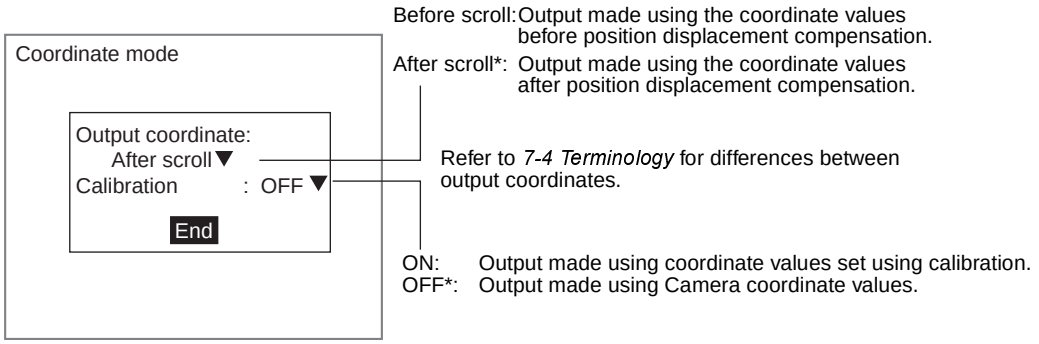


3. Select ***Execute***.

   The region will be cleared and the screen in (1.) will return.

2-17-3 Setting the Coordinate Mode

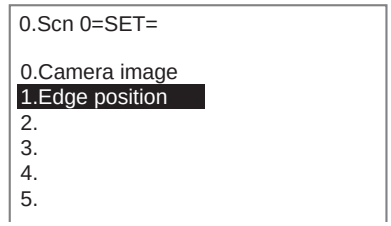
Select the type of coordinate values.



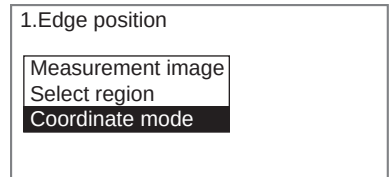
The asterisk (*) indicates the default setting.

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.

1. Select ***Edge position***.

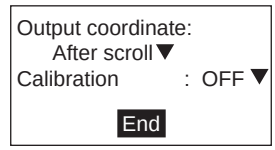


The settings selections will be displayed.



2. Select ***Coordinate mode***.

   The Coordinate Mode Settings Screen will be displayed.



3. Make the settings for each item.
4. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

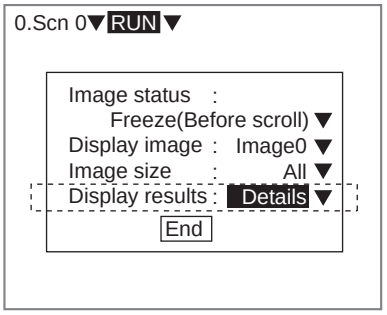
2-17-4 Measurement Screens

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

This section describes what kind of information can be displayed for edge positioning.

SeeAlso Refer to *SECTION 3 Monitor Mode and Run Mode* for details on Monitor and Run modes.

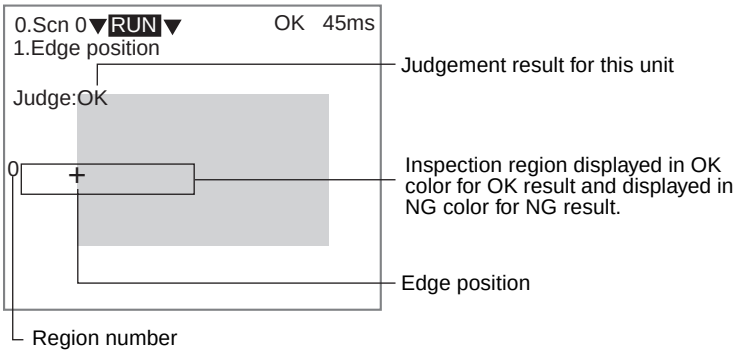
CHECK Press the **SHIFT+ESC** Keys on the Run Screen to access the following screen and change ***Display results*** to ***Details.***



Use the **Up** or **Down** Key to change to the unit for which edge positioning is set and the following detailed screens will be displayed.

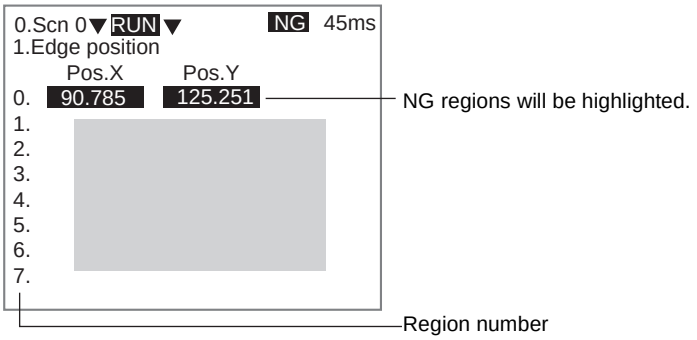
Use the **SHIFT+Right** or **Left** Keys to switch in order between the two screens.

Judgement Result



List of Positions

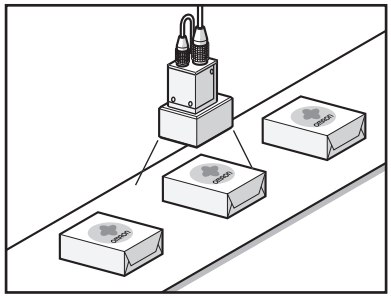
A list of edge positions for each region will be displayed.

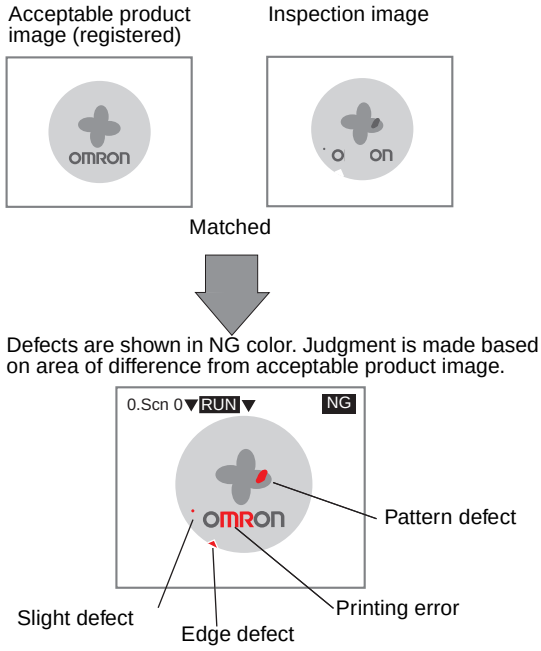


2-18 Fine Matching

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



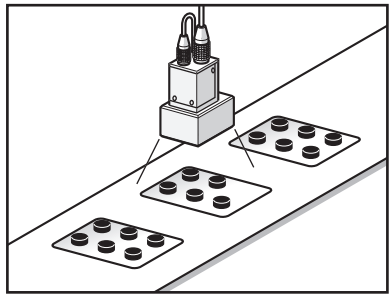


Refer to *SECTION 1 Basic Operating Procedures* for details.

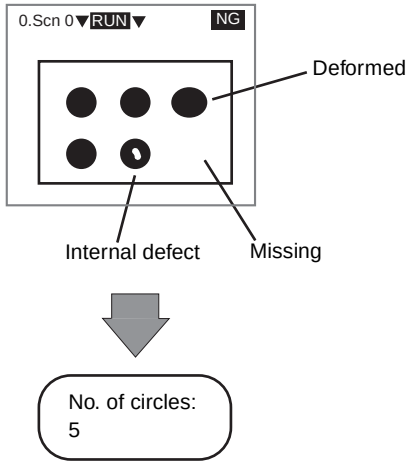
2-19 EC Circle Count

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

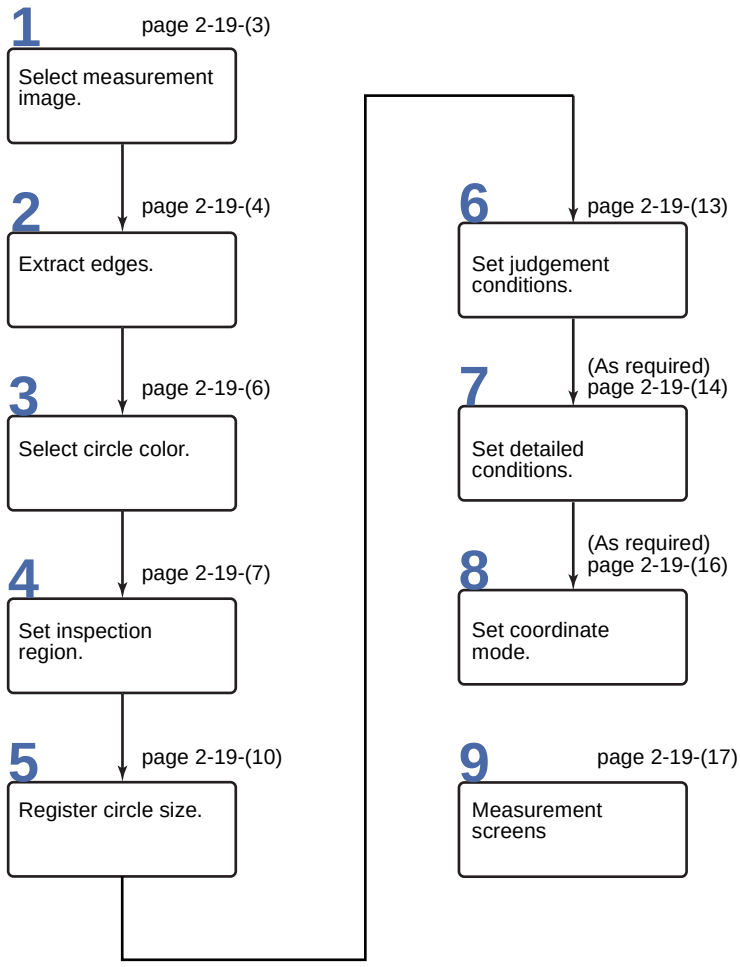


Circles are recognized and counted even if they are deformed or if there are internal defects. The permissible range for defects can be changed.



HELP Refer to *7-4 Terminology* for information on edge codes (EC).

Operational Flow

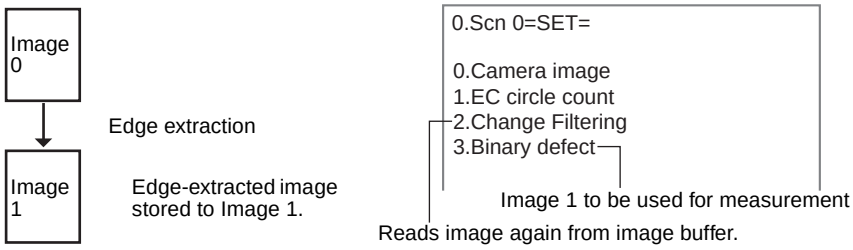


2-19-1 Selecting Measurement Images

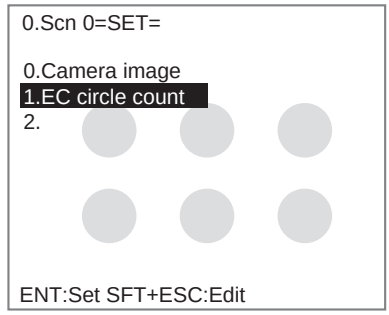
This section describes how to select an image stored at either Image 0 or Image 1 as the image for measurement.

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 count was set. Then store the image stored in the image buffer to Image 0 or Image 1.

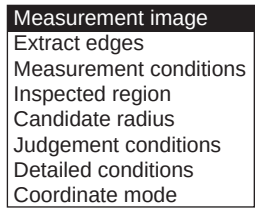
Example: When Image 0 Is Selected as Measurement Image



1. Select ***EC circle count***.

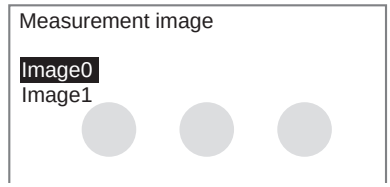


The initial EC Circle Count Screen will be displayed.



2. Select ***Measurement Image***.

   The selections will be displayed.



3. Select which image will be used for measurement, the image stored at Image 0 or the image stored at Image 1.
4. Press the **ENT** Key.

   The settings will be registered and the screen in (1.) will return.

2-19-2 Extracting Edges

EC circle count is performed for images for which the edges have been extracted.

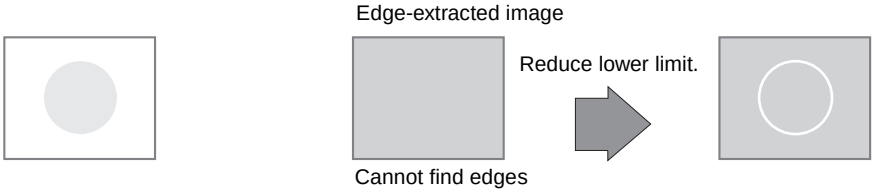
Adjust the upper and lower levels for edge extraction if there is low contrast between the measurement object and the background and to remove noise.

Upper and Lower Limits

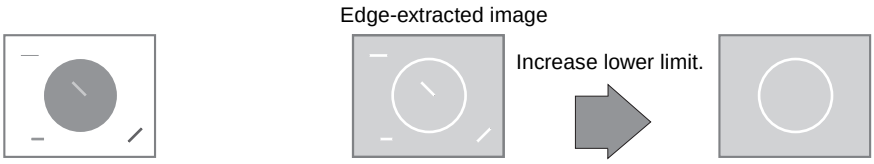
Set the level to which the background will be cut. The levels can be set between 10 and 255 (default 100:255).

Areas with a density above the lower limit will become the edge of the measurement object. Refer to the following examples and adjust the upper and lower limits.

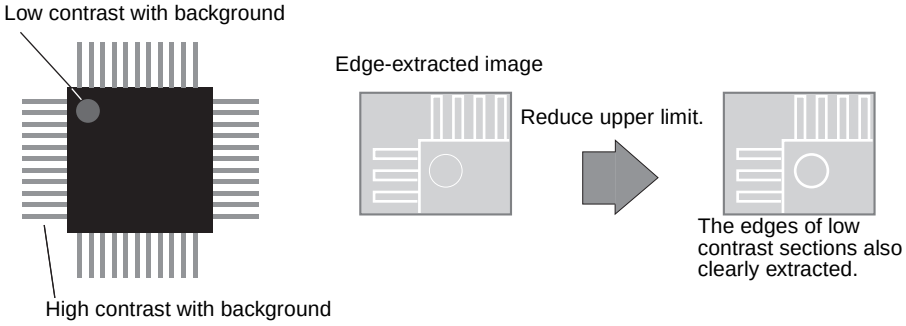
Example: Cannot Find Edges Due to Low Contrast



Example: To Remove Noise



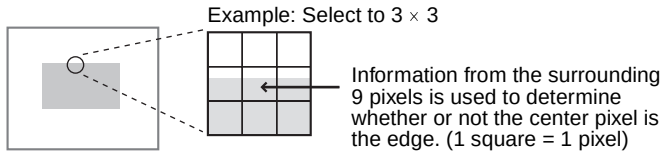
Example: Other Edges Clearly Extracted But Cannot Find Desired Mark Edge with Stability



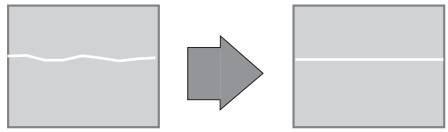
Mask Size

The mask size function is used when searching for edges to judge edges using peripheral information. Select how much peripheral pixel information to use. The selections are 5 × 5 (default) or 3 × 3.

CHECK This setting will be enabled only if *Frame/Field* under *Camera image* is set to *Frame*. If set to *Field*, the effect will remain the same as if 5 × 5 is selected even if 3 × 3 is selected.



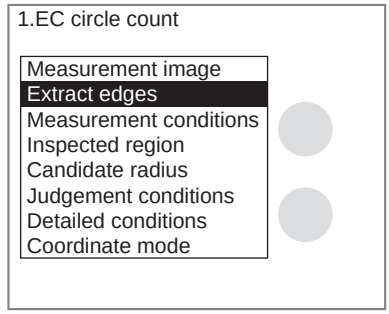
The greater the mask size, the more the variations in surrounding pixels can be absorbed. Select 5 × 5 to ignore uneven edges.



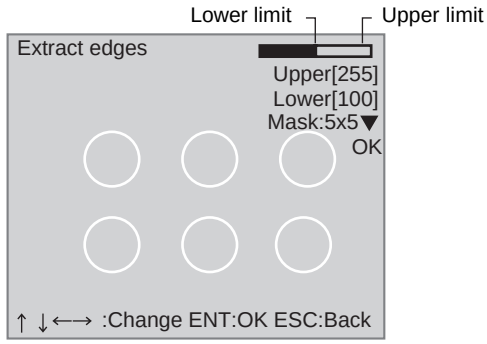
CHECK This function is even more effective if smoothing is used.

SeeAlso Refer to *2-1 Inputting Camera Images* and *2-4 Filtering Again* (where smoothing can be set to be executed twice).

1. Select ***Extract edges***.



The screen for setting edge extraction levels will be displayed.



2. Set the upper and lower limits.

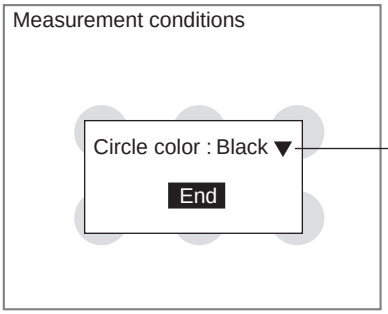
Right Key:	Increases the lowest digit by one.
SHIFT+Right Keys:	Increases the value 10 times faster.
Left Key:	Decreases the lowest digit by one.
SHIFT+Left Keys:	Decreases the value 10 times faster.
Up and Down Keys:	Switches between setting items.

3. Select the mask size.
4. Press the **ENT** Key.

   The settings will be registered and the screen in (1.) will return.

2-19-3 Selecting Circle Color

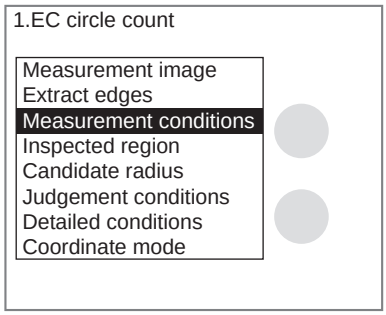
Select the color of the circles to be inspected.



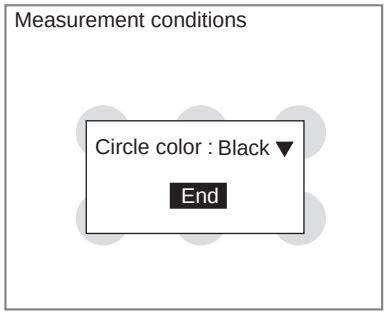
Select whether the circle color is white or black compared to the background.
Select *Both* for circles not necessarily white or black.
(Black*, white, both)

The asterisk (*) indicates the default setting.

1. Select ***Measurement conditions***.



The Measurement Conditions Settings Screen will be displayed.



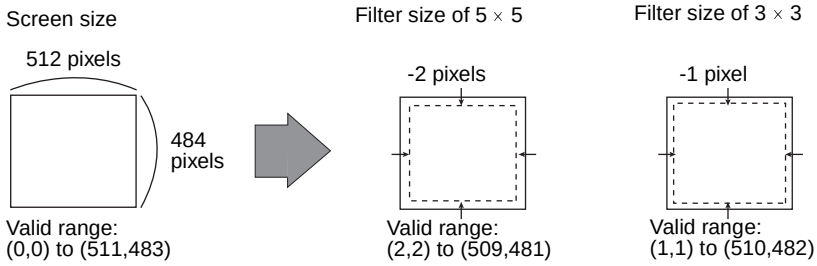
2. Select the circle color.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

2-19-4 Setting Inspection 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 inspection region.



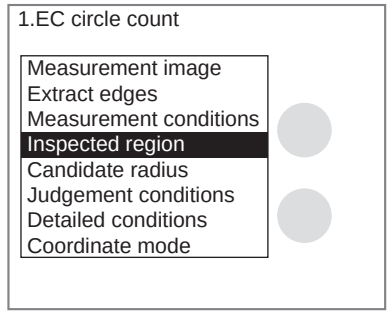
Each time the image is filtered, the range of inaccurate pixels will be increased further. For example, if filtering is performed twice, the valid range will be reduced as follows:

Filter size of 5 × 5: -2 pixels × 3 = -6 pixels
Filter size of 3 × 3: -1 pixel × 3 = -3 pixels

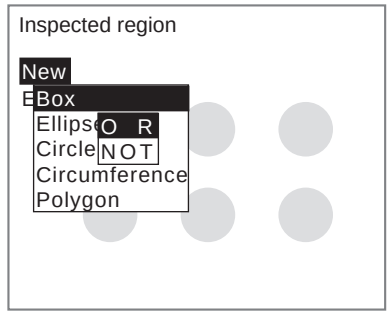
(Filtering is also performed once in edge extraction, so filtering is actually performed a total of three times.)

CHECK Regions 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.

1. Select ***Inspected region***.



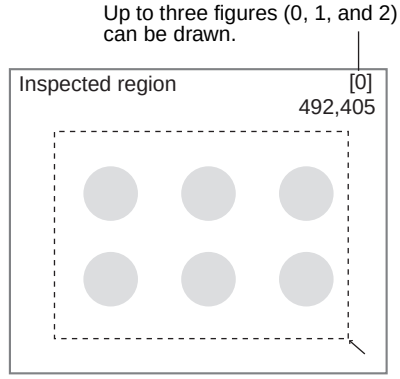
The screen for drawing regions will be displayed.



2. Select ***New***.
3. Select the desired figure.

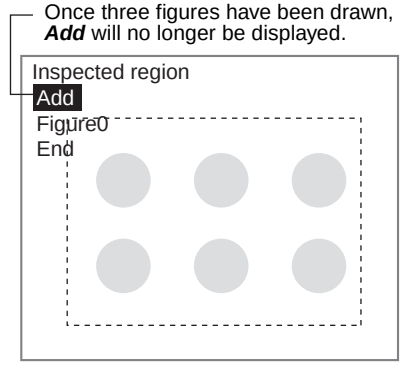
4. Select the desired drawing mode (***OR***/***NOT***).

   An arrow cursor will appear.



5. Draw the figure for the inspection region.

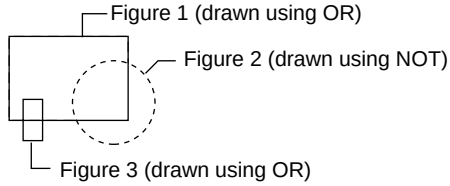
   The figure will be registered.



6. If additional figures are to be drawn, select ***Add***.
7. Repeat steps 3 to 5 as necessary to create the desired shape.
8. After drawing is completed, select ***End.***

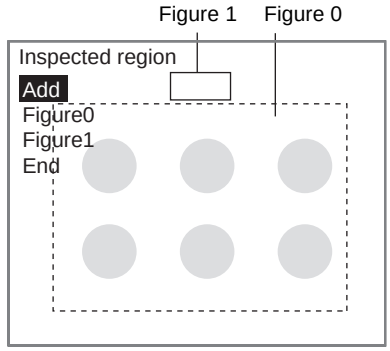
   The measurement region will be registered and the screen in (1.) will return.

CHECK Figures drawn in OR mode are displayed in solid lines. Figures drawn in NOT mode are displayed in dotted lines.



Correcting or Clearing Figures

1. In the screen for step 6 above, select the figure to be changed or cleared using the **Up** and **Down** Keys and press the **ENT** Key.



The figure for the figure number selected using the cursor will be displayed with solid lines. The selections ***Correct*** and ***Clear*** will be displayed.

2. Select either ***Correct*** or ***Clear*** and press the **ENT** Key.

   If ***Correct*** is selected, the cursor will be displayed. Correct the size and position of the figure as desired.

   If ***Clear*** is selected, the selected figure will be cleared.

2-19-5 Registering Circle Sizes

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

Registration method	Details
Input figure	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.
Input parameter	The radius of the circle and the permissible range are entered as parameters (in pixel units).

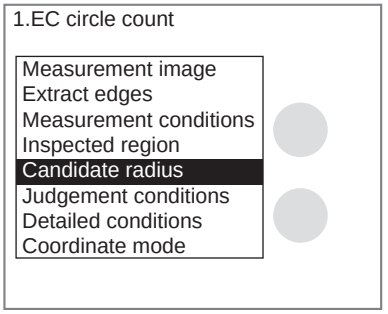
CHECK The size of the circle registered here is used to find circle candidates.

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.

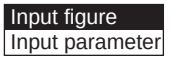
SeeAlso Refer to page 2-19-(14).

Inputting Figures

1. Select ***Candidate radius***.

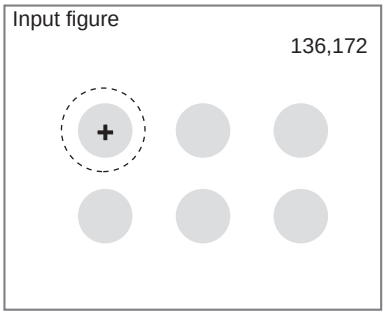


The registration selections will be displayed.



2. Select ***Input figure***.

The screen for drawing figures will be displayed.

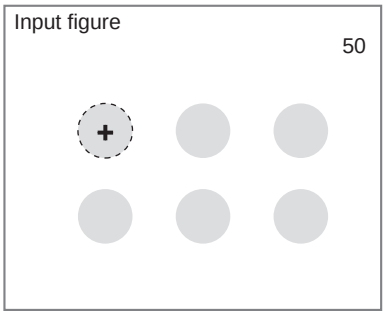


3. Specify the center position of the circle.

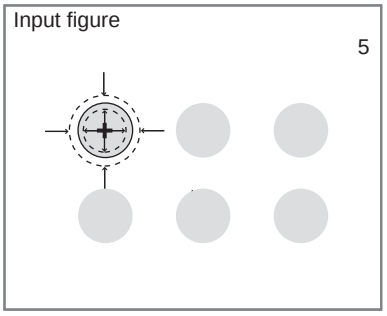
Up/Down/Left/Right Keys: Move the cursor.

ENT Key: Confirms the setting.

The screen for setting the radius will be displayed.



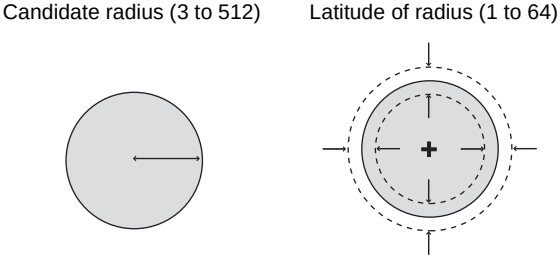
4. Specify the radius (3 to 512 pixels).
   Up/Right Keys: Larger
   Down/Left Keys: Smaller
   ENT Key: Confirms the setting.
   The screen for setting the latitude of the radius will be displayed.



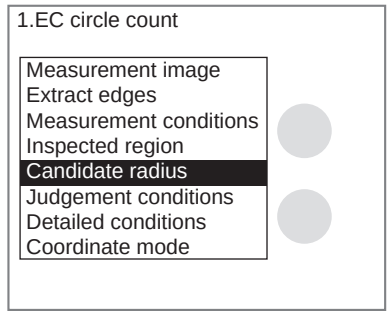
5. Specify the latitude of the radius (1 to 64 pixels).
   Up/Right Keys: Larger
   Down/Left Keys: Smaller
   ENT Key: Confirms the setting.
   The settings will be registered and the screen in (1.) will return.

Inputting Parameters

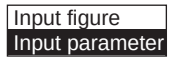
Input the parameters in pixel units for the radius and latitude of the circle.



1. Select ***Candidate radius***.

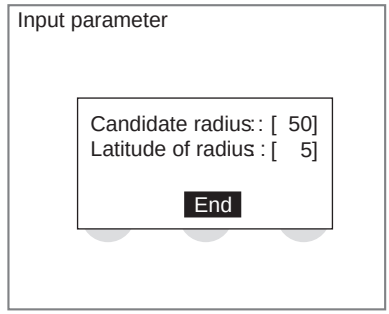


The registration selections will be displayed.



2. Select ***Input parameter***.

The Input Parameter Settings Screen will be displayed.

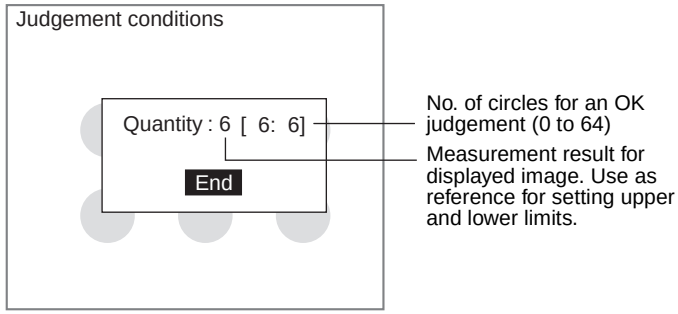


3. Make the settings for each item.
4. Select ***End***.

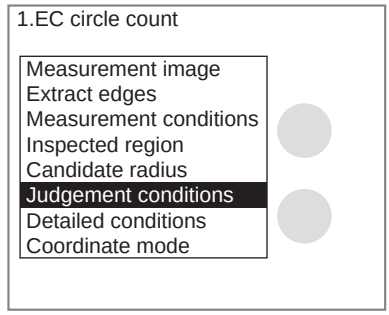
The settings will be registered and the screen in (1.) will return.

2-19-6 Setting Judgement Conditions

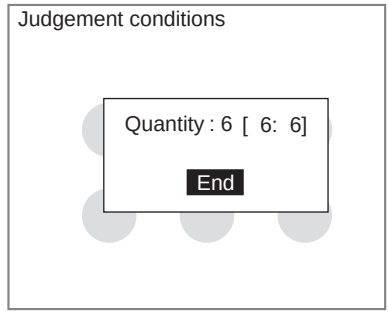
Set the number of circles for an OK judgement.



1. Select ***Judgement conditions***.



The Judgement Conditions Settings Screen will be displayed.



2. Set the conditions for an OK judgement.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

2-19-7 Setting Detailed Conditions

Adjust the detailed conditions if the circle detection is unstable or if circles of different sizes are counted.

CHECK Finding Circles

1. Extracting Circle Candidates

   Size: Set under *Candidate radius***.**

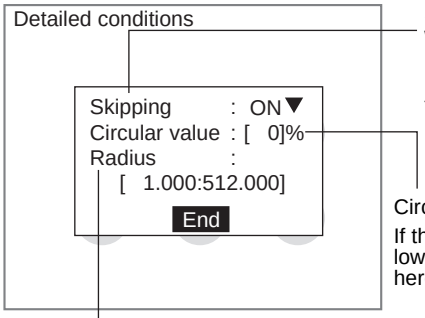
SeeAlso Refer to page 2-19-(10).

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?



Select whether pixel skipping (1 pixel) will be used when searching for circle candidates. (ON*, OFF)

Processing is faster if pixel skipping is ON and normally it is appropriate to set pixel skipping to ON. However, if the measurement values vary, set to OFF.

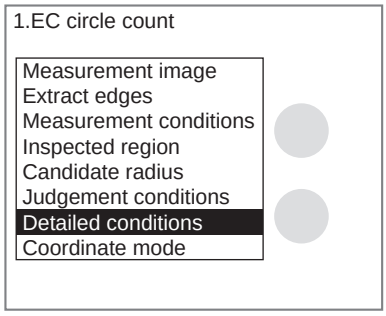
Circle deformity check (0 to 100 (0*))

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.

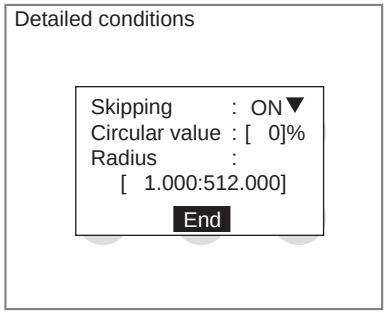
Set the radius for circles to be counted. (1.000 to 9999.999 (1.000 to 512.000*))
Candidate circles that do not fall within this radius range are not counted.

The asterisk (*) indicates the default setting.

1. Select ***Detailed conditions***.



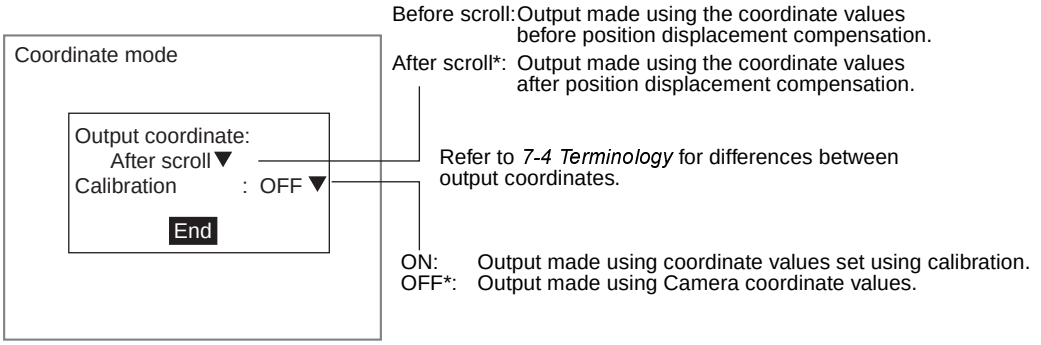
The Detailed Conditions Settings Screen will be displayed.



2. Make the settings for each item.
3. Select ***End***.
   The settings will be registered and the screen in (1.) will return.

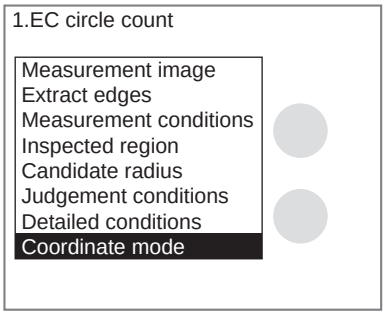
2-19-8 Setting the Coordinate Mode

Select the type of coordinate values if the center coordinates of circles are to be output.

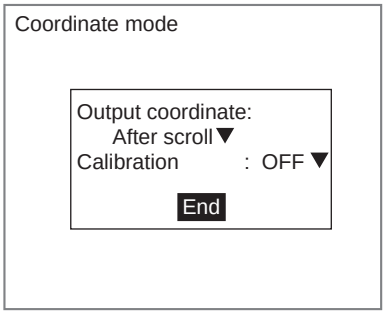


The asterisk (*) indicates the default setting.

1. Select ***Coordinate mode***.



The Coordinate Mode Settings Screen will be displayed.



2. Make the settings for each item.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

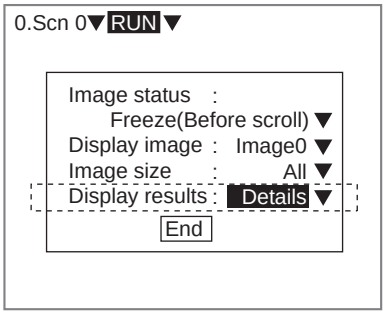
2-19-9 Measurement Screens

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

This section describes what kind of information can be displayed for EC circle count.

SeeAlso Refer to *SECTION 3 Monitor Mode and Run Mode* for details on Monitor and Run modes.

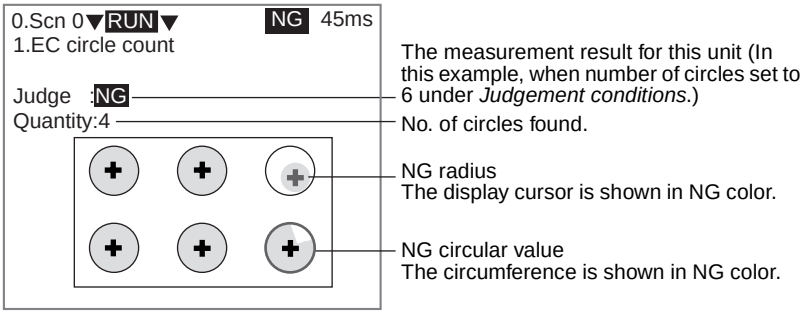
CHECK Press the **SHIFT+ESC** Keys on the Run Screen to access the following screen and change ***Display results*** to ***Details.***



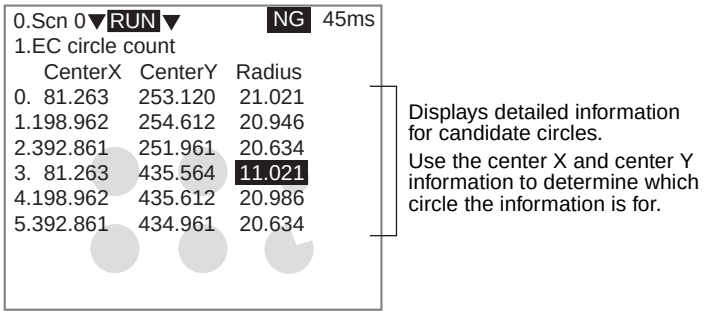
Use the **Up** or **Down** Key to change to the unit for which EC circle count inspection is set and the following detailed screens will be displayed.

Use the **SHIFT+Right** or **Left** Keys to switch in order between the three screens.

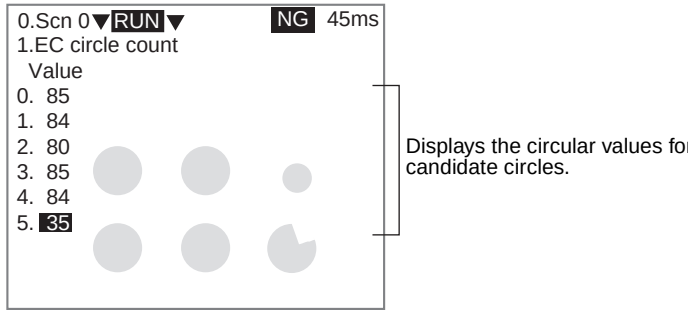
Judgement Result



Circle Information (Center Position and Radius)



Circle Information (Circular Value)



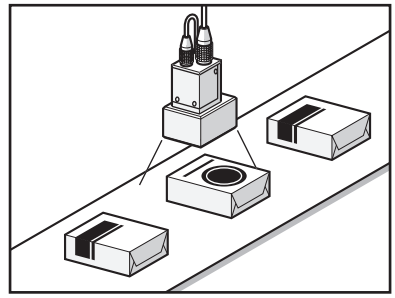
CHECK If the font size is set to small the circle information screens will be shown together.

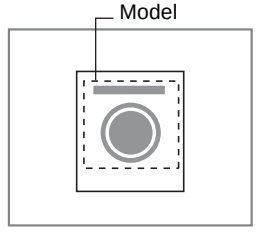
2-20 Pattern

Use the Pattern processing item to distinguish between measurement object shapes or positions.

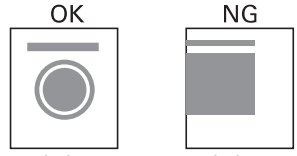
The part of the input image that most corresponds to the special characteristics of the measurement image (model) is found and the correlation (degree of similarity) and position are detected. Up to 64 regions can be registered to 1 unit and search processing can be executed simultaneously for these regions.

Example: Detecting for Mixed Varieties of Packaging



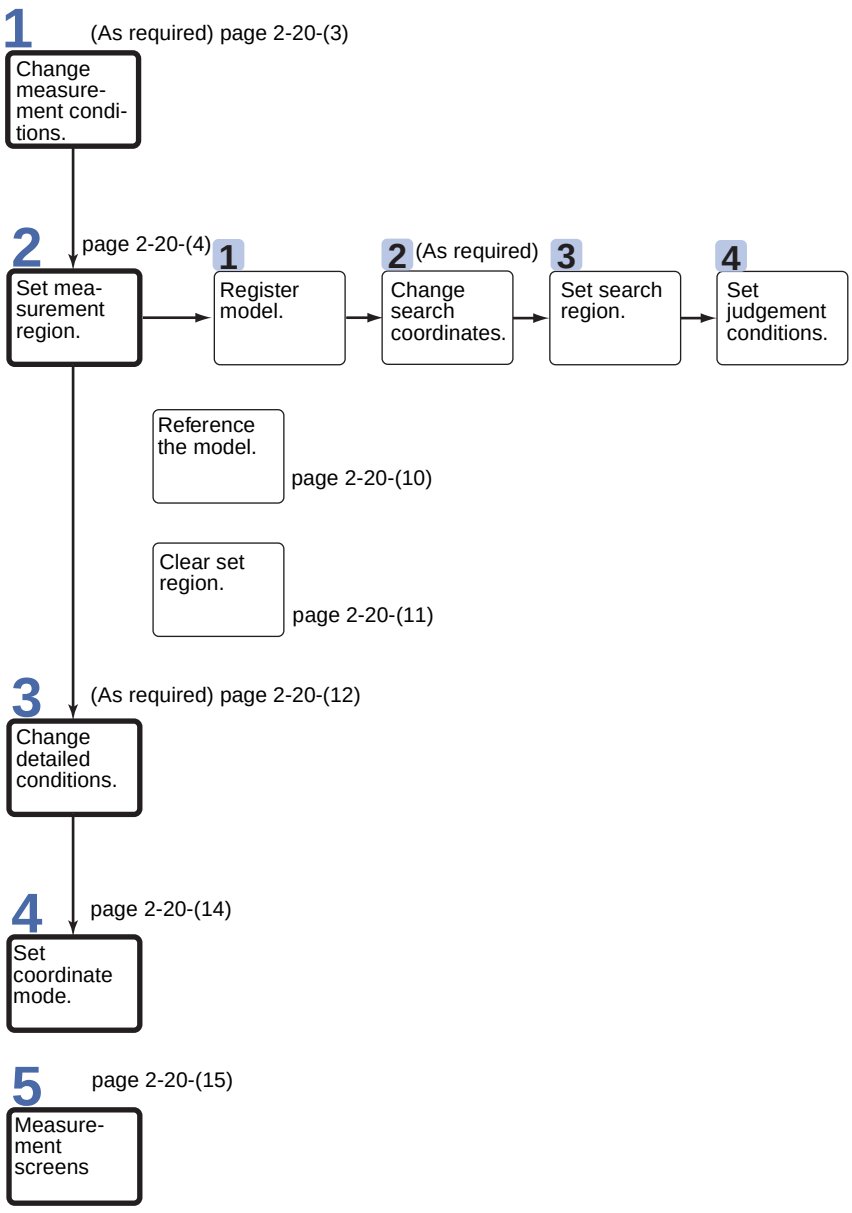


When judgement value (correlation) set to 70



Correlation: 80 Correlation: 20

Operational Flow



CHECK Pattern inspection uses the image stored at Image 0 as the measurement image; there is no menu for selecting the measurement image.

2-20-1 Changing Measurement Conditions

Change the settings for searches common to all measurement regions. Change these conditions for high-precision model position detection. 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.

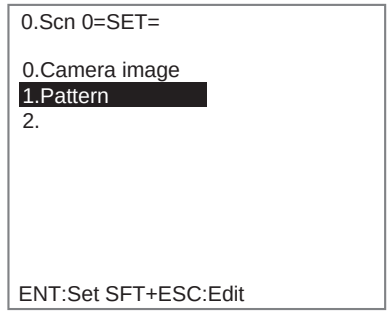
Accuracy

Select the degree of precision when searching for model positions.

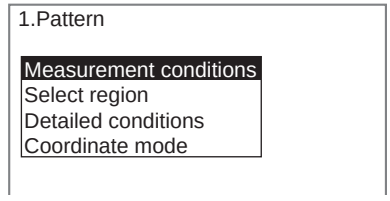
Accuracy setting	Details
Normal*	Finds the position in pixel units.
Precise	Finds the position in sub-pixel units. The measurement is performed with greater precision than the normal search, but processing time is longer.

The asterisk (*) indicates the default setting.

1. Select ***Pattern***.

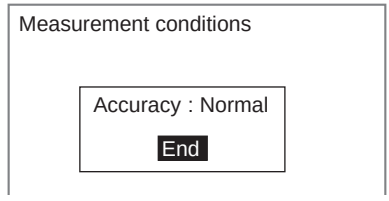


The selects for pattern inspections will be displayed.



2. Select ***Measurement conditions***.

   The Measurement Conditions Settings Screen will be displayed.

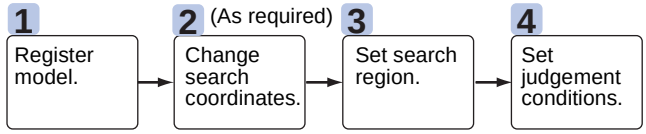


3. Change the accuracy setting.
4. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

2-20-2 Setting Measurement Regions

Up to 64 regions can be set.



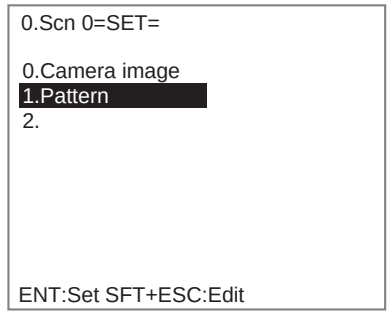
STEP 1: Registering the Model

The area of the image to be inspected is registered as a model.

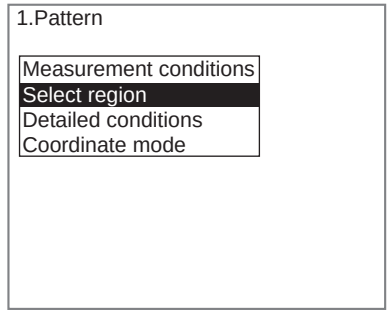
When a model is registered, the center position of the model is registered as the search coordinates. When several figures have been combined in the drawing, the center coordinates of circumscribing rectangle becomes the search coordinates.

CHECK Regions 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.

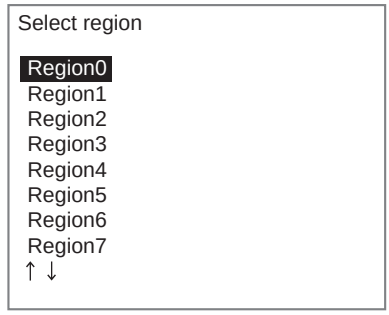
1. Select ***Pattern***.



The settings selections will be displayed.



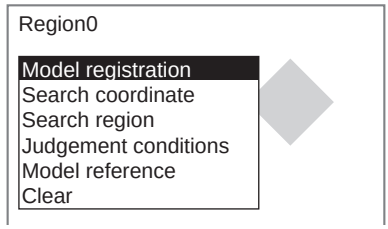
2. Select ***Select region***.
   A list of regions will be displayed.



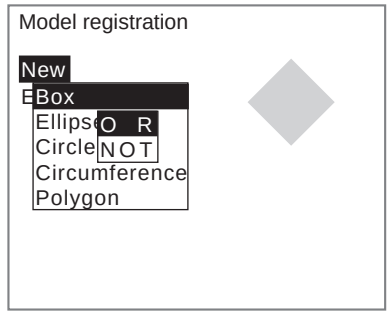
3. Select a region number.

CHECK Use the **Up** and **Down** Keys to display regions 8 to 63.

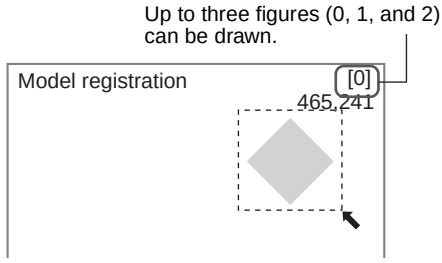
The selections for that region will be displayed.



4. Select ***Model registration***.
   The Model Registration Screen will be displayed.

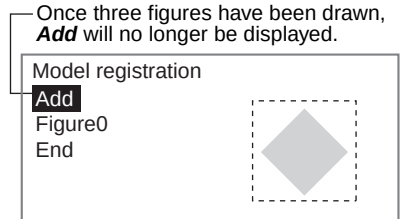


5. Select ***New***.
6. Select the desired figure.
7. Select the desired drawing mode (***OR***/***NOT***).
   An arrow cursor will appear.



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

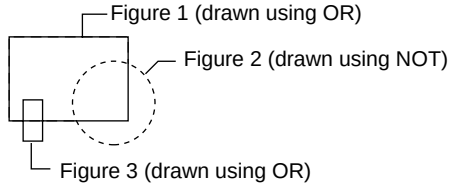
   The figure will be registered.



9. If additional figures are to be drawn, select ***Add***.
10. Repeat steps 6 to 8 as necessary to create the desired shape.
11. After drawing is completed, select ***End.***

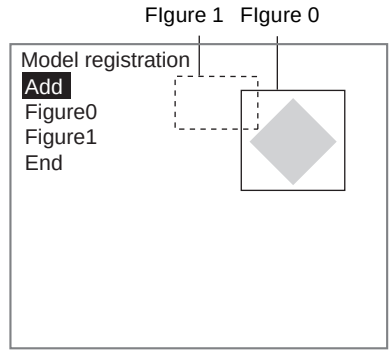
    The measurement region will be registered and the screen in (3.) will return. The search coordinates (display cursor) and the model region will be displayed.

CHECK Figures drawn using OR mode are displayed with solid lines and figures drawn using NOT mode are displayed with dotted lines.



Correcting or Clearing Figures

1. In the screen for step 8 above, select the figure to be changed or cleared using the **Up** and **Down** Keys and press the **ENT** Key.



   The figure for the figure number selected using the cursor will be displayed with solid lines. The selections ***Correct*** and ***Clear*** will be displayed.

2. Select either ***Correct*** or ***Clear*** and press the **ENT** Key.

   If ***Correct*** is selected, the cursor will be displayed. Correct the size and position of the figure as desired.

   If ***Clear*** is selected, the selected figure will be cleared.

CHECK To re-register a model, repeat the procedure from step 4 of *Step 1: Registering the Model*.

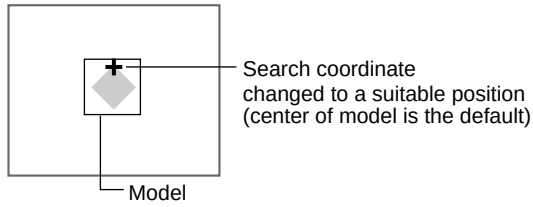
STEP 2: Changing the Search Coordinates

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.

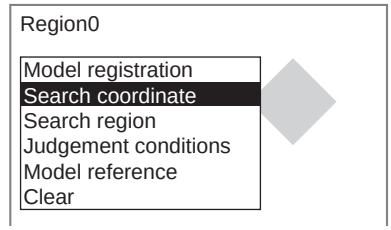
CHECK The search coordinates are used for the point output as the measurement value. The search coordinates can be changed to any point inside the model. If multiple figures have been combined to create the model, the search coordinates will be limited to the circumscribing rectangle.

Changing the Point Output as the Measurement Value

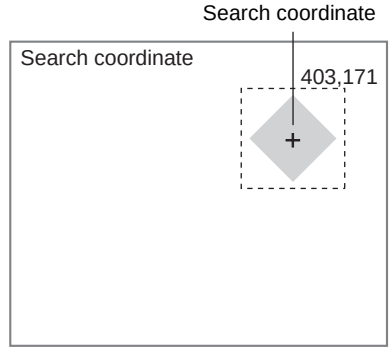


CHECK If the model is re-registered, the search coordinates are changed to the center position of the new model.

1. Select ***Search coordinates.***



A cursor will appear in the center position.



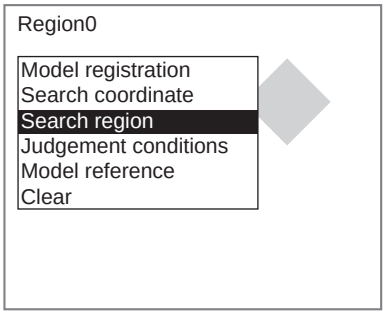
2. To change the position, use the **Up**/**Down** and **Right**/**Left** Keys to move the cursor.
3. Press the **ENT** Key.

   The setting will be registered and the screen in (1.) will return.

STEP 3: Setting the Search Region

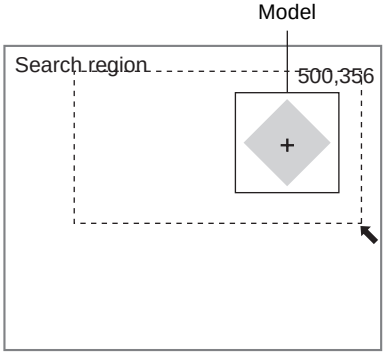
Set the region in which the model is to be searched for. It is possible to perform a search for the entire input image but accuracy can be increased by setting limits on the search region.

1. Select ***Search region***.



An arrow cursor will appear.

The model will be displayed in solid lines.



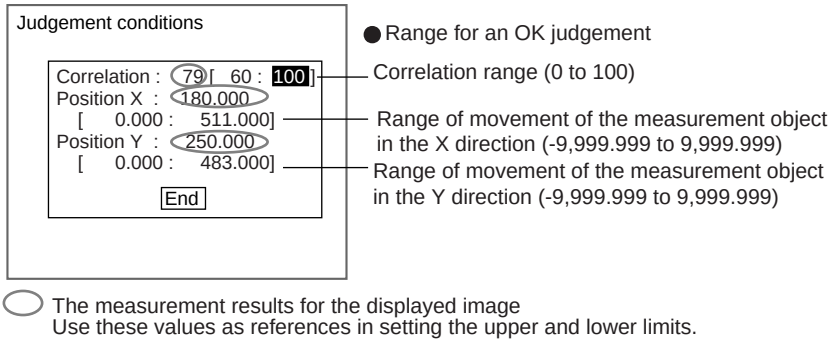
2. Draw a box-shaped search region.

CHECK The only figure that can be drawn is a box.

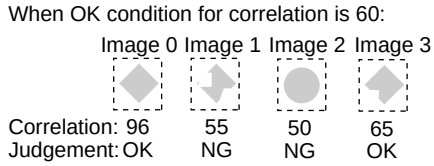
The search region will be set and the screen in (1.) will return.

STEP 4: Setting Judgement Conditions

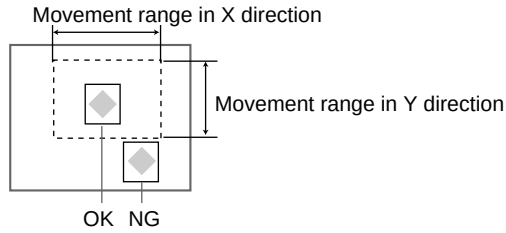
Set the judgement conditions for the correlation with the model and for the position (X, Y) where the object was detected.



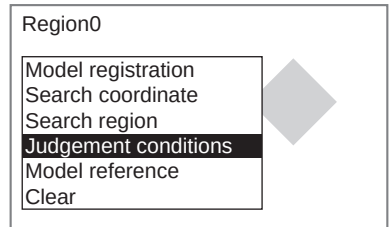
CHECK Correlation



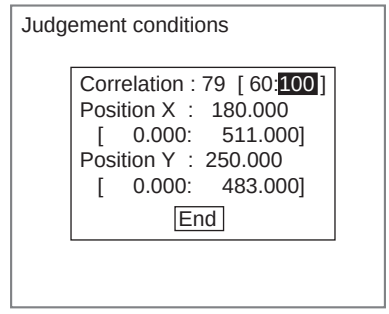
CHECK Position X and Position Y



1. Select ***Judgement conditions***.



The Judgement Conditions Settings Screen will be displayed.



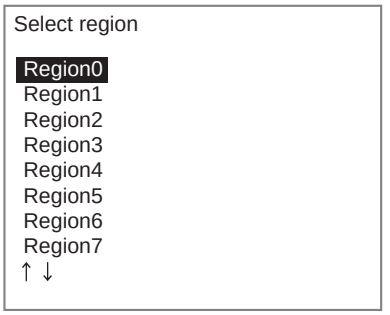
2. Make the settings.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

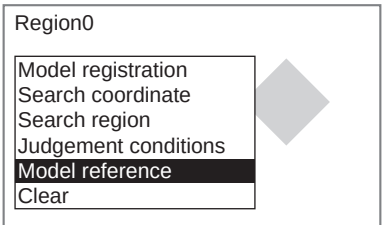
2-20-2-1 Referencing Models

Use this operation to confirm registered models.

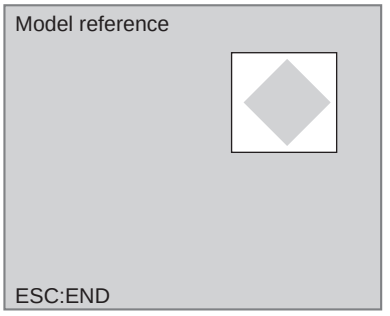
1. Select the region number for the model to be checked.



A list of selections will be displayed.



2. Select ***Model Reference***.
   The model will be displayed at the position where registered.

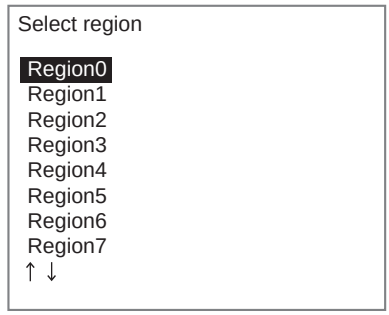


3. Press the **ESC** Key to exit this screen.
   The screen in (1.) will return.

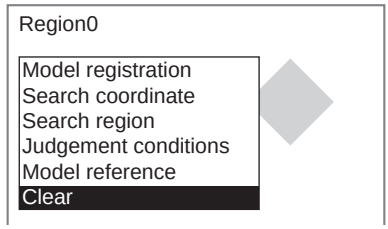
2-20-2-2 Clearing Set Regions

The clear operation is performed separately for each region.

1. Select the number of the region to be cleared.

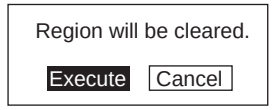


A list of selections will be displayed.



2. Select ***Clear***.

A confirmation message will be displayed.



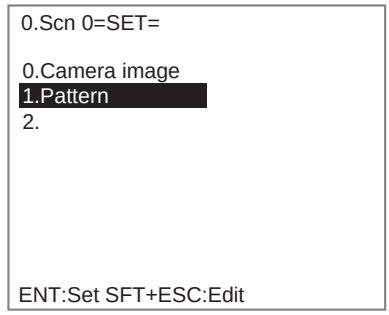
3. Select ***Execute***.

The region will be cleared and the screen in (1.) will return.

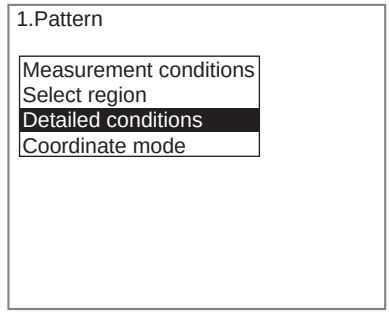
2-20-3 Setting Detailed Conditions

The search settings can be changed here. Change the conditions if the measurement results are unstable. 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.

1. Select ***Pattern***.

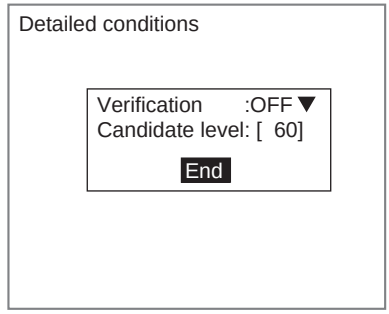


A list of settings selections will be displayed.



2. Select ***Detailed conditions***.

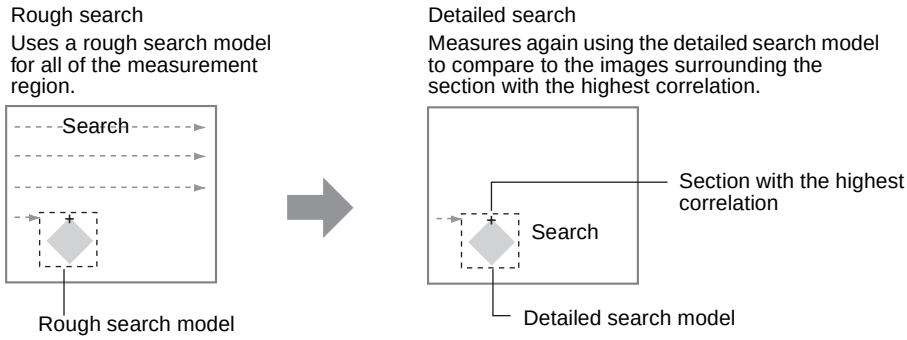
The Detailed Conditions Settings Screen will be displayed.



3. Change the settings.
4. Select ***End***.

The settings will be registered and the screen in (1.) will return.

CHECK The Controller performs the following 2-stage processing internally.



Search Verification and Candidate Levels

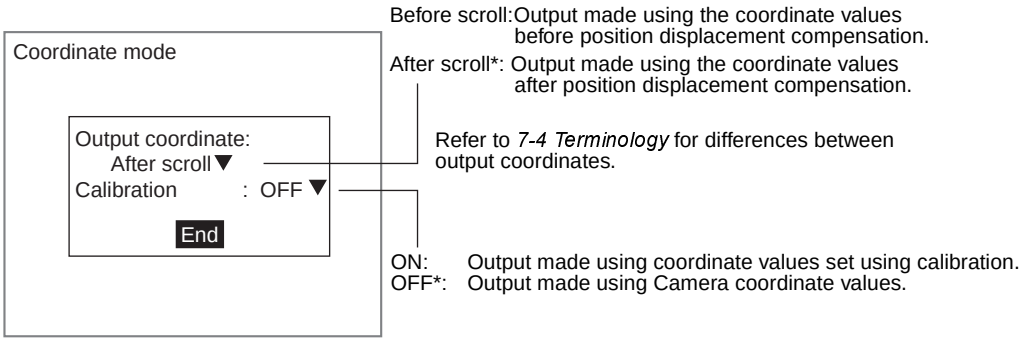
Select whether or not to perform detailed searches on models at the candidate level or higher. If model searches are unstable, set search verification to ON and adjust the candidate level.

Setting item	Selection/ Setting range	Details
Search verification	OFF*	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 (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 search verification is set to ON.

The asterisk (*) indicates the default setting.

2-20-4 Setting the Coordinate Mode

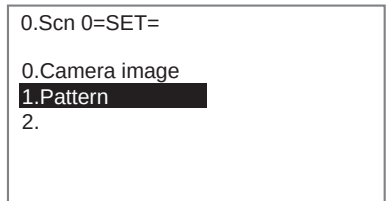
Select the type of coordinate values.



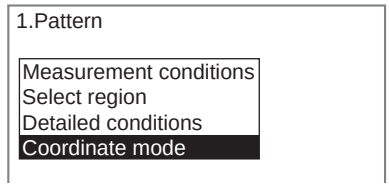
The asterisk (*) indicates the default setting.

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.

1. Select ***Pattern***.

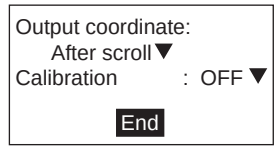


The settings selections will be displayed.



2. Select ***Coordinate mode***.

   The Coordinate Mode Settings Screen will be displayed.



3. Make the settings for each item.
4. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

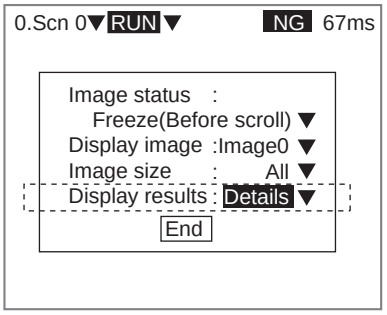
2-20-5 Measurement Screens

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

This section describes what kind of information can be displayed for pattern inspections.

SeeAlso Refer to *SECTION 3 Monitor Mode and Run Mode* for details on Monitor and Run modes.

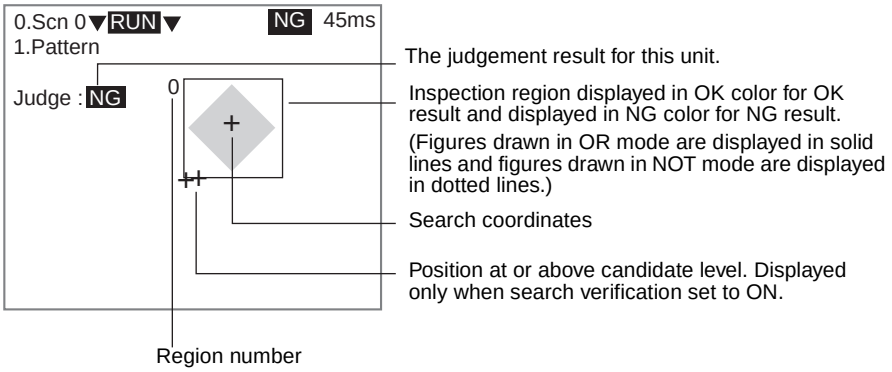
CHECK Press the **SHIFT+ESC** Keys on the Run Screen to access the following screen and change ***Display results*** to ***Details***.



Use the **Up** or **Down** Key to change to the unit for which pattern inspection is set and the following detailed screens will be displayed.

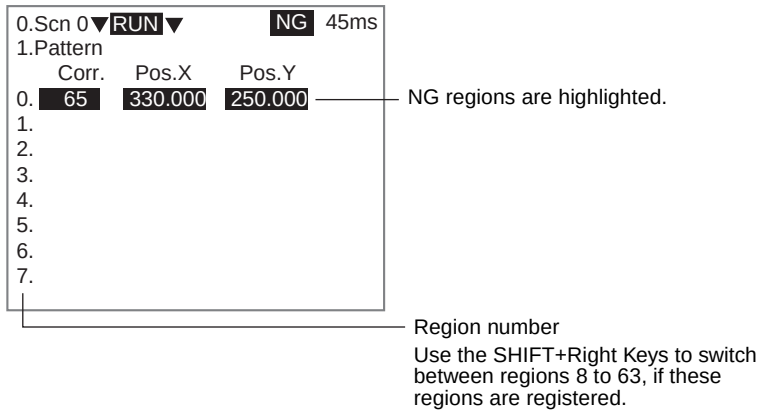
Use the **SHIFT+Right** or **Left** Keys to switch in order between the two screens.

Measurement Region and Position Display



Measurement Value Display

The measurement values for each region are displayed.



CHECK If the font size is set to small, regions 0 to 31 will be shown together.

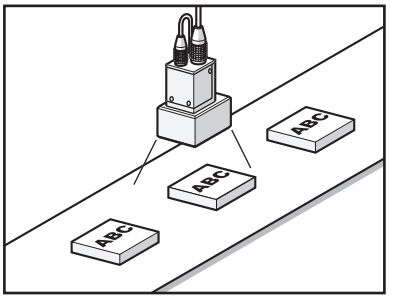
2-21 QUEST Character Verification

The QUEST Character Verification processing item (QUEST OCV) is used to recognize alphanumeric characters and symbols.

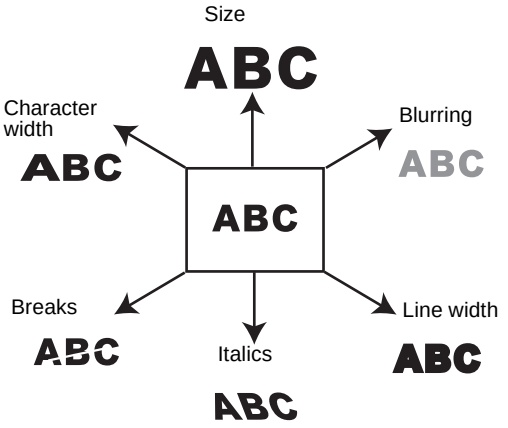
Expiration dates, lot numbers, and other characters can be found (in a process called a “quest”) without being affected by variations or deformities.

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



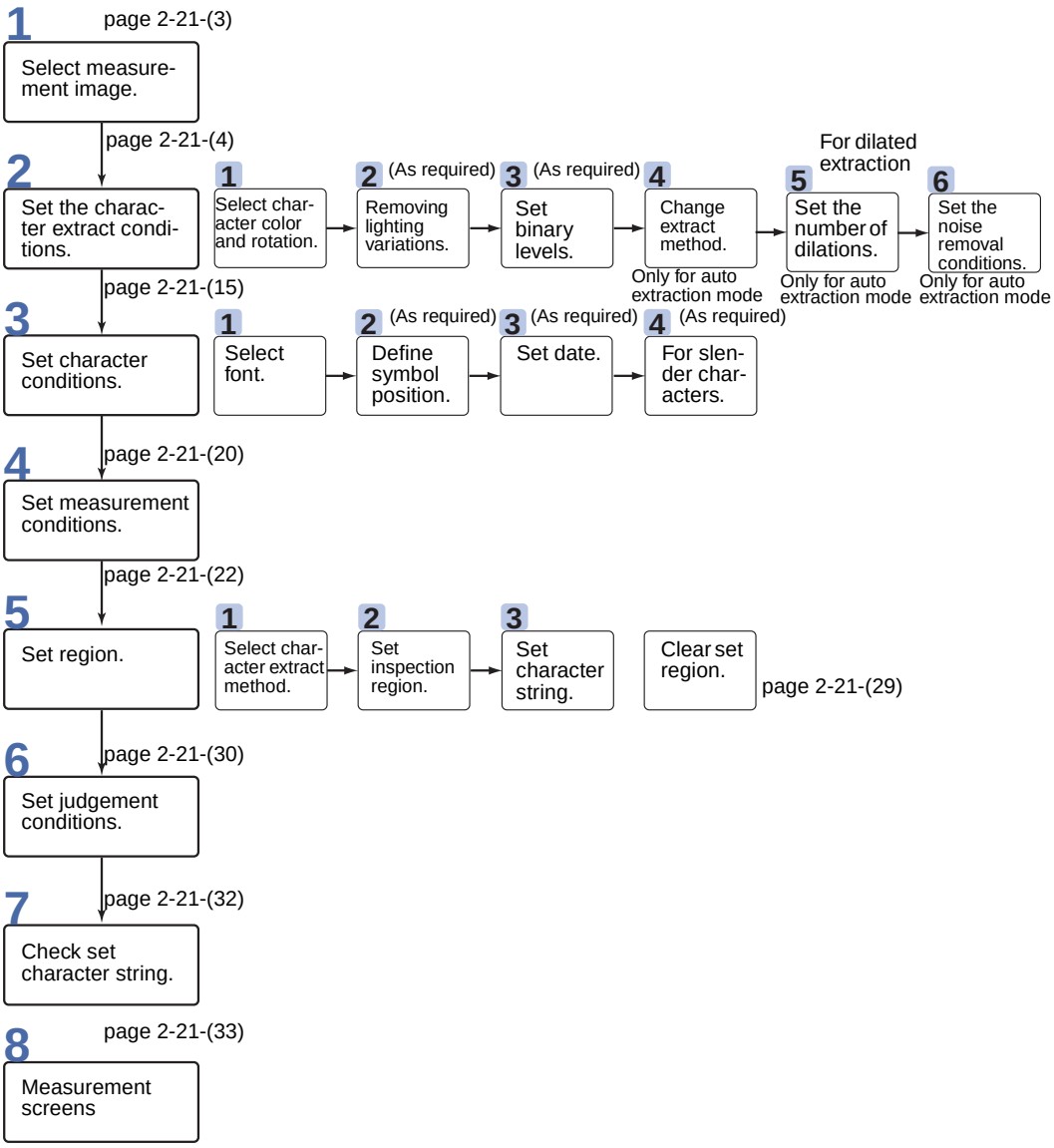
The following character variations are handled by the QUEST OCV.



Performance

Item	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.	

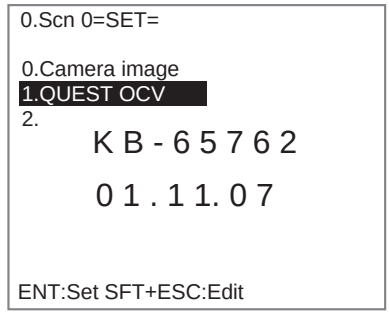
Operational Flow



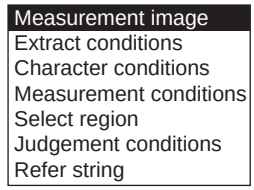
2-21-1 Selecting Measurement Images

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

1. Select ***QUEST OCV***.



The initial QUEST OCV Screen will be displayed.



2. Select ***Measurement image***.

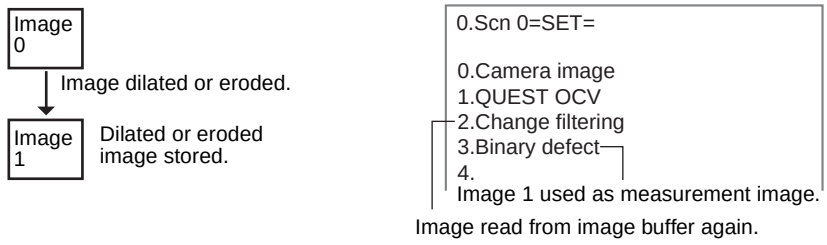
   The selections will be displayed.

3. Select which image will be used for measurement, the image stored at Image 0 or the image stored at Image 1.
4. Press the **ENT** Key.

   The settings will be registered and the screen in (1.) will return.

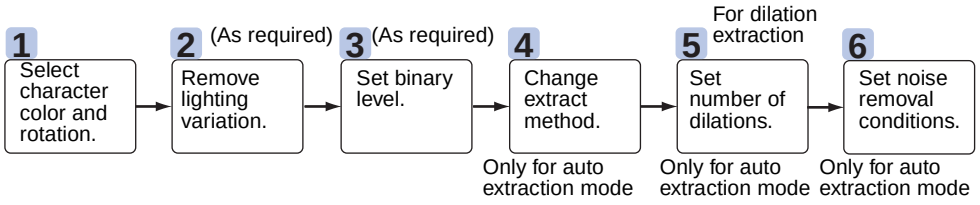
CHECK If *Shading* is set under *Extract conditions* (i.e., the shading level has been set to 1 or higher), the image selected here will be dilated or eroded and stored at the other image number. Set Change Filtering as the next processing item to use this image for measurement for units after the unit for which QUEST OCV 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



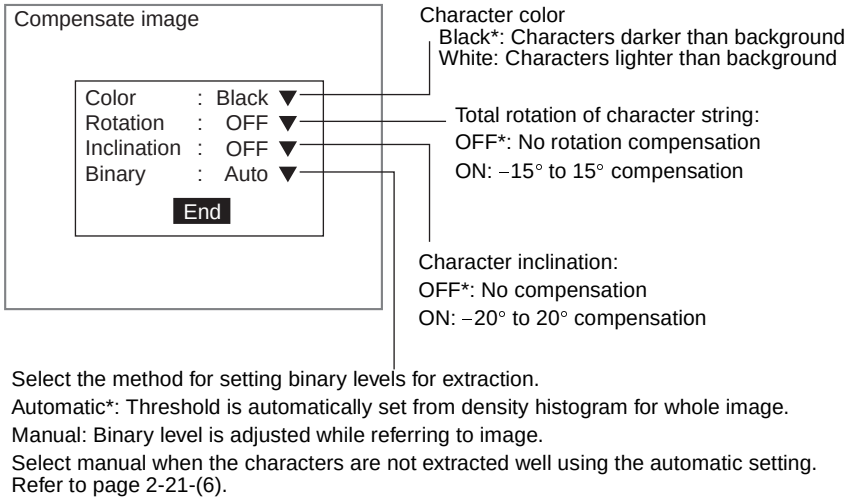
2-21-2 Setting Extract Conditions

Operational Flow



STEP 1: Selecting Character Color and Rotation

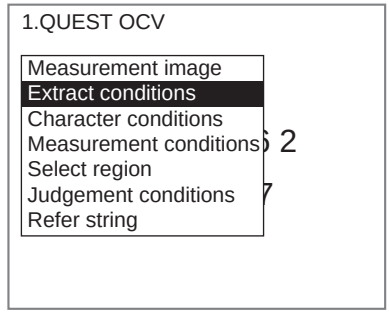
Set the character color and whether or not to use rotation compensation.



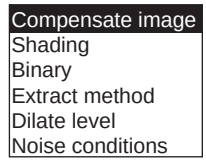
Select the method for setting binary levels for extraction.
Automatic*: Threshold is automatically set from density histogram for whole image.
Manual: Binary level is adjusted while referring to image.
Select manual when the characters are not extracted well using the automatic setting.
Refer to page 2-21-(6).

Note The rotation and inclination settings are enabled only for regions for which automatic extraction is selected under *Select region/Region/Mode*.

1. Select ***Extract conditions***.

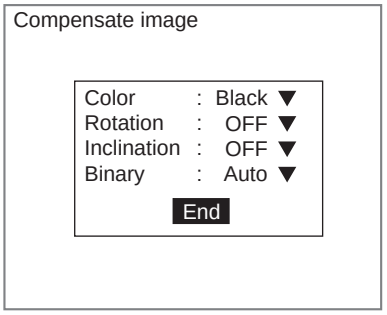


The settings selections will be displayed.



2. Select ***Compensate image***.

   The Compensate Image Settings Screen will be displayed.

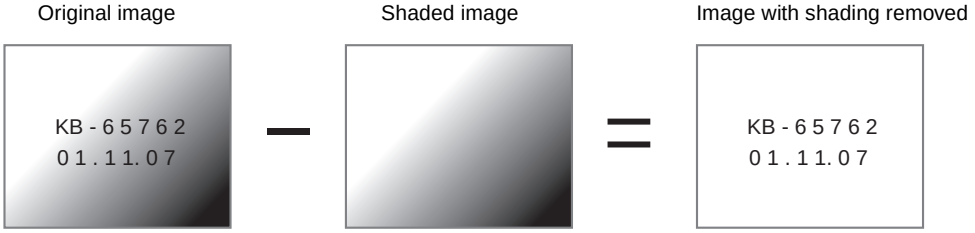


3. Change the settings.
4. Select ***End***.

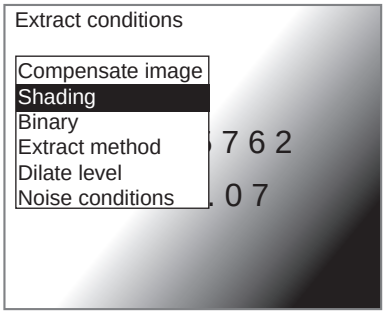
   The settings will be registered and the screen in (1.) will return.

STEP 2: Removing Lighting Variations

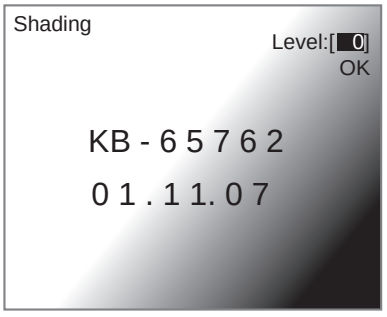
Characters cannot be extracted accurately if lighting variations cause the characters to become illegible.



1. Select ***Shading***.



The Shading Levels Settings Screen will be displayed.

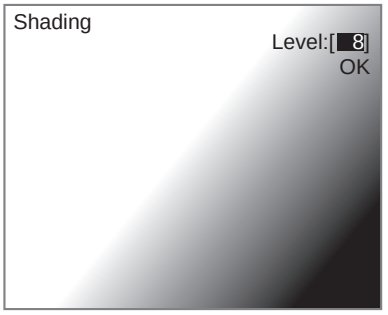


2. Place the cursor on the level and use the **Left** and **Right** Keys to change the level to between 0 and 10.

   Right Key: Increases the value by one.

   Left Key: Decreases the value 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.



3. Select ***OK***.

   The settings will be registered and the screen in (1.) will return.

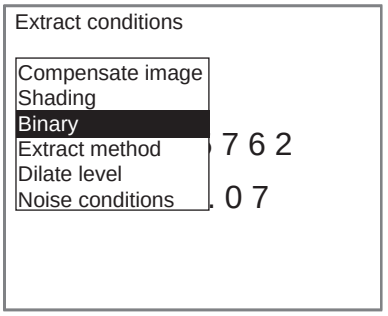
STEP 3: Setting Binary Levels

The QUEST OCV 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.

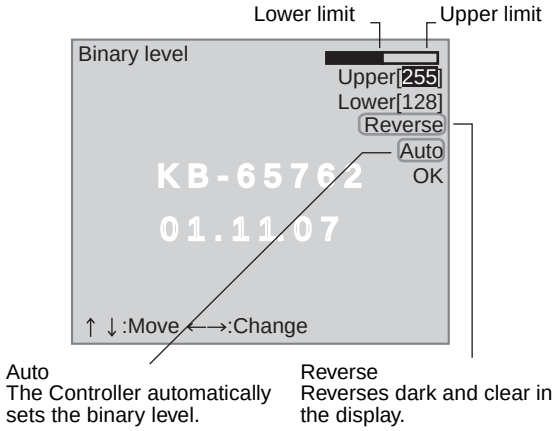
CHECK When Binary Method Is Set to Automatic

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.

1. Select ***Binary***.



The settings screen for binary levels will be displayed.

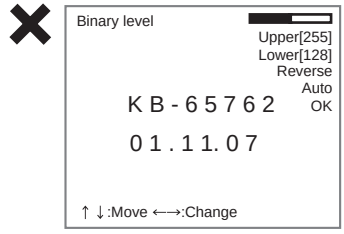


2. Move the cursor to the upper limit and use the **Left** and **Right** Keys to change the value.

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 10 times faster.
Up and Down Keys:	Switches between setting items.

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

CHECK Set the upper and lower limits so that the characters are displayed as white pixels.



4. Select ***OK***.

   The settings will be registered and the screen in (1.) will return.

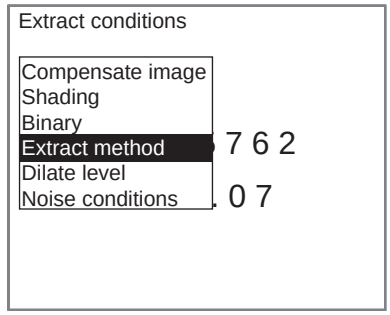
CHECK It is also possible to set the binary level so that measurement is performed only for an intermediate density range.

STEP 4: Changing Extract Methods

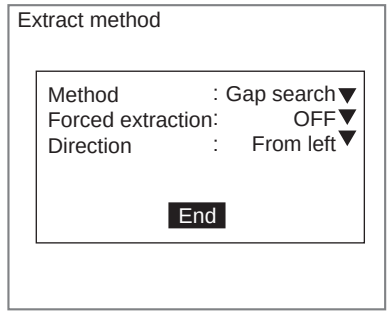
Change the extract method if the characters are not extracted accurately. Normally, the method can be left on the default setting. After changing the setting, perform a measurement to check that the characters can still be extracted correctly.

CHECK The extract method setting is enabled only for regions for which automatic extraction is selected under *Select region/Region/Mode*.

1. Select ***Extract method***.

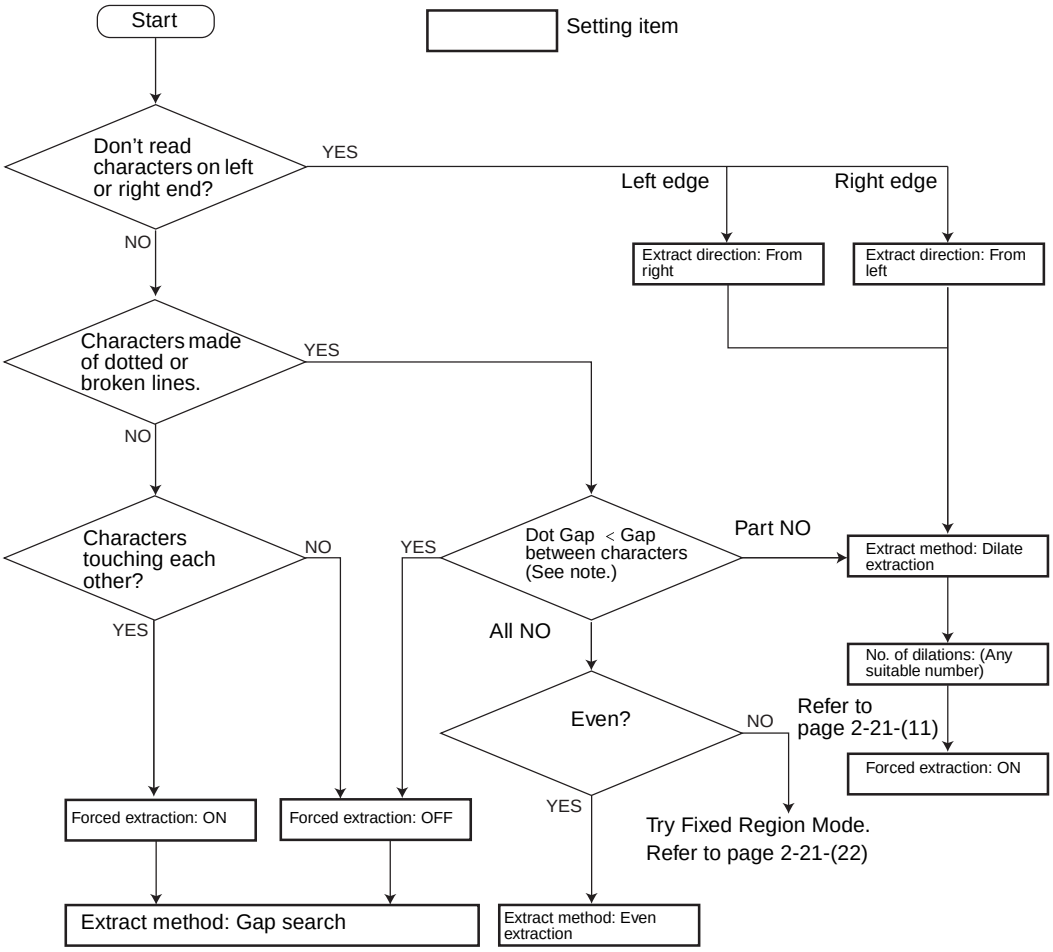


The Extract Method Settings Screen will be displayed.



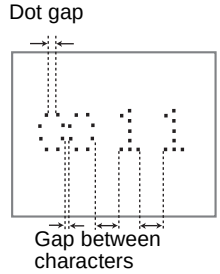
2. Change the settings.
3. Select ***End***.
   The settings will be registered and the screen in (1.) will return.

Guide to Setting Conditions

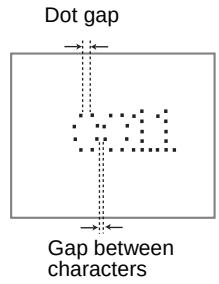


Note Select the extract methods according to the relationship between the dot gap and the gap between characters as follows:

- 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.



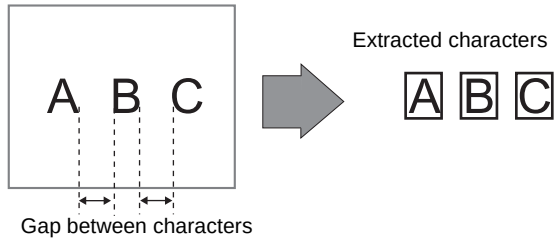
In the following descriptions, the asterisk (*) indicates the default setting.

Extract Methods

Gap Search*

Finds the gap between characters and extracts the characters.

Select this method for most applications.



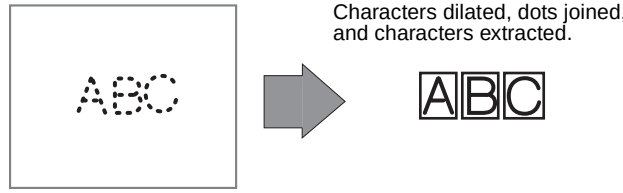
Dilate Extraction

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, select dilation 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*.

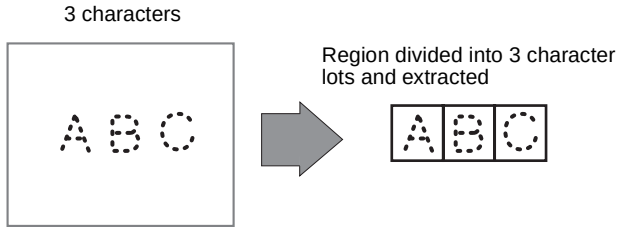
SeeAlso Refer to page 2-21-(11).

CHECK Use in conjunction with forced extraction because the gap between characters are also joined when the characters are dilated.



Even Extraction

The character string is divided into a specified number of characters and extracted at even intervals.



Forced Extraction

If the set number of characters cannot be extracted, select whether or not to use forced extraction. The settings are OFF* or ON.

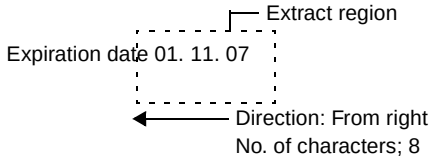
The forced extraction function extracts characters that are joined due to printing errors or because they are inclined.

Forced extraction is enabled only when *Gap search* or *Dilate extraction* are selected as the extract method.

Extract Direction

The direction setting is enabled only when *Dilate extraction* is selected as the extract method. The direction choices are from left* or from right.

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.

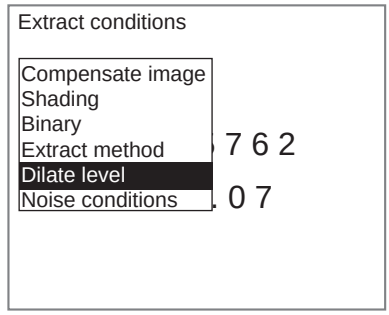


Extraction is performed on 8 characters starting from the right, so final “e” in “Expiration date” is ignored.

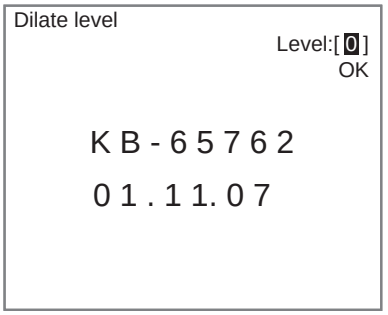
STEP 5: Setting Number of Dilations

Set the number of dilations between 0 and 9 if dilate extraction has been chosen as the extract method.

1. Select ***Dilate level***.



The Dilate Level Settings Screen will be displayed.



2. Move the cursor to the level value and use the **Left** and **Right** Keys to change the value (0 to 9).

   Right Key: Increases the level by 1.

   Left Key: Decreases the level by 1.

3. Select ***OK***.

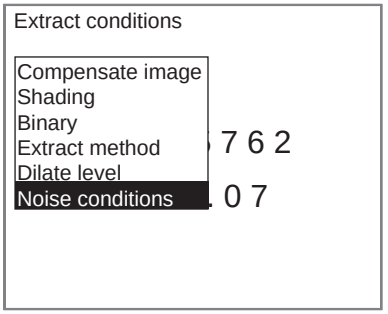
   The settings will be registered and the screen in (1.) will return.

STEP 6: Setting Noise Removal Conditions

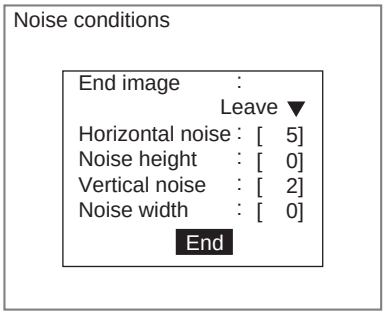
Set the conditions for ignoring noise when executing character extraction.

CHECK The noise removal settings are enabled only for regions for which automatic extraction is selected under *Select region/Region/Mode*.

1. Select ***Noise conditions***.



The Noise Conditions Settings Screen will be displayed.



2. Change the conditions.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

In the following descriptions, the asterisk (*) indicates the default setting.

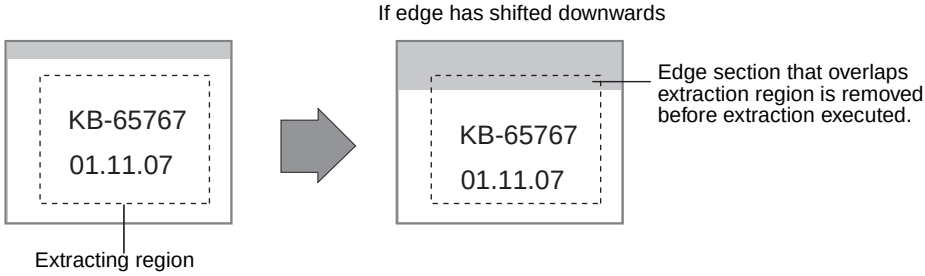
End Images

Select whether to leave or remove the area adjacent to the extracting region.

(Leave*, Erase (horizontal), Erase (vertical))

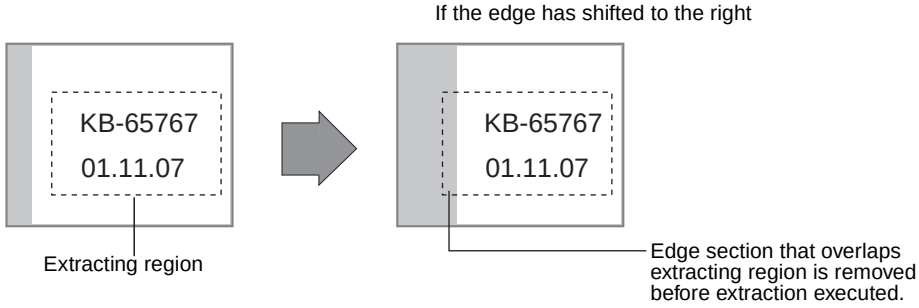
For Measurement Objects that Move Vertically

Select ***Erase (vertical)***.



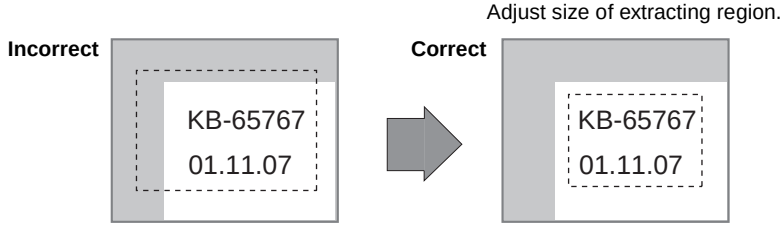
For Measurement Objects that Move Horizontally

Select ***Erase (horizontal)***.



For Measurement Objects That May Move Vertically or Horizontally

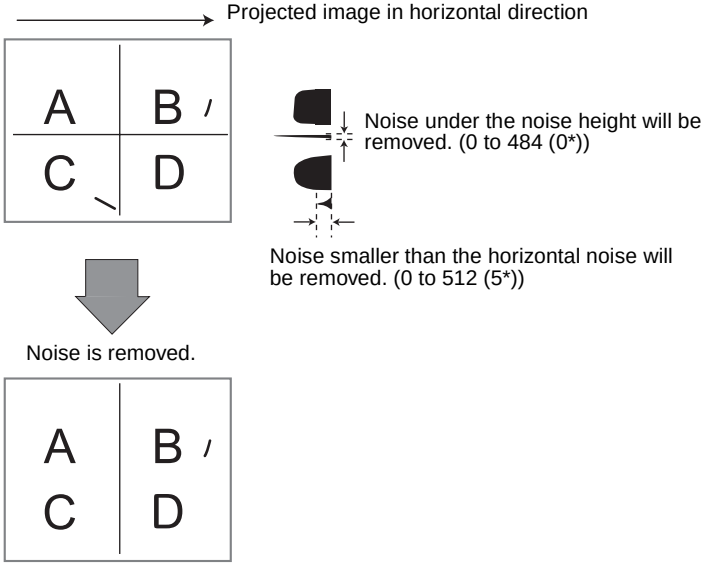
Only edges that overlap either vertically or horizontally can be removed. If the edges overlap both vertically and horizontally, the characters cannot be extracted correctly. If the possibility exists of overlap in both directions, adjust the position and size of the extracting region so that only the characters to be extracted fall within the extracting region.



In the following descriptions, the asterisk (*) indicates the default setting.

Horizontal Noise and Noise Height

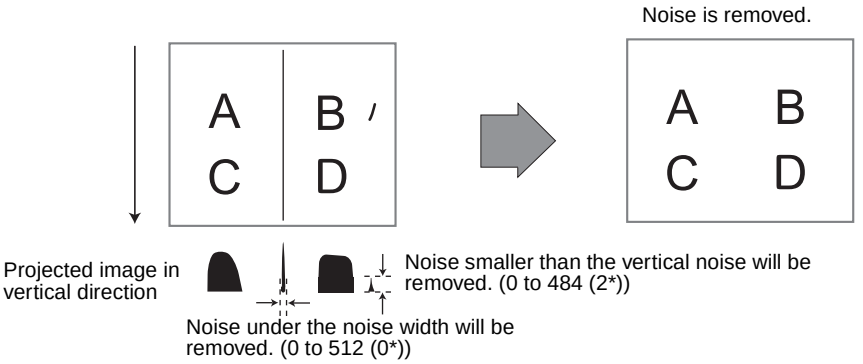
To extract lines, a projected image in the horizontal direction must be created. Set the size to be removed as noise from this projected image.



Vertical Noise and Noise Width

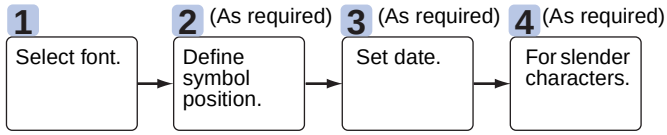
To extract characters in an image after lines have been extracted, a projected image must be created in the vertical direction.

Set the size to be removed as noise from this projected image.



2-21-3 Setting Character Conditions

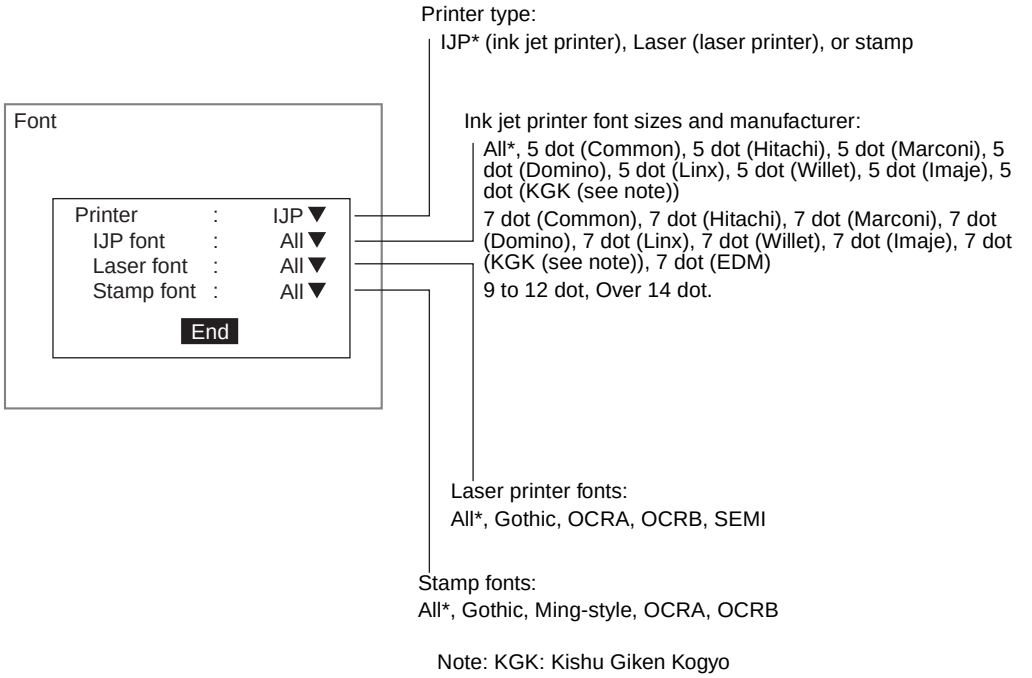
Operational Flow



STEP 1: Selecting Fonts

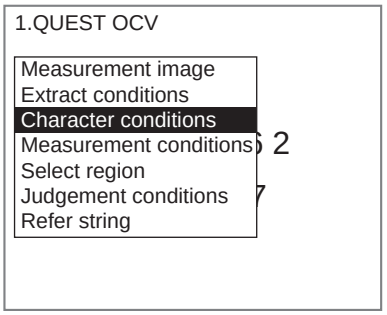
Select the font for the characters to be verified.

If the font is unknown, change IJP font, laser font, and stamp font settings to *All*.

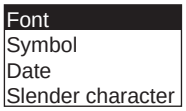


The asterisk (*) indicates the default setting.

1. Select ***Character conditions***.

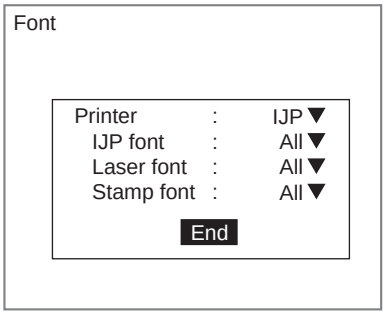


The settings selections will be displayed.



2. Select ***Font***.

The Font Settings Screen will be displayed.



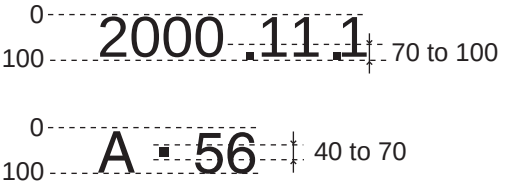
3. Set the font conditions.
4. Select ***End***.

The settings will be registered and the screen in (1.) will return.

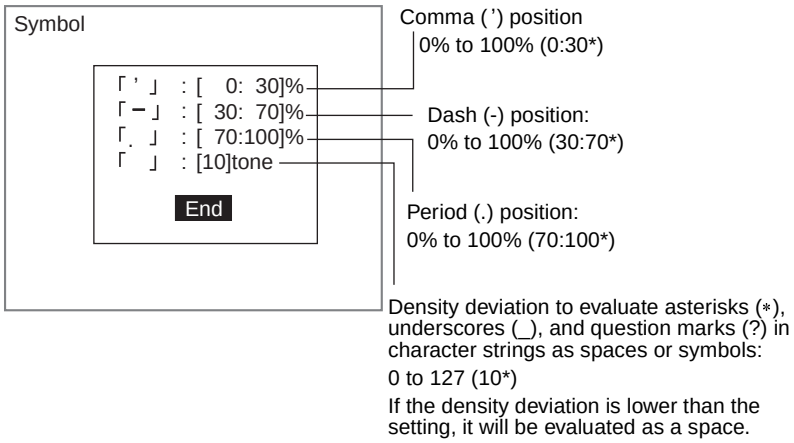
STEP 2: Defining Symbol Positions

The meanings of the comma (,), 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.



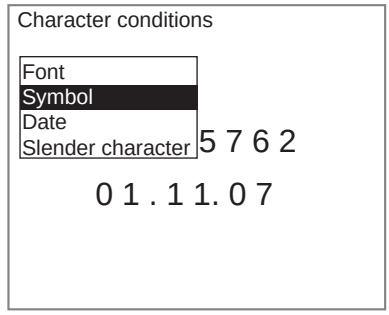
If the character string contains asterisks (*), underscores (_), or question marks (?), set the reference value for the density deviation to evaluate these symbols as spaces or symbols.



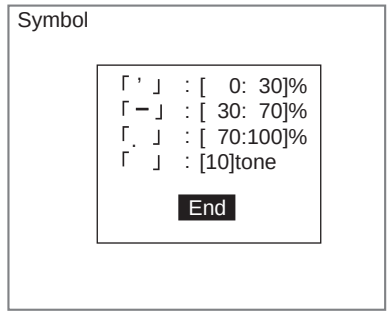
The measurement value for density deviation can be checked under the detailed results display on the measurement screen.

The asterisk (*) indicates the default setting.

1. Select ***Symbol***.



The Symbol Settings Screen will be displayed.



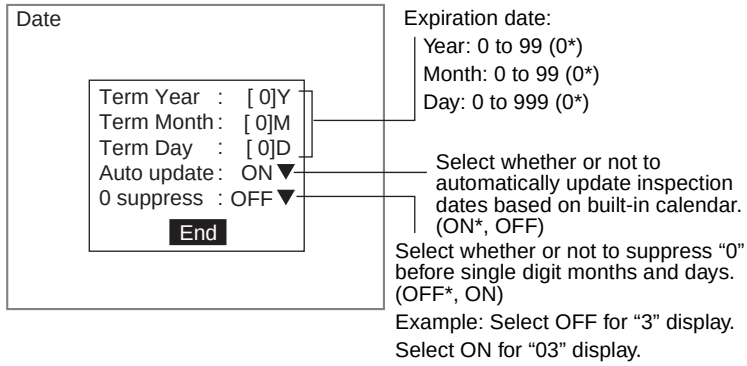
2. Set the range for each symbol to be recognized.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

STEP 3: Setting Dates

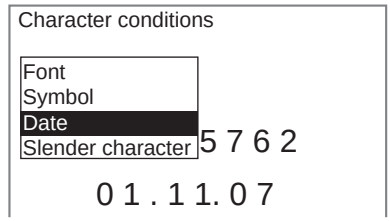
The Controller has a built in calendar. Character strings that are inspected in accordance with this calendar can be updated automatically. The expiration date from the production date can be set so that the expiration date can be automatically updated.

SeeAlso Refer to *SECTION 5 System Settings* for information on setting the calendar.

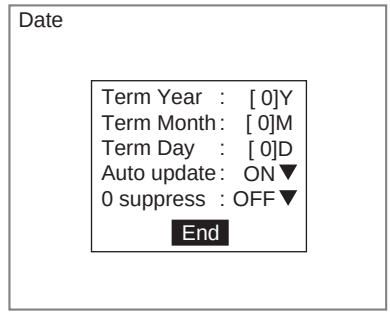


The asterisk (*) indicates the default setting.

1. Select ***Date***.



The Date Settings Screen will be displayed.



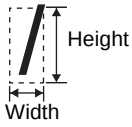
2. Set the date conditions.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

STEP 4: Slender Characters

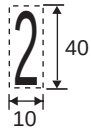
The frame size of the extracted characters is checked during QUEST character verification and if the horizontal to vertical aspect ratio is greater than the set value, the verification will be performed using the “1”, “I”, “J”, “:”, and “/” dictionary models only.

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)

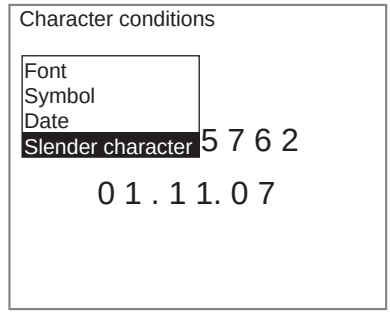
Example:



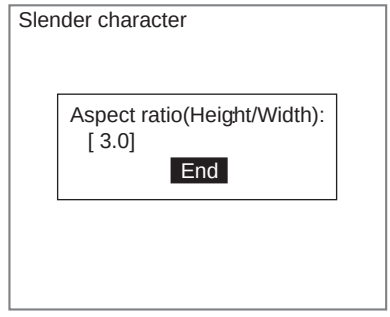
40 ÷ 10 = 4

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.

1. Select ***Slender character***.



The Slender Character Settings Screen will be displayed.



2. Set the aspect ratio.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

2-21-4 Setting Measurement Conditions

Change the conditions as required if the character verification is unstable or to increase processing speed.

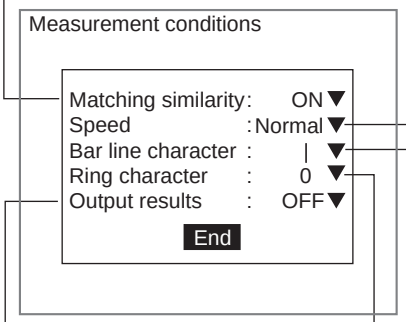
Select whether or not to distinguish between similar characters. (ON*, OFF)

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.



Select whether or not to decrease the number of matching models and increase execution speed.

Normal*: 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.

Note: This speed setting is ignored if “?” is set for the characters (OCR mode).

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”.

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, Ø, will be read as the number 0 regardless of this setting.)

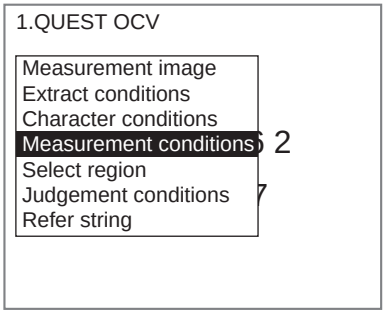
Select whether or not to output to a serial port the 1st candidate character strings. (OFF*, ON)

If 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.

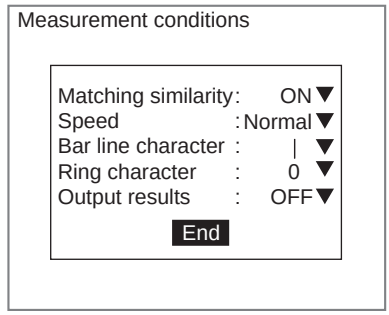
Output format
<unit number>, <region number>, <line number>, <number of characters>, <1st candidate character string>*delimiter*.

The asterisk (*) indicates the default setting.

1. Select ***Measurement conditions***.



The Measurement Conditions Settings Screen will be displayed.



2. Make the settings.
3. Select ***End***.
   The settings will be registered and the screen in (1.) will return.

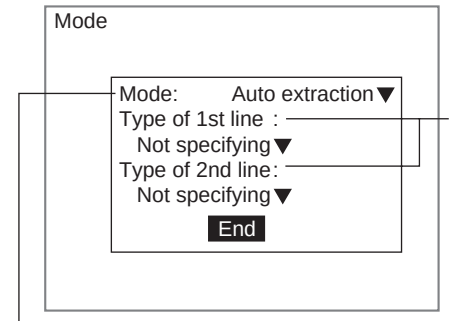
2-21-5 Setting Regions

Operational Flow

STEP 1: Selecting Character Extraction Mode

There are two character extraction modes: 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.

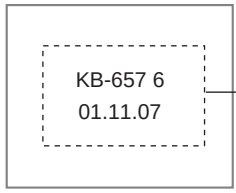


Dictionary setting:

Specifying: Numerals are matched only with the numeral dictionary models and letters are matched only with the alphabet dictionary models.

Not specifying*: Characters are matched against all dictionary models.

Auto Extraction

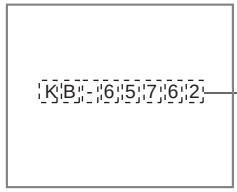


Inspection region

Characters are extracted automatically from this region.

Two lines of up to 20 characters per line can be extracted.

Fixed region

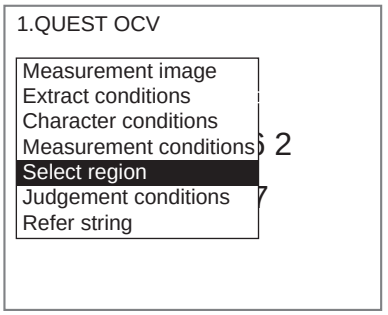


Inspection region

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.

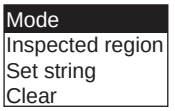
1. Select ***Select region***.



A list of region numbers will be displayed.

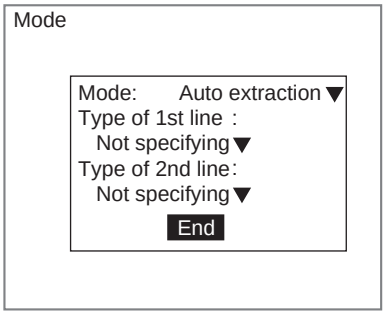
2. Select a region number.

   A list of operation selections will be displayed.



3. Select ***Mode***.

   The screen for specifying the mode will be displayed.



4. Select the mode.
5. Select ***End***.

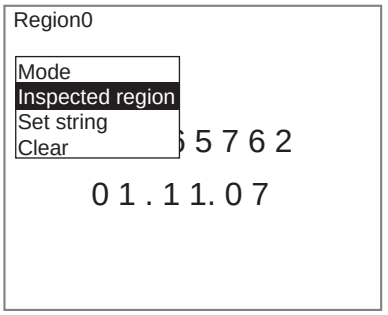
   The settings will be registered and the screen in (2.) will return.

STEP 2: Setting Inspection Regions

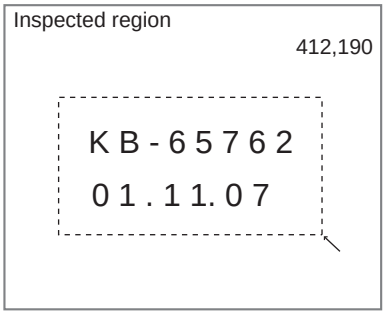
When Automatic Extraction Mode Is Selected

Draw one region for extracting characters.

1. Select ***Inspected region***.



An arrow cursor will appear.



2. Draw a rectangular inspected region.

   Specify the upper left and lower right coordinates.

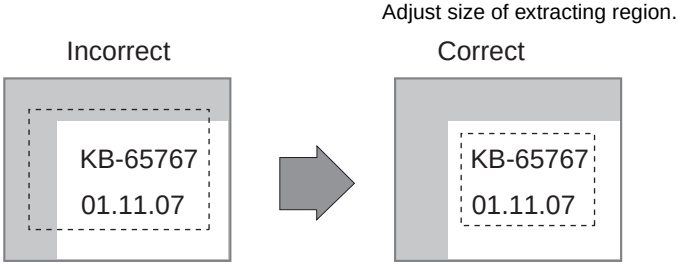
   Up/Down/Left/Right Keys: Move the cursor.

   ENT Key: Confirms the settings.

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.

SeeAlso Refer to page 2-21-(13).

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 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.

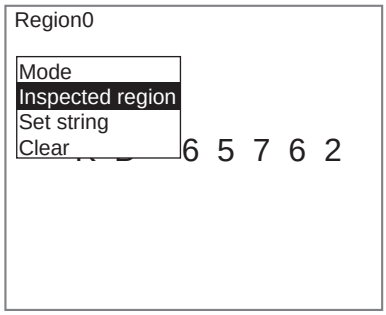


When the bottom right coordinates have been set, the screen in (1.) will return.

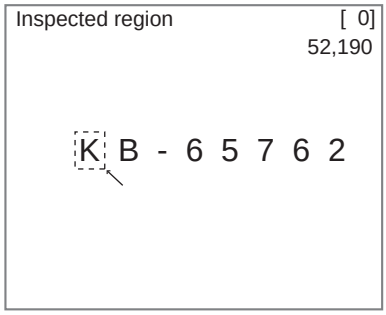
When Fixed Region Mode Is Selected

Draw a region for each character. Up to 20 regions can be drawn.

1. Select ***Inspected region***.



An arrow cursor will appear.



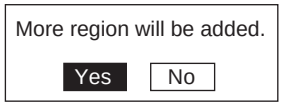
2. Draw a rectangular search region.

   Specify the upper left and lower right coordinates.

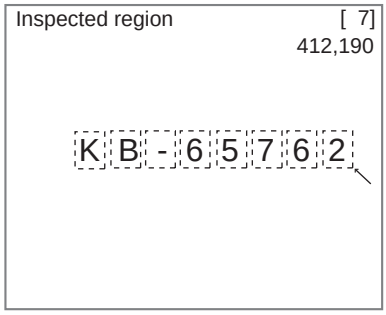
   Up/Down/Left/Right Keys: Move the cursor.

   ENT Key: Confirms the settings.

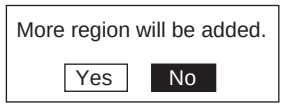
   When the bottom right coordinates have been set, a confirmation message will appear.



3. Select ***Yes***.
4. Repeat steps 2 and 3 to draw the remaining regions. Up to 20 regions can be drawn.



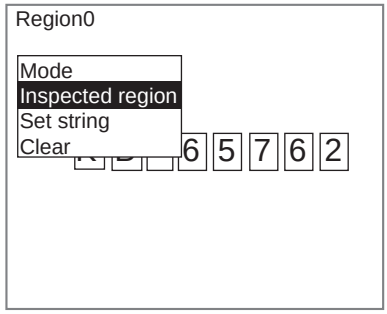
5. When enough regions have been drawn, select ***No*** from the confirmation message.



The screen in (1.) will return.

Adding, Correcting, and Deleting Fixed Regions

1. Select ***Inspected region***.

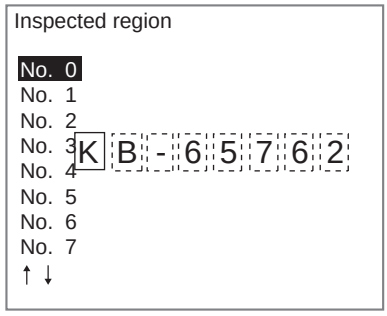


An edit menu will be displayed.

CHECK If *Add* is selected, the screen for drawing inspection regions will be displayed. Repeat the steps outlined above to add inspection regions.

2. Select ***Correct*** or ***Delete***.

The screen for selecting regions will be displayed.



3. Select the number of the region to be edited.

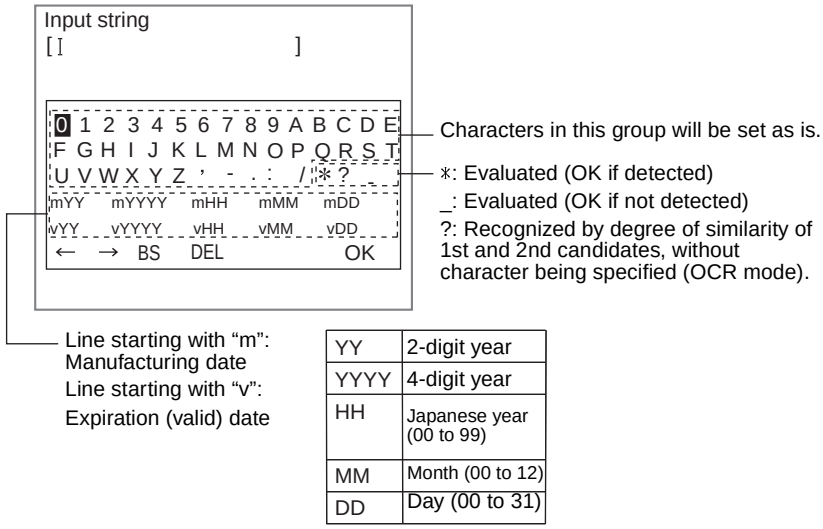
Correct: The screen for correcting the selected region will be displayed.

Delete: A confirmation message will be displayed.

STEP 3: Setting Characters Strings

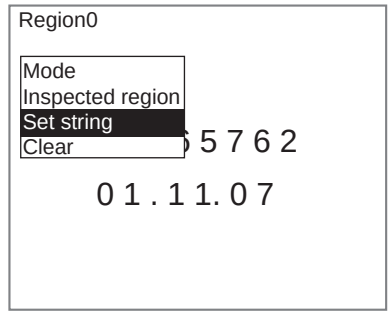
Register the correct character string that will be the reference for verification.

Character strings can be set as outlined below.

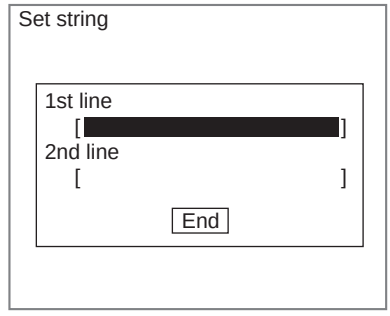


YY	2-digit year
YYYY	4-digit year
HH	Japanese year (00 to 99)
MM	Month (00 to 12)
DD	Day (00 to 31)

1. Select ***Set string***.

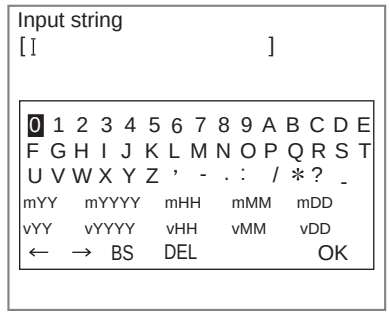


The Set String Settings Screen will be displayed.



2. Place the cursor in the square brackets for the character string and press the **ENT** Key.

The software keyboard will be displayed.



3. Set up to 20 characters for the character string.

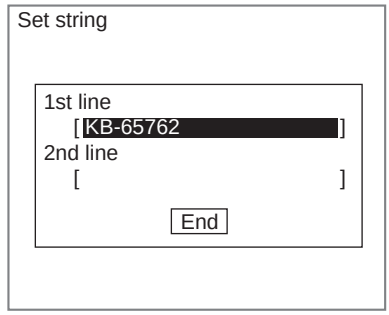
   The “m” and “v” of lines starting with these characters will not be counted in the number of characters.

   E.g., “mYY” will be counted as 2 characters.

4. Select ***OK***.

   The screen in (1.) will return.

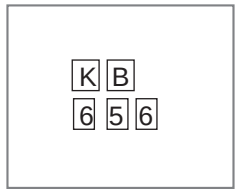
   Repeat steps 2 to 4 to set the character string for the second line.



5. Select ***End***.

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.

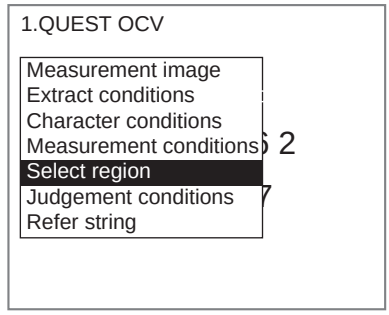
Example: 1st line: [KB656]



The character strings will be set and the screen in (1.) will return.

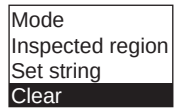
Clearing Set Regions

1. Select ***Select region***.

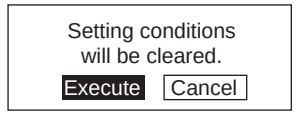


   A list of region numbers will be displayed.

2. Select the number of the region to be cleared.
   The operation selections will be displayed.



3. Select ***Clear***.
   A confirmation message will be displayed.



4. Select ***Execute***.
   The region will be cleared and the screen in (2.) will return.

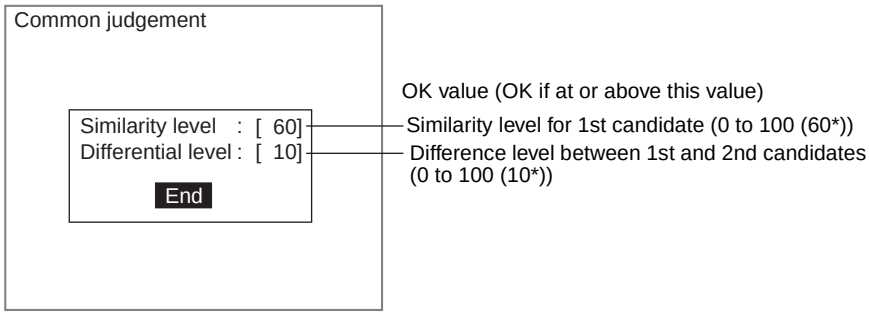
2-21-6 Setting Judgement Conditions

Set the conditions for judging the 1st candidate character.

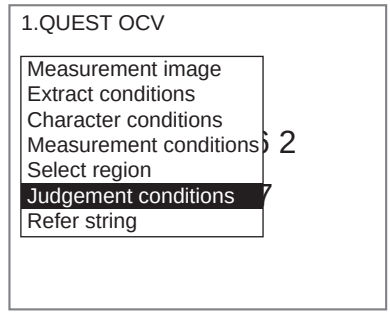
There are two types of judgement conditions: Common judgement and individual judgement. In normal circumstances, adjust the common judgement conditions. Set the individual judgement conditions to perform strict or lenient judgement for a particular character.

Common Judgement Conditions

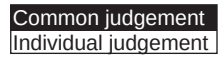
Use this function to set common judgement conditions for all models.



1. Select ***Judgement conditions***.

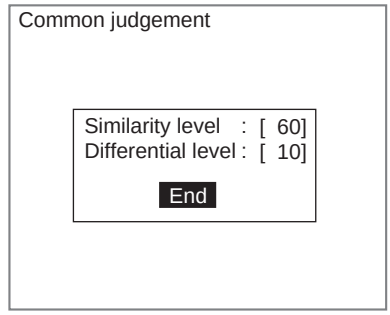


The screen for selecting common or individual judgement will be displayed.



2. Select ***Common judgement***.

   The Common Judgement Settings Screen will be displayed.



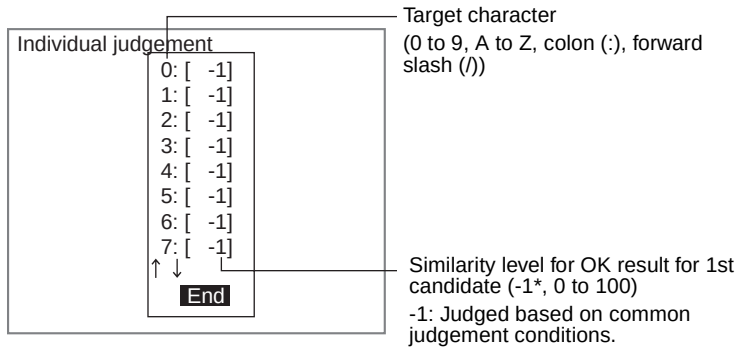
3. Set the conditions.
4. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

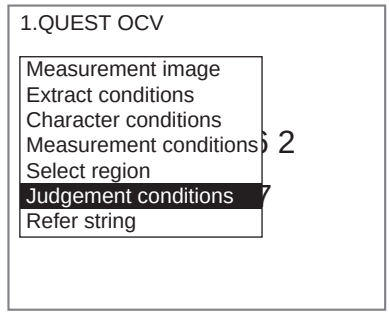
Individual Judgement Conditions

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.



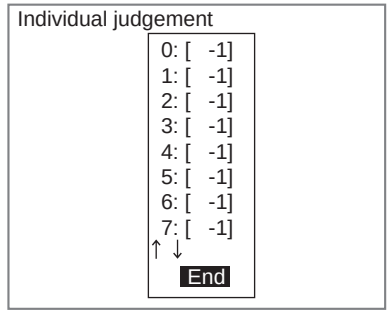
1. Select ***Judgement conditions***.



The common and individual judgement selections will be displayed.

2. Select ***Individual judgement***.

   The Individual Judgement Settings Screen will be displayed.



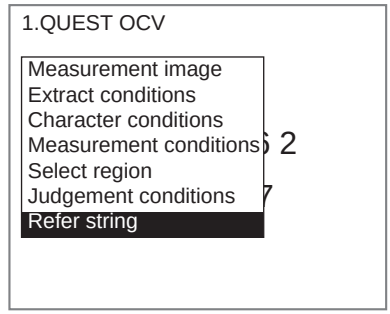
3. Set the judgement conditions.
4. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

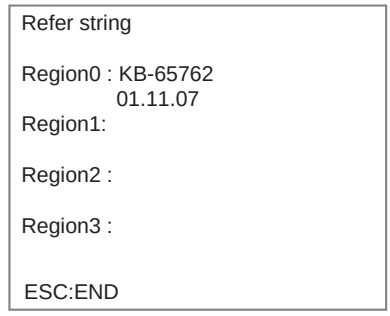
2-21-7 Checking Set Character Strings

Use this function to check what characters have been set as the reference for verification.

1. Select ***Refer string***.



The characters strings set for each region will be displayed.



2. Press the **ESC** Key to close this screen.
   The screen in (1.) will return.

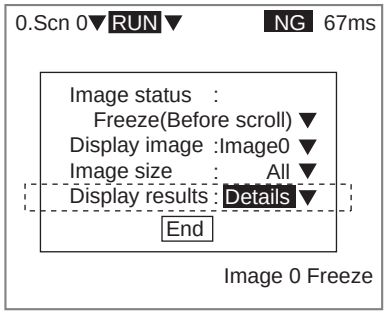
2-21-8 Measurement Screens

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

This section describes what kind of information can be displayed for QUEST character verification.

SeeAlso Refer to *SECTION 3 Monitor Mode and Run Mode* for details on Monitor and Run modes.

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

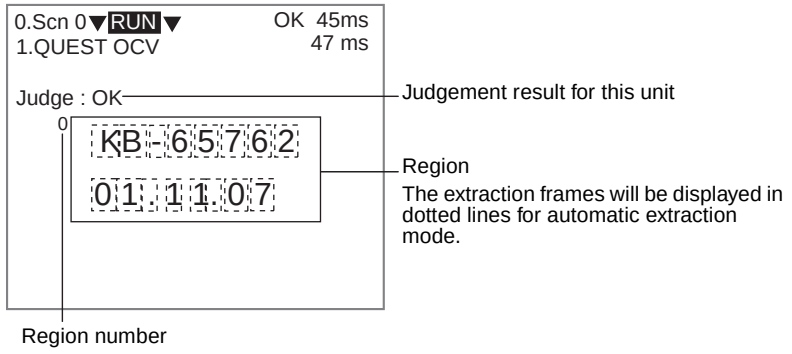


Use the **Up** or **Down** Key to change to the unit for which QUEST character verification is set and the following detailed screens will be displayed.

Use the **SHIFT+Right** or **Left** Keys to switch in order between the three screens.

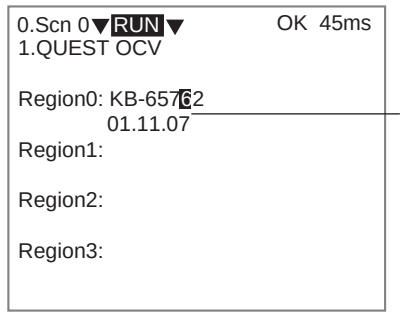
Measurement Regions

The judgement result for this unit, the set regions, and the extraction frame for each character will be displayed.



Set Character Strings

A list of character strings set as the reference for verification will be displayed.

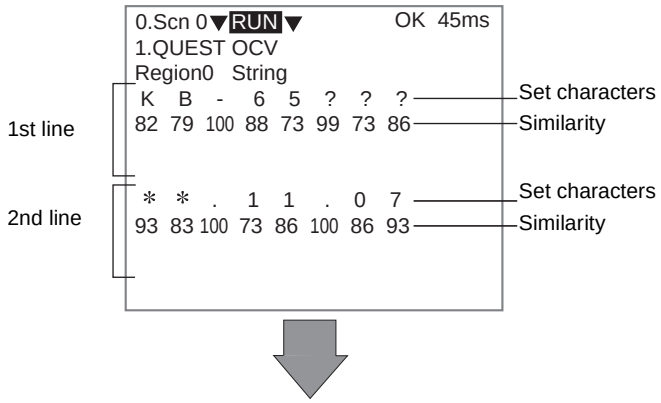


Measurement Values for Each Region

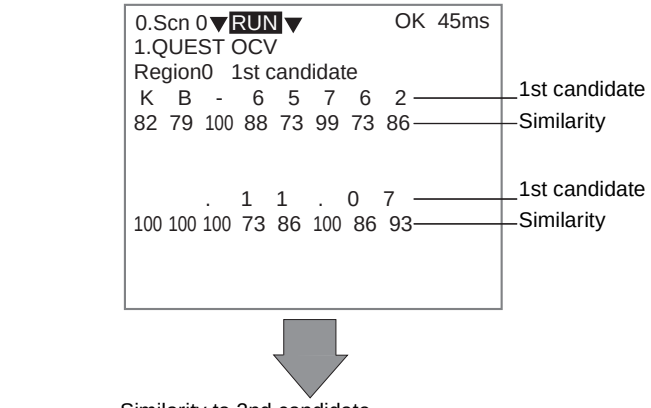
The detailed measurement results for each region will be displayed.

Press the **SHIFT+ Right** or **Left** Keys to display the following four screens in order: Similarity to set characters; similarity to 1st candidate; similarity to 2nd candidate; and density deviation.

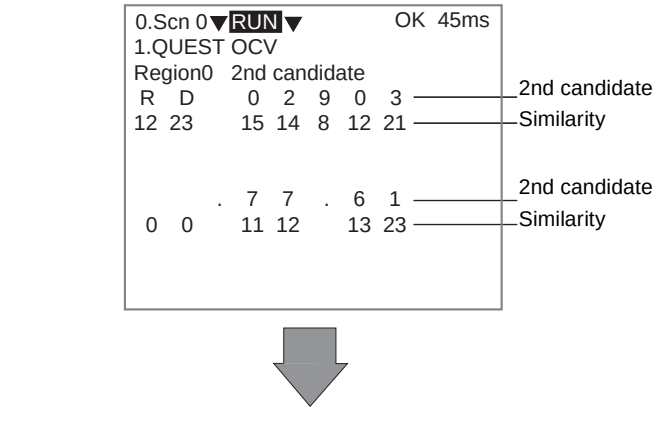
Similarity to set characters



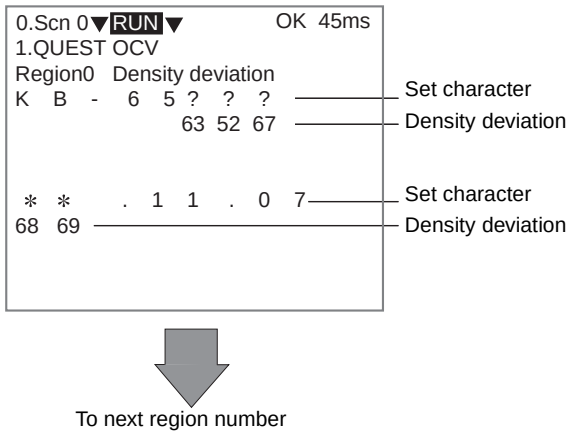
Similarity to 1st candidate



Similarity to 2nd candidate



Density deviation (Only sections with ∗, _, and ? characters will be displayed.)

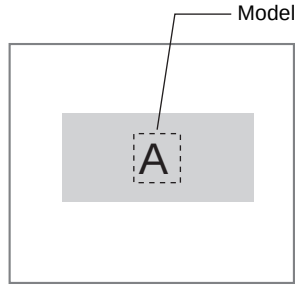


CHECK If the font size is set to small, regions 0 to 3 will be shown together.

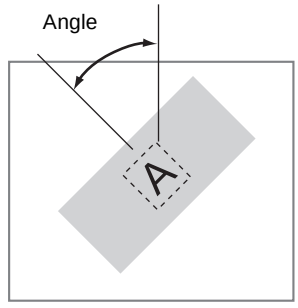
2-22 Rotation Positioning

The Rotation Positioning processing item detects the angle of inclination and the position of the measurement object.

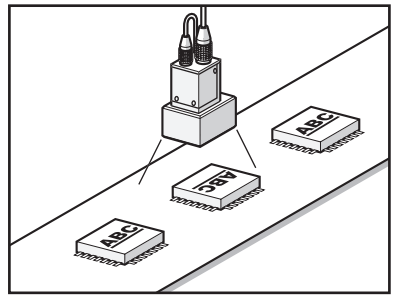
Register a reference image pattern as the model.



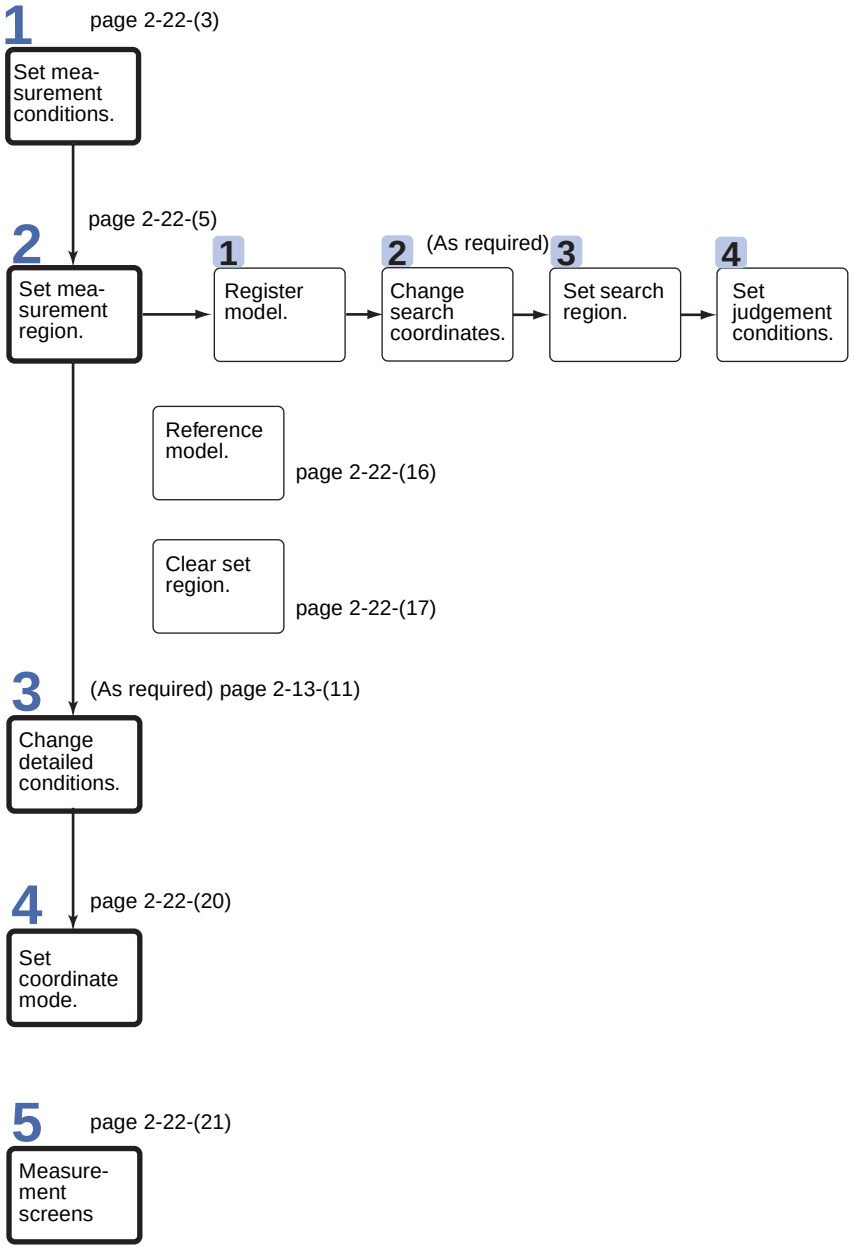
The Controller detects the angle of inclination of the input image compared to the reference image (model).



Example: Recognition of the position and angle of parts.



Operational Flow



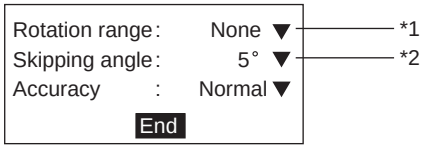
CHECK Rotation positioning uses the image stored at Image 0 as the measurement image; there is no menu for selecting the measurement image.

2-22-1 Changing Measurement Conditions

Set the search conditions.

The Controller searches using a model that rotates in skipping angle (*2) increments within the rotation range (*1).

The settings are used for all measurement regions.

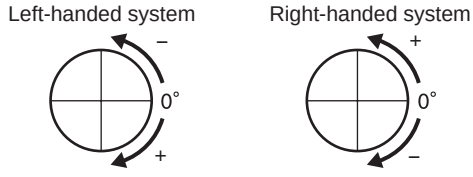


Setting item	Selections	Details	
Rotation range	None* ± 2° ± 5° ± 8° ± 10° ± 15° ± 30° ± 45° ± 60° ± 90° All angles	Select the range for model rotation.	Example: Rotation range: ± 30°, Skipping angle: 15° Creates a model that rotates 15° at a time between −30° and 30°. (Coordinate system: Left-hand) Image  +30° +15° 0° −15° −30°
Skipping angle	1° 10° 2° 15° 3° 20° 5° * 30° 6°	Select 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. However, the processing time is longer. Position X and position Y: Subpixel units Angle: 0.01° units.	
	Normal*	Finds the measurement value in integers. Position X and position Y: Pixel units Angle: 1° units.	

CHECK Coordinates and Rotation Angle Direction

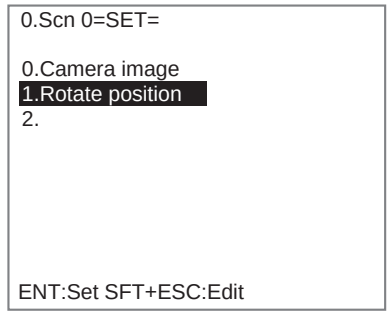
Depending on whether a right-hand or left-hand coordinate system has been set, the rotation angle direction changes. Check the rotation angle direction before making rotation search settings.

- When *Rotation positioning/Coordinate mode/Calibration* is set to OFF, the coordinate system becomes a left-hand system.
- When *Rotation positioning/Coordinate mode/Calibration* is set to ON, the coordinate system is determined by the *Calibration* setting.

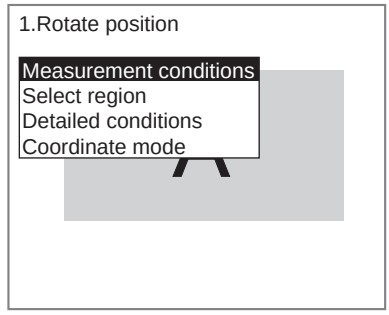


SeeAlso Refer to *2-1 Inputting Camera Images* for information on checking and changing the coordinate system.

1. Select ***Rotate position***.

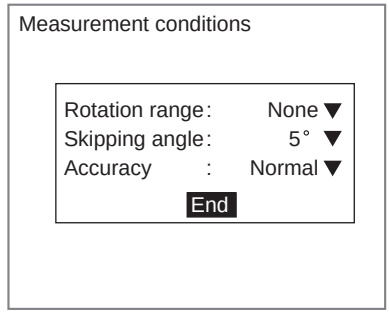


The settings selections will be displayed.



2. Select ***Measurement conditions***.

The Measurement Conditions Settings Screen will be displayed.

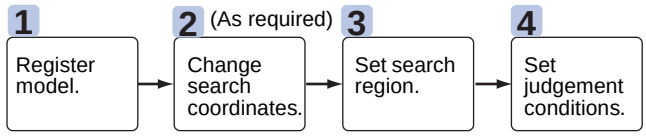


3. Change the settings.
4. Select ***End***.

The settings will be registered and the screen in (1.) will return.

2-22-2 Setting Measurement Regions

Up to 8 measurement regions can be set.



STEP 1: Registering a Model

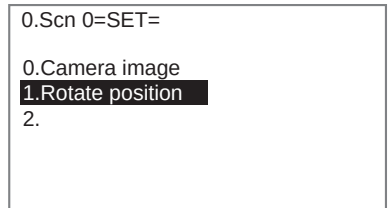
The area of the image to be inspected is registered as a model.

When a model is registered, that orientation becomes 0° and 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 the circumscribing rectangle become the search coordinates.

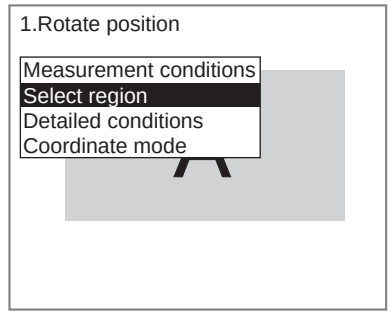
HELP Refer to *7-4 Terminology* for information on models.

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.

1. Select ***Rotate position***.

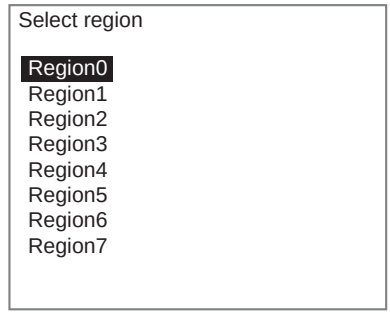


The settings selections will be displayed.

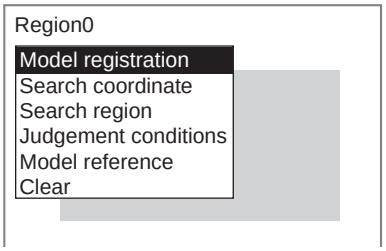


2. Select ***Select region***.

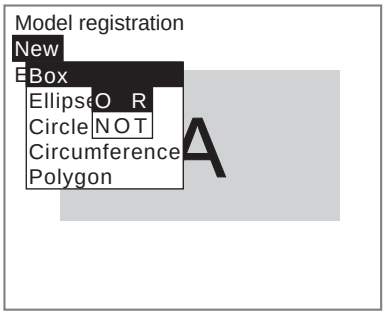
   The region numbers will be displayed.



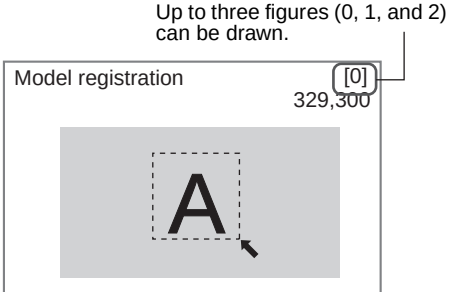
3. Select the region number.
   The operation selections will be displayed.



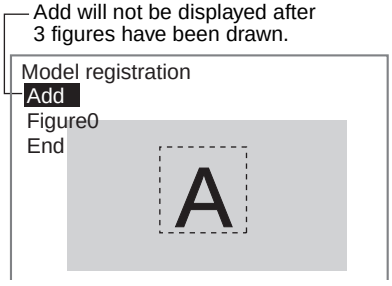
4. Select ***Model registration***.
   The Model Registration Screen will be displayed.



5. Select ***New***.
6. Select the desired figure.
7. Select the desired drawing mode (***OR***/***NOT***).
   An arrow cursor will appear.



8. Draw the region to be registered as the model with the selected figure.
   The figure will be registered.



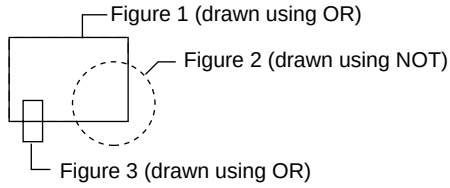
9. If additional figures are to be drawn, select ***Add***.

10. Repeat steps 6 to 8 as necessary to create the desired shape.
11. After drawing is completed, select ***End.***

    The measurement region will be registered and the screen in (3.) will return.

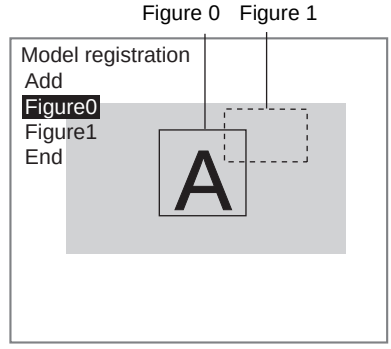
    The search coordinates (display cursor) and model region will be displayed.

CHECK Figures drawn using OR mode are displayed with solid lines and figures drawn using NOT mode are displayed with dotted lines.



Correcting or Clearing Figures

1. In the screen for step 8 above, select the figure to be changed or cleared using the **Up** and **Down** Keys and press the **ENT** Key.



The figure for the figure number selected using the cursor will be displayed with solid lines. The selections ***Correct*** and ***Clear*** will be displayed.

2. Select either ***Correct*** or ***Clear*** and press the **ENT** Key.

   If ***Correct*** is selected, the cursor will be displayed. Correct the size and position of the figure as desired.

   If ***Clear*** is selected, the selected figure will be cleared.

CHECK To re-register models, repeat from step 4 under *Step 1: Registering Models*.

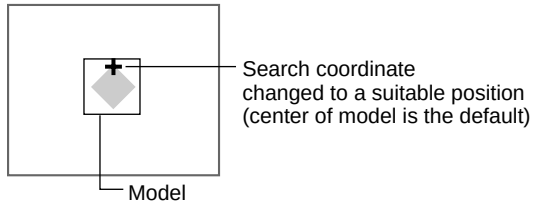
STEP 2: Changing the Search Coordinates

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. However, this function can be used to register a point other than the center of the model as the search coordinates.

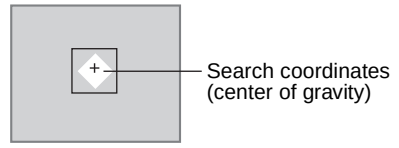
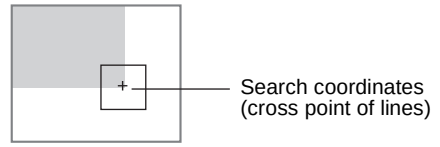
CHECK The search coordinates are used for the point output as the measurement value. The search coordinates can be changed to any point inside the model. If multiple figures have been combined to create the model, the search coordinates will be limited to within the circumscribing rectangle.

Changing the Point Output as the Measurement Value



CHECK If the model is re-registered, the search coordinates are changed to the center position of the new model.

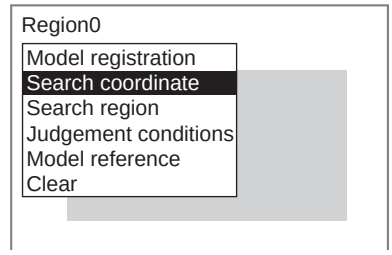
There are 3 registration methods available: Manual, gravity, and edge.

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. This method can be used if the measurement object is rectangular. Select this method to register the edge or corner of the measurement object as the search coordinates. 

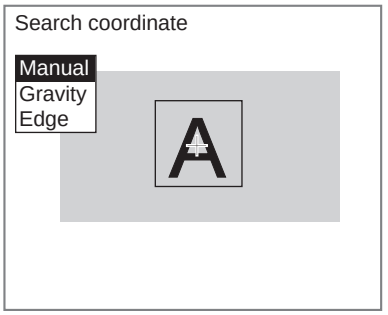
Manual

Any position in the model rectangle can be specified (in pixel units) as the search coordinates.

1. Select ***Search coordinates***.

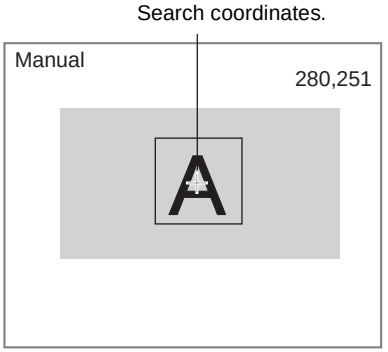


The registration selections will be displayed.



2. Select ***Manual***.

   A cursor will appear at the center of the model.



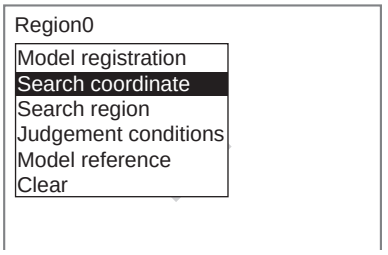
3. Use the **Up/Down/Left/Right** Keys to change the position if required.
4. Press the **ENT** Key.

   The search coordinates will be registered and the screen in (1.) will return.

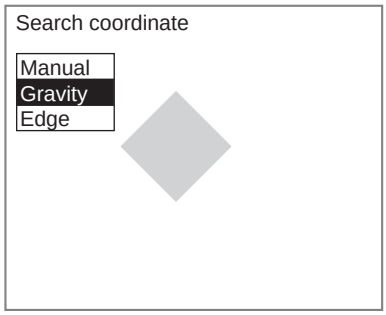
Gravity

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.

1. Select ***Search coordinate***.

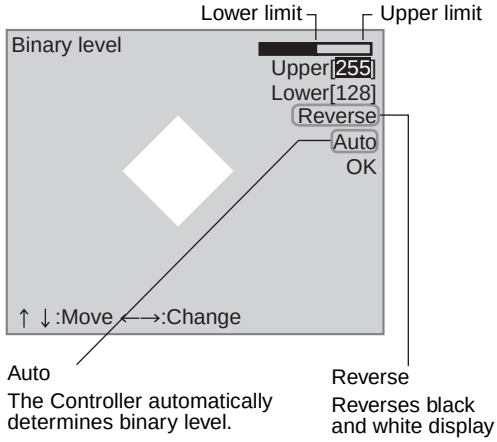


The registration selections will be displayed.



2. Select ***Gravity***.

   The Binary Level Settings Screen will be displayed.

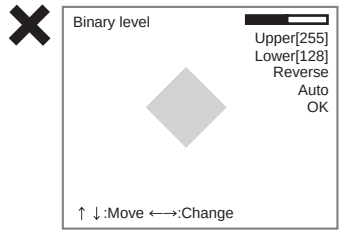


3. Move the cursor to the upper limit and use the **Left** and **Right** Keys to change the value.

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 10 times faster.
Up and Down Keys:	Switches between setting items.

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

CHECK Set the upper and lower limits to make the measurement object white pixels.



5. Select ***OK***.

   The search coordinates will be registered and the screen in (1.) will return.

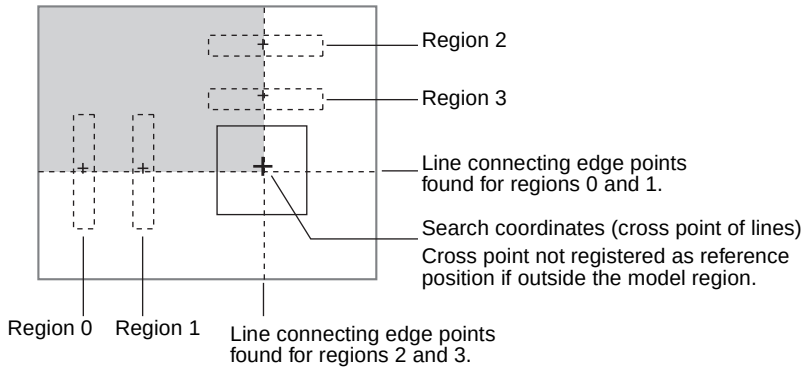
   A display cursor will appear at the center of gravity (search coordinates).

CHECK It is also possible to set the binary level so that measurement is performed only for an intermediate density range.

Edge

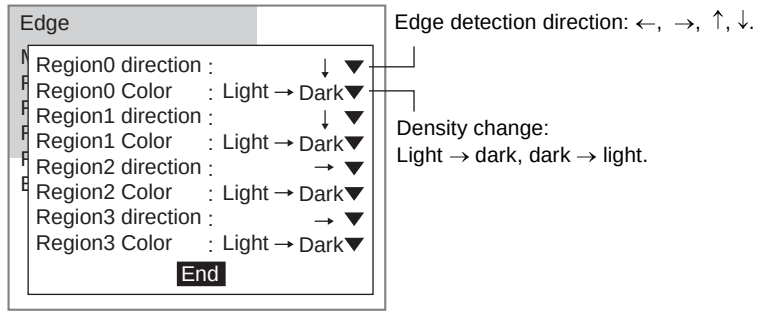
The edge registration method can be used when the measurement object is rectangular.

Draw 4 regions. One edge is detected from each region and that becomes the reference position.

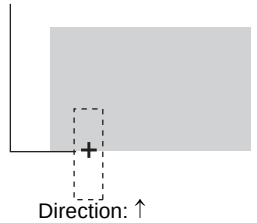


1. Setting Edge Detection Conditions

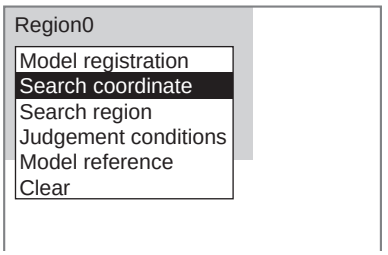
   Set the direction to search for the 4 edges and the density change as the measurement conditions.



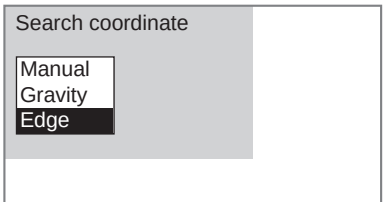
Example: Finding this position in region 0.



a) Select ***Search coordinate***.

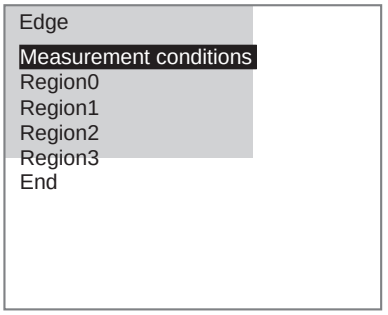


The registration selections will be displayed.



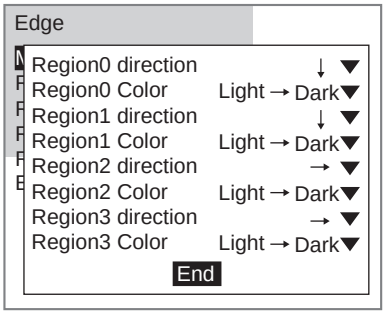
b) Select ***Edge***.

The Edge Measurement Screen will be displayed.



c) Select ***Measurement conditions***.

The Measurement Conditions Settings Screen will be displayed.



d) Set the conditions.

e) Select ***End***.

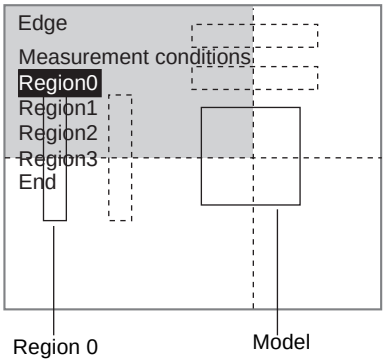
The settings will be registered and the screen in (b.) will return.

2. Drawing Measurement Regions

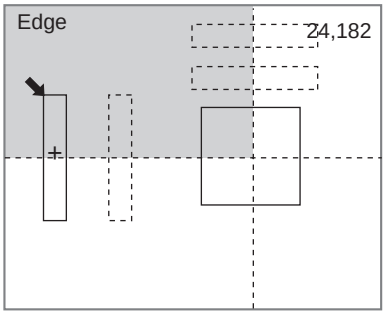
Draw 4 regions to include all edges.

a) Select ***Region 0***.

The region at the cursor position will be displayed in solid lines. The model will also be displayed in solid lines.

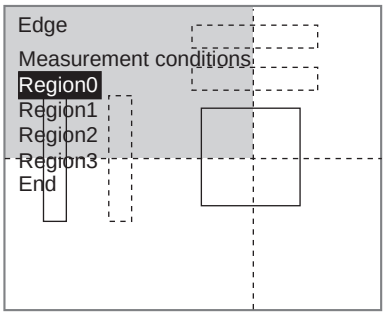


The screen for drawing regions will be displayed.



b) Draw a box-shaped region.

The region will be registered.



c) Repeat steps (a) and (b) until the 4 regions are drawn.

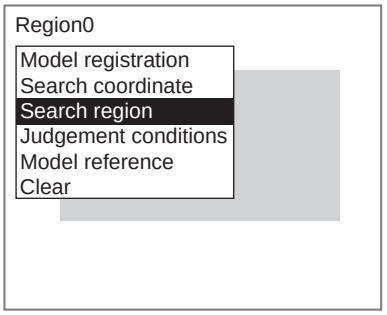
d) Once the 4 regions have been drawn, select ***End***.

The search coordinates will be registered.

STEP 3: Setting Search Regions

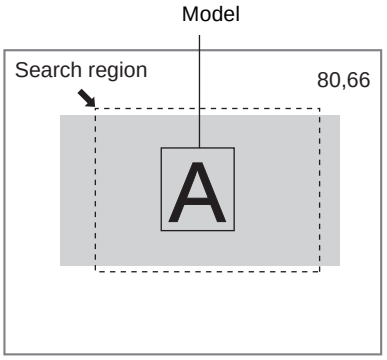
Set the region to search for the model. The whole region of the input image can be searched. Accuracy improved, however, by limiting the search region.

1. Select ***Search region***.



An arrow cursor will appear.

The model will be displayed with solid lines.



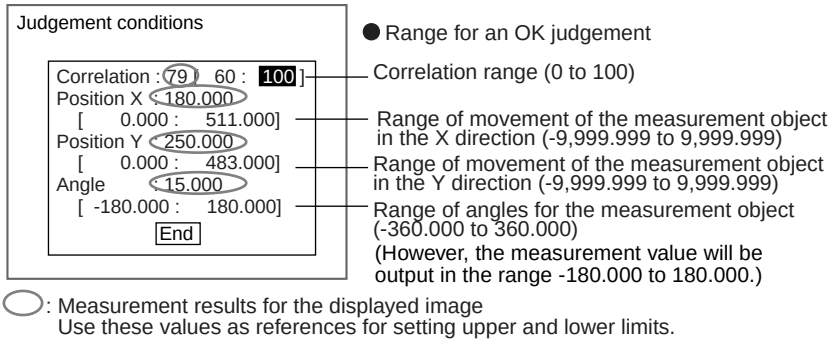
2. Draw a box-shaped search region.

CHECK The only figure that can be drawn is a box.

The search region will be set and the screen in (1.) will return.

STEP 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.

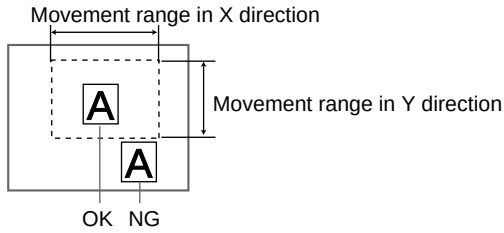


CHECK Correlation

When OK condition for correlation is set between 60 and 100:

	Image 0	Image 1	Image 2	Image 3
	A	A	C	A
Correlation:	96	55	50	65
Judgement:	OK	NG	NG	OK

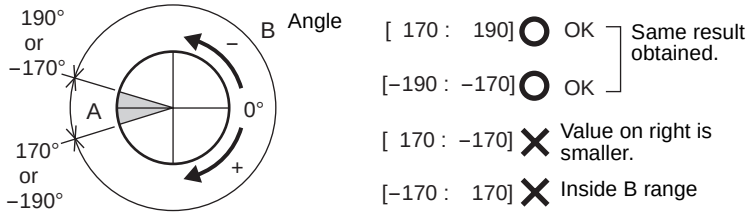
CHECK Position X and Position Y



CHECK Angle

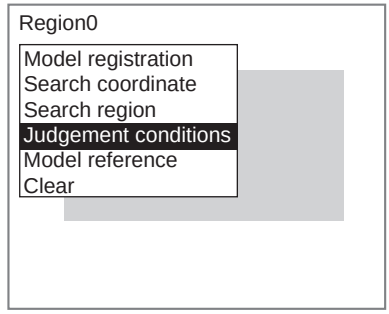
Two values between -360° and 360° can be set. The value on the right, however, must be higher than the value on the left.

To set region A in the following diagram to give an OK result:

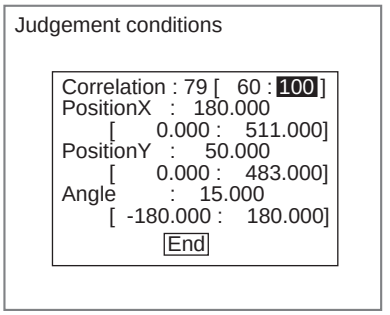


The measurement results are output in the range -180° to 180°, so the angle 190° will be output as -170°.

1. Select ***Judgement conditions***.



The Judgement Conditions Settings Screen will be displayed.



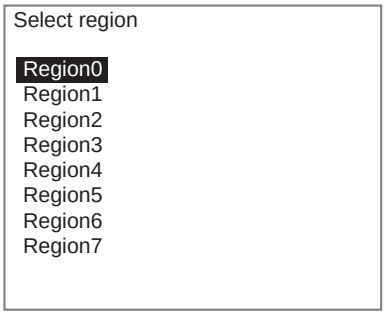
2. Change the settings.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

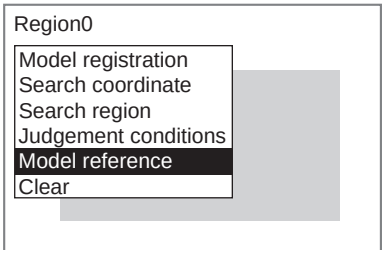
2-22-2-1 Referencing Models

Use this operation to display and confirm registered models.

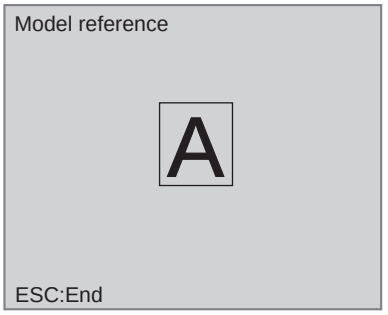
1. Select the region number for the model to be checked.



The operation selections will be displayed.



2. Select ***Model reference***.
   The model will be displayed at the registered position.

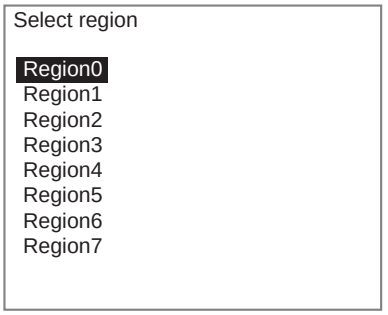


3. Press the **ESC** Key to close this screen.
   The screen in (1.) will return.

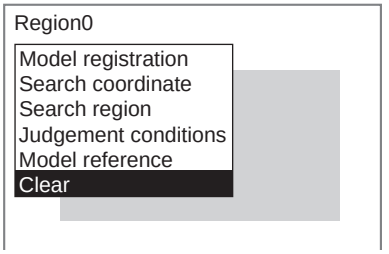
2-22-2-2 Clearing Set Regions

The clear operation is performed separately for each region.

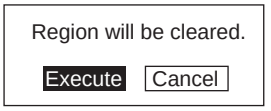
1. Select the number of the region to be cleared.



   A list of selections will be displayed.



2. Select ***Clear***.
   A confirmation message will be displayed.



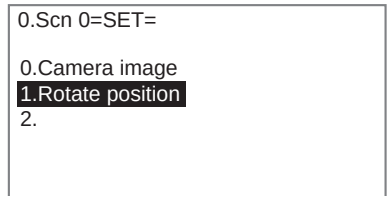
3. Select ***Execute***.
   The region will be cleared and the screen in (1.) will return.

2-22-3 Changing Detailed Conditions

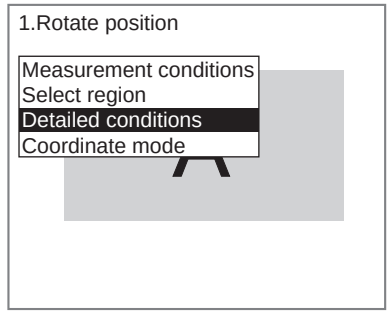
Use this operation to change the search-related settings. Change the conditions if the measurement results are unstable. Normally, however, the default settings are sufficient.

Once the settings have been changed, check that actual measurement is performed correctly.

1. Select ***Rotate position***.

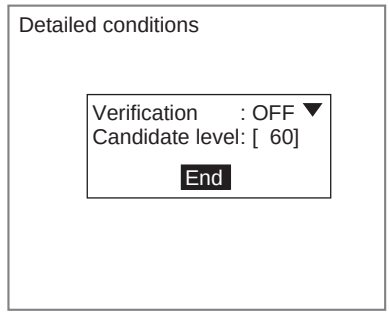


A list of settings selections will be displayed.



2. Select ***Detailed conditions***.

   The Detailed Conditions Settings Screen will be displayed.



3. Change the settings.
4. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

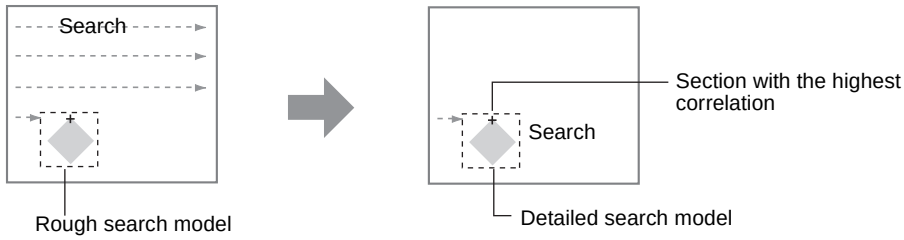
CHECK The Controller performs the following 2-stage processing internally.

Rough search

Searches all of the measurement region using the rough search model.

Detailed search

Measures again using the detailed search model to compare to the images surrounding the section with the highest correlation.



Search Verification and Candidate Levels

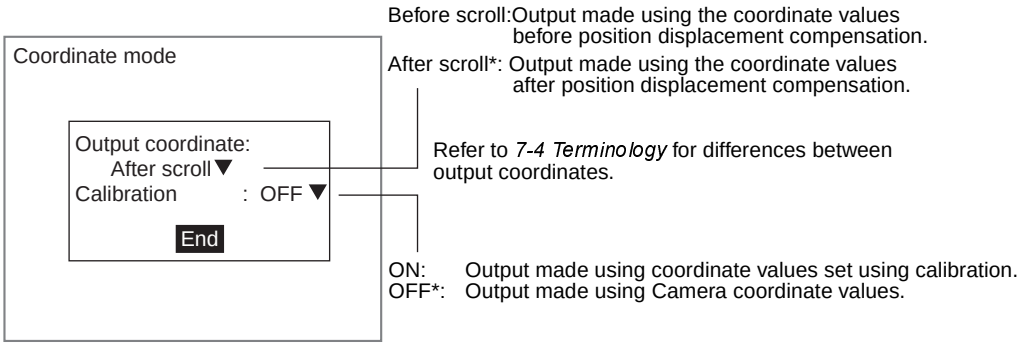
Select whether or not to perform detailed searches on models at the candidate level or higher. If model searches are unstable, set search verification to ON and adjust the candidate level.

Setting item	Selection/ Setting range	Details
Search verification	OFF*	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 (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 search verification is set to ON.

The asterisk (*) indicates the default setting.

2-22-4 Setting the Coordinate Mode

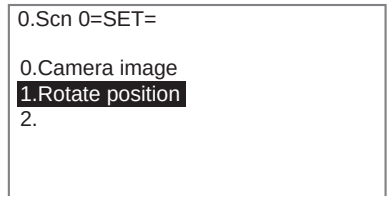
Select the type of coordinate values.



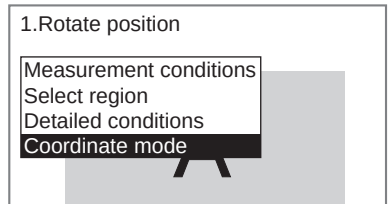
The asterisk (*) indicates the default setting.

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.

1. Select ***Rotate position***.

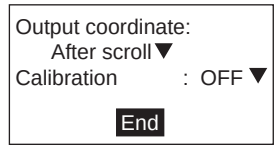


The settings selections will be displayed.



2. Select ***Coordinate mode***.

   The Coordinate Mode Settings Screen will be displayed.



3. Make the settings for each item.
4. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

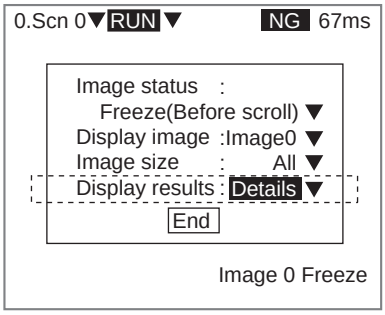
2-22-5 Measurement Screens

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

This section describes what kind of information can be displayed for rotation positioning.

SeeAlso Refer to *SECTION 3 Monitor Mode and Run Mode* for details on Monitor and Run modes.

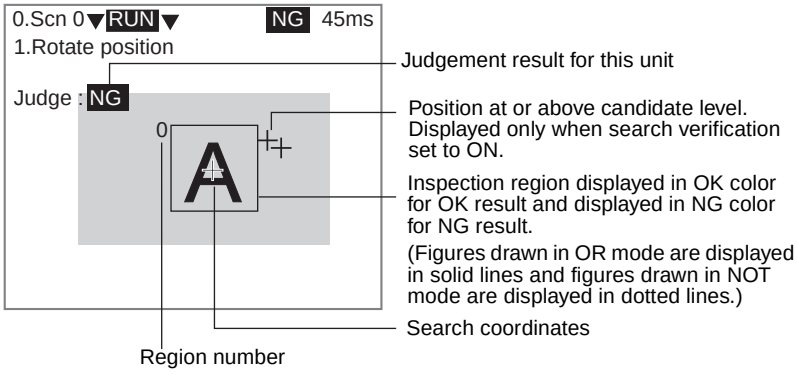
CHECK Press the **SHIFT+ESC** Keys on the Run Screen to access the following screen and change ***Display results*** to ***Details***.



Use the **Up** or **Down** Key to change to the unit for which rotation positioning is set and the following detailed screens will be displayed.

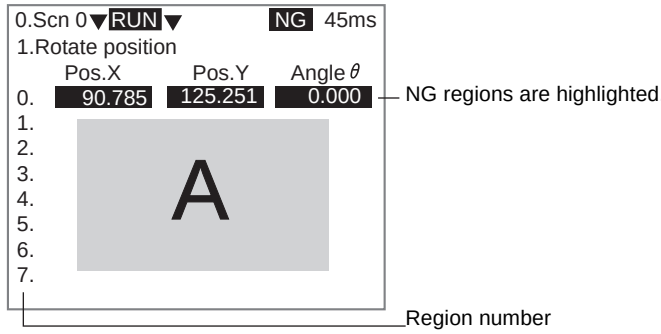
Use the **SHIFT+Right** or **Left** Keys to switch in order between the three screens.

Judgement Result



Position and Angle

A list of search positions and angles for each region will be displayed.

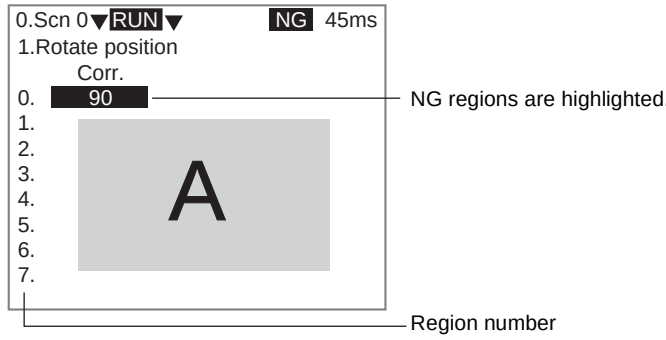


CHECK If the font size is set to small, the position and angle and correlation screens will be shown together.

If the font size is set to normal, these two screens will be displayed consecutively.

Correlation

A list of correlations for each region will be displayed.

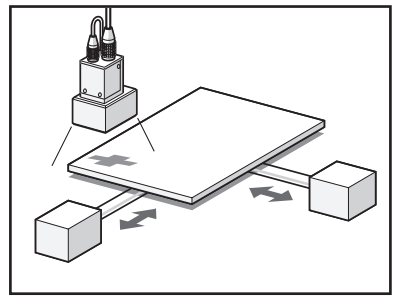


2-23 ECM Search

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.

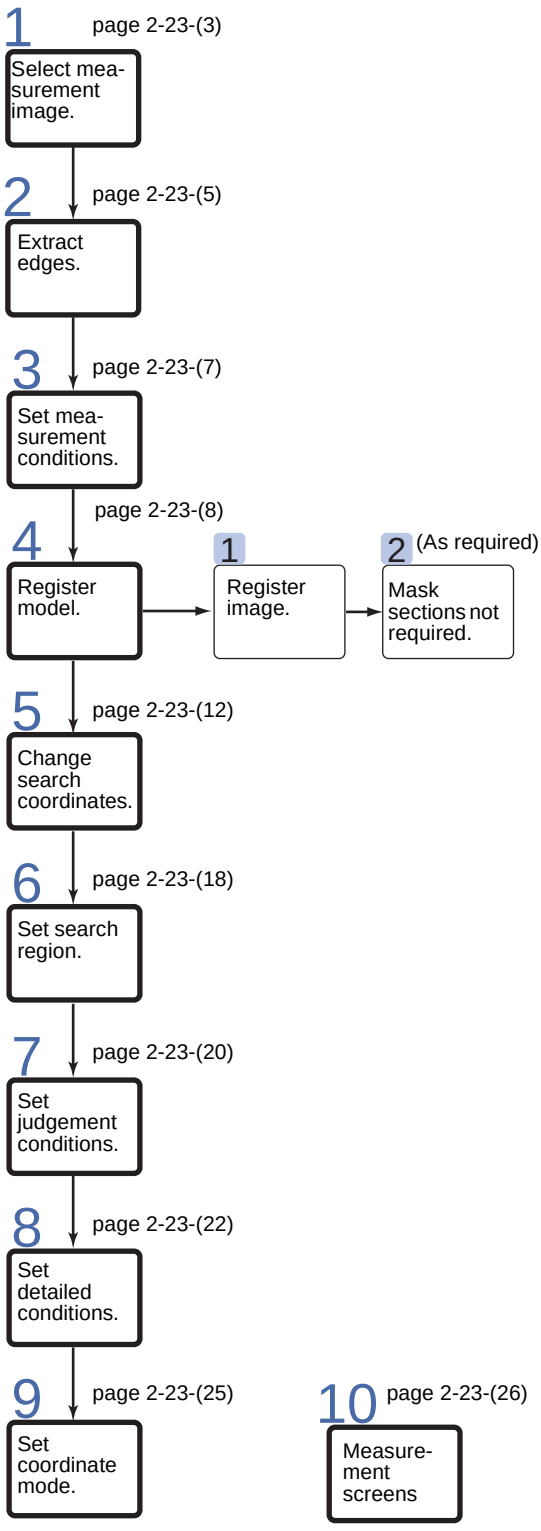
A lot of noise

Chipped

Low contrast

HELP Refer to *7-4 Terminology* for information on edge codes (EC).

Operational Flow

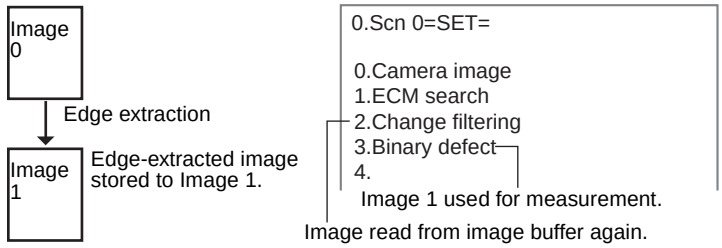


2-23-1 Selecting Measurement Images

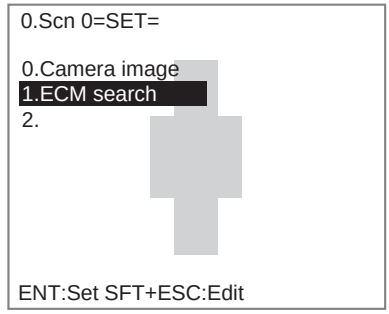
This section describes how to select an image stored at either Image 0 or Image 1 as the image for measurement.

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 all units after the unit for which ECM search was set. Then store the image stored in the image buffer to Image 0 or Image 1.

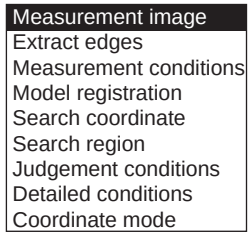
When Image 0 Is Selected as Measurement Image



1. Select ***ECM search***.

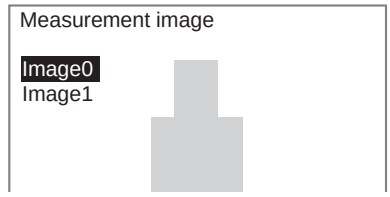


The initial ECM Search Screen will be displayed.



2. Select ***Measurement Image***.

   The selections will be displayed.



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

4. Press the **ENT** Key.
   The settings will be registered and the screen in (1.) will return.

2-23-2 Extracting Edges

ECM search is performed for images for which the edges have been extracted.

Adjust the upper and lower levels so that the edges of the mark to be found are extracted.

Upper and Lower Limits

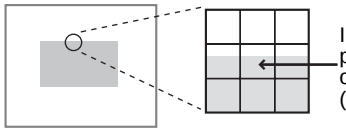
Set the upper and lower limits so that the edges of the mark to be found are extracted. The levels can be set between 10 and 255 (default 100:255).

Mask Size

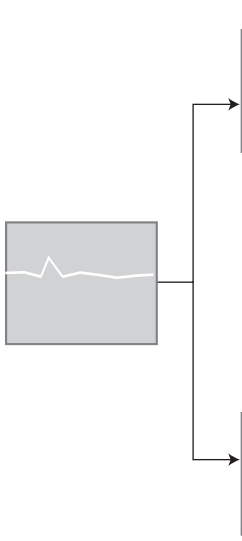
The mask size function is used when searching for edges to judge edges using peripheral information. Select how much peripheral pixel information to use. The selections are 5 × 5 (default) or 3 × 3.

CHECK This setting will be enabled only if *Frame/Field* under *Camera image* is set to *Frame*. If set to *Field*, the effect will remain the same as if 5 × 5 is selected even if 3 × 3 is selected.

Example: Select 3 × 3



Information from the surrounding 9 pixels is used to determine whether or not the center pixel is the edge. (1 square = 1 pixel)



[5 × 5]

The greater the mask size, the more the variations in surrounding pixels can be absorbed. Select 5 × 5 to ignore uneven edges.

The edges are thicker when 5 × 5 is selected. If the size of the measurement object varies or if the measurement objects are on an angle, thicker edges give greater performance.

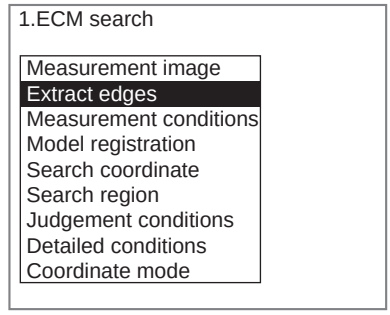
This function is even more effective if smoothing is used.

Refer to *2-1 Inputting Camera Images* and *2-4 Filtering Again* (where smoothing can be set to be executed twice).

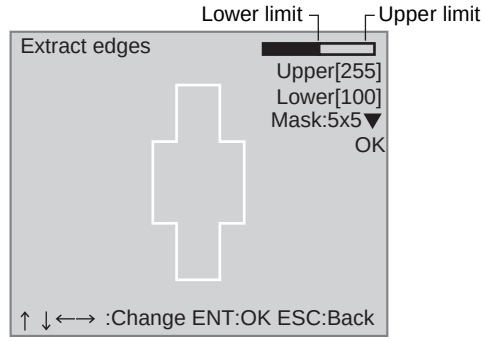
[3 × 3]

Select 3 × 3 to detect minute differences from the model.

1. Select ***Extract edges***.



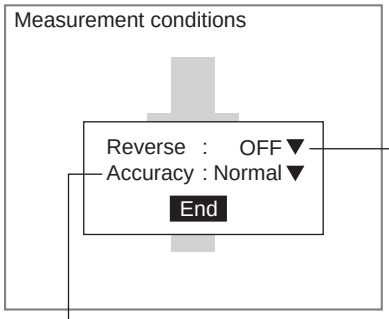
The screen for setting edge extraction levels will be displayed.



2. Set the upper and lower limits.
   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 10 times faster.
   Up and Down Keys: Switches between setting items.
3. Select the mask size.
4. Select **OK**.
   The settings will be registered and the screen in (1.) will return.

2-23-3 Setting Measurement Conditions

Set the conditions for searching for the model.



OFF*: Searches for the registered model. The search is not performed if black and white are reversed.

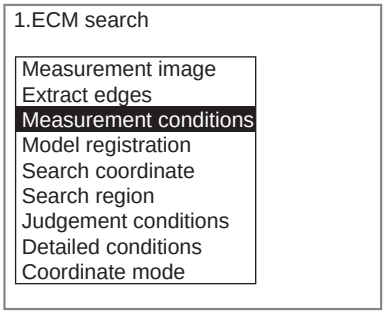
ON: Performs the search even if black and white are reversed for the model.

Normal*: Finds the measurement value in integers (pixel units).

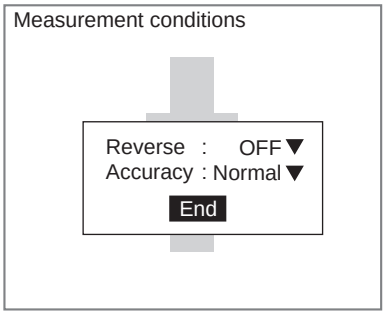
Precise: Finds the measurement value in decimals (sub-pixel units).

The asterisk (*) indicates the default setting.

1. Select ***Measurement conditions***.



The Measurement Conditions Settings Screen will be displayed.

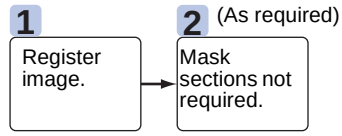


2. Make the reverse and accuracy settings.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

2-23-4 Registering Models

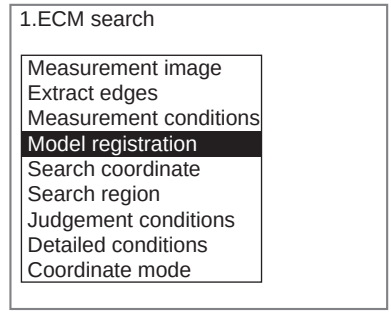
Register the mark to be found as a model.



STEP 1: Registering Images

Specify the region to be used for model registration by enclosing it in a box.

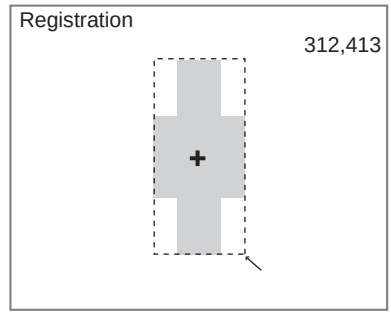
1. Select ***Model registration***.



The operation selections will be displayed.

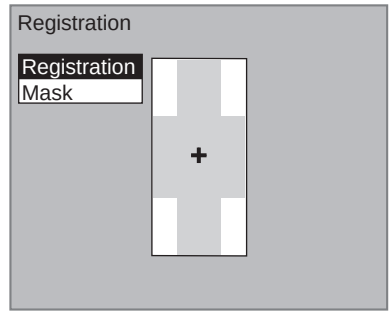
2. Select ***Registration***.

The Registration Screen will be displayed.

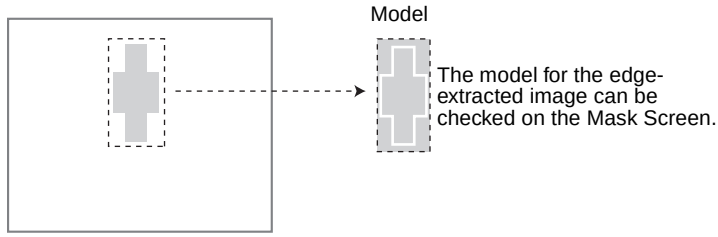


3. Draw a box that encloses the mark.

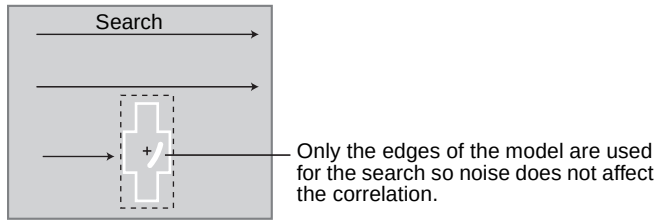
The image inside the box is registered.



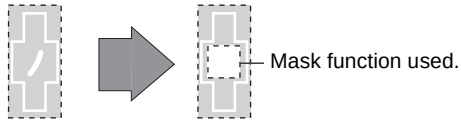
CHECK The model is registered internally using the edge-extracted image.



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.

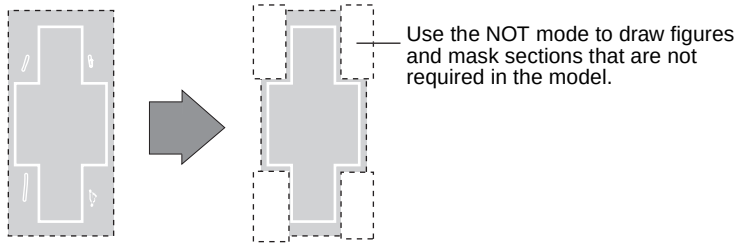


If, however, there is noise in the model itself, the correlation will be reduced because noise becomes part of the search. In such cases, use the mask function to remove noise from the model before registration.



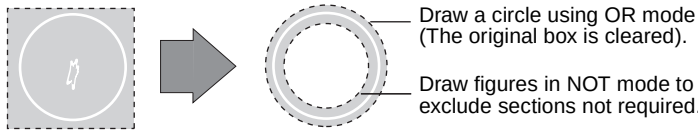
STEP 2: Masking Sections Not Required

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.

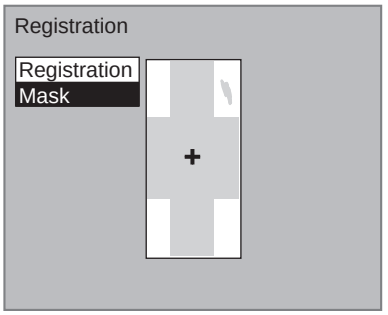


CHECK The box drawn using *Registration* is registered as Figure 0 and the position and size of that box can be adjusted.

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.

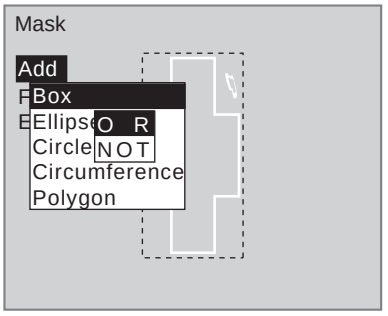


1. Select ***Mask***.



The screen for drawing regions will be displayed.

The box drawn using *Registration* is registered as Figure 0.



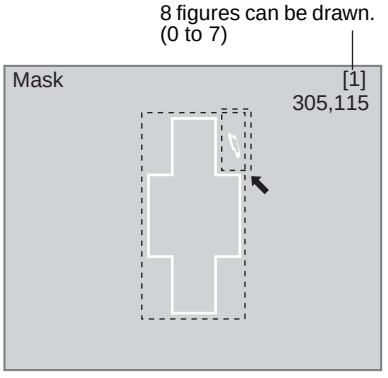
CHECK The model is registered using the edge-extracted image, so the edge-extracted image is displayed on this screen.

2. Select ***Add***.
3. Select the desired figure.
4. Select the drawing mode (***OR*** or ***NOT***).

CHECK Select ***NOT*** to use the mask function.

Select ***OR*** to draw a different figure.

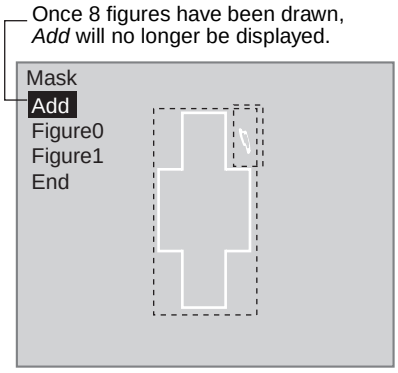
An arrow cursor will appear.



5. Draw the figure.

The figure will be registered.

6. Select ***Add*** to draw more figures. Up to 8 figures can be drawn.

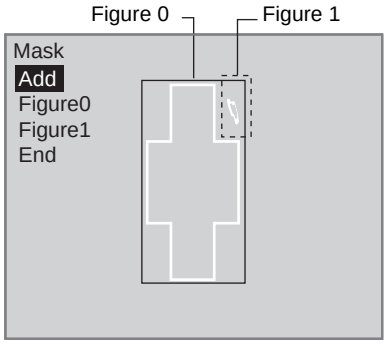


7. Repeat steps 3 to 5 as necessary to create the desired shape.
8. Select ***End*** to finish drawing.

   The settings will be registered and the screen in (1.) will return.

Correcting or Clearing Figures

1. In the screen for step 6 above, select the figure to be changed or cleared using the **Up** and **Down** Keys and press the **ENT** Key.



   The figure for the figure number selected using the cursor will be displayed with solid lines. The selections ***Correct*** and ***Clear*** will be displayed.

2. Select either ***Correct*** or ***Clear*** and press the **ENT** Key.

   If ***Correct*** is selected, the cursor will be displayed. Correct the size and position of the figure as desired.

   If ***Clear*** is selected, the selected figure will be cleared.

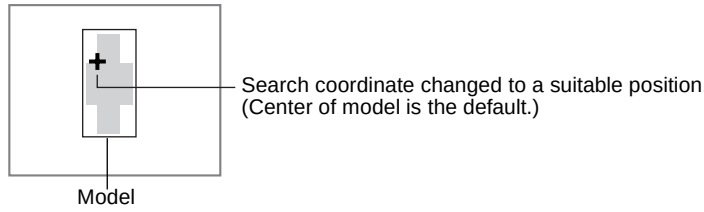
2-23-5 Changing the Search Coordinates

Use this function to change the search coordinates only.

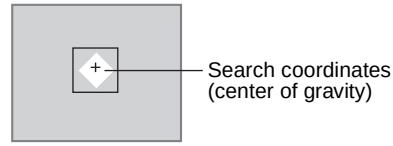
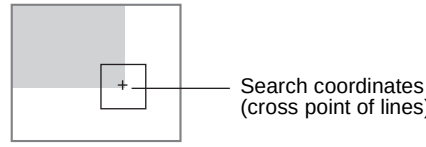
When a model is registered, the center position of the model is registered as the search coordinates. However, this function can be used to register a point other than the center of the model as the search coordinates.

CHECK The search coordinates are used for the point output as the measurement value. This point can be changed to any suitable point.

Changing the Point Output as the Measurement Value



There are 3 methods available for changing search coordinates.

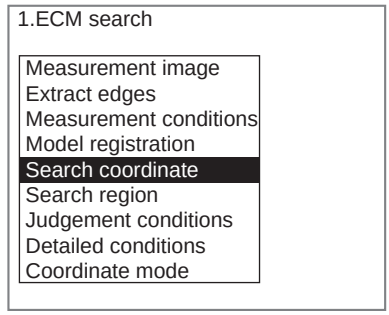
Registration method	Details
Manual	Any position can be specified for registration.
Gravity	The image is converted to binary and the center of gravity of the white pixel area in the model is registered as the search coordinates. Select this method to use the center of gravity of the measurement object as the search coordinates. 
Edge	The edge position is used for registration. This method can be used if 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).

Manual

Any position can be specified (in pixel units) for the search coordinates.

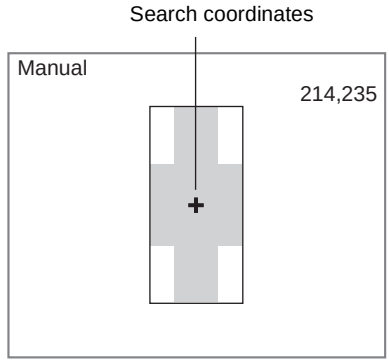
1. Select ***Search coordinates***.



The registration methods will be displayed.

2. Select ***Manual***.

   A cursor will appear at the center of the model.



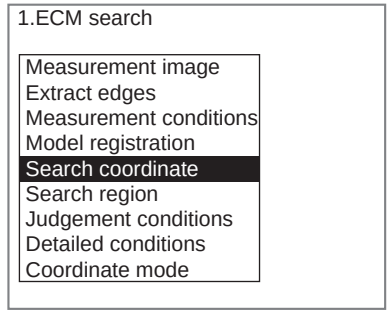
3. Use the **Up/Down/Left/Right** Keys to change the position if required.
4. Press the **ENT** Key.

   The search coordinates will be registered and the screen in (1.) will return.

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.

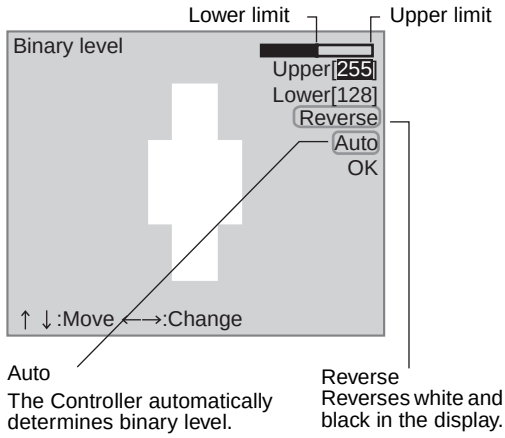
1. Select ***Search coordinate***.



The registration selections will be displayed.

2. Select ***Gravity***.

   The Binary Level Settings Screen will be displayed.

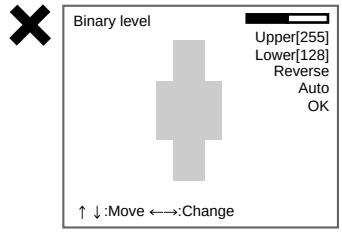


3. Move the cursor to the upper limit and use the **Left** and **Right** Keys to change the value.

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 10 times faster.
Up and Down Keys:	Switches between setting items.

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

CHECK Set the upper and lower limits so that the measurement object is displayed as white pixels.



5. Select ***OK***.

   The settings will be registered and the screen in (1.) will return.

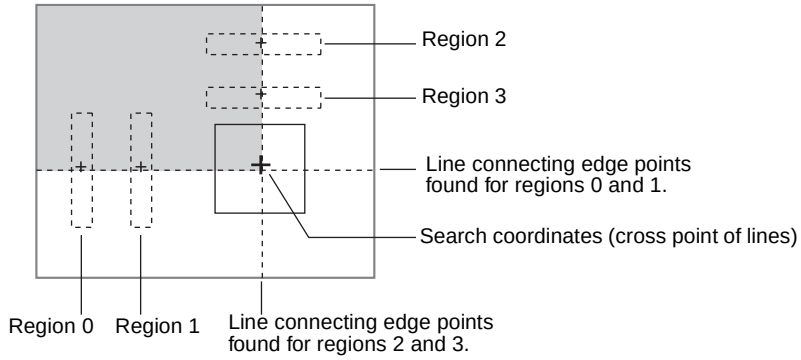
   A display cursor will appear at the center of gravity (search coordinates).

CHECK It is also possible to set the binary level so that measurement is performed only for an intermediate density range.

Edge

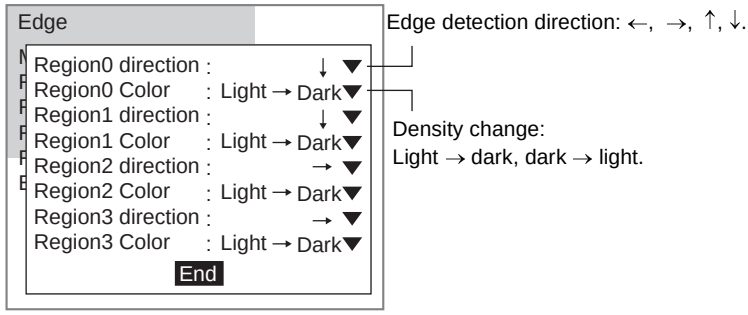
The edge registration method can be used when the measurement object is rectangular.

Draw 4 regions. One edge is detected from each region and that becomes the reference position.

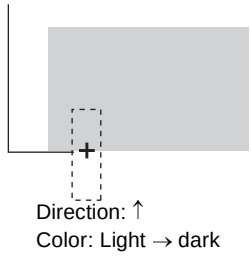


1. Setting Edge Detection Conditions

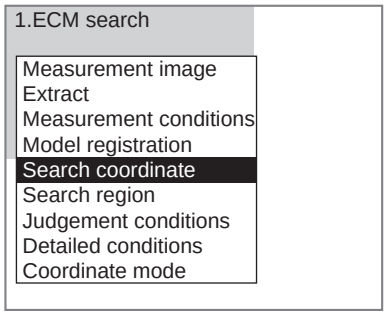
   Set the direction to search for the 4 edges and the density change as the measurement conditions.



Example: Finding this position in region 0.



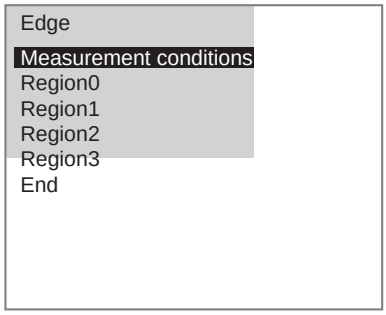
a) Select ***Search coordinate***.



The registration selections will be displayed.

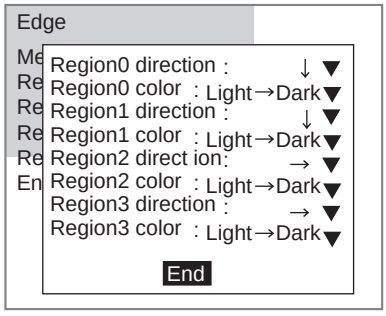
b) Select ***Edge***.

The Edge Measurement Screen will be displayed.



c) Select ***Measurement conditions***.

The Measurement Conditions Settings Screen will be displayed.



d) Set the conditions.

e) Select ***End***.

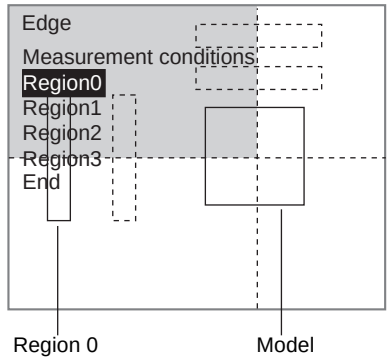
The settings will be registered and the screen in (b.) will return.

2. Drawing Measurement Regions

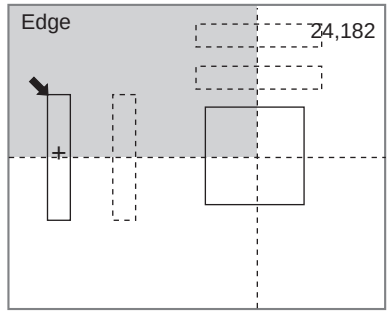
Draw 4 regions to include all edges.

a) Select ***Region 0***.

The region at the cursor position will be displayed in solid lines. The model will also be displayed in solid lines.

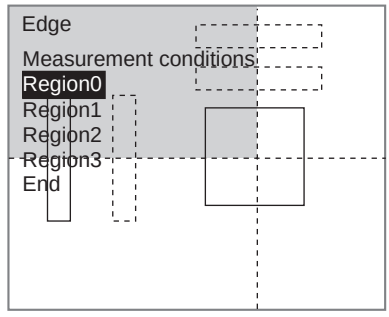


The screen for drawing regions will be displayed.



b) Draw a box-shaped region.

The region will be registered.



c) Repeat steps a and b until the 4 regions are drawn.

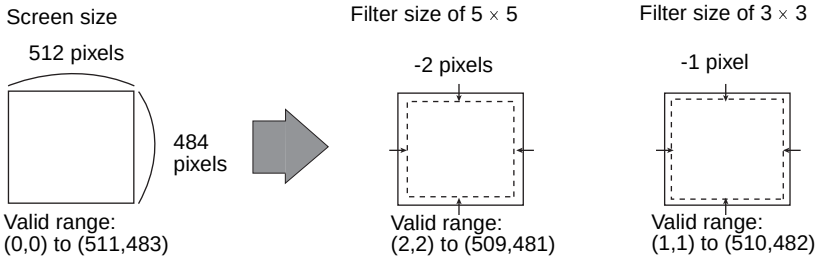
d) Once the 4 regions have been drawn, select ***End***.

The search coordinates will be registered.

2-23-6 Setting Search Regions

Set the region to search for the model. The whole region of the input image can be searched. Processing time can be reduced and accuracy improve, however, by limiting 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 search region.

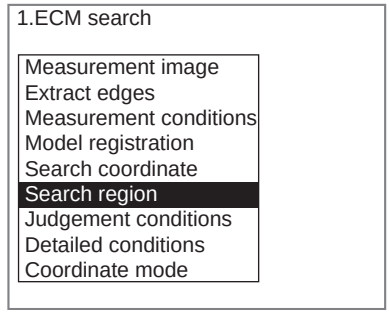


Each time the image is filtered, the range of inaccurate pixels will be increased further. For example, if filtering is performed twice, the valid range will be reduced as follows:

Filter size of 5 × 5: -2 pixels × 3 = -6 pixels
Filter size of 3 × 3: -1 pixel × 3 = -3 pixels

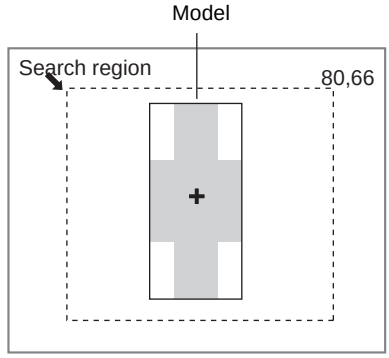
(Filtering is also performed once in edge extraction, so filtering is actually performed a total of three times.)

1. Select ***Search region***.



An arrow cursor will appear.

The model will be displayed with solid lines.

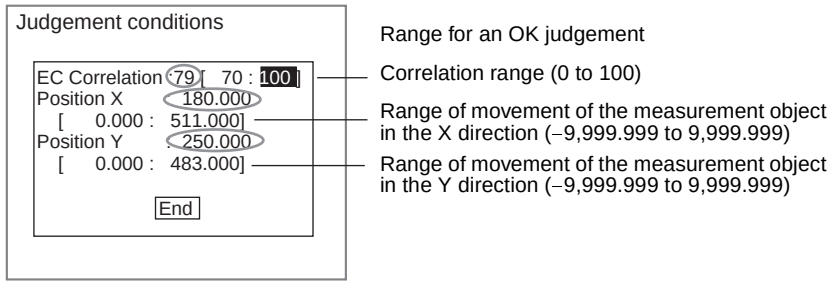


2. Draw a box-shaped search region.

CHECK The only figure that can be drawn is a box.
The search region will be set and the screen in (1.) will return.

2-23-7 Setting Judgement Conditions

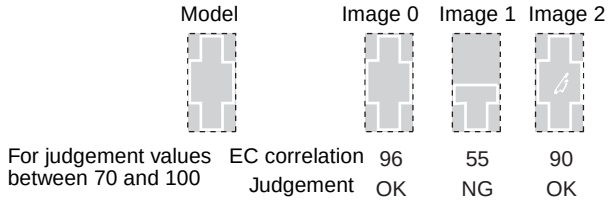
Set the judgement conditions for the correlation to the model and the position to be found (X,Y).



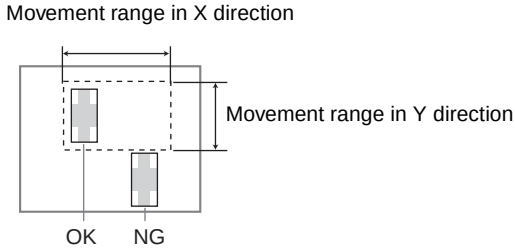
: Measurement results for the displayed image
Use these values as a reference for setting upper and lower limits.

CHECK EC Correlation

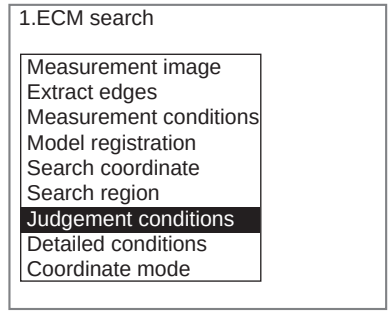
The edge-extracted image is used for matching with the model. The EC correlation value indicates the degree of similarity for the edge-extracted image.



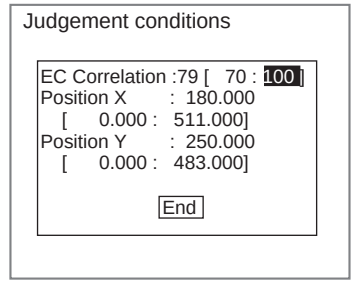
CHECK Position X and Position Y



1. Select ***Judgement conditions***.



The Judgement Conditions Settings Screen will be displayed.

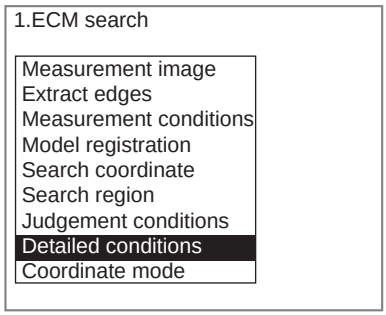


2. Change the settings.
3. Select ***End***.
   The settings will be registered and the screen in (1.) will return.

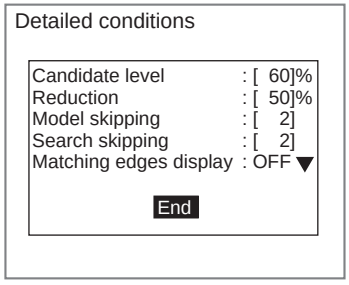
2-23-8 Setting Detailed Conditions

The search settings can be changed here. Change the conditions if the measurement results are unstable or if high-speed processing is required. Normally, 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.

1. Select ***Detailed conditions***.



The Detailed Conditions Settings Screen will be displayed.



2. Change the settings.
3. Select ***End***.

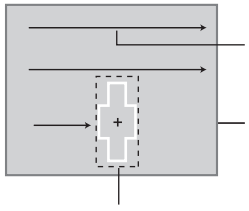
   The settings will be registered and the screen in (1.) will return.

Candidate Level, Reduction, Model Skipping, and Search Skipping

The Controller performs the following 2-stage processing internally.

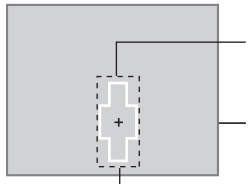
1. Rough Search

   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.



- 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.



- Model reduced by the amount set under *Reduction*.
- Model where number of pixels set under *Model skipping* have been skipped.

CHECK

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.

SeeAlso

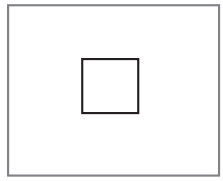
Refer to page 2-23-(7) for information on setting *Accuracy*.

Setting items	Range	Details
Candidate level	0 to 100 (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 candidate level if the model searches are unstable. The processing speed, however, will be slower.
Reduction	25 to 100 (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 9 (2*)	Set the number of pixels to be skipped for the model.
Search skipping	1 to 9 (2*)	Set the number of pixels to be skipped in the search region when performing rough searches.

The asterisk (*) indicates the default setting.

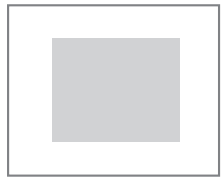
CHECK The following parameters can be adjusted in line with the measurement object to increase processing speed.

When the model is a line drawing



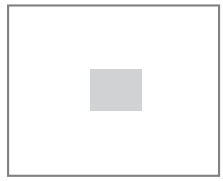
Increase the model skipping setting.

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.

Matching Edge Display

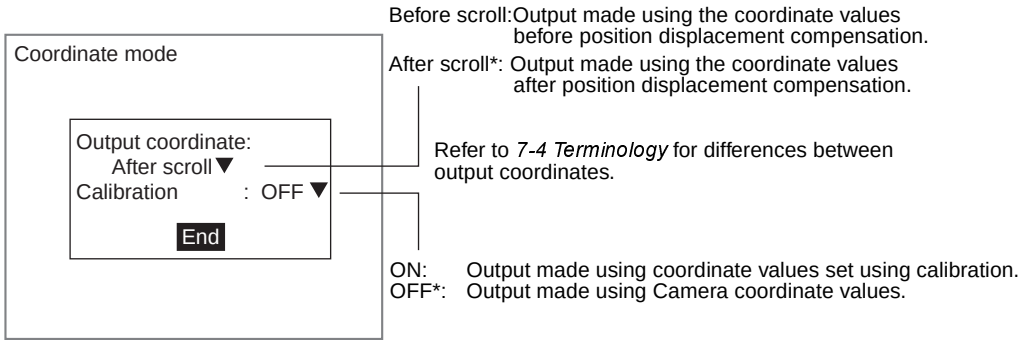
When the ECM search function is used, the edge codes are used to match the model and the input image. Select whether or not to display matching edge codes on the measurement screen when the edge codes of the model and the input image match.

Settings	Details
ON	The sections where the edge codes match are displayed in color. The processing time is longer than when set to OFF.
OFF*	The matching edge codes are not displayed.

The asterisk (*) indicates the default setting.

2-23-9 Setting the Coordinate Mode

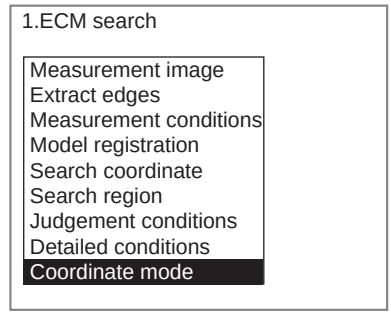
Select the type of coordinate values.



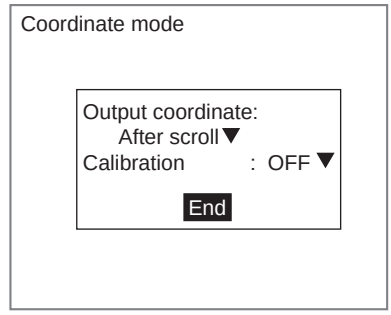
The asterisk (*) indicates the default setting.

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.

1. Select ***Coordinate mode*.**



The Coordinate Mode Settings Screen will be displayed.



2. Make the settings for each item.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

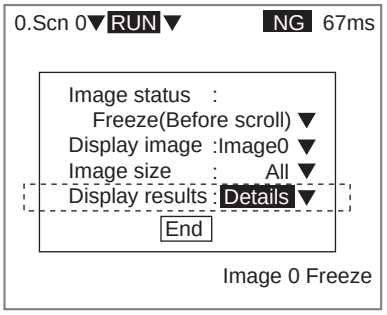
2-23-10 Measurement Screens

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

This section describes what kind of information can be displayed for ECM searches.

SeeAlso Refer to *SECTION 3 Monitor Mode and Run Mode* for details on Monitor and Run modes.

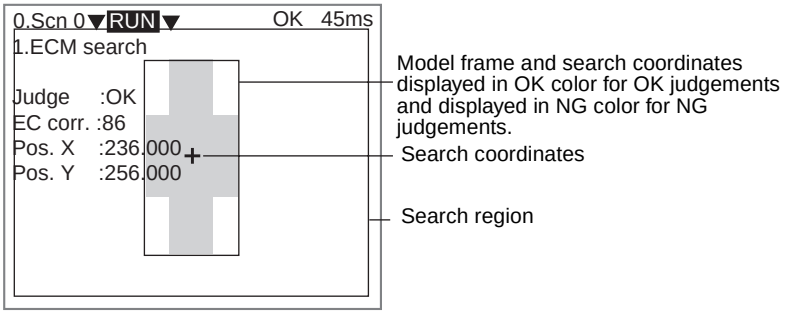
CHECK Press the **SHIFT+ESC** Keys on the Run Screen to access the following screen and change ***Display results*** to ***Details***.



Use the **Up** or **Down** Key to change to the unit for which ECM search is set and the following detailed screens will be displayed.

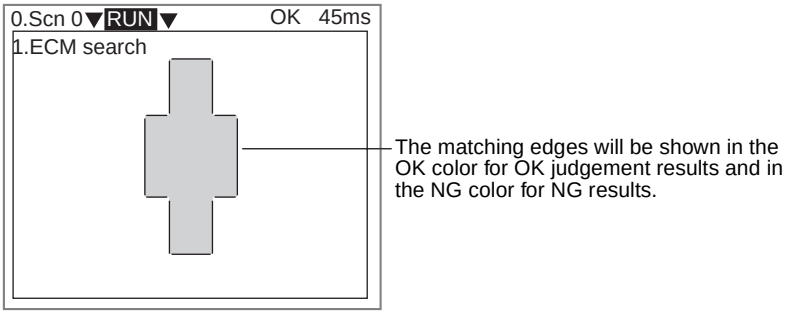
Use the **SHIFT+Right** or **Left** Keys to switch in order between the two screens.

Measurement Values and Positions



Matching Edges

If *Detailed conditions/Matching edges* is set to ON, the following screen will be displayed.

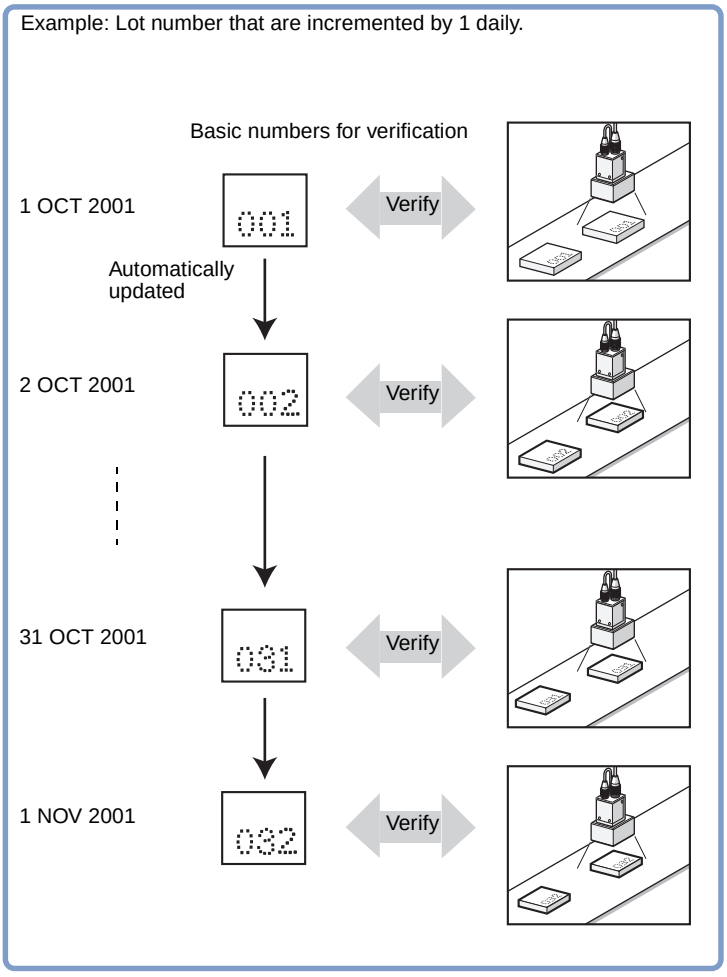


2-24 Lot Number OCV 1

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.

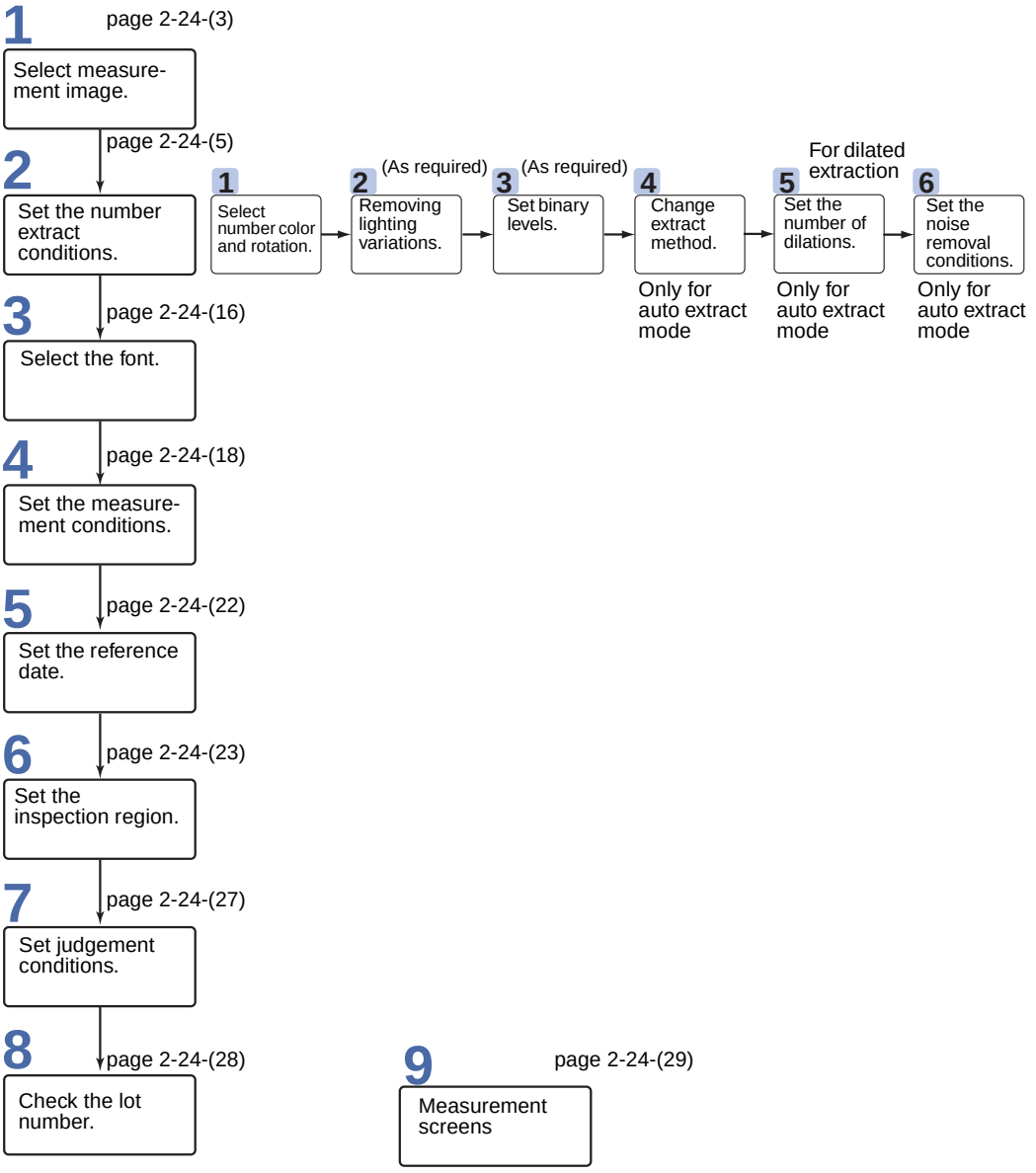
The Controller also has built-in dictionaries of the shape characteristics of various fonts so that basic characters do not need to be registered.



Performance

Item	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

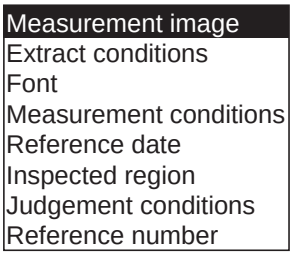


2-24-1 Selecting Measurement Images

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

1. Select ***Lot-No. OCV1.***

The setting selections will be displayed.



2. Select ***Measurement image***.

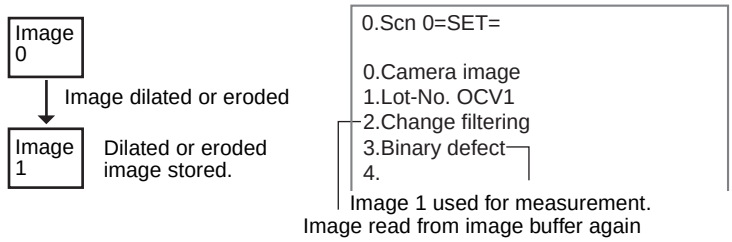
   The selections will be displayed.

3. Select which image will be used for measurement, the image stored at Image 0 or the image stored at Image 1.
4. Press the **ENT** Key.

   The settings will be registered and the screen in (1.) will return.

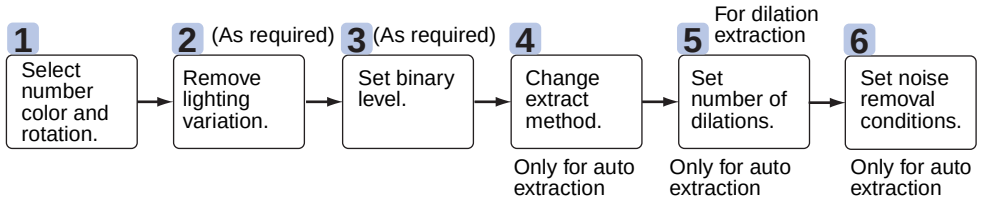
CHECK If *Shading* is set under *Extract conditions* (i.e., the shading level has been set to 1 or higher), the image selected here will be dilated or eroded and stored at the other image number. Set Change Filtering as the next processing item to use this image for measurement for units after the unit for which Lot Number OCV1 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



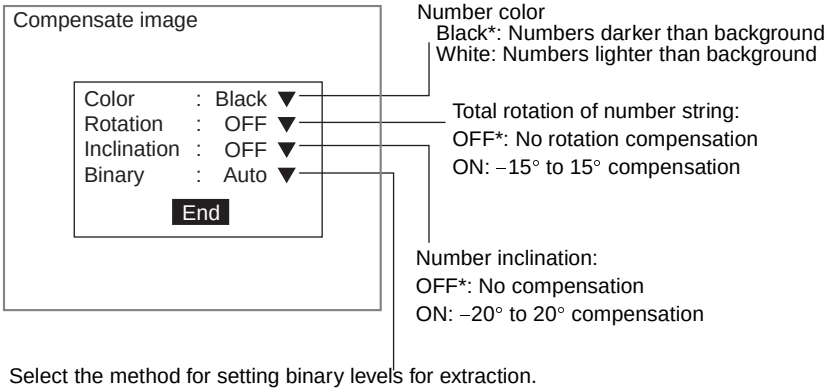
2-24-2 Setting Number Extract Conditions

Operational Flow



STEP 1: Selecting Number Color and Rotation

Set the color of the lot number and rotational corrections.

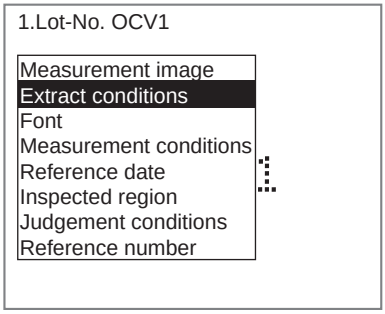


Select the method for setting binary levels for extraction.
Automatic*: Threshold is automatically set from density histogram for whole image.
Manual: Binary level is adjusted while referring to image.
Select fixed when the numbers are not extracted well using the automatic setting. Refer to page 2-24-(7).

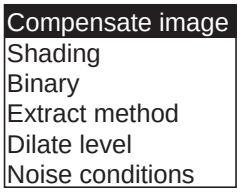
The asterisk (*) indicates the default setting.

CHECK The rotation and inclination settings are enabled only for regions for which automatic extraction is selected under *Measurement Conditions/Extract method*.

1. Select ***Extract conditions***.

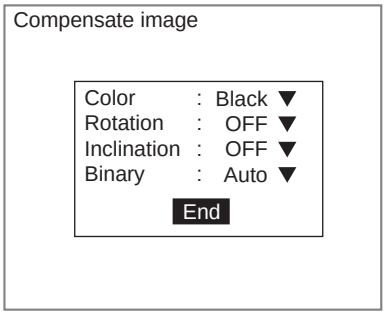


The settings selections will be displayed.



2. Select ***Compensate image***.

   The Compensate Image Settings Screen will be displayed.

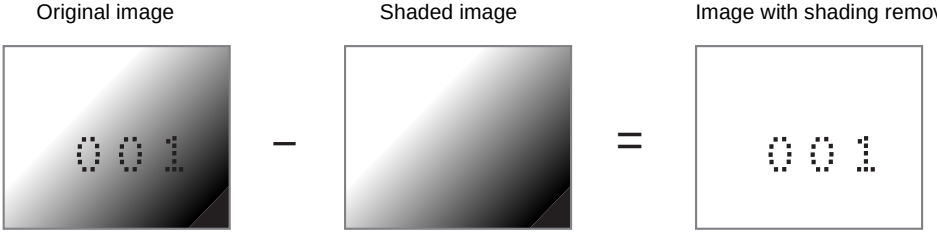


3. Change the settings.
4. Select ***End***.

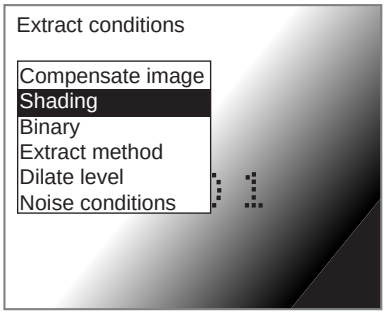
   The settings will be registered and the screen in (1.) will return.

STEP 2: Removing Lighting Variations

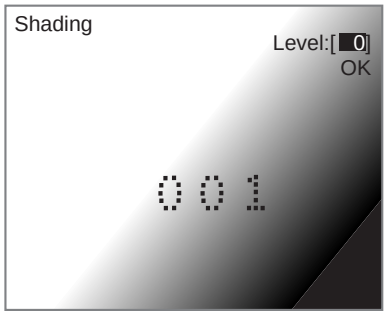
Numbers cannot be extracted accurately if lighting variations cause the numbers to become illegible. Adjustments can also be made for shaded images.



1. Select ***Shading***.



The Shading Levels Settings Screen will be displayed.

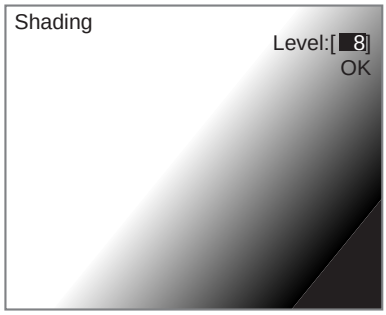


2. Place the cursor on the level and use the **Left** and **Right** Keys to change the level to between 0 and 10.

   Right Key: Increases the value by one.

   Left Key: Decreases the value by one.

CHECK The higher the level, the narrower the number lines in the image. Adjust the level until the lines start to disappear. The higher the level, the longer the processing time.



3. Select ***OK***.

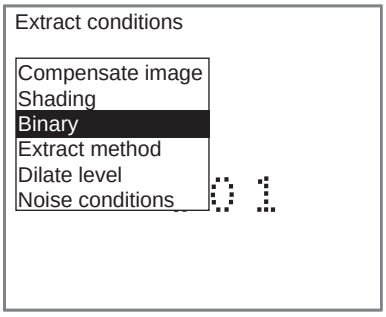
   The settings will be registered and the screen in (1.) will return.

STEP 3: Setting Binary Levels

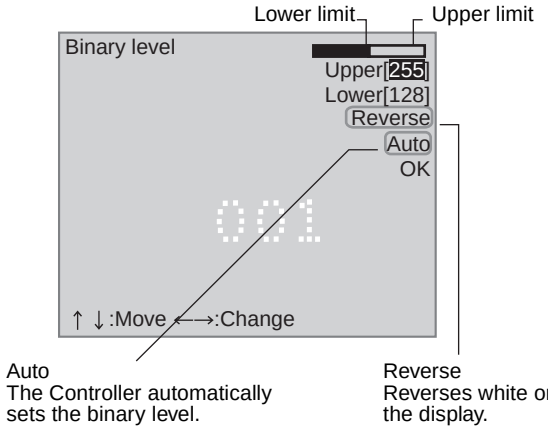
The Lot Number OCV1 processing item converts density images to binary images and performs number extraction on the binary images. The binary level set here is enabled only when the binary method is set to manual under *Extract conditions/Compensate image/Binary method*. Adjust the binary level so that the numbers for verification are displayed as white pixels.

CHECK When Binary Method Is Set to Automatic under *Extract conditions/Compensate image/Binary method*
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.

1. Select ***Binary***.



The settings screen for binary levels will be displayed.

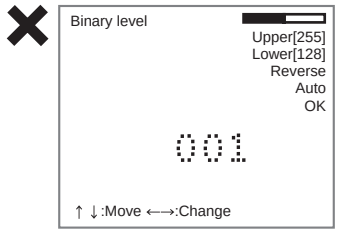


2. Move the cursor to the upper limit and use the **Left** and **Right** Keys to change the value.

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 10 times faster.
Up and Down Keys:	Switches between setting items.

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

CHECK Set the upper and lower limits so that the numbers are displayed as white pixels.



4. Select ***OK***.

   The settings will be registered and the screen in (1.) will return.

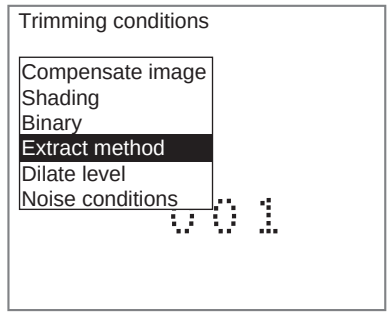
CHECK It is also possible to set the binary level so that measurement is performed only for an intermediate density range.

STEP 4: Changing Extract Methods

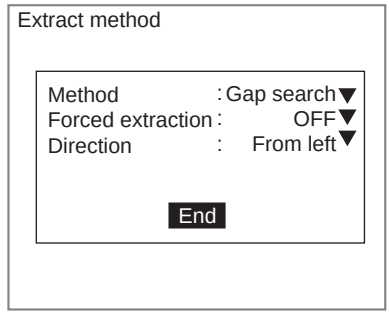
Change the extract method if the numbers are not extracted accurately. Normally, the method can be left on the default setting. After changing the setting, perform a measurement to check that the numbers can still be extracted correctly.

CHECK The extract method setting is enabled only for regions for which automatic extraction is selected under *Measurement conditions/Extract method*.

1. Select ***Extract method***.



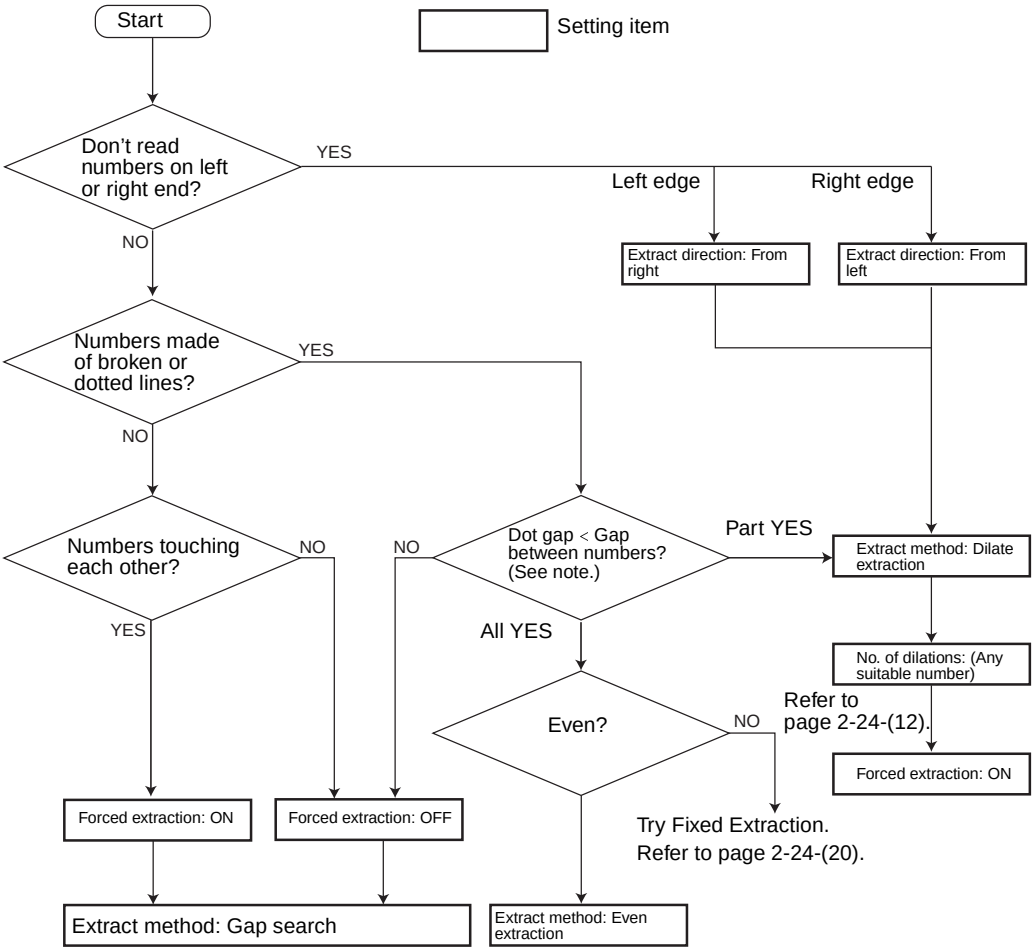
The Extract Method Settings Screen will be displayed.



2. Change the settings.
3. Select ***End***.

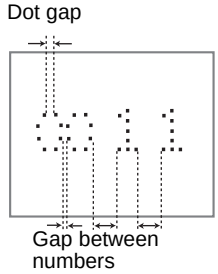
   The settings will be registered and the screen in (1.) will return.

Guide to Setting Conditions

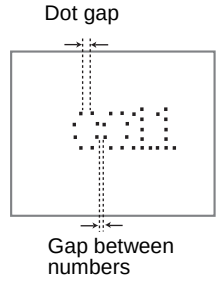


Note Select the extract methods according to the relationship between the dot gap and the gap between numbers as follows:

- If there are only portions where the dot gap is larger than the gap between numbers, set dilation extraction.



- If without exception the dot gap is larger than the gap between numbers, set even extraction.



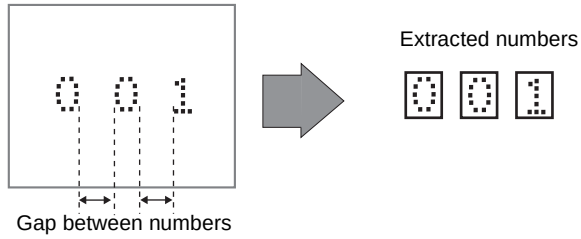
In the following descriptions, the asterisk (*) indicates the default setting.

Extract Methods

Gap Search*

Finds the gap between numbers and extracts the numbers.

Select this method for most applications.



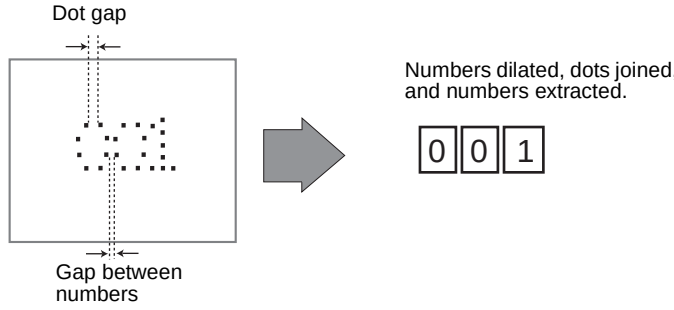
Dilate Extraction

With dot numbers, the gap search may not extract correctly if the gap between dots is greater than the gap between numbers. In such cases, select dilation extraction. The numbers are dilated, the dot gaps joined, and then the numbers are extracted.

Set the number of dilations under *Extract conditions/Dilate level*.

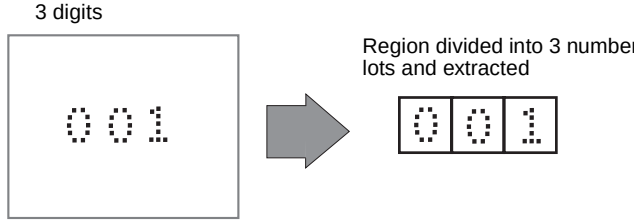
SeeAlso Refer to *STEP 5: Setting Number of Dilations on page 2-24-(12)*.

CHECK Use in conjunction with forced extraction because the gap between numbers are also joined when the numbers are dilated.



Even Extraction

The number of digits in the lot number is specified and the numbers are extracted at even intervals.



In the following descriptions, the asterisk (*) indicates the default setting.

Forced Extraction

If the set number of digits cannot be extracted, select whether or not to use forced extraction. The settings are OFF* or ON.

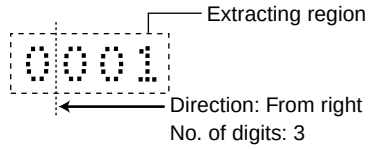
The forced extraction function extracts numbers that are joined due to printing errors or because they are inclined.

Forced extraction is enabled only when *Gap search* or *Dilate Extraction* are selected as the extract method.

Extract Direction

The direction setting is enabled only when *Dilate* is selected as the extract method. The direction choices are from left* or from right.

Number extraction is performed only until the set number of digits have been extracted. If there are extra numbers in the extracting region, these numbers can be ignored (excluded from the extraction process) by starting extraction from the opposite direction.



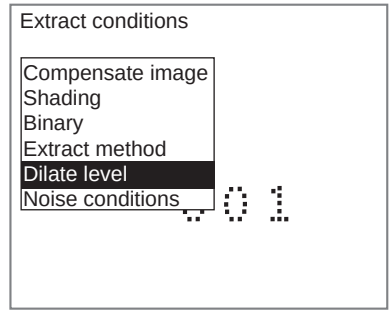
Extraction is performed on 3 numbers starting from the right, so the “0” on the left is ignored.

STEP 5: Setting Number of Dilations

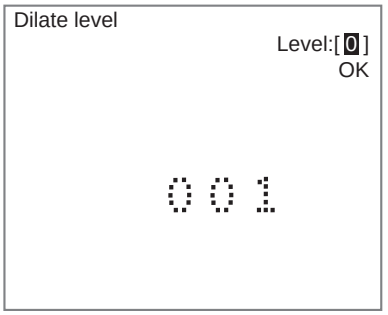
Set the number of dilations between 0 and 9 if dilate extraction has been chosen as the extract method. Dilation is performed until the width between dots is eliminated, and then the numbers are extracted.

CHECK The Number of Dilations setting is enabled only for regions for which automatic extraction is selected under *Measurement conditions/Extract method*.

1. Select ***Dilate level***.



The Dilate Level Settings Screen will be displayed.



2. Move the cursor to the level value and use the **Left** and **Right** Keys to change the value (0 to 9).

   Right Key: Increases the level by one.

   Left Key: Decreases the level by one.

3. After the dot have joined, select ***OK***.

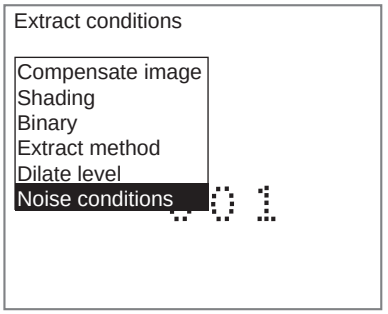
   The settings will be registered and the screen in (1.) will return.

STEP 6: Setting Noise Removal Conditions

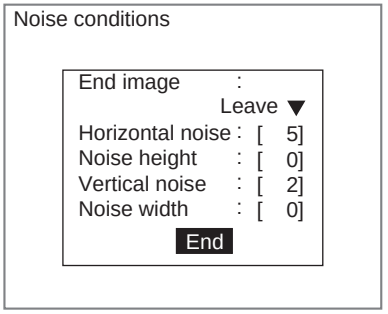
Set the conditions for ignoring noise when executing number extraction.

CHECK The noise removal settings are enabled only for regions for which automatic extraction is selected under *Measurement conditions/Extract method*.

1. Select ***Noise conditions***.



The Noise Conditions Settings Screen will be displayed.



2. Change the conditions.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

In the following descriptions, the asterisk (*) indicates the default setting.

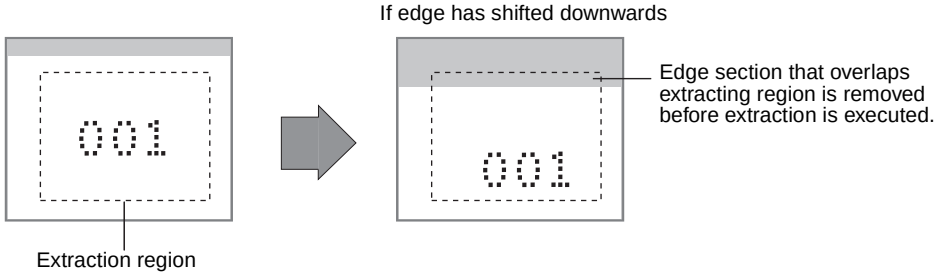
End Images

Select whether to leave or remove the area adjacent to the extracting region.

(Leave*, Erase (horizontal), Erase (vertical)

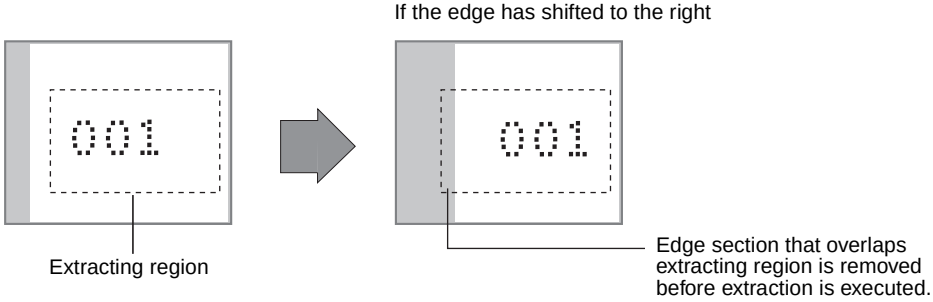
For Measurement Objects that Move Vertically

Select ***Erase (vertical)***.



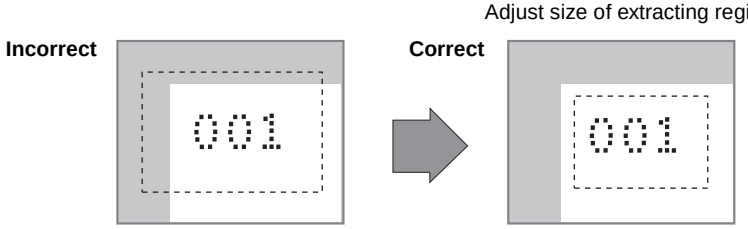
For Measurement Objects that Move Horizontally

Select ***Erase (horizontal)***.



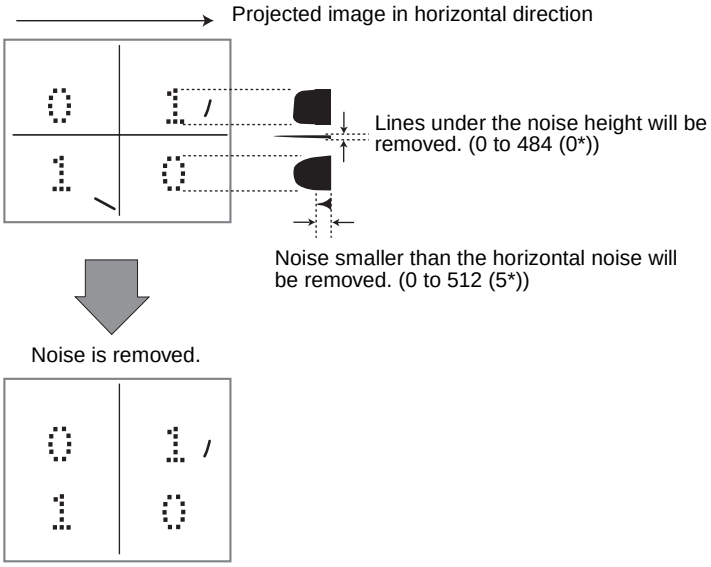
For Measurement Objects That May Move Vertically or Horizontally

Only edges that overlap either vertically or horizontally can be removed. If the edges overlap both vertically and horizontally, the numbers cannot be extracted correctly. If the possibility exists of overlap in both directions, adjust the position and size of the extracting region so that only the numbers to be extracted fall within the extracting region.



Horizontal Noise and Noise Height

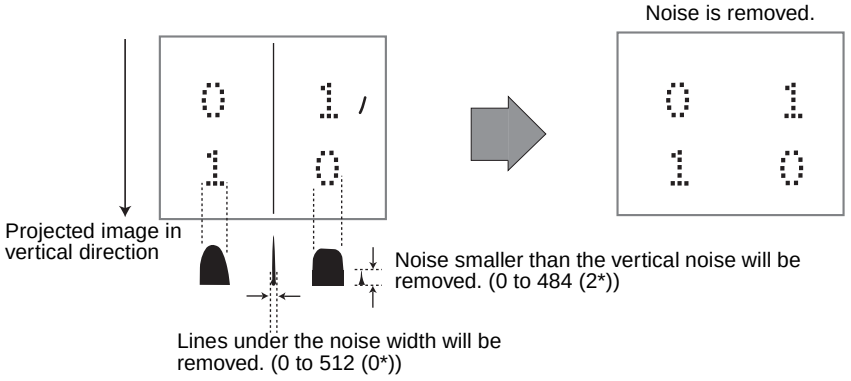
To extract lines, a projected image in the horizontal direction must be created. Set the size to be removed as noise from this projected image.



Vertical Noise and Noise Width

To extract numbers in an image after lines have been extracted, a projected image must be created in the vertical direction.

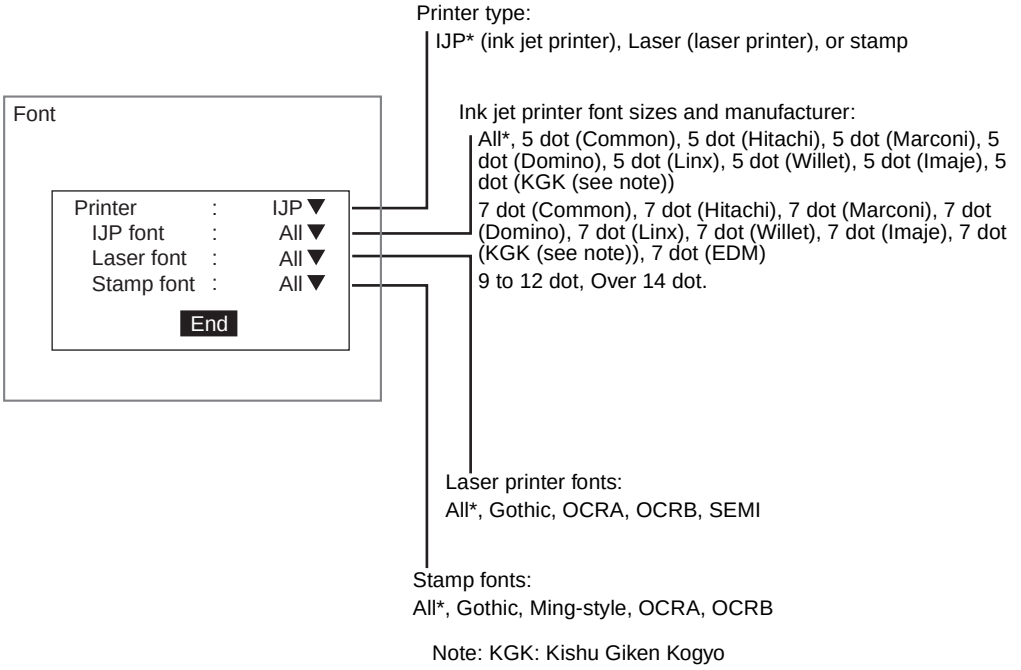
Set the size to be removed as noise from this projected image.



2-24-3 Selecting Fonts

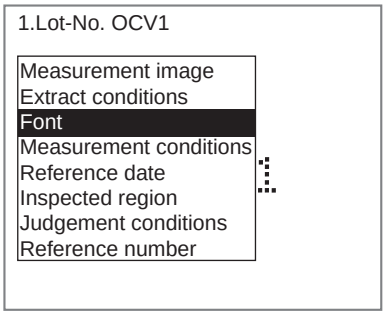
Select the font for the lot numbers to be verified.

If the font is unknown, change IJP font, laser font, and stamp font settings to *All*.

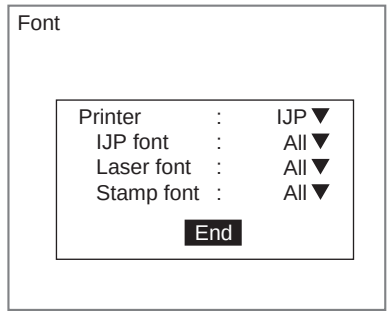


The asterisk (*) indicates the default setting.

1. Select ***Font***.



The Font Settings Screen will be displayed.



2. Set the font conditions.
3. Select ***End***.
   The settings will be registered and the screen in (1.) will return.

2-24-4 Setting the Measurement Conditions

Set the initial value and incrementing method for the lot numbers.

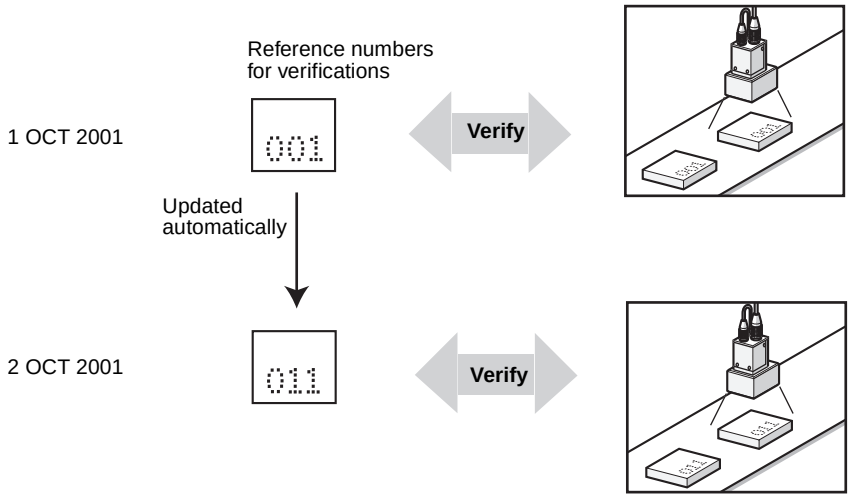
CHECK Set the data information correctly; this information serves as the basic for incrementing the lot numbers.

SeeAlso Refer to *5-8 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.

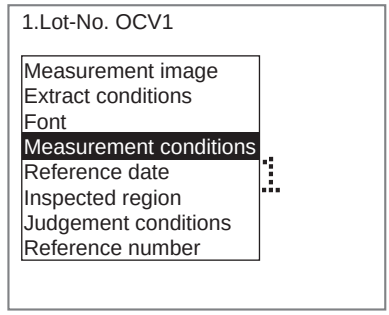
SeeAlso Refer to *2-24-5 Setting the Reference Date*.

Example:
Reference date:1 OCT 2001
Lot No. default:001
Lot No. add method:Day
Lot No. add value:10

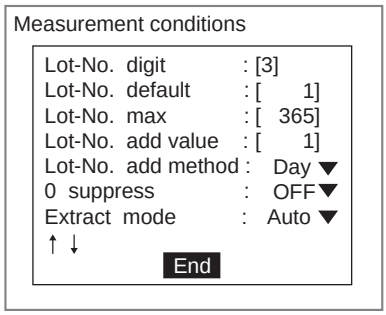


A value of 10 is added when 1 day has elapsed from the reference date.

1. Select ***Measurement conditions.***



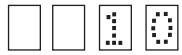
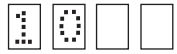
The conditions setting screen will be displayed.



2. Set the conditions.
3. Select ***END.***
   The settings will be registered and the screen in (1.) will return.

Setting Items and Contents

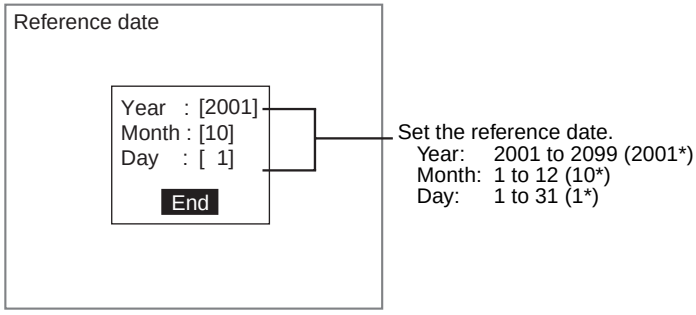
Setting	Contents
Lot-No. digits	Set the number of digits in the lot number. (1 to 4, 3*) Set to a value at least as large as the number of digits in the maximum lot number. If a smaller value is set, it will be increased automatically to the number of digits in the maximum lot number.
Lot-No. default	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. (0 to 9999, 1*)
Lot-No. max.	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. (0 to 9999, 365*)
Lot-No. add value	Set the value to be added to the lot number each cycle defined by the add method. (0 to 9999, 1*)
Lot-No. add method	Set the period at which to increment the lot number. Lot numbers will be calculated as follows based on the built-in calender. (Day*, Week, Month, Year) 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. Example: 8 OCT 2001 to 1 NOV 2001 (Days are ignored.) Year: The lot number will be incremented every year. Example: 1 OCT 2001 to 1 JAN 2002 (Months and days are ignored.)
0 suppress	Set whether initial zeros are present or not when the lot number does not require all of the digits. (OFF*, ON) Example: If the number of digits is 3 and the lot number is 4, turn OFF suppression when “4” is printed and turn ON suppression when only “004” is printed.
Extract mode	Set the mode to use to extract numbers. (Auto*, Fixed) 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. 

Setting	Contents
Position	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. (Right*, Left)  Right  Left
Output	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

The asterisk (*) indicates the default setting.

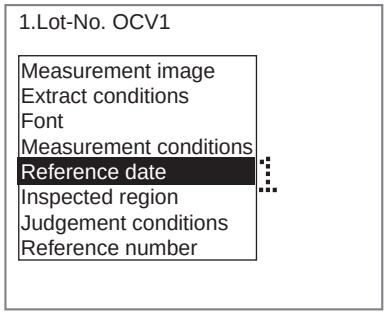
2-24-5 Setting the Reference Date

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.

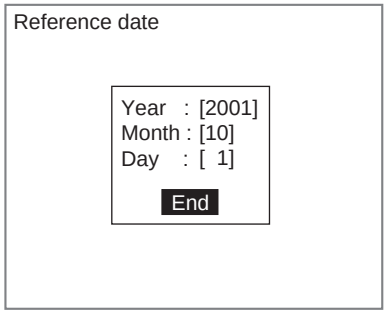


The asterisk (*) indicates the default setting.

1. Select ***Reference date.***



The setting screen will be displayed.



2. Set the reference date.
3. Select ***End.***

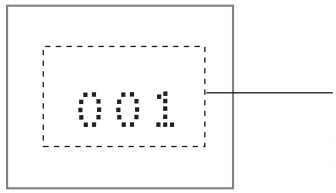
   The settings will be registered and the screen in (1.) will return.

2-24-6 Setting the Inspection Region

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.

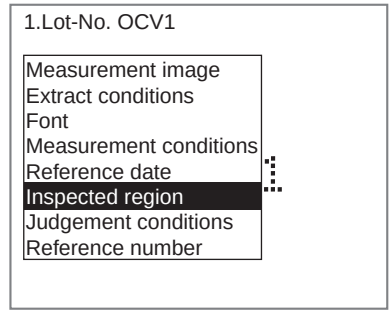
The numbers will be automatically extracted from this region. The following settings are used when extracting.

Extract conditions/Extraction method: page 2-24-(9)

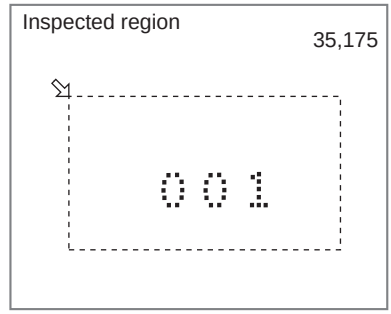
Extract conditions/Dilate level: page 2-24-(12)

Extract conditions/Noise conditions: page 2-24-(13)

1. Select ***Inspected region.***



An arrow cursor will be displayed.



2. Draw the inspected region as a square block.

   Specify the upper left and lower right coordinates.

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

   ENT Key: Confirms the setting.

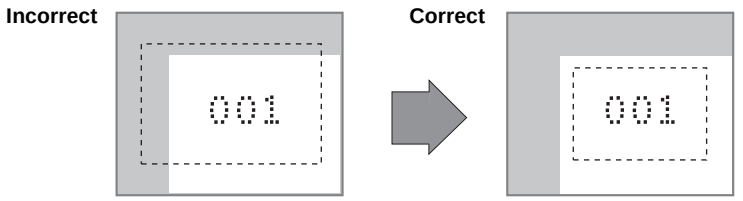
CHECK Draw the region so that only the target numbers fall within the region. Use *End Image* to remove anything other than the target numbers that overlap either vertically or horizontally on the inspected region.

SeeAlso Refer to page 2-24-(13).

If the edges overlap both vertically and horizontally, the numbers cannot be extracted correctly. If the edges overlap in both directions, adjust the posi-

tion and size of the inspected region so that only the numbers to be extracted fall within the inspected region.

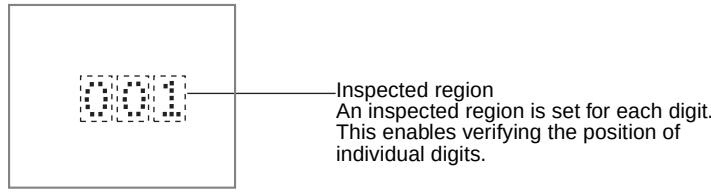
Adjust size of inspected region.



When the bottom right coordinates have been set, the screen in (1.) will return.

CHECK Repeat the procedure from (1.) to change the inspected region.

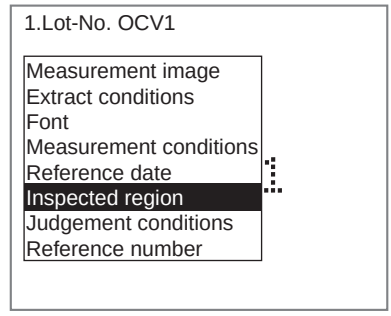
Fixed Extraction



CHECK Set the number of digits under *Measurement conditions/Lot-No. digits*.

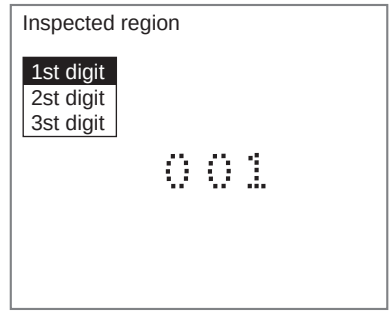
SeeAlso Refer to page 2-24-(18).

1. Select ***Inspected region.***



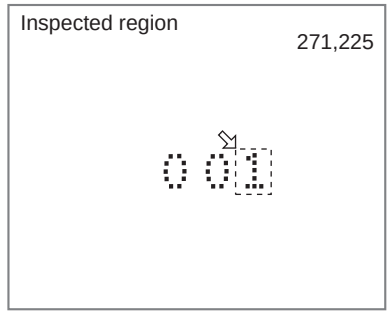
A digit selection screen will be displayed.

When 3 digits have been specified



2. Select ***1st digit.***

   The region setting screen will be displayed.



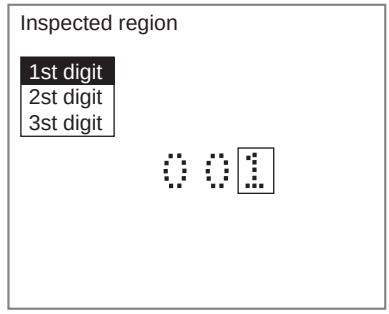
3. Draw the inspected region for the first digit as a square block.

   Specify the upper left and lower right coordinates.

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

   ENT Key: Confirms the setting.

   When the lower right coordinates have been specified, the inspected region will be set and digit number selection screen will be displayed.



4. Draw inspected regions for the other digits in the same way as for the first.
5. When regions have been drawn for all digits, press the **Esc** Key from the digit selection screen.

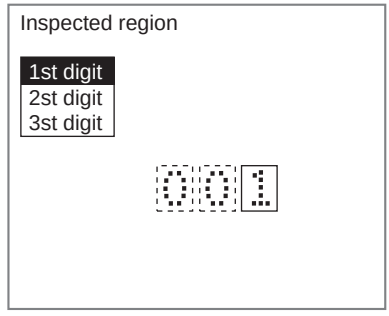
   The screen in (1.) will return.

CHECK If the number of digits set for the lot number in the measurement conditions is changed, all of the inspected regions will be cleared. Repeat the settings from (1.).

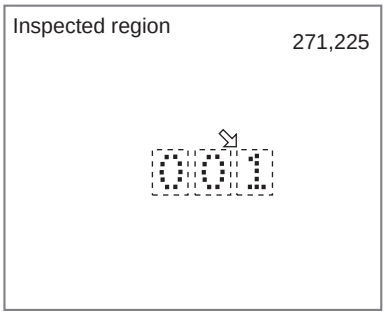
Correcting Fixed Regions

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.

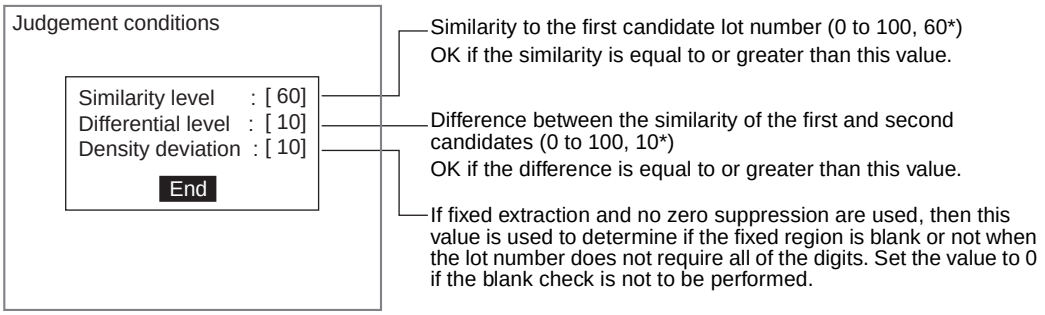


2. Change the region.

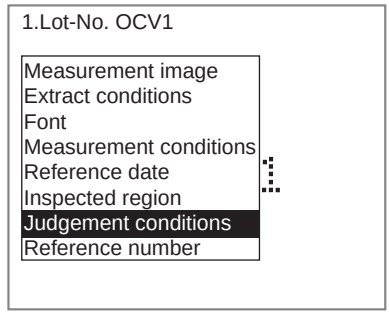
   When the lower right coordinates have been set, the screen in (1.) will return.

2-24-7 Setting Judgement Conditions

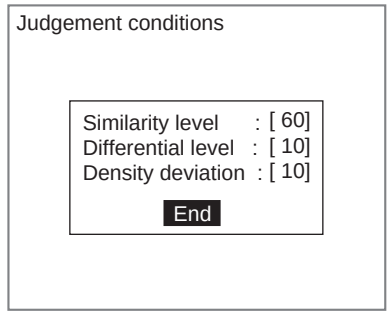
Set the judgement conditions to determine if the first candidate matches a correct lot number.



1. Select ***Judgement conditions***.



The judgement conditions setting screen will be displayed.



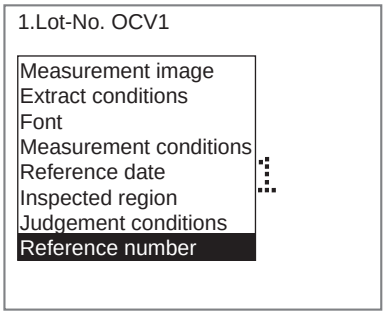
2. Make the settings for each item.
3. Select ***END.***

   The settings will be registered and the screen in (1.) will return.

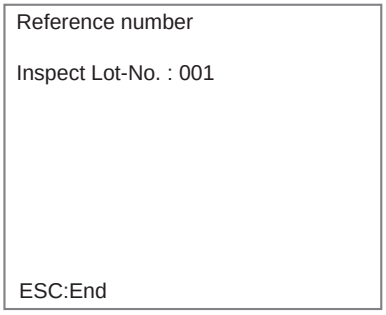
2-24-8 Checking the Lot Number

This function can be used to check the numbers that are being verified.

1. Select ***Reference number.***



The set lot number will be displayed.



2. Press the **ESC** Key to end.
   The screen in (1.) will return.

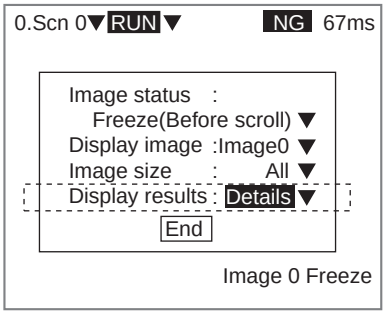
2-24-9 Measurement Screens

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

This section describes what kind of information can be displayed for the Lot Number OCV1 processing item.

SeeAlso Refer to *SECTION 3 Monitor Mode and Run Mode* for details on Monitor and Run modes.

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



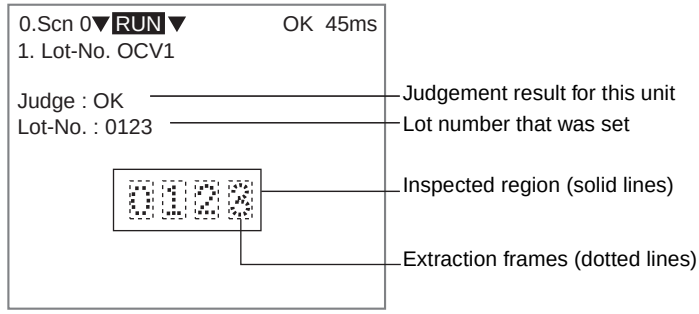
Use the **Up** or **Down** Key to change to the unit for which Lot Number OCV1 is set and the following detailed screens will be displayed.

Use the **SHIFT+Right** or **Left** Keys to switch in order between the two screens.

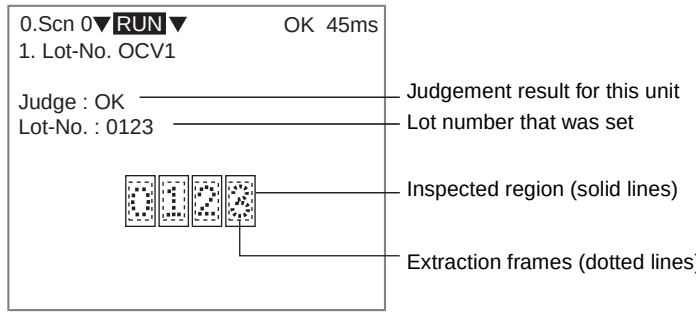
Inspected Regions

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

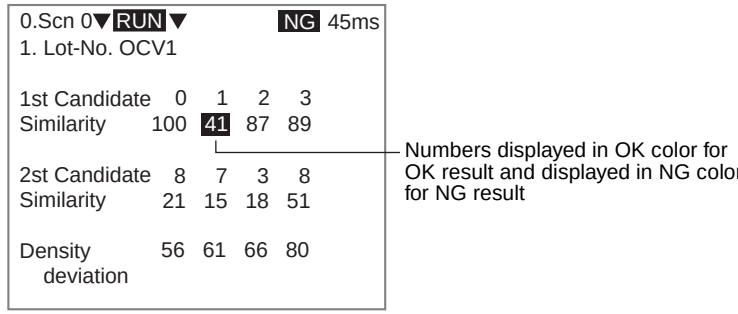


- Fixed Extract Mode



Measurement Values

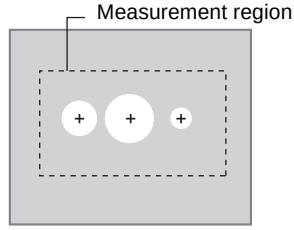
The first candidate similarity, second candidate similarity, and density deviation are displayed in list form.



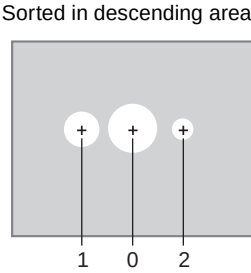
2-25 Labeling

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.

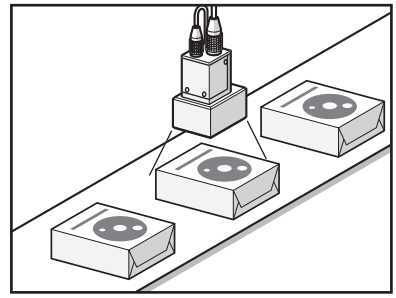
Images are converted to binary images so that the labels are white, and the areas and centers of gravity of the labels are calculated.



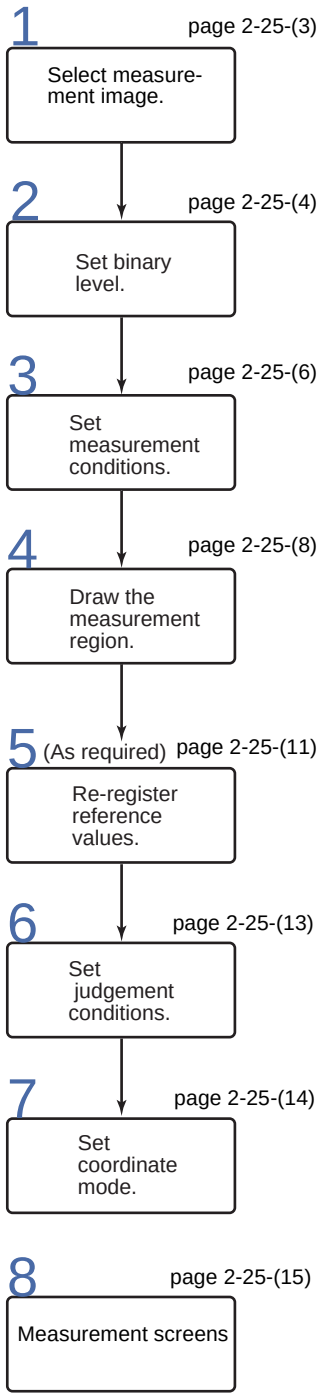
The labels that are extracted are sorted according to area or position of their center of gravity, and each label is assigned a number.



Example: Inspecting the Number of Labels



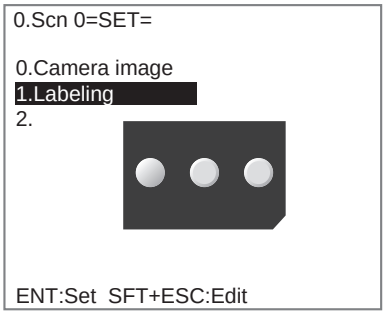
Operational Flow



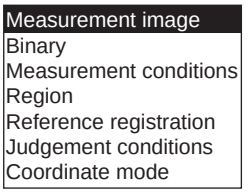
2-25-1 Selecting the Measurement Image

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

1. Select ***Labeling.***

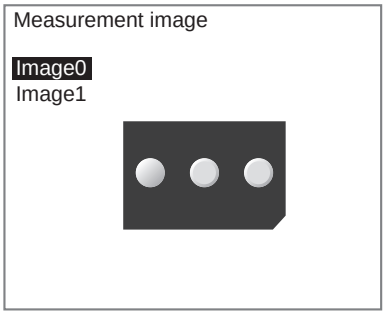


The initial screen for Labeling will be displayed.



2. Select ***Measurement image***.

   The selections will be displayed.



3. Select which image will be used for measurement, the image stored at Image 0 or the image stored at Image 1.
4. Press the **ENT** Key.

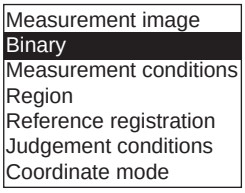
   The settings will be registered and the screen in (1.) will return.

2-25-2 Setting the Binary Level

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.

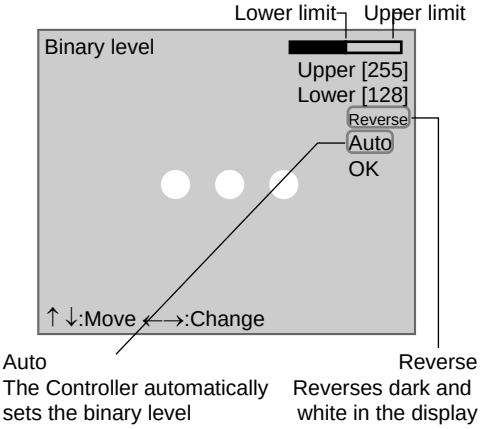
In this explanation, 3 circles on a measurement object will be used as an example.

1. Select ***Binary***.



The screen for setting the binary level will be displayed.

2. Move the cursor to the upper 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 in 10s.

Left Key: Decreases the lowest digit by one.

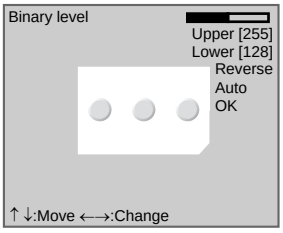
SHIFT + Left Keys: Decreases the value in 10s.

Up and Down Keys: Switches between setting items.

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

CHECK Set the upper and lower limits to make the area to be measured for labels white.

Incorrect



4. Select ***OK***.

The settings will be registered and the screen in (1.) will return.

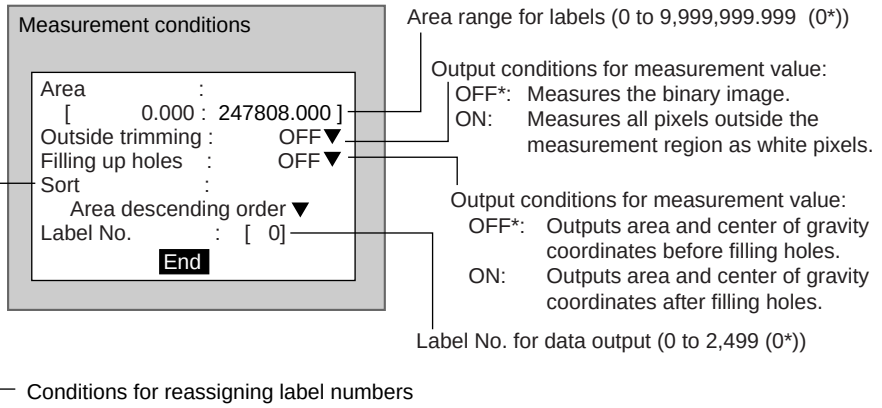
CHECK It is also possible to set the binary level so that measurement is performed only for an intermediate density range.

2-25-3 Setting Measurement Conditions

Set the *Area*, *Sort*, and *Label No.* as conditions for label measurement.

Change the other settings as well when necessary.

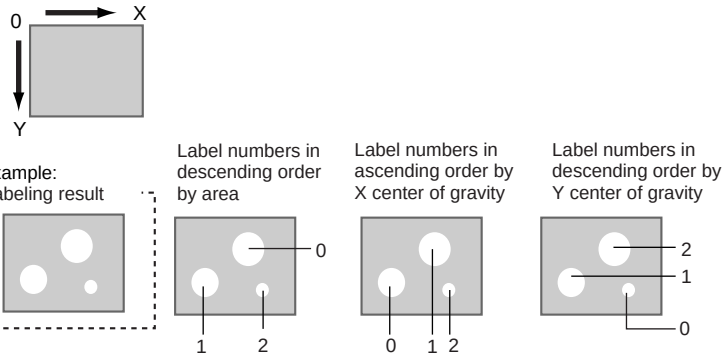
The asterisk (*) indicates the default setting.



Conditions for reassigning label numbers

Area descending order:*	Sorts in descending order by area.
Area ascending:	Sorts in ascending order by area.
X coordinate descending:	Sorts in descending order by center of gravity X coordinate. (See note.)
X coordinate ascending:	Sorts in ascending order by center of gravity X coordinate. (See note.)
Y coordinate descending:	Sorts in descending order by center of gravity Y coordinate. (See note.)
Y coordinate ascending:	Sorts in ascending order by center of gravity Y coordinate. (See note.)

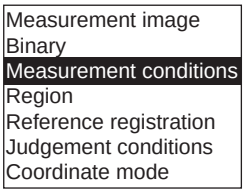
Note When X and Y center of gravity are sorted, the upper left corner of the measurement region is the origin.



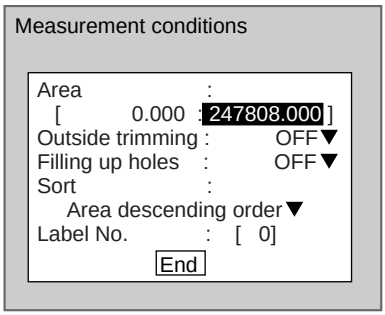
CHECK The coordinates set using calibration are not affected by labeling.

CHECK When *Position compensation* is set, the sort is performed on center of gravity coordinates *after* position compensation.

1. Select ***Measurement conditions.***



The Measurement Conditions Settings Screen will be displayed.

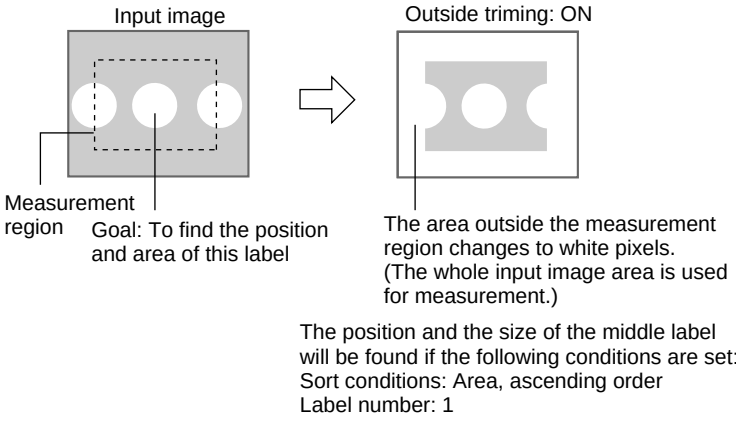


2. Change the settings.

   The settings will be registered and the screen in (1.) will return.

CHECK Outside Trimming

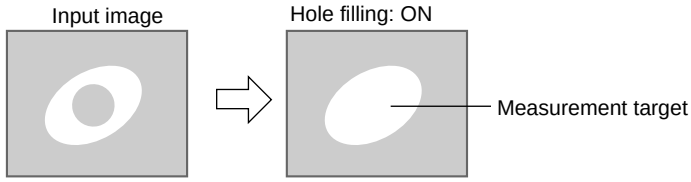
Select *Outside trimming* when there is a white-pixel area inside the measurement region that is not to be measured.



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

CHECK 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.

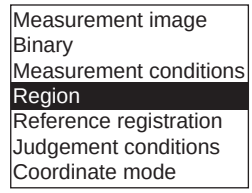


2-25-4 Drawing Measurement Regions

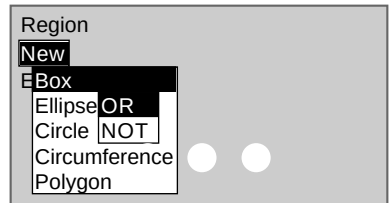
When a measurement region is drawn, measurement is performed for the displayed image and the results are registered as the reference values (area and the position of center of gravity of the label number specified under *Measurement conditions*).

CHECK Regions can be created by combining up to 3 different figures. Regions with difficult shapes can be drawn and sections not to be measured can be left out of the region by combining different figures.

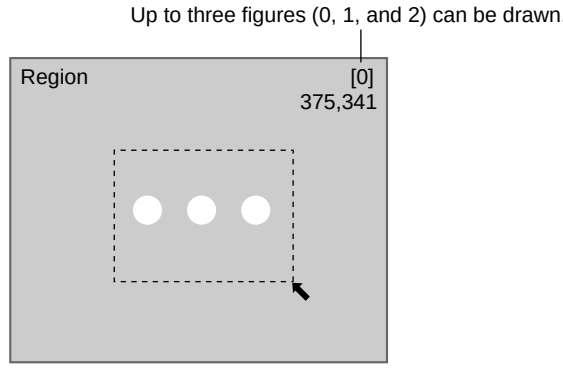
1. Select ***Region***.



The Region Settings Screen will be displayed.

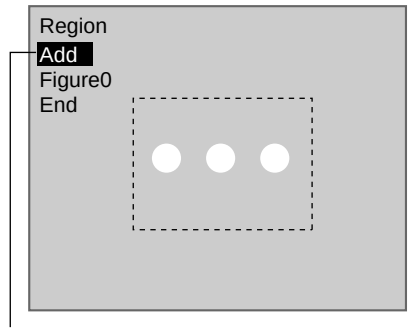


2. Select ***New***.
3. Select the shape of the desired figure.
4. Select the desired drawing mode (***OR***/***NOT***).
   An arrow cursor will appear.



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

The figure will be registered.

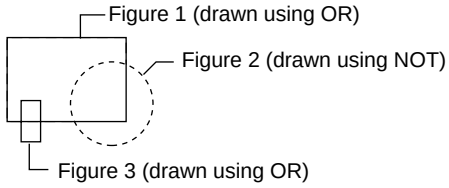


Once three figures have been drawn,
Add will no longer be displayed.

6. If additional figures are to be drawn, select ***Add***.
7. Repeat steps 3 to 5 as necessary to create the desired shape.
8. After drawing is completed, select ***End.***

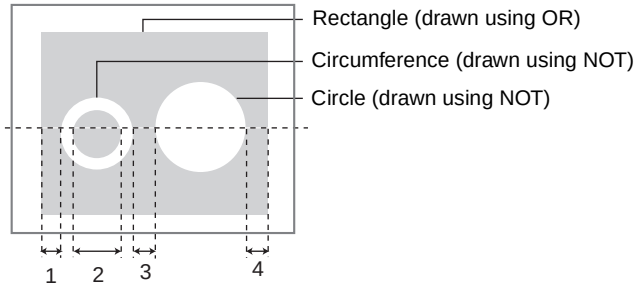
   The measurement region will be registered and the screen in (1.) will return. The center of gravity (display cursor) and measurement region will be displayed.

CHECK Figures drawn using OR mode are displayed with solid lines and figures drawn using NOT mode are displayed with dotted lines.



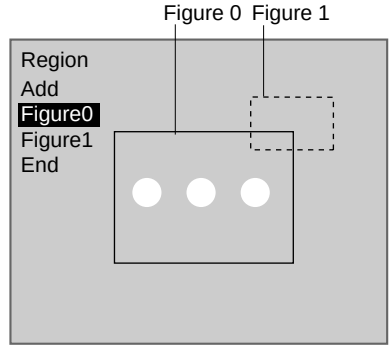
CHECK Set the model region so that no more than three areas lie along any one straight line.

INCORRECT



Correcting or Clearing Figures

1. In the screen for step 6 above, select the number of the figure to be changed or cleared using the **Up** and **Down** Keys and press the **ENT** Key.



The figure for the figure number selected using the cursor will be displayed with solid lines. The selections ***Correct*** and ***Clear*** will be displayed.

2. Select either ***Correct*** or ***Clear*** and press the **ENT** Key.

   If ***Correct*** is selected, the cursor will be displayed. Correct the size and position of the figure as desired.

   If ***Clear*** is selected, the selected figure will be cleared.

2-25-5 Re-registering Reference Values

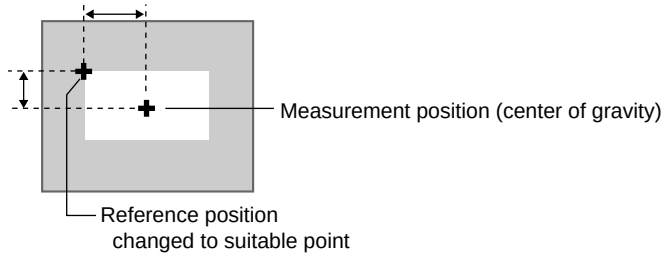
This operation is performed when only the reference values are to be re-registered.

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 when *Region* is selected.

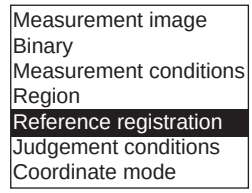
Inspecting Positions from a Specified Point

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 values return to the default setting.

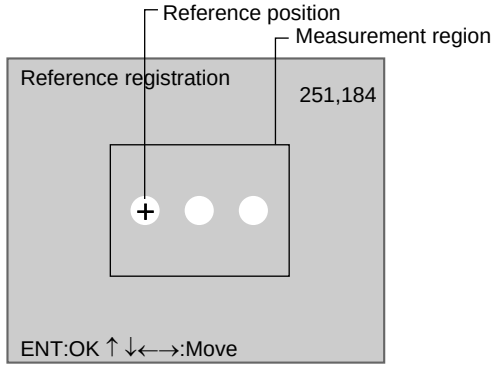
1. Select ***Reference registration***.



A cursor will appear at the center of gravity of the label number set under *measurement conditions*.

If the following conditions are set, the screen shown in the following diagram will be displayed:

Sort conditions: X coordinate ascending
Label number: 0

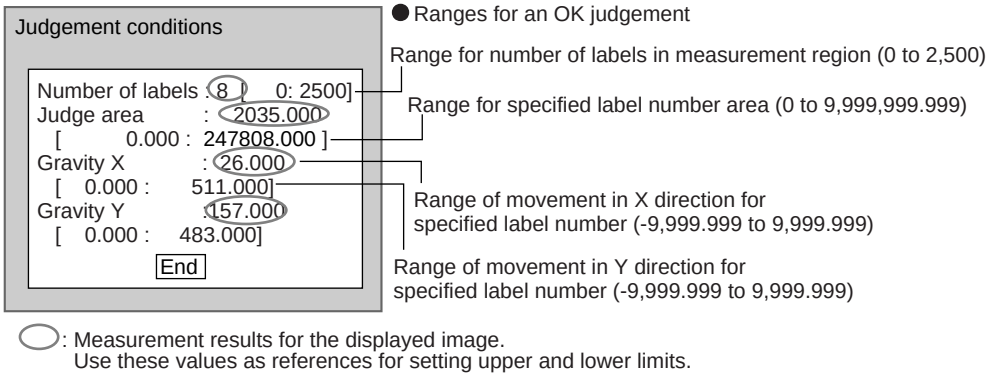


2. To change the position, use the **Up**/**Down** and **Right**/**Left** Keys to move the cursor.
3. Press the **ENT** Key to confirm the setting.

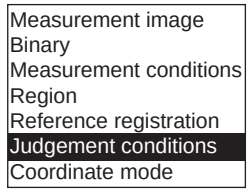
   The setting will be registered and the screen in (1.) will return.

2-25-6 Setting Judgement Conditions

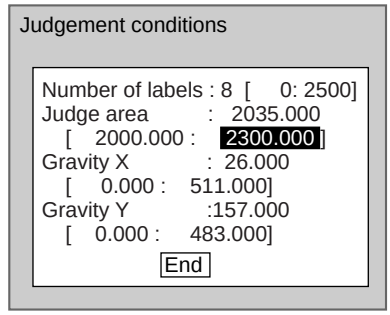
Set the ranges for the number of labels, area and center of gravity for an OK judgement.



1. Select ***Judgement conditions***.



The Judgement Conditions Settings Screen will be displayed.

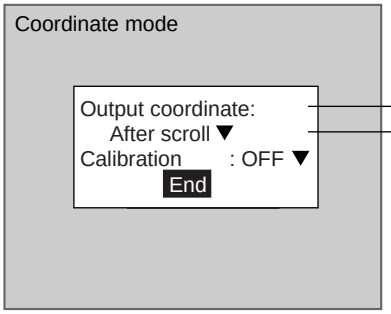


2. Make the settings for each item.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

2-25-7 Setting the Coordinate Mode

Select the type of coordinates.



Before scroll: Output made using the coordinate values before position displacement compensation.
After scroll*: Output made using the coordinate values after position displacement compensation.

SeeAlso

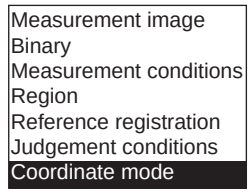
Output Coordinates: Refer to *7-4 Terminology* for differences between output coordinates.

ON : Output made using coordinate values set using calibration.
OFF*: Output made using Camera coordinate values.

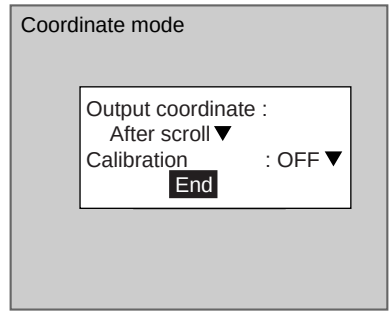
The asterisk (*) indicates the default setting.

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.

1. Select ***Coordinate mode***.



The Coordinate Mode Settings Screen will be displayed.



2. Make the settings for each item.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

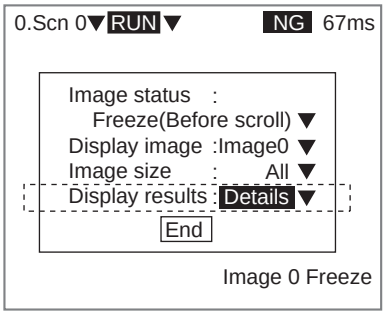
2-25-8 Measurement Screens

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

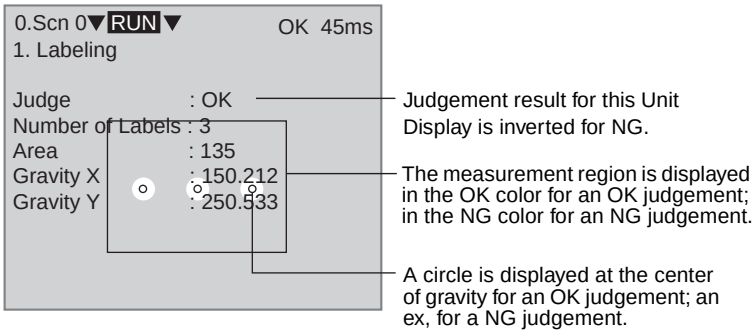
This section describes what kind of information can be displayed for labeling.

SeeAlso Refer to *SECTION 3 Monitor Mode and Run Mode* for details on Monitor and Run modes.

CHECK 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 labeling is set and the following detailed screens will be displayed.

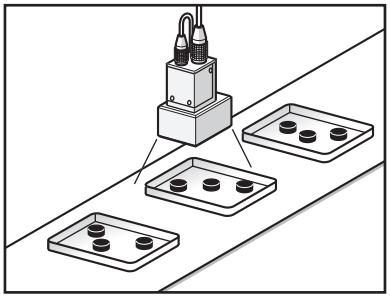


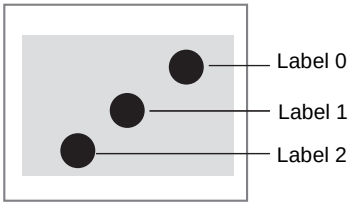
2-26 Label Data

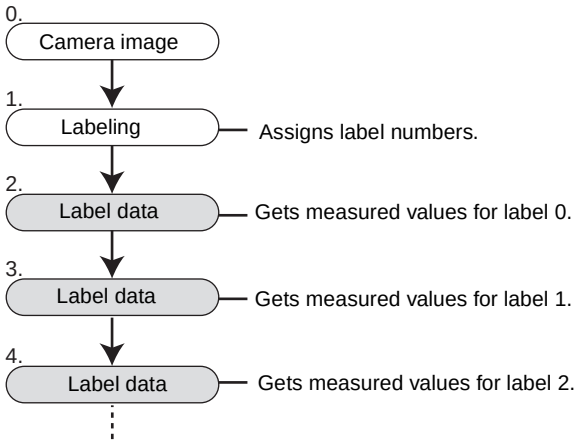
The Label Data processing item can be used to get the data for a specified label number from the measured values held by another unit. The referenced processing item must be one of the following, all of which perform label processing.

- Labeling
- Fine matching
- EC Defect

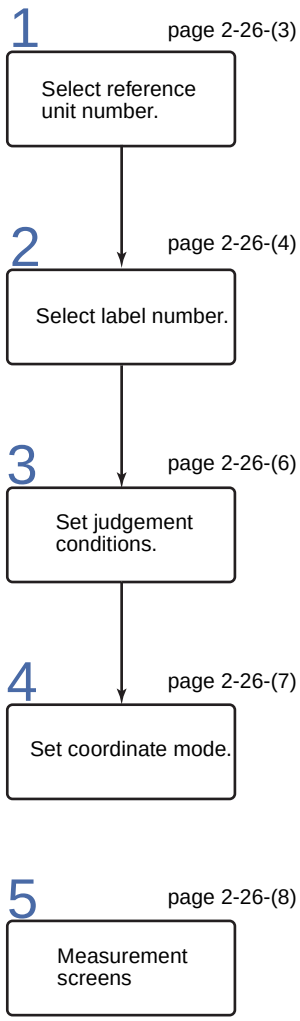
Example: Getting the Position for Each Group







Operational Flow



2-26-1 Selecting the Reference Unit Number

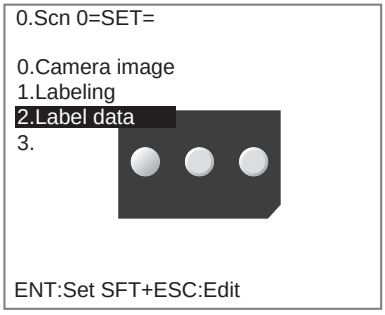
Select the unit number of the processing item to be referenced. The unit numbers for which the following processing items are set will be displayed as selections.

- 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.)

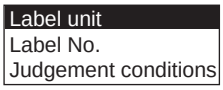
CHECK Do not allow units for the following processing items to come between the label data unit and the unit that is being referenced.

Processing item	Affect
Camera image	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.

1. Select ***Label data.***



The initial display for Label Data will be displayed.



2. Select ***Label unit.***

   A screen to select the unit number will be displayed.

3. Select the unit number of the “labeling” processing item from which to get the date.

4. Select ***End.***

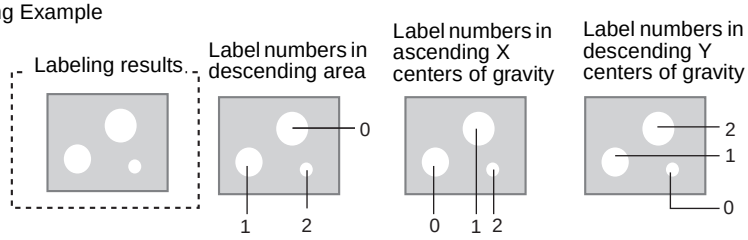
   The settings will be registered and the screen in (1.) will return.

2-26-2 Selecting the Label Number

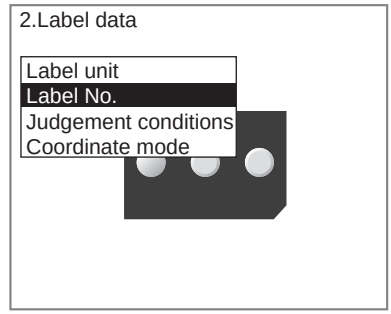
Select the label number that is to be referenced. When an EC Defect processing item is being referenced, select the inspection region number as the label number.

CHECK Label numbers are assigned during the labeling process according to the sort conditions.

Sorting Example



1. Select ***Label No.***



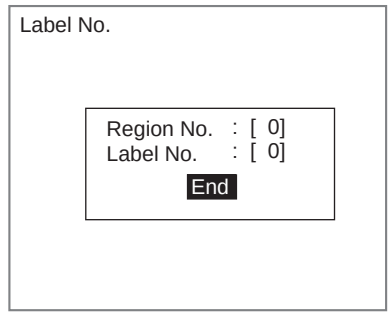
The initial screen for Label No. will be displayed.

Example for when Labeling or Fine Matching is the reference unit

2. Set the label number.

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

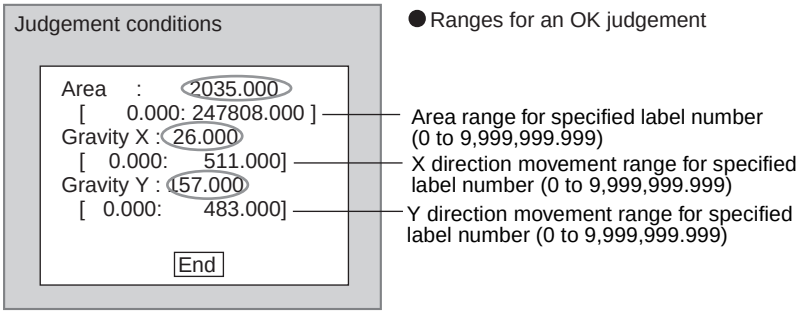


3. Select ***End.***

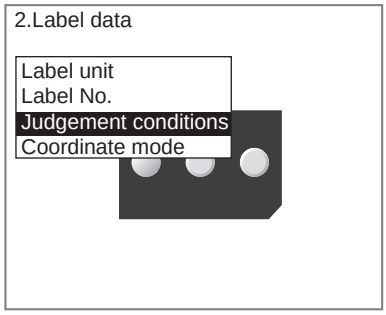
   The settings will be registered and the screen in (1.) will return.

2-26-3 Setting the Judgement Conditions

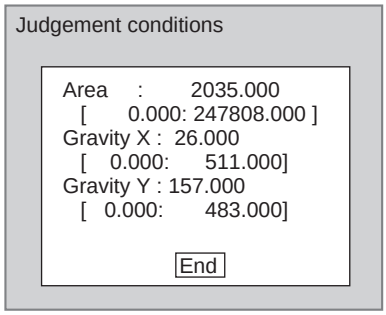
Set the judgement conditions for the label data that was obtained (area and center of gravity).



1. Select ***Judgement conditions.***



A screen to input the judgement conditions will be displayed.

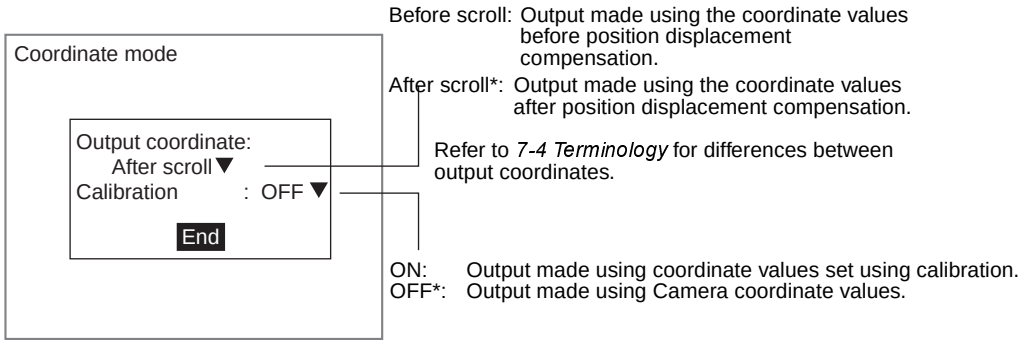


2. Set the judgement conditions.
3. Select ***End.***

   The settings will be registered and the screen in (1.) will return.

2-26-4 Setting the Coordinate Mode

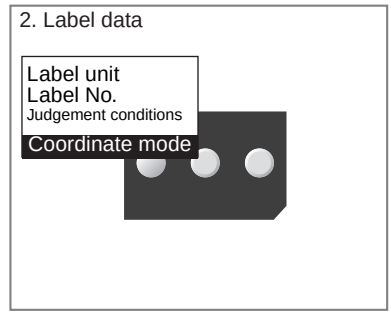
Select the type of coordinate values.



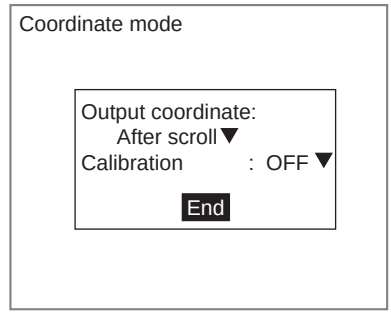
The asterisk (*) indicates the default setting.

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.

1. Select ***Coordinate mode*.**



A screen will be displayed to set the coordinate mode.



2. Make the settings for each item.
3. Select ***End.***

   The settings will be registered and the screen in (1.) will return.

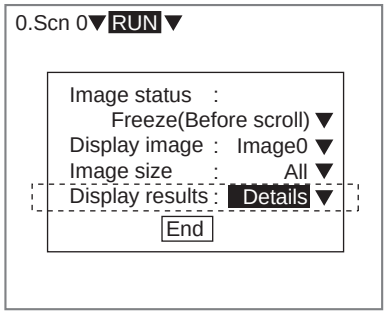
2-26-5 Measurement Screens

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

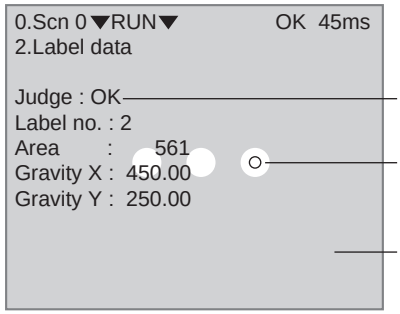
This section describes what kind of information can be displayed for label data.

SeeAlso Refer to *SECTION 3 Monitor Mode and Run Mode* for details on Monitor and Run modes.

CHECK 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.



Judgement result for this Unit

A circle is displayed at the center of gravity of the specified label for an OK judgement; an ex, for a NG judgement.

Display Image

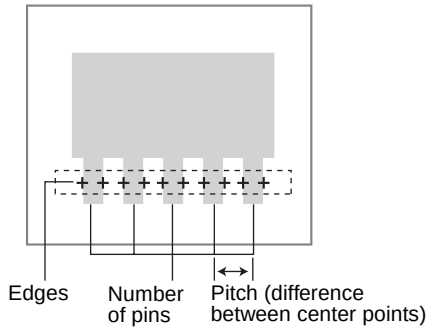
Binary image for Labeling reference unit

Gray image for Fine Matching or EC Defect reference unit

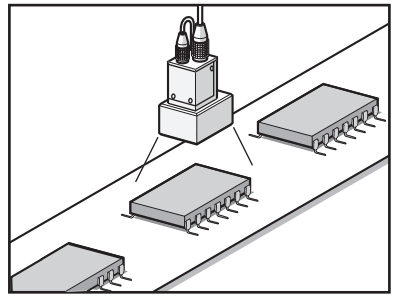
2-27 Edge Pitch

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.

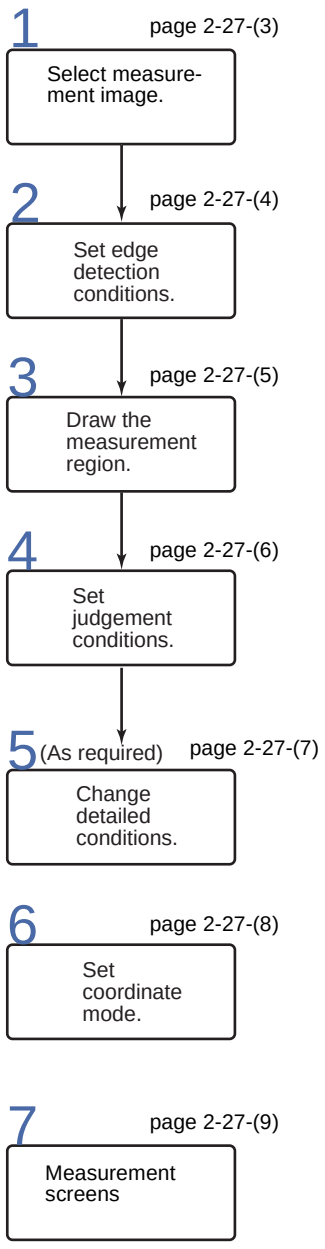
The number of pins can be obtained, along with the pitch and width.



Example: Inspection for the Number of IC Pins



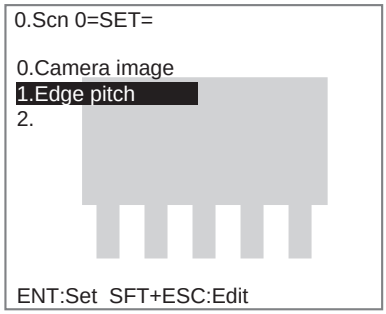
Operational Flow



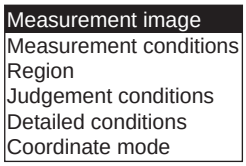
2-27-1 Selecting the Measurement Image

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

1. Select ***Edge pitch.***

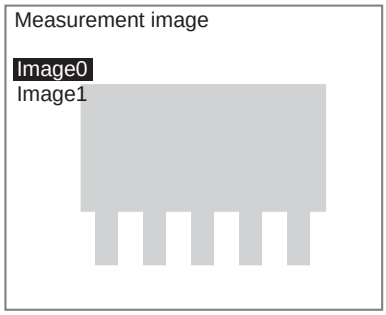


The initial screen for Edge Pitch will be displayed.



2. Select ***Measurement image***.

   The selections will be displayed.

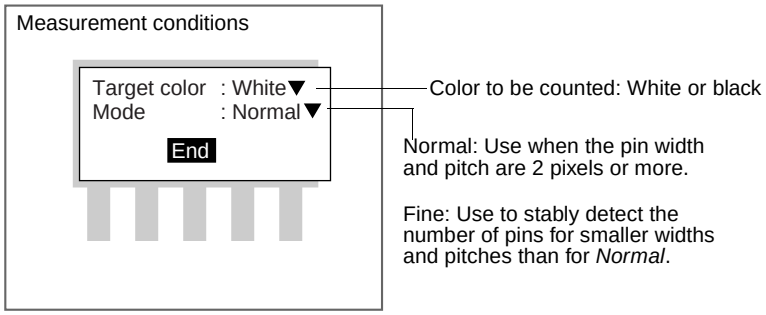


3. Select which image will be used for measurement, the image stored at Image 0 or the image stored at Image 1.
4. Press the **ENT** Key.

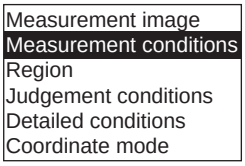
   The settings will be registered and the screen in (1.) will return.

2-27-2 Setting the Edge Detection Conditions

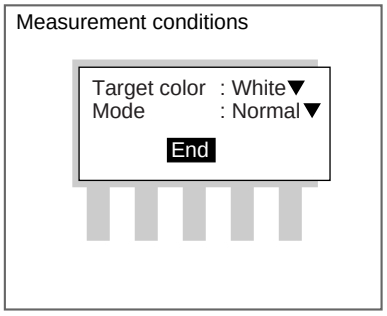
Set the conditions for the edge search.



1. Select ***Measurement conditions.***



The Measurement Conditions Settings Screen will be displayed.



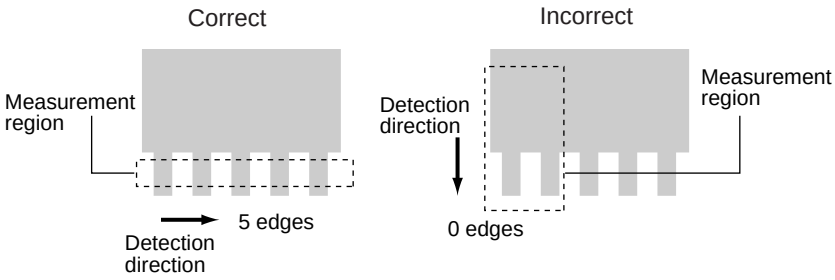
2. Select the edge detection conditions.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

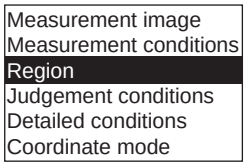
2-27-3 Drawing Measurement Regions

Draw a region to include all the edges to be detected.

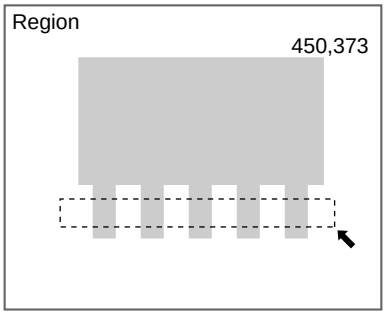
CHECK Edges are detected in the direction of the long side of the measurement region.



1. Select ***Region***.



The Region Settings Screen will be displayed.



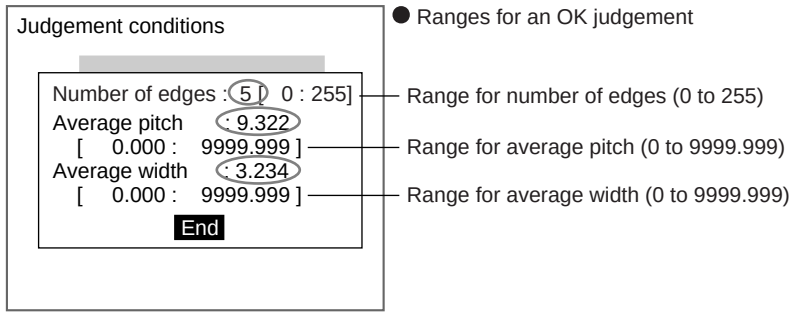
2. Draw a box-shaped measurement region.

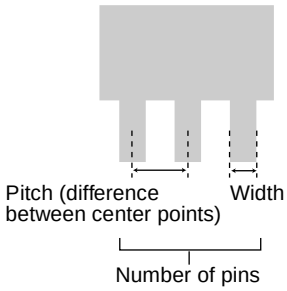
CHECK The only figure that can be drawn is a box.

When the bottom right coordinates have been set, the screen in (1.) will return.

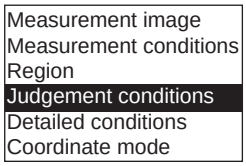
2-27-4 Setting Judgement Conditions

Set the ranges for an OK judgement.

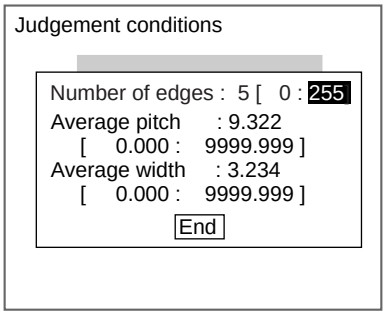




1. Select ***Judgement conditions***.



The Judgement Conditions Settings Screen will be displayed.



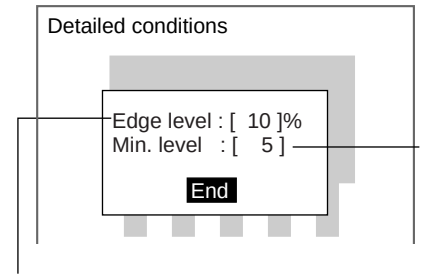
2. Make the settings for each item.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

2-27-5 Changing Detailed Conditions

Change the detailed conditions when the measurement results are unstable. Normally, these conditions can be left on the default settings.

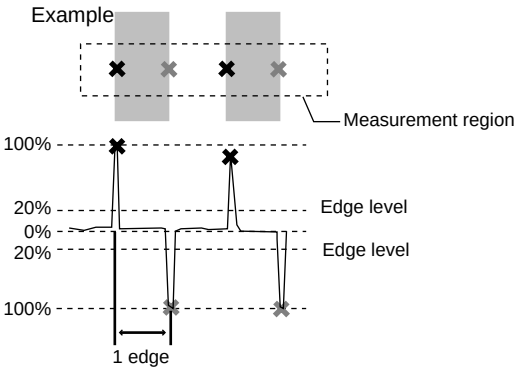
If any of the settings are changed, take actual measurements to confirm that they are correct.



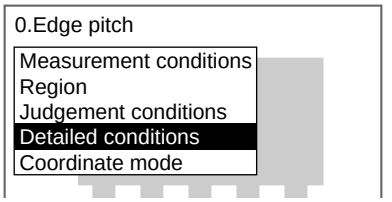
To prevent incorrect detection due to noise (0 to 255).
(If the density variation is less than the minimum value, it will be considered to be noise.)

Threshold value for finding an edge (0 to 100).
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.

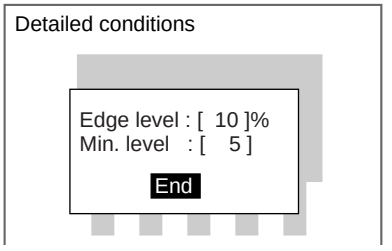
Edges are detected in the following way:
1. The density differentiation for the entire measurement range is obtained.
2. The points corresponding to the maximums and minimums that exceed the edge level setting are detected as edges.



1. Select ***Detailed conditions***.



The Detailed Conditions Settings Screen will be displayed.

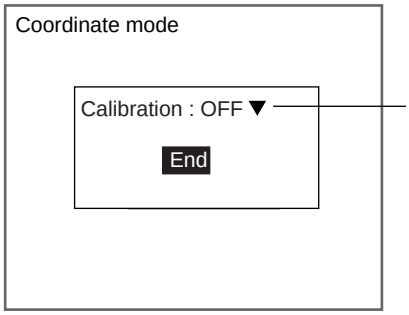


2. Change the settings.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

2-27-6 Setting the Coordinate Mode

Select the type of coordinates.

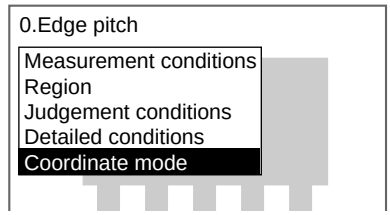


ON: Output made using coordinate values set using calibration.
OFF*: Output made using Camera coordinate values.

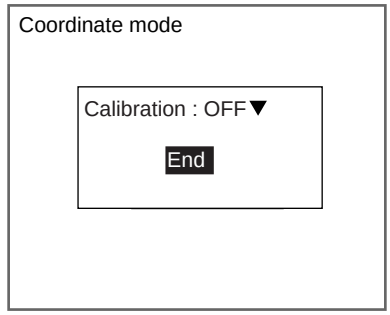
The asterisk (*) indicates the default setting.

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.

1. Select ***Coordinate mode***.



The Coordinate Mode Settings Screen will be displayed.



2. Make the settings for each item.
3. Select ***End***.
   The settings will be registered and the screen in (1.) will return.

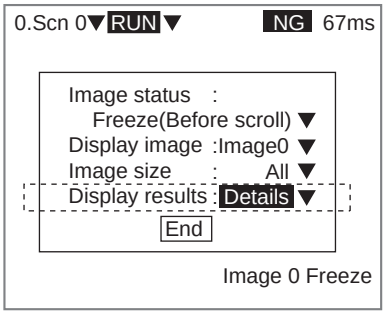
2-27-7 Measurement Screens

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

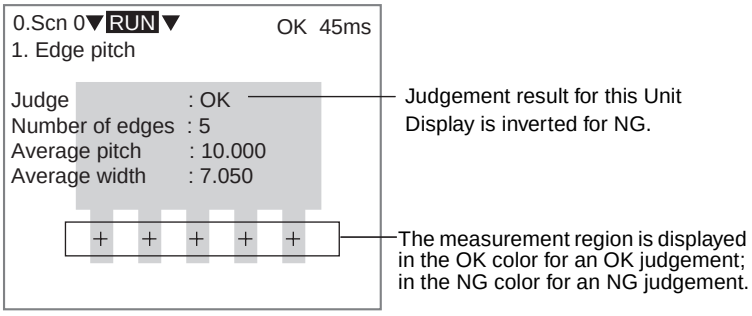
This section describes what kind of information can be displayed for edge pitch.

SeeAlso Refer to *SECTION 3 Monitor Mode and Run Mode* for details on Monitor and Run modes.

CHECK 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 edge pitch is set and the following detailed screens will be displayed.

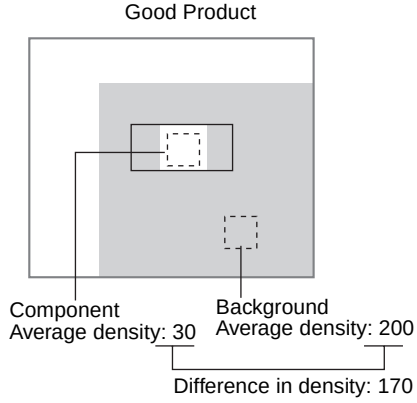


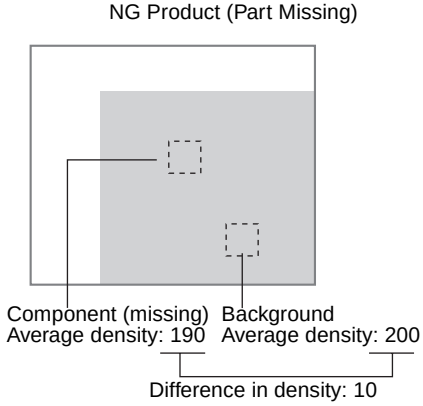
2-28 Density Data

The Density Data processing item can be used to inspect for the presence of the measurement object.

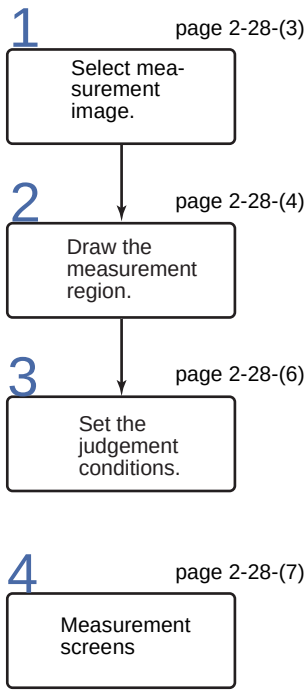
The Density Data processing item detects the density of each pixel (0 to 255) and calculates the density average and deviation to be used for inspection. Because the density deviations are compared, the effects on inspection of dark images can be reduced, e.g., when illumination deteriorates.

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.





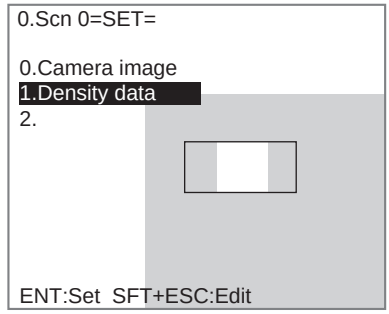
Operational Flow



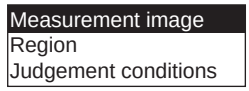
2-28-1 Selecting the Measurement Image

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

1. Select ***Density data***.

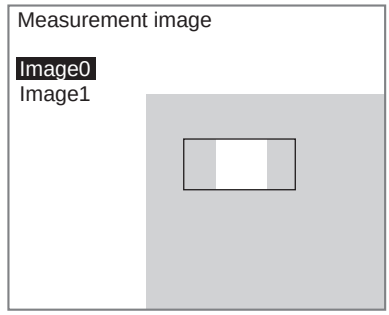


The initial screen for Density Data will be displayed.



2. Select ***Measurement image***.

The selections will be displayed.



3. Select which image will be used for measurement, the image stored at Image 0 or the image stored at Image 1.
4. Press the **ENT** Key.

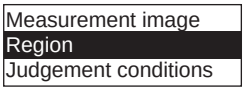
The settings will be registered and the screen in (1.) will return.

2-28-2 Drawing Measurement Regions

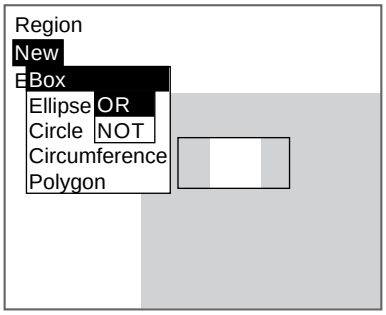
Draw the region for which the density is to be found.

CHECK Regions can be created by combining up to 3 different figures. Regions with difficult shapes can be drawn and sections not to be measured can be left out of the region by combining different figures.

1. Select ***Region***.

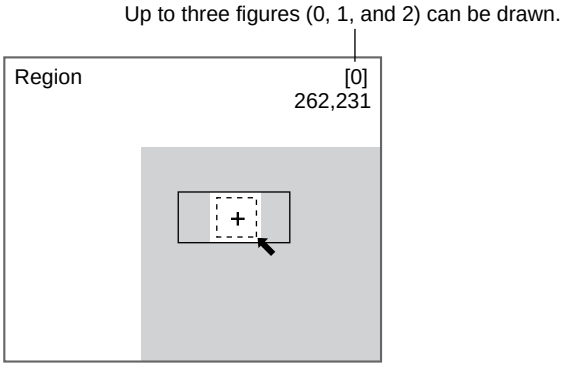


The Region Settings Screen will be displayed.



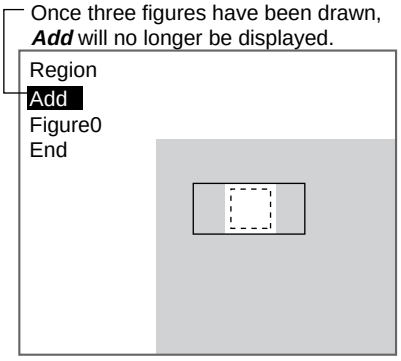
2. Select ***New***.
3. Select the shape of the desired figure.
4. Select the desired drawing mode (***OR***/***NOT***).

An arrow cursor will appear.



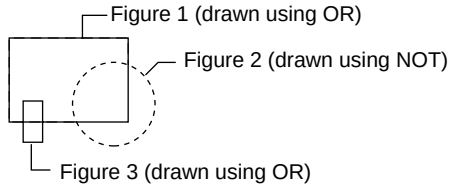
5. Draw a figure in the region to be used as the measurement region.

The figure will be registered.



6. If additional figures are to be drawn, select ***Add***.
7. Repeat steps 4 to 6 as necessary to create the desired shape.
8. After drawing is completed, select ***End.***

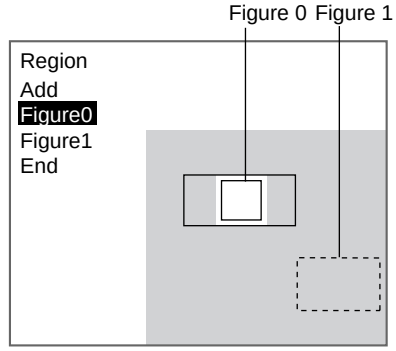
   The measurement region will be registered and the screen in (1.) will return. The measurement region will be displayed with a + cursor at the center of gravity.



CHECK Figures drawn using OR mode are displayed with solid lines and figures drawn using NOT mode are displayed with dotted lines.

Correcting or Clearing Figures

1. In the screen for step 5 above, select the figure to be changed or cleared using the **Up** and **Down** Keys and press the **ENT** Key.



   The figure for the figure number selected using the cursor will be displayed with solid lines. The selections ***Correct*** and ***Clear*** will be displayed.

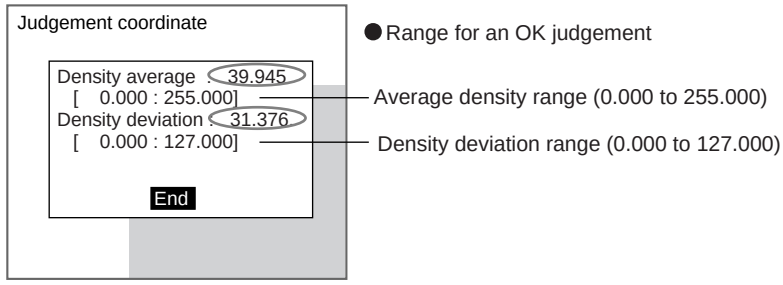
2. Select either ***Correct*** or ***Clear*** and press the **ENT** Key.

   If ***Correct*** is selected, the cursor will be displayed. Correct the size and position of the figure as desired.

   If ***Clear*** is selected, the selected figure will be cleared.

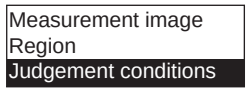
2-28-3 Setting Judgement Conditions

Set the average density and density deviation range for an OK judgement.

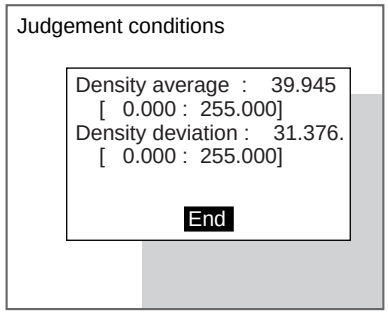


○: Measurement results for the displayed image.
Use these values as a reference for setting upper and lower limits.

1. Select ***Judgement conditions***.



The Judgement Conditions Settings Screen will be displayed.



2. Make the settings for each item.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

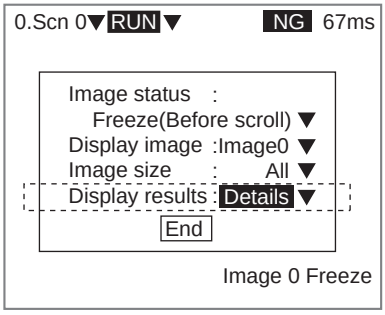
2-28-4 Measurement Screens

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

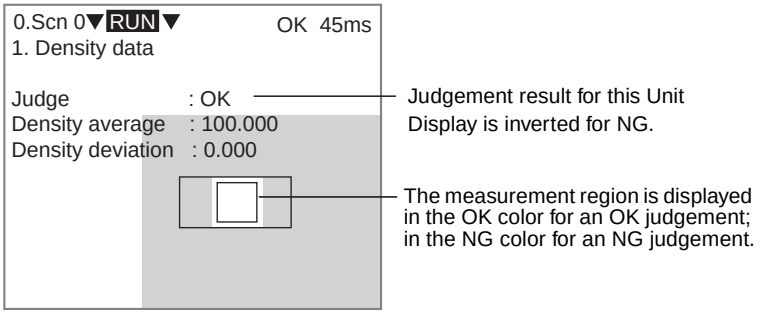
This section describes what kind of information can be displayed for density data.

SeeAlso Refer to *SECTION 3 Monitor Mode and Run Mode* for details on Monitor and Run modes.

CHECK 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 density data is set and the following detailed screens will be displayed.

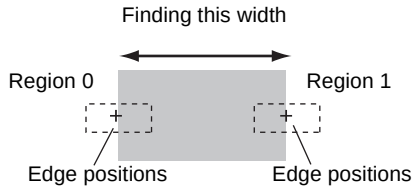


2-29 Calculation

The Calculation processing item is used to perform calculations using the results and measurement values for the processing items registered to the units.

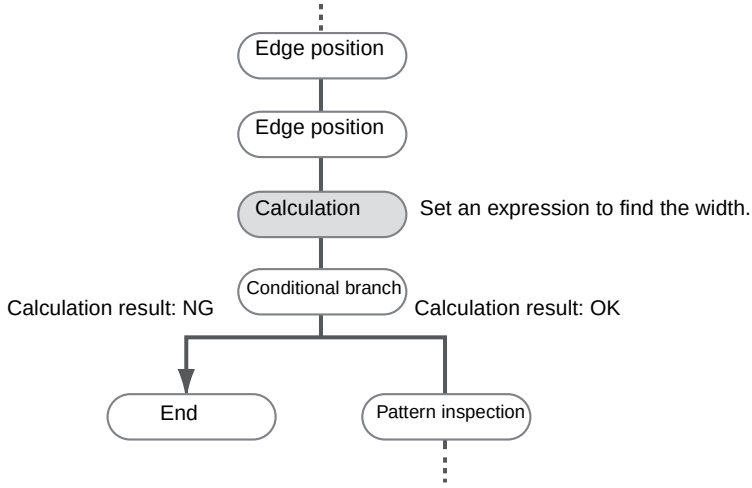
Example: Finding the Width of a Measurement Object

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.



Width = region 0 edge position − region 1 edge position.

If combined with conditional branching, the inspection conditions can be changed based on the calculation result.



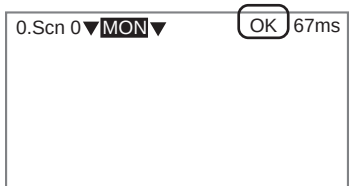
2-29-1 Select Reflection in Overall Judgement

It is possible to select whether or not the judgement result of the calculation will be reflected in the overall judgement output on the parallel interface OR signal.

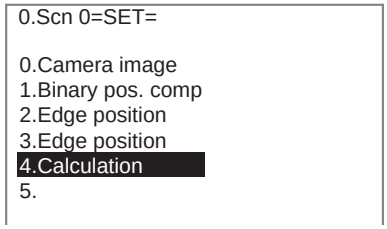
CHECK The overall judgement is also displayed on the Monitor and Measurement Screens.

The overall judgement can be set to not be displayed also by using the display settings function.

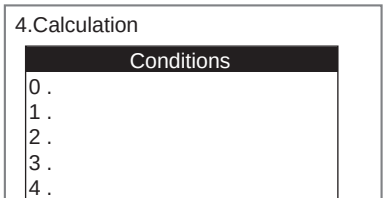
SeeAlso Refer to *5-3 Screen Display and Monitor*.



1. Select ***Calculation***.

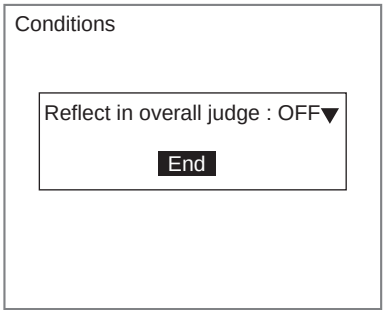


The list of set expressions will be displayed.



2. Select ***Conditions***.

The Conditions Settings Screen will be displayed.

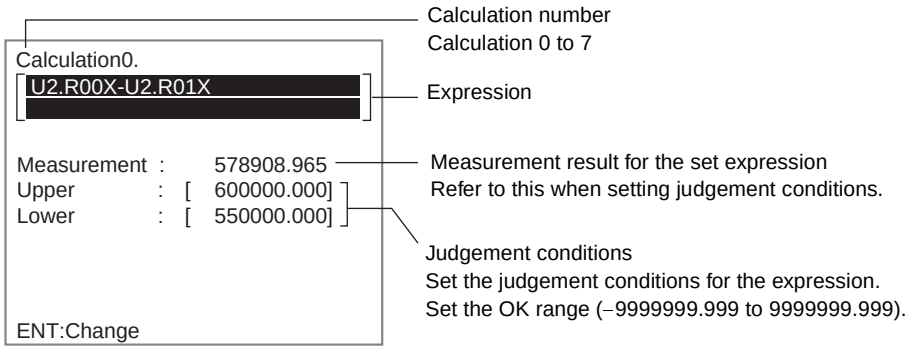


3. Change the setting.
4. Select ***End***.

The setting will be registered and the screen in (1.) will return.

2-29-2 Setting Expressions

Up to 8 expressions (0 to 7) can be set for one unit.



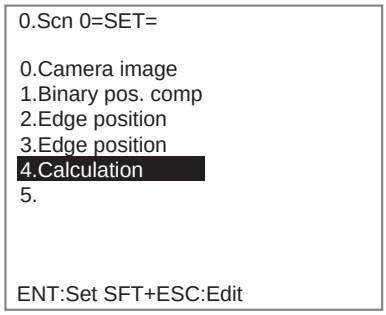
CHECK The calculation result is not output to an external device. Select the result output processing items for results output if the calculation result needs to be output to an external device.

SeeAlso Refer to *2-38 Memory Card Data*, *2-39 DO Data*, *2-40 DO Judgement*, *2-41 Host Link Data*, and *2-42 Normal Data*.

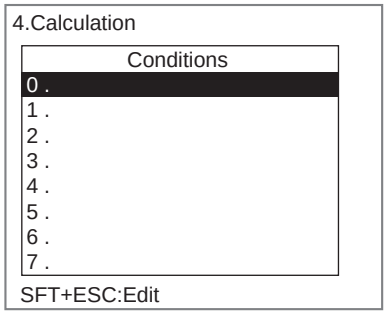
CHECK The calculation results can be set to be reflected in the overall result.

SeeAlso Refer to page 2-29-(2).

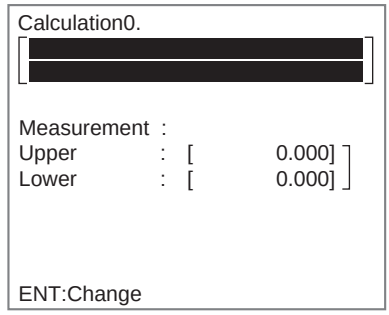
1. Select ***Calculation***.



The list of calculation settings will be displayed.

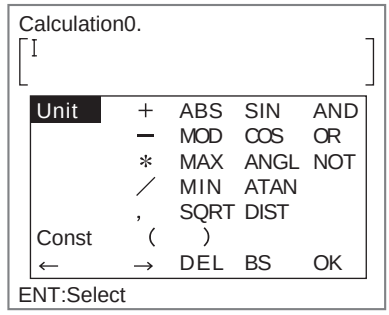


2. Select the number to which the expression is to be set.
   The Expression Settings Screen will be displayed.

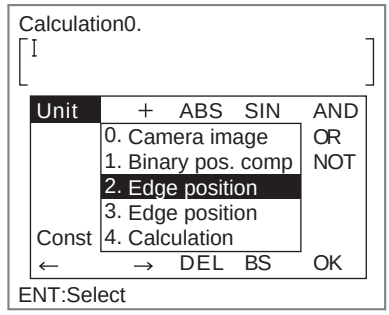


3. Place the cursor inside the square brackets for the formula and press the **ENT** Key.
   A list of items will be displayed.

SeeAlso Refer to page 2-29-(7) for the list of items.

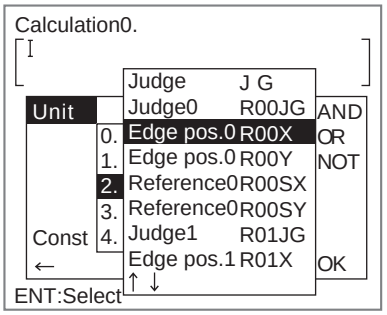


4. Select the item to be set.
   (This explanation will be based on the selection of *unit.)*
   The units set to the scene currently displayed will be displayed.

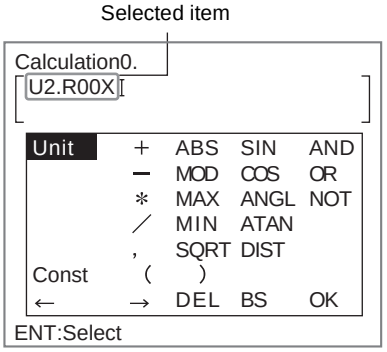


5. Select the unit to be set.
   A submenu will be displayed.
   The submenu will depend on the unit that was selected.

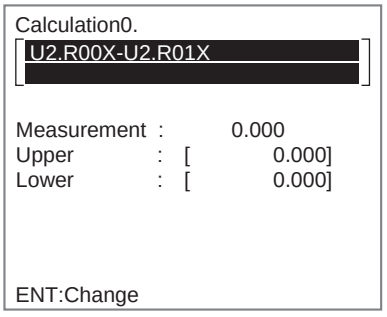
SeeAlso Refer to page 2-29-(9) for information on submenus.



6. Select the required items from the submenu.
   The selected items will be displayed in the expression.

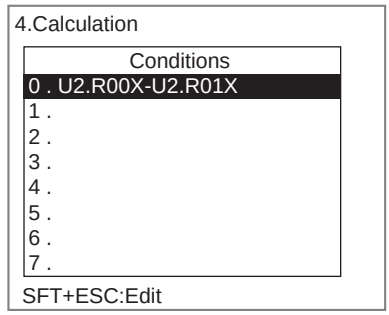


7. Repeat this operation to create the expression.
8. Once the expression has been completed, select ***OK***.
   The expression will be saved.



9. Set the upper and lower limits for judgement.
10. Press the **ESC** Key.

The settings will be registered.



CHECK The expression can be copied or cleared by pressing the **SHIFT + ESC** Keys on this screen.

SeeAlso Refer to page 2-29-(6) and page 2-29-(7).

11. Repeat steps 2 to 10 to set the expressions.
12. Once the expressions have been set, press the **ESC** Key.

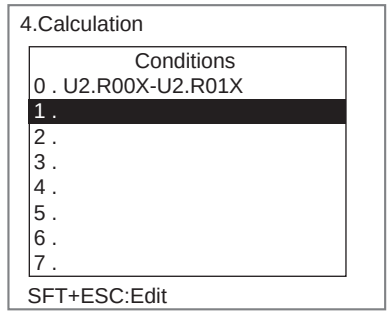
    The screen in (1.) will return.

Copying Expressions

The copy function is useful when using the expression again elsewhere or using the same expression with only one part changed.

If relative information is set for an expression, that information too will be copied.

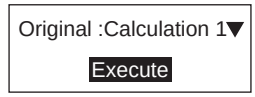
1. Use the **Up** and **Down** Keys to select the number to which the copy is to be made from the calculation settings list then press the **SHIFT + ESC** Keys.



The selections will be displayed.

2. Select ***Copy***.

   The Original Calculation Selection Screen will be displayed.

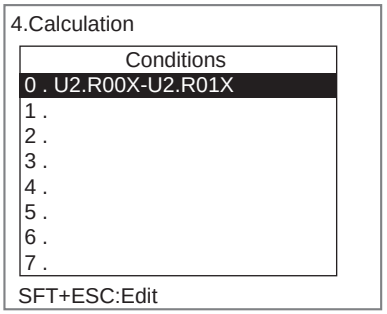


3. Select the number of the expression to be copied.
4. Select ***Execute***.

   The selected expression will be copied and the screen in (1.) will return.

Clearing Expressions

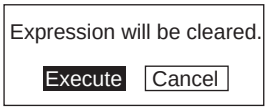
1. Use the **Up** and **Down** Keys to select the number of the expression to be cleared from the calculation settings list then press the **SHIFT + ESC** Keys.



The selections will be displayed.

2. Select ***Clear***.

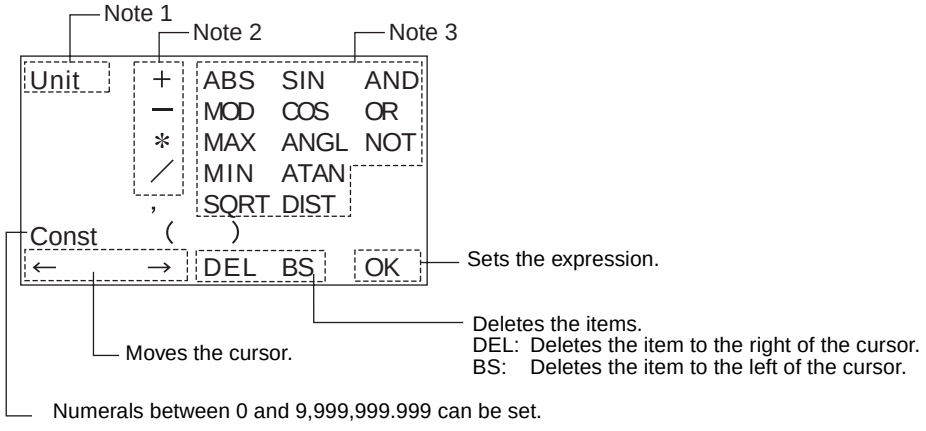
   A confirmation message will be displayed.



3. Select ***Execute***.

   The expression will be cleared and the screen in (1.) will return.

List of Items



Note **1. Unit**

Calculations can be performed using the measurement results for the units set to the scene currently displayed.

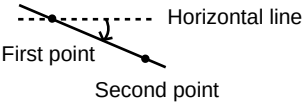
If this item is selected, the unit numbers and processing item names will be displayed. Select the unit number and then select the measurement item to be used in the calculation from the submenu that is displayed.

CHECK The submenus differ depending on the selected unit. Refer to page 2-29-(9).

2. Arithmetic Operators

Operators	Meaning
+	Addition
–	Subtraction
*	Multiplication
/	Real number division

3. Functions

Function	Meaning
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. Examples 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 and the judgement will be NG. SQRT(argument)
SIN	Calculates the sine. The result will be given between -1 and 1. The angle in the expression is specified in degrees. SIN(expression)
COS	Calculates the cosine. The result will be given between -1 and 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, and a horizontal line. The result will be in the range -180 to 180°. ANGL(Y component, X component) Example: Set the following to calculate the angle between the straight line joining the center of gravity for region 0 and the center of gravity for region 1 and a horizontal line. ANGL(R1.Y-R0.Y,R1.X-R0.X)  If both arguments are 0, the result will also be 0 and the judgement will be NG.

Function	Meaning
ATAN	Calculates the arc tangent for the Y component/X component. The result is given as a radian of -pi to pi. 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 center of gravity for region 1. DIST(R0.X,R0.Y,R1.X,R1.Y) The following calculation is performed internally. $\sqrt{(R1.X - R0.X)^2 + (R1.Y - R0.Y)^2}$
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)

Submenus

The following table shows the processing items that can be used in calculations.

Classification	Processing item	Page
Position compensation items	Binary position compensation	page 2-29-(11)
	EC position compensation	page 2-29-(11)
	Edge position compensation	page 2-29-(13)
	Model position compensation	page 2-29-(13)
	Circle position compensation	page 2-29-(14)
	Scroll	page 2-29-(14)

Classification	Processing item	Page
Measurement items	Binary defect inspection	page 2-29-(15)
	Classification	page 2-29-(15)
	Density defect inspection	page 2-29-(16)
	EC defect inspection	page 2-29-(17)
	EC positioning	page 2-29-(18)
	Gray edge positioning	page 2-29-(19)
	Fine matching	page 2-29-(19)
	EC circle count inspection	page 2-29-(19)
	Pattern inspection	page 2-29-(19)
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Measurement support items	Calculation	page 2-29-(22)
	Elapsed time	page 2-29-(22)
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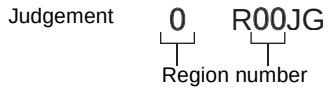
Branching control items	Conditional branching	page 2-29-(23)
	DI input branching	page 2-29-(23)
Results output items	Memory Card data output	page 2-29-(23)
	DO data output	page 2-29-(23)
	DO judgement output	page 2-29-(23)
	Host link data output	page 2-29-(23)
	Normal data output	page 2-29-(23)
Results display items	Display measure	page 2-29-(23)
	Display judgement	page 2-29-(24)
	Display line	page 2-29-(24)
	Display box	page 2-29-(24)
	Display circle	page 2-29-(24)
	Display cursor	page 2-29-(24)

How to Read Displays

Each measurement item shows the region number when there are multiple measurement regions for a processing item.



Example: Reference position (X coordinate) for region 3
Reference position **3**R**03**SX

Binary Position Compensation

Measurement item	Details	
Judgement JG	For unit	Judgement result
Scroll X DX		Compensation in X direction for measurement result
Scroll Y DY		Compensation in Y direction for measurement result
Scroll θ DT		Compensation angle for measurement result
Measurement X X		X coordinate for measurement result
Measurement Y Y		Y coordinate for measurement result
Measurement angle TH		Angle for measurement result
Judgement □ R▲ JG	For region □	Judgement result
Gravity □ R▲ X		Gravity X coordinate for measurement result
Gravity □ R▲Y		Gravity Y coordinate for measurement result
Axis angle □ R▲TH		Axis angle for measurement result
Area □ R▲AR		Area for measurement result
Reversed area □ R▲RA		Difference between area of measurement region and area for measured result
Reference position □ R▲SX		X coordinate for reference position
Reference position □ R▲SY		Y coordinate for reference position
Reference axis □ R▲ST		Axis angle when measurement region drawn
Reference area □ R▲SA		Area when measurement region drawn

□: Region number (0 or 1)

▲: Region number (00 or 01)

EC Position Compensation

Measurement item	Details	
Judgement JG	For unit	Judgement result
Scroll X DX		Compensation in X direction for measurement result
Scroll Y DY		Compensation in Y direction for measurement result
Scroll θ DT		Compensation angle for measurement result
Measurement X X		X coordinate for measurement result
Measurement Y Y		Y coordinate for measurement result
Measurement angle TH		Angle for measurement result

Measurement item	Details	
Judgement □ R▲JG	For region □	Judgement result
Search position □ R▲X		X coordinate for where mark found.
Search position □ R▲Y		Y coordinate for where mark found.
Search angle □ R▲TH		Angle where mark found.
Reference position □ R▲SX		X coordinate for reference position
Reference position □ R▲SY		Y coordinate for reference position
Axis reference □ 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 □ R▲L1		Length of measured edge 1 (for cross points and multiple cross points)
Line length □ R▲L2		Length of measured edge 2 (for cross points and multiple cross points)
Apex □ R▲PX1		X coordinate of measured upper left corner (for boxes)
Apex □ R▲PY1		Y coordinate of measured upper left corner (for boxes)
Apex □ R▲PX2		X coordinate of measured lower left corner (for boxes)
Apex □ R▲PY2		Y coordinate of measured lower left corner (for boxes)
Apex □ R▲PX3		X coordinate of measured upper right corner (for boxes)
Apex □ R▲PY3		Y coordinate of measured upper right corner (for boxes)
Apex □ R▲PX4		X coordinate of measured lower right corner (for boxes)
Apex □ R▲PY4		Y coordinate of measured lower right corner (for boxes)

□: Region number (0 or 1)

▲: Region number (00 or 01)

Edge Position Compensation

Measurement item	Details	
Judgement JG	For unit	Judgement result
Scroll X DX		Compensation in X direction for measurement result
Scroll Y DY		Compensation in Y direction for measurement result
Scroll θ DT		Compensation angle for measurement result
Measurement X X		X coordinate for measurement result
Measurement Y Y		Y coordinate for measurement result
Measurement angle TH		Angle for measurement result
Judgement □ R▲JG	For region □	Judgement result
Edge position □ R▲X		X coordinate for measured edge position
Edge position □ R▲Y		Y coordinate for measured edge position
Reference position □ R▲SX		X coordinate for reference position
Reference position □ R▲SY		Y coordinate for reference position

□: Region number (0 or 1)

▲: Region number (00 or 01)

Model Position Compensation

Measurement item	Details	
Judgement JG	For unit	Judgement result
Scroll X DX		Compensation in X direction for measurement result
Scroll Y DY		Compensation in Y direction for measurement result
Scroll θ DT		Compensation angle for measurement result
Measurement X X		X coordinate for measurement result
Measurement Y Y		Y coordinate for measurement result
Measurement angle TH		Angle for measurement result
Judgement □ R▲JG	For region □	Judgement result
Correlation □ R▲CR		Model correlation value
Search position □ R▲X		X coordinate for position where model found
Search position □ R▲Y		Y coordinate for position where model found
Measurement angle □ R▲TH		Angle of found model

□: Region number (0 or 1)

▲: Region number (00 or 01)

Circle Position Compensation

Measurement item	Details	
Judgement JG	For unit	Judgement result
Scroll X DX		Compensation in X direction for measurement result
Scroll Y DY		Compensation in Y direction for measurement result
Scroll θ DT		Compensation angle for measurement result
Measurement X X		X coordinate for measurement result
Measurement Y Y		Y coordinate for measurement result
Measurement angle TH		Angle for measurement result
Judgement □ R▲JG	For region □	Judgement result
Correlation □ R▲CR		Model correlation value
Search position □ R▲X		X coordinate for position where model found
Search position □ R▲Y		Y coordinate for position where model found

□: Region number (0 to 4)

▲: Region number (00 to 04)

Scroll

Measurement item	Details
Judgement JG	Judgement result
Scroll X DX	Compensation in X direction for measurement result
Scroll Y DY	Compensation in Y direction for measurement result
Scroll θ DT	Compensation angle for measurement result
Measurement X X	X coordinate for measurement result
Measurement Y Y	Y coordinate for measurement result
Measurement angle TH	Angle for measurement result
Reference X SX	X coordinate of reference position
Reference Y SY	Y coordinate of reference position
Reference angle ST	Angle of reference position

Binary Defect Inspection

Measurement item	Details	
Judgement JG	Unit judgement result	
Judgement □ R▲JG	For region □	Judgement result
Measurement region □ R▲X1		Upper left X coordinate of measurement region
Measurement region □ R▲Y1		Upper left Y coordinate of measurement region
Measurement region □ R▲X2		Bottom right X coordinate of measurement region
Measurement region □ R▲Y2		Bottom right Y coordinate of measurement region
Gravity □ R▲X		X coordinate of center gravity for measurement result
Gravity □ R▲Y		Y coordinate of center gravity for measurement result
Axis angle □ R▲TH		Axis angle for measurement result.
Area □ R▲AR		Area for measurement result
Reversed area □ R▲RA		Difference between area measurement value and area for measurement result
Reference position □ R▲SX		X coordinate for reference position
Reference position □ R▲SY		Y coordinate for reference position
Reference axis □ R▲ST		Axis angle when measurement region drawn
Reference area □ R▲SA		Area when measurement region drawn

□: Region number (0 to 7)

▲: Region number (00 to 07)

Classification

Measurement item	Details
Judgement JG	Judgement result
Search position X X	X coordinate of position where model found
Search position Y Y	Y coordinate of position where model found
Correlation CR	Correlation with model
Index IN	Number of model with highest correlation

Density Defect Inspection

Measurement item	Details	
Judgement JG	Unit judgement result	
Judgement □ R▲JG	For region □	Judgement result
Measurement region □ R▲X1		Upper left X coordinate of measurement region
Measurement region □ R▲Y1		Upper left Y coordinate of measurement region
Measurement region □ R▲X2		Bottom right X coordinate of measurement region
Measurement region □ R▲Y2		Bottom right Y coordinate of measurement region
Large defect □ R▲BD		Degree of large defect for measurement result
Small defect □ R▲LD		Degree of small defect for measurement result
Maximum density □ R▲GA		Maximum density in the measurement region
Minimum density □ R ▲GI		Minimum density in the measurement region
Deviation □ R▲DV		Density deviation for measurement result
Large defect position □ R▲BX		X coordinate of largest defect measured
Large defect position □ R▲BY		Y coordinate of largest defect measured
Small defect position □ R▲LX		X coordinate of smallest defect measured
Small defect position □ R▲LY		Y coordinate of smallest defect measured
Deviation position □ R▲VX		X coordinate of measured deviation defect position
Deviation position □ RY▲VY		Y coordinate of measured deviation defect position
Reference position large □ R▲SBX		X coordinate of position of large defect when region drawn
Reference position large □ R▲SBY		Y coordinate of position of large defect when region drawn
Reference position small □ R▲SLX		X coordinate of position of small defect when region drawn
Reference position small □ R▲SLY		Y coordinate of position of small defect when region drawn
Reference position deviation □ R ▲SVX		X coordinate of deviation defect position when region drawn
Reference position deviation □ R ▲SVX		Y coordinate of deviation defect position when region drawn

□: Region number (0 to 7)

▲: Region number (00 to 07)

EC Defect Inspection

Measurement item	Details	
Judgement JG	Unit judgement result	
Judgement □ R▲JG	For region □	Judgement result
Defect width □ R▲SW		Defect width for measurement result
Defect length □ R▲SL		Defect length for measurement result
Gravity position □ R▲X		X coordinate of center of gravity for measurement result
Gravity position □ R▲Y		Y coordinate of center of gravity for measurement result
Area □ R▲AR		Area for measurement result
Number of Labels □ R▲DA		Number of measured labels

□: Region number (0 to7)

▲: Region number (00 to 07)

EC Positioning

Measurement items	Details	
Judgement JG	Unit judgement result	
Judgement □ R▲JG	For region □	Judgement result
Measurement position □ R▲X		X coordinate of position where tag found
Measurement position □ R▲Y		Y coordinate of position where tag found
Angle □ R▲TH		Axis angle of found tag
Reference position □ R▲SX		X coordinate for reference position
Reference position □ R▲SY		Y coordinate for 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 □ R▲L1		Length of measured edge 1 (for cross points and multiple cross points)
Line length □ R▲L2		Length of measured edge 2 (for cross points and multiple cross points)
Apex □ R▲PX1		X coordinate of measured upper left corner (for boxes)
Apex □ R▲PY1		Y coordinate of measured upper left corner (for boxes)
Apex □ R▲PX2		X coordinate of measured lower left corner (for boxes)
Apex □ R▲PY2		Y coordinate of measured lower left corner (for boxes)
Apex □ R▲PX3		X coordinate of measured upper right corner (for boxes)
Apex □ R▲PY3		Y coordinate of measured upper right corner (for boxes)
Apex □ R▲PX4		X coordinate of measured lower right corner (for boxes)
Apex □ R▲PY4		Y coordinate of measured lower right corner (for boxes)
Num. of points □ R▲CN		Number of measured cross points (for multiple cross points)
Cross point position □ R▲CX1		X coordinate of 1st measured cross point (for multiple cross points) (See note.)
Cross point position □ R▲CY1		Y coordinate of 1st measured cross point (for multiple cross points) (See note.)
to		to
Cross point position □ R▲CXK		X coordinate of 20th measured cross point (for multiple cross points) (See note.)
Cross point position □ R▲CYK		Y coordinate of 20th measured cross point (for multiple cross points) (See note.)

Note The order will be based on the sorting order set under cross point extraction conditions (0 to 20).

□: Region number (0 to 7)

▲: Region number (00 to 07)

Edge Position

Measurement item	Details	
Judgement JG	Unit judgement result	
Judgement □ R▲JG	For region □	Judgement result
Edge position □ R▲X		X coordinate of measured edge position
Edge position □ R▲Y		Y coordinate of measured edge position
Reference position □ R▲SX		X coordinate for reference position
Reference position □ R▲SY		Y coordinate for reference position

□: Region number (0 to 7)

▲: Region number (00 to 07)

Fine Matching

Measurement item	Details
Judgement JG	Judgement result
Quantity DA	Number of labels for measurement result
Area AR	Area for measurement result
Gravity X	X coordinate of center of gravity for measurement result
Gravity Y	Y coordinate of center of gravity for measurement result

EC Circle Count Inspection

Measurement item	Details	
Judgement JG	For unit	Judgement result
Quantity CN		Number of measured circles
Circle center □ CX ▲	For region □	X coordinate of center of measured circle
Circle center □ CY ▲		Y coordinate of center of measured circle
Circle radius □ CR ▲		Radius of measured circle
Circular value □ CV ▲		Evaluation value of measured circle

□: Region number (0 to 63)

▲: Region number (00 to 63)

Pattern Inspection

Measurement item	Details	
Judgement JG	Judgement result	
Judgement □ R▲JG	For region □	Judgement result
Correlation □ R▲CR		Correlation with model
Search position □ R▲X		X coordinate of position where model found
Search position □ R▲Y		Y coordinate of position where model found
Reference position □ R▲SX		X coordinate of reference position
Reference position □ R▲SY		Y coordinate of reference position

□: Region number (0 to 63)

▲: Region number (00 to 63)

QUEST Character Verification

Measurement item	Details	
Judgement JG	Unit judgement result	
Judgement □ R □ JG	For region □	Judgement result
Similarity R □ VO01		Similarity for character set as character 1, line 1
Candidate 1 R □ CF01		Character code for 1st candidate for character 1, line 1
Similarity 1 R □ VF01		Similarity for 1st candidate for character 1, line 1
Candidate 2 R □ CS01		Character code for 2nd candidate for character 1, line 1
Similarity 2 R □ VS01		Similarity for 2nd candidate for character 1, line 1
to		to
Similarity R □ VO40		Similarity for candidate set for character 20, line 2
Candidate 1 R □ CF40		Character code for 1st candidate for character 20, line 2
Similarity 1 R □ VF40		Similarity for 1st candidate for character 20, line 2
Candidate 2 R □ CS40		Character code for 2nd candidate for character 20, line 2
Similarity 2 R □ VS40		Similarity for 2nd candidate for character 20, line 2

□: Region number (0 to 3)

Rotation Positioning

Measurement item	Details	
Judgement JG	Unit judgement result	
Judgement □ R▲JG	For region □	Judgement result
Correlation □ R▲CR		Correlation with model
Search position □ R▲X		X coordinate of position where model found
Search position □ R▲Y		Y coordinate of position where model found
Search angle □ R▲TH		Angle of found model
Reference position □ R▲SX		X coordinate for reference position
Reference position □ R▲ SY		Y coordinate for reference position

□: Region number (0 to 7)

▲: Region number (00 to 07)

ECM Search

Measurement item	Details
Judgement JG	Unit judgement result
EC correlation CR	Correlation with model
Search position X	X coordinate of position where model found
Search position Y	Y coordinate of position where model found
Reference position SX	X coordinate of reference position
Reference position SY	Y coordinate of reference position

Lot Number OCV1

Measurement item	Details	
Judgement JG	Unit judgement result	
Judgement □ JG	Digit □	Judgement result
Candidate □ 1 CF		First candidate lot number
Similarity 1 □ VF		Similarity of first candidate lot number
Candidate 2 □ CS		Second candidate lot number
Similarity 2 □ VS		Similarity of second candidate lot number

Note □: Digit number (1 to 4)

Labeling

Measurement item	Details
Judge JG	Judgement result
Number of labels L	Number of labels measured
Gravity X X	X coordinate of center of gravity for measurement result
Gravity Y Y	Y coordinate of center of gravity for measurement result
Area AR	Area of 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 X DX	Difference between measured and reference X coordinate
Displacement Y DY	Difference between measured and reference Y coordinate
Difference area DA	Difference between measured area and reference area

Label Data

Measurement item	Details
Judge JG	Judgement result
Label No. LN	Measured label number
Gravity X X	X coordinate of center of gravity for measurement result
Gravity Y Y	Y coordinate of center of gravity for measurement result
Area AR	Area for measurement result

Edge Pitch

Measurement item	Details
Judge JG	Judgement result
Number of edges N	Number of detected edges
Average pitch P	Average detected edge pitch
Max. pitch PH	Maximum detected edge pitch
Min. pitch PL	Minimum detected edge pitch
Average width W	Average detected edge width
Max. width WH	Maximum detected edge width
Min. width WL	Minimum detected edge width

Density Data

Measurement item	Details
Judge JG	Judgement result
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

Measurement item	Details
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

Calculation

Measurement item	Details
Judgement JG	Unit judgement result
Data 0 D00	Result of expression set to calculation 0
Data 1 D01	Result of expression set to calculation 1
Data 2 D02	Result of expression set to calculation 2
Data 3 D03	Result of expression set to calculation 3
Data 4 D04	Result of expression set to calculation 4
Data 5 D05	Result of expression set to calculation 5
Data 6 D06	Result of expression set to calculation 6
Data 7 D07	Result of expression set to calculation 7
Judgement 0 J00	Judgement result for expression set to calculation 0
Judgement 1 J01	Judgement result for expression set to calculation 1
Judgement 2 J02	Judgement result for expression set to calculation 2
Judgement 3 J03	Judgement result for expression set to calculation 3
Judgement 4 J04	Judgement result for expression set to calculation 4
Judgement 5 J05	Judgement result for expression set to calculation 5
Judgement 6 J06	Judgement result for expression set to calculation 6
Judgement 7 J07	Judgement result for expression set to calculation 7

Elapsed Time

Measurement item	Details
Elapsed Time TM	Time since trigger input

Get Unit Data

Measurement item	Details
Judgement JG	Judgement result
Acquired Data DT	Obtained unit data

Set Unit Data

Measurement item	Details
Judgement JG	Judgement result
Data DT	Calculation result for set data

Trend Monitor

Measurement item	Details
Judgement JG	Unit judgement result
Measurement DT	Latest measurement
Warning WN	Warnings generated (0: No, -1: Yes)
Maximum value MX	Maximum measurement value for recording interval
Minimum value MN	Minimum measurement value for recording interval
Average AV	Average measurement value for recording interval
Normal deviation DV	Deviation in measurement results since measurement started

Measurement item	Details
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

Conditional Branching

Measurement item	Details
Judgement JG	Unit judgement result
Data A D0	Result of expression set to data A
Data B D1	Result of expression set to data B
Value RS	Comparative expression result
Branch destination BU	Number of the unit that was branched to

DI Input Branching

Measurement item	Details
Judgement JG	Unit judgement result
DI data DI	DI input value
Branch destination BU	Number of the unit that was branched to

Memory Card Data Output, DO Data Output, Host Link Data Output, and Normal Data Output

Measurement item	Details
Judgement JG	Unit judgement result
Data 0 D00	Result of expression set to output number 0
Data 1 D01	Result of expression set to output number 1
Data 2 D02	Result of expression set to output number 2
Data 3 D03	Result of expression set to output number 3
Data 4 D04	Result of expression set to output number 4
Data 5 D05	Result of expression set to output number 5
Data 6 D06	Result of expression set to output number 6
Data 7 D07	Result of expression set to output number 7

DO Judgement Output

Measurement item	Details
Judgement JG	Unit judgement result
Data 0 D00	Result of expression set to output number 0
Data 1 D01	Result of expression set to output number 1
to	
Data 30 D30	Result of expression set to output number 30
Data 31 D31	Result of expression set to output number 1
Judgement 0 J00	Judgement result for expression set to output number 0
Judgement 1 J01	Judgement result for expression set to output number 1
to	
Judgement 30 J30	Judgement result for expression set to output number 30
Judgement 31 J31	Judgement result for expression set to output number 31

Measurement Value Display

Measurement item	Details
Measurement data DT	Result of set expression

Judgement Character Display

Measurement item	Details
Display judgement DJ	Displayed judgement result characters
Measurement data DT	Result of set expression

Line Result Display and Box Result Display

Measurement item	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	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

Display Cursor Results Display

Measurement item	Details
X coordinate X	Result of expression set to X coordinate
Y coordinate Y	Result of expression set to Y coordinate

Judgment JG

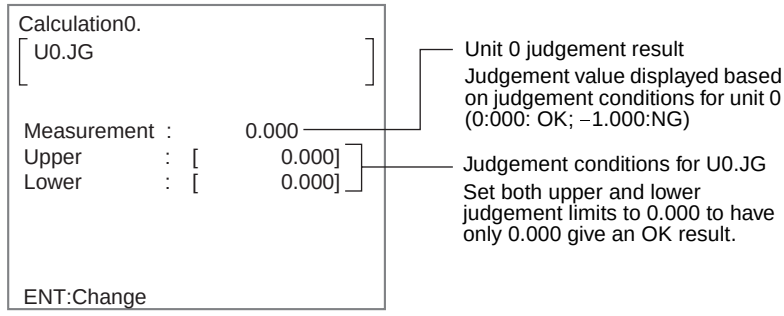
When unit judgement results are used in expressions, the following two-stage judgement is performed.

1. Judgement based on judgement conditions set for each unit

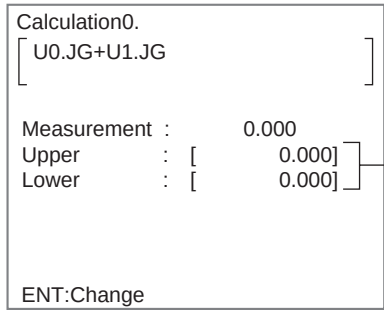
   As a result, “0.000” (OK) or “-1.000” (NG) is output to the measurement result.

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



If set to “0.000”, the following evaluations will occur:

If both OK: Measurement value 0.000 and judgement OK.

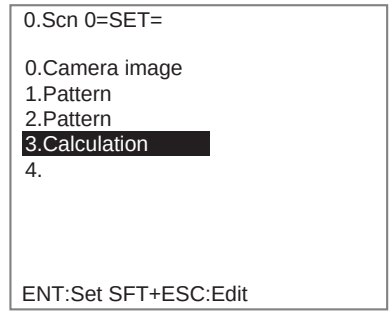
If either one is NG: Measurement value is −1.000 and judgement is NG.

If both are NG: Measurement value is −2.000 and judgement is NG.

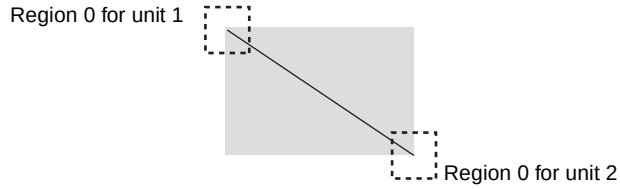
Calculations Using Other Expression Values

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.

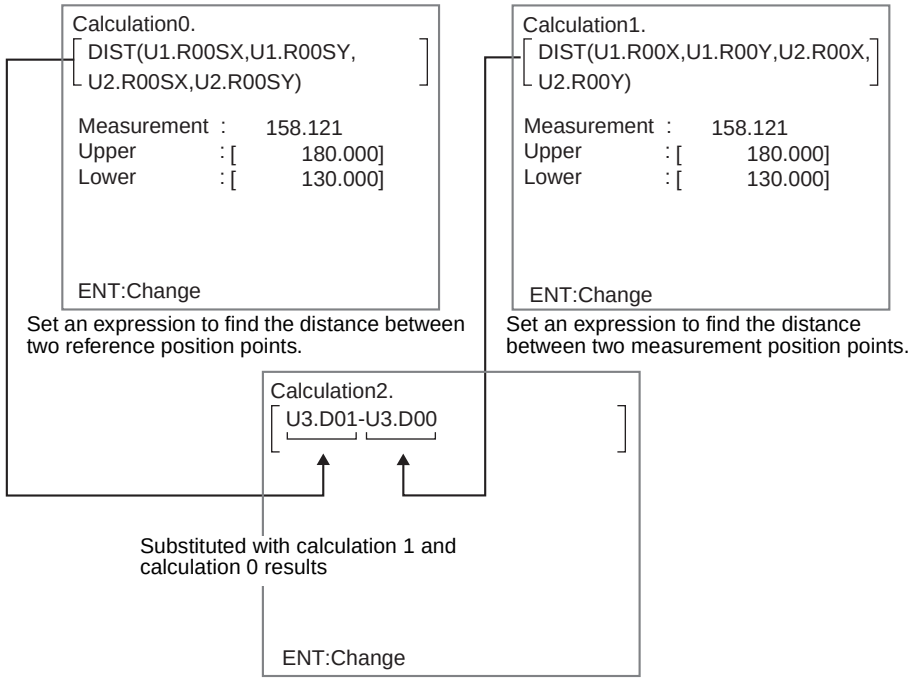
Example for the Following Scene Settings



Example 1: Finding the reference position distance and measurement result distance using pattern inspection and outputting the difference

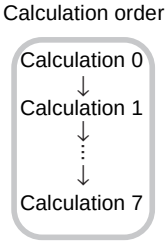


The settings for the expression are shown in the following diagram.

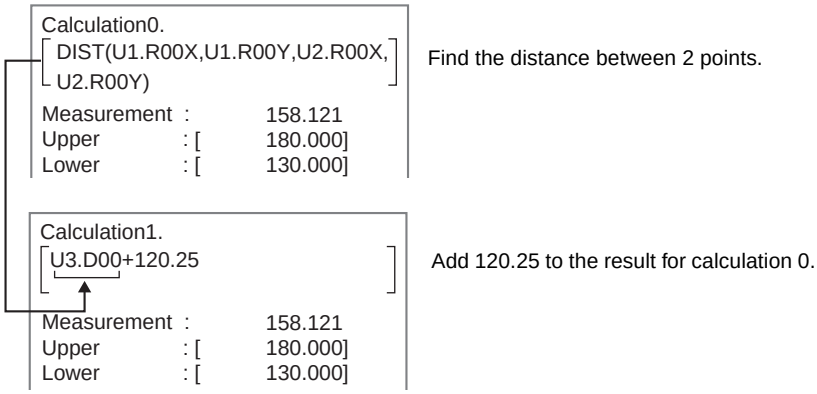


CHECK Expressions are calculated in the order shown in the following diagram.

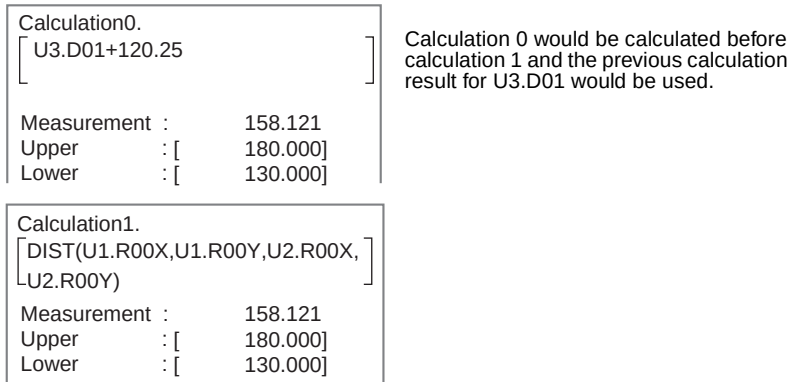
When using the calculation results from another expression, set the calculation number to a value larger than the number of the calculation for which the results are being used. If a smaller number is set, the result of a previous calculation will be inserted instead of the results of the latest calculation.



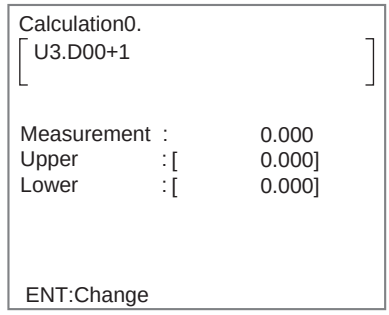
To find the distance between the 2 measurement region points in example 1 and then add 120.25 to that value.



If the expression was set in the reverse order



Example 2: Counting the number of measurements



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.

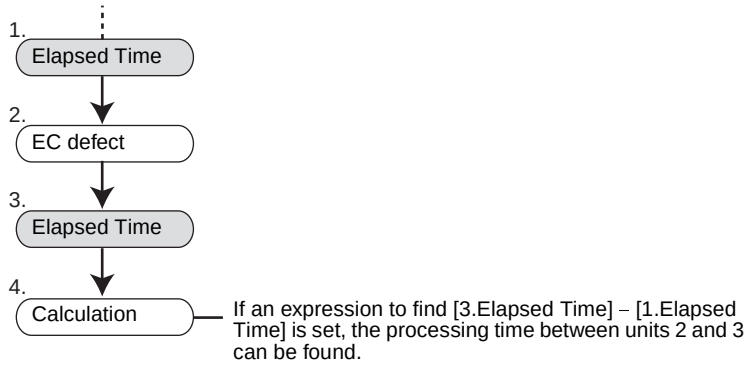
2-30 Elapsed Time

The Elapsed Time processing item finds the amount of time (in ms) that has passed since the measurement trigger was input.

All that is necessary is to set the Time processing item for a unit. No other settings are required.

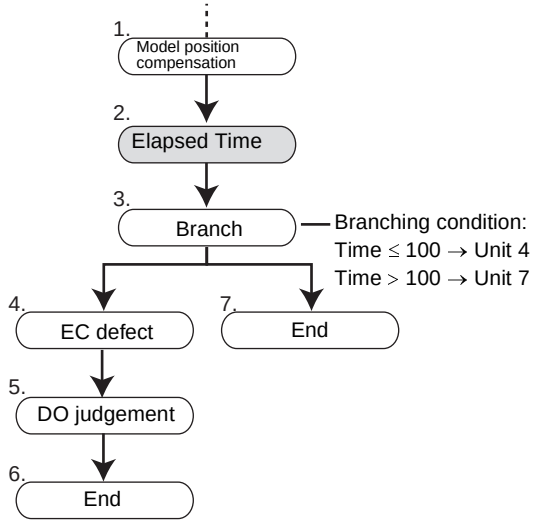
The processing time can then be calculated by setting the Elapsed Time processing item for units before and after other units, and then using the Calculation processing item to find the time.

Example 1: Finding the Processing Time for A Particular Unit



Example 2: Stopping Measurement if Processing Time Exceeds Set Time

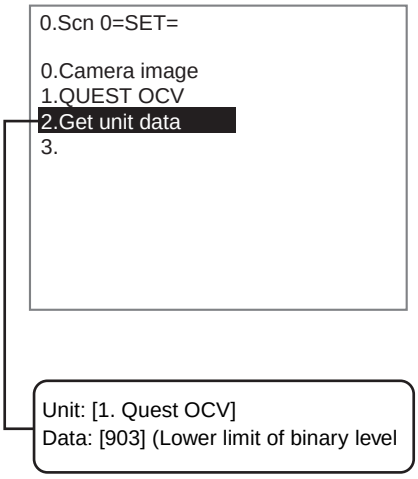
The settings are combined with conditional branching.



2-31 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.

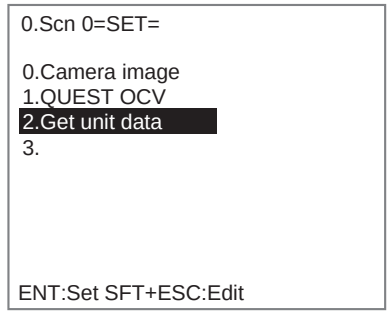
Example: Obtaining Binary Level Automatically Set for QUEST Character Verification



Set the data to be obtained.

Item	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. The data numbers are the same as for UNITDATA for serial interfaces (Normal).

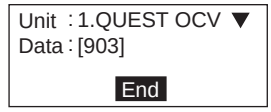
1. Select ***Get unit data***.



Data no. will be displayed.

2. Press the **ENT** Key.

The screen for selecting the unit and data numbers will be displayed.

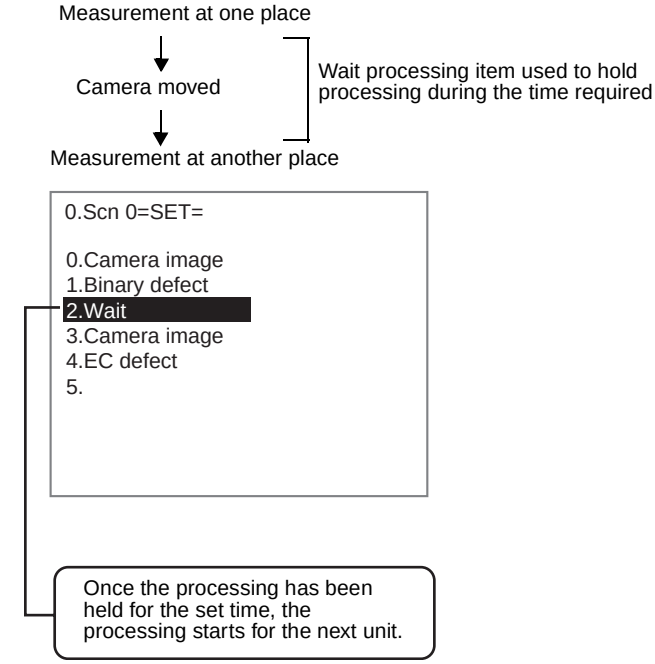


3. Make the unit and data number settings.
4. Select ***End***.
   The settings will be registered and the screen in (1.) will return.

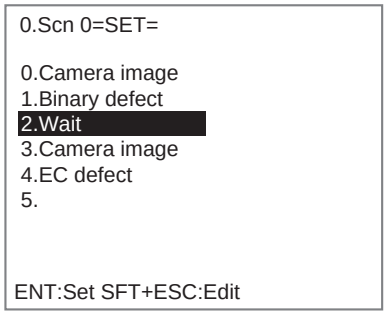
2-32 Wait

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.

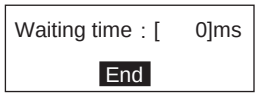
Example



1. Select ***Wait***.



The Waiting Time Settings screen will be displayed.



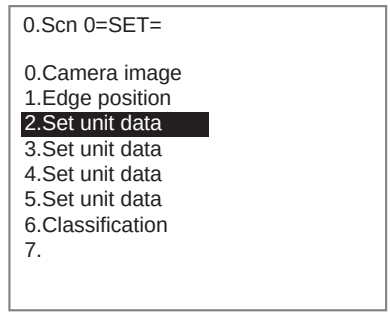
2. Set the waiting time to 0 ms or longer (0 to 9999).
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

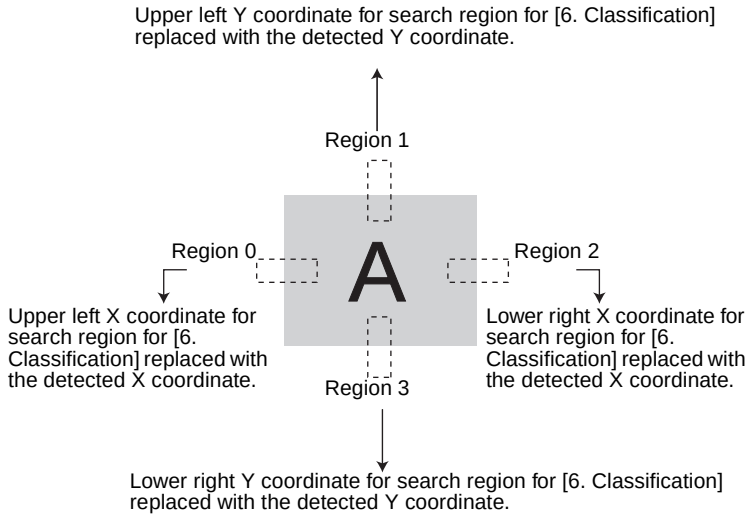
2-33 Set Unit Data

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.

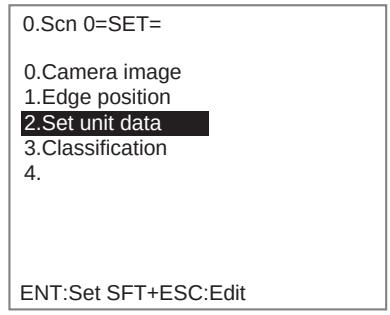


2-33-1 Selecting Unit and Data Numbers

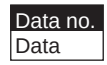
Select the unit number and data number to be replaced. The data number allocations differ for each processing item. The data numbers are the same, however, as the serial interface (Normal) UNITDATA.

SeeAlso Refer to *6-2 Normal Serial Interface* (Normal).

1. Select ***Set unit data***.

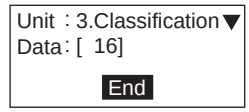


The initial Set Unit Data Screen will be displayed.



2. Select ***Data no.***

The screen for setting unit and data numbers will be displayed.



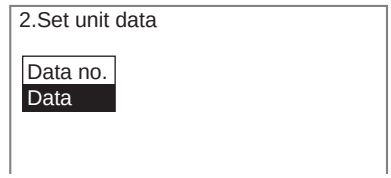
3. Set the unit and data numbers.
4. Select ***End***.

The settings will be registered and the screen in (1.) will return.

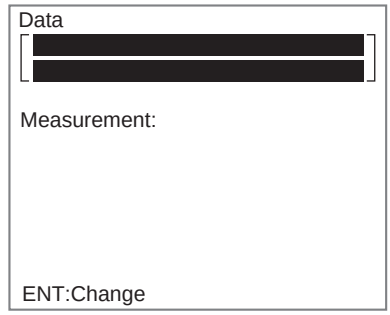
2-33-2 Setting the Replacement Details

Set an expression for the data to be replaced.

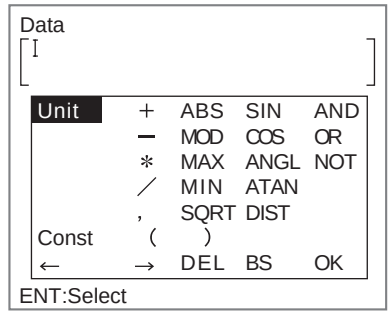
1. Select ***Data***.



The Expression Settings Screen will be displayed.



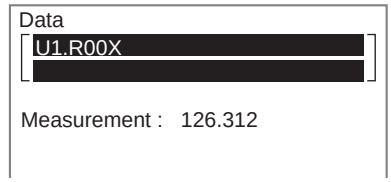
2. Place the cursor in the square brackets and press the **ENT** Key.
   The list of setting items will be displayed.



3. Select the desired items and write the expression.

SeeAlso Refer to *2-29 Calculation*.

4. Once the expression has been set, select ***OK***.
   The expression will be saved and the second screen in (1.) will return.

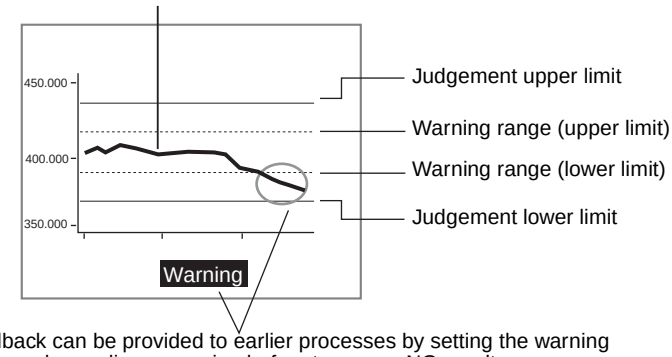


5. Press the **ESC** Key.
   The settings will be registered and the first screen in (1.) will return.

2-34 Trend Monitor

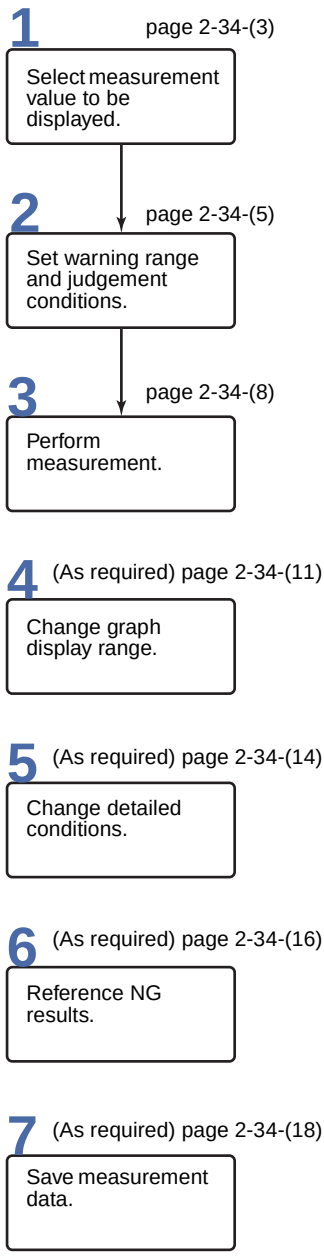
The Trend Monitor processing item is used to display the measurement results history on the Monitor. Observation of the measurement value trends helps to prevent frequent occurrences of non-conforming articles and to find the cause of NG results when they occur.

Measurement results over time are shown on a graph.
The latest 1,000 measurement results are held.



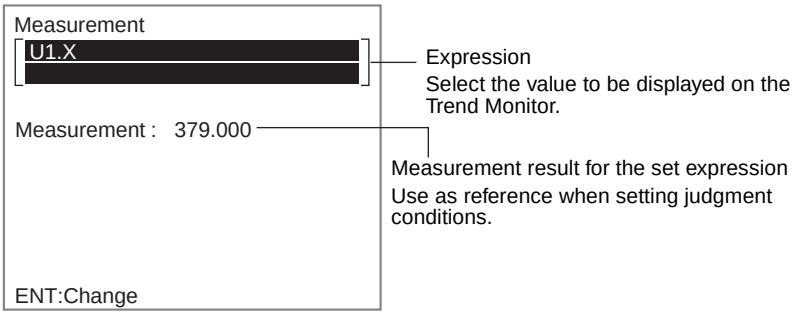
Feedback can be provided to earlier processes by setting the warning range and sounding a warning before too many NG results occur.

Operational Flow

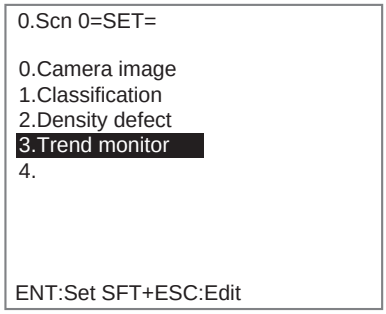


2-34-1 Selecting Measurement Values to be Displayed

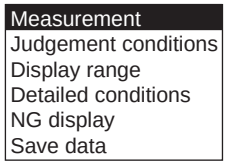
Select the measurement values that are to be displayed on the Trend Monitor. The measurement values are set using expressions. One item can be displayed for each Trend Monitor unit.



1. Select ***Trend monitor***.

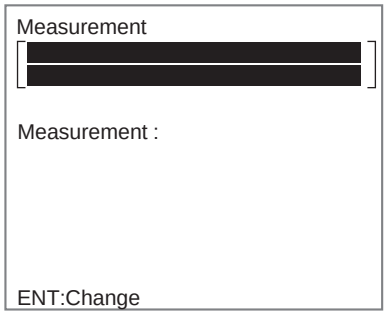


The settings selections will be displayed.



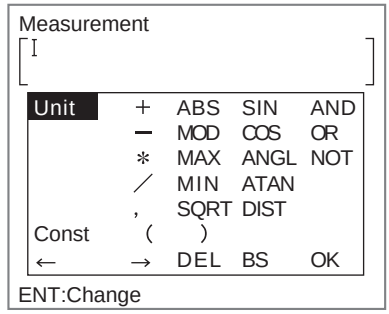
2. Select ***Measurement***.

The Measurement Settings Screen will be displayed.



3. Place the cursor in the square brackets for the expression and press the **ENT** Key.

   A list of expression items will be displayed.



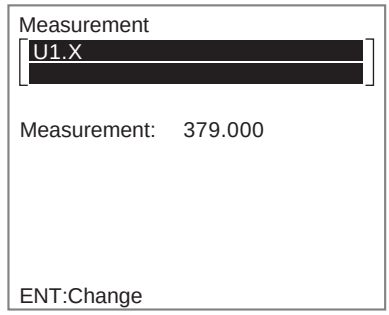
4. Select the items to be set.

SeeAlso Refer to *2-29 Calculation.*

CHECK When setting *unit*, select the unit number before the Trend Monitor. The trend graph will not be displayed if later unit numbers are selected.

5. Once the expression has been set, select ***OK***.

   The expression will be saved and the screen in (2.) will return.

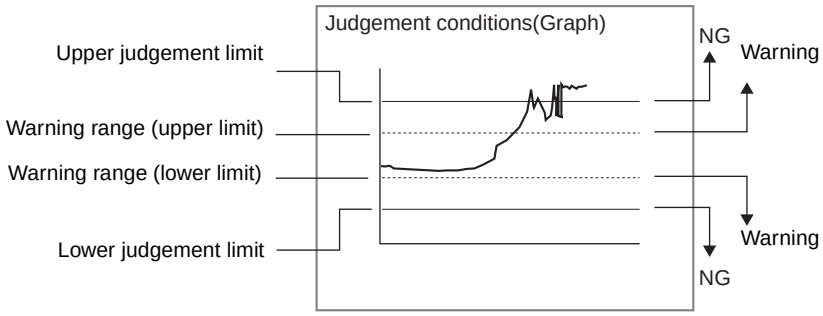


6. Press the **ESC** Key.

   The settings will be registered and the screen in (1.) will return.

2-34-2 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.

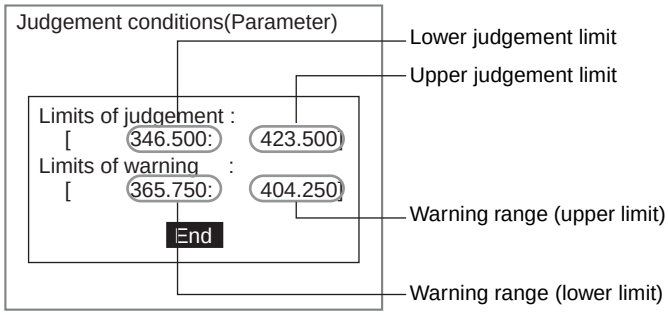
SeeAlso Refer to page 2-34-(14).

CHECK When a warning is generated, the word *Warning* appears on the screen.

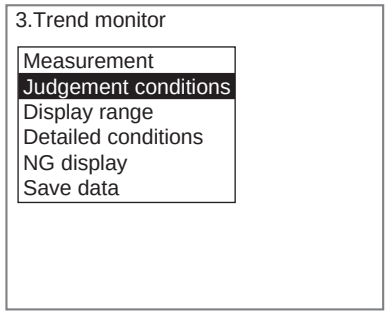
If an expression is set to output the Trend Monitor measurement result (warning) using DO Judgement Output or other results output processing items, an external device can be notified that a warning was generated.

Parameter

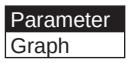
Use parameters to set the upper and lower judgement limits and the warning range.



1. Select ***Judgement conditions***.

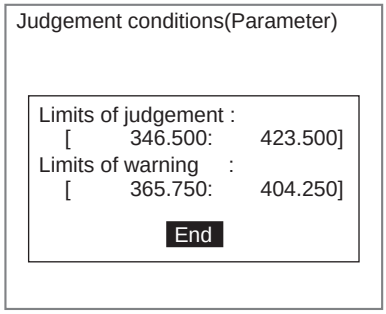


The *Parameter* and *Graph* setting method selections will be displayed.



2. Select ***Parameter***.

   The Parameter Judgement Conditions Settings Screen will be displayed.



3. Set the judgement and warning conditions.
4. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

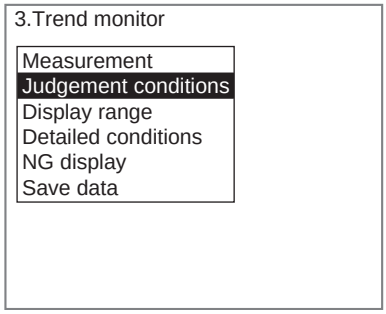
Graph

Move lines on the graph to set the upper and lower judgement limits and the warning range.

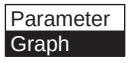
CHECK Actual measurements can be executed and the measurement values displayed on a graph to be used as a guide when setting lines here.

SeeAlso Refer to page 2-34-(8).

1. Select ***Judgement conditions***.

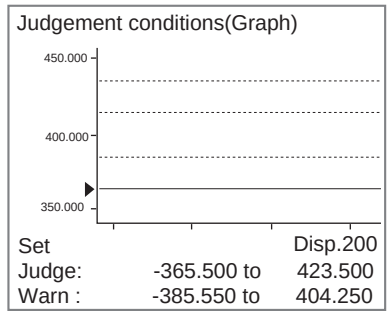


The *Parameter* and *Graph* setting method selections will be displayed.



2. Select ***Graph***.

The graph will be displayed.

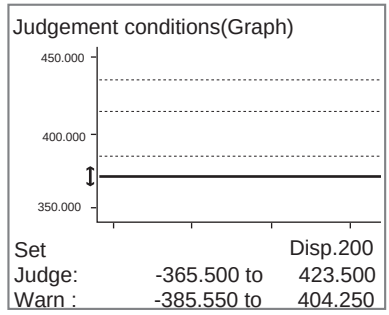


CHECK The scale of the vertical axis in the graph and the display range are automatically set based on the measurement values for the displayed image. Press the **SHIFT + ESC** Keys to move to the screen for changing the display range.

SeeAlso Refer to page 2-34-(11).

3. Use the **Up** and **Down** Keys to specify the line to be changed and press the **ENT** Key.

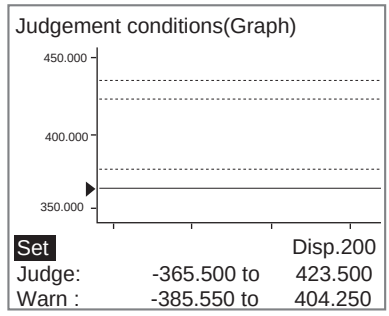
   The cursor will change to a vertical movement cursor.



4. 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 3 and 4 to change other lines on the graph.

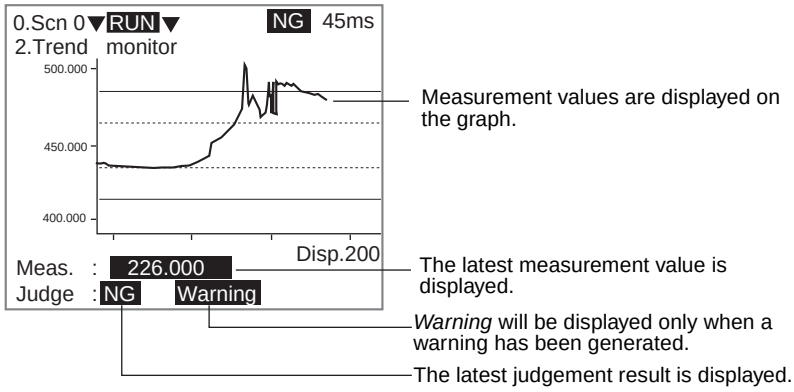


5. Select ***Set***.

   The settings will be registered and the screen in (1.) will return.

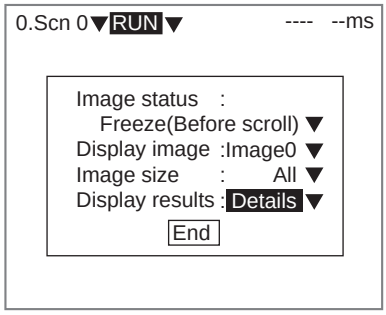
2-34-3 Performing Measurement

Perform an actual measurement and display the Trend Monitor.



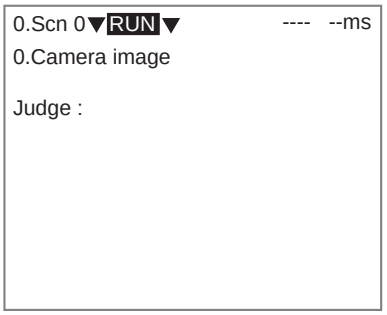
1. Enter Monitor or Run modes.

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.



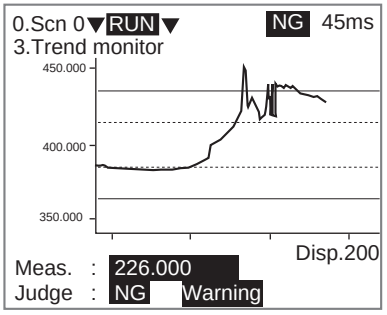
5. Press the **Down** Key to display the unit to which the Trend Monitor is set.
6. Execute the measurement.

   The measurement result will be displayed on a graph.

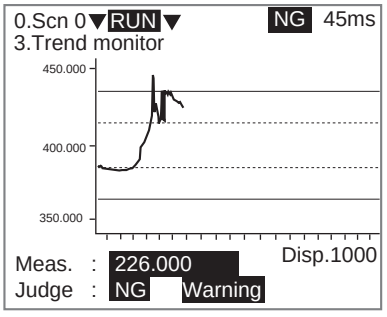
CHECK Measurement Screens

Press the **Shift + Right/Left** Keys to display following three graphs in order.

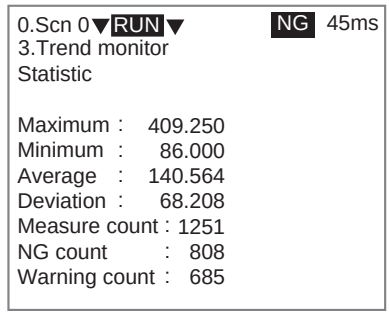
1. 200 Measurement Results Display



2. 1,000 Measurement Results Display



3. Statistics



2-34-4 Changing Graph Display Ranges

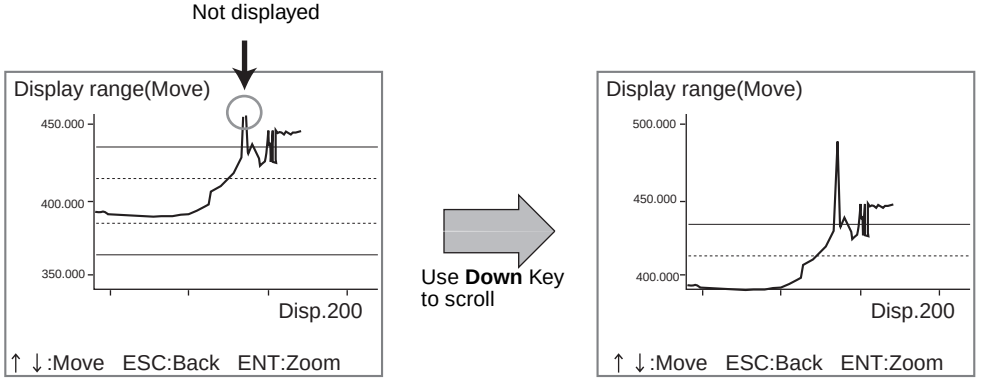
If the section required is not displayed, scroll the vertical display range of the graph and enlarge or reduce the display.

The number of measurement results shown horizontally can also be switched between 200 or 1,000 measurement result display.

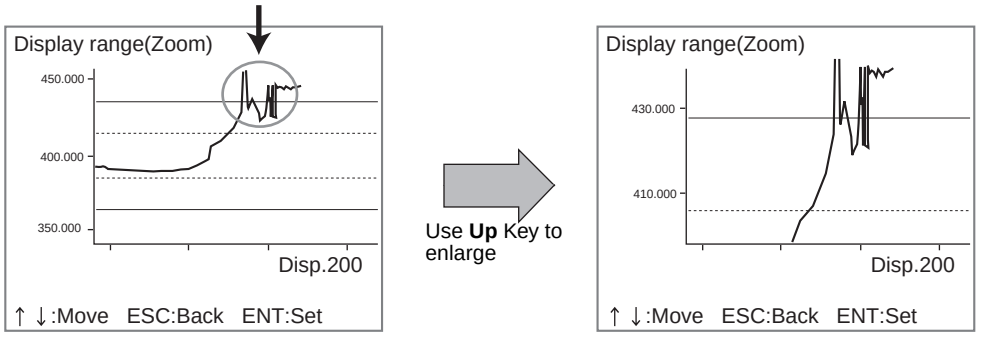
Changing the Vertical Display Range

The vertical axis can be scrolled and the scale of the vertical display can be changed.

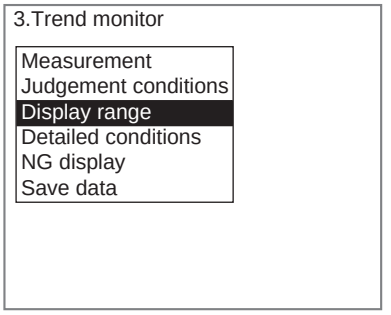
Example: NG Measurement Results Not Shown with Default Display Range



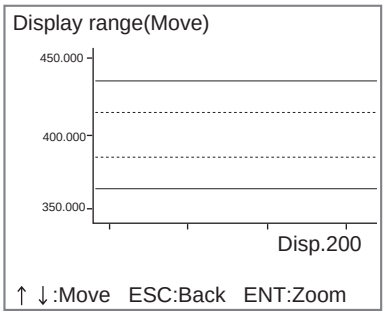
Example: Measurement Results are Cluttered and That Section Needs to Be Enlarged



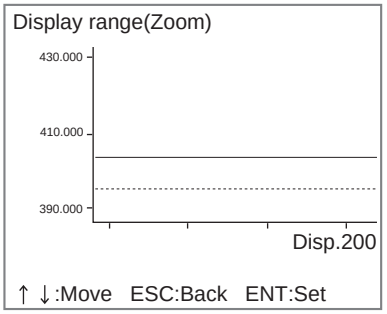
1. Select ***Display range***.



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 to set the display.
   The Display Range (Zoom) Screen will be displayed.

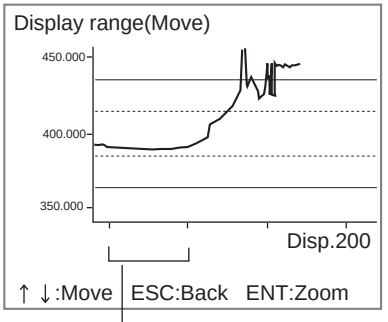


4. Use the **Up** and **Down** Keys to change the vertical scale.
   Up Key: Enlarges the scale.
   Down Key: Reduces the scale.
5. Press the **ENT** Key.
   The settings will be registered and the screen in (1.) will return.

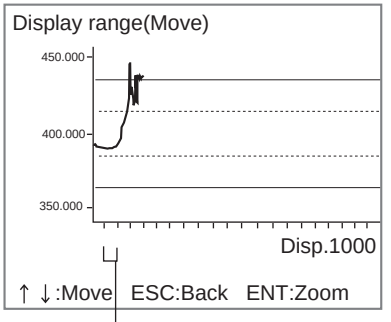
Changing the Number of Displayed Measurement Results

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

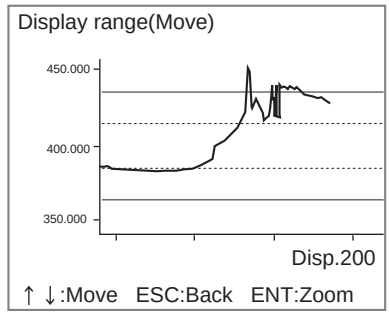


1,000 Measurement Results Display



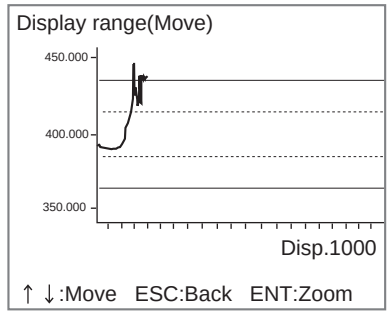
Each graduation indicates 50 measurements.

1. Press the **SHIFT + Left/Right** Keys while the graph is displayed.



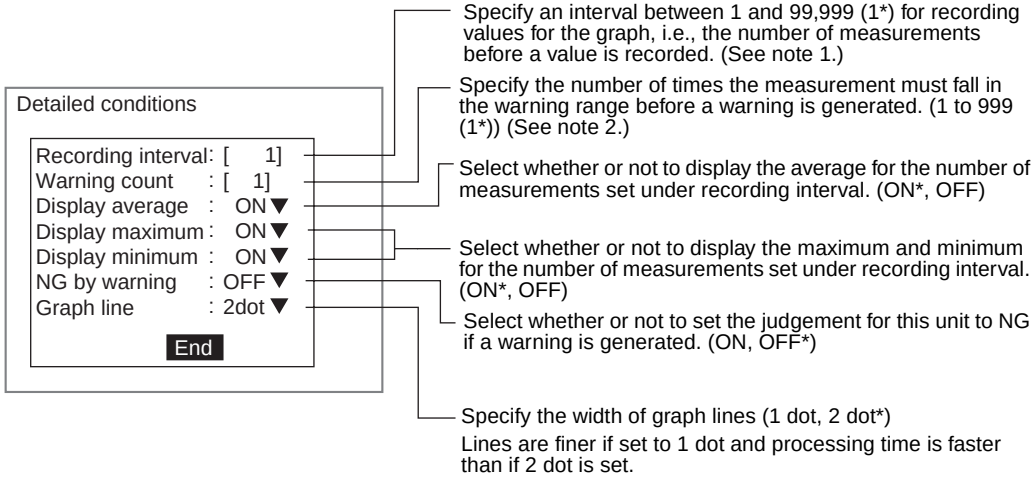
The number of displayed measurement results changes.

Each time the **SHIFT+Left/Right** Keys are pressed, the display switches between 200 and 1,000 measurement results.



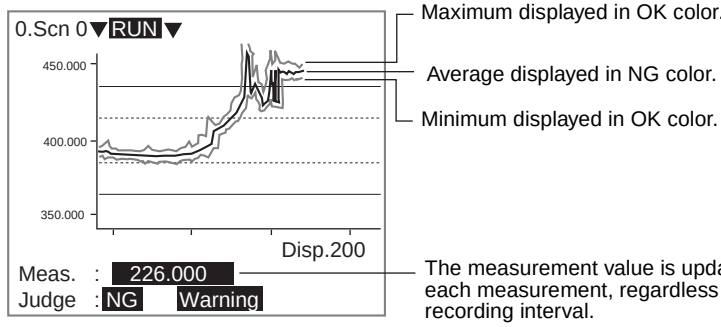
2-34-5 Changing Detailed Conditions

The items displayed on the Trend Monitor and the timing of warnings can be changed. Change these detailed conditions as required.

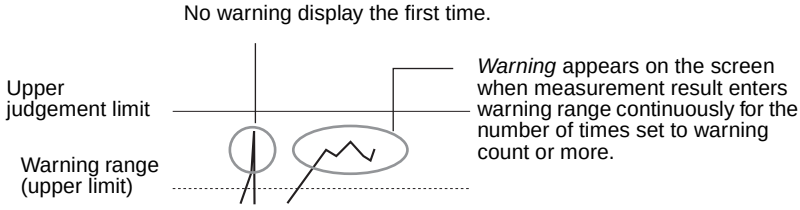


The asterisk (*) indicates the default setting.

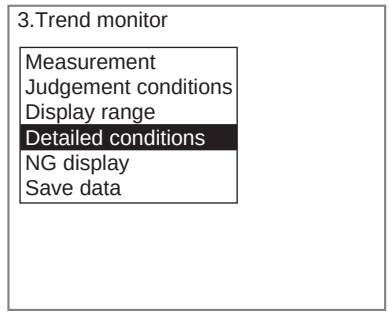
Note 1. If the recording interval is set to 2 or higher, the minimum and maximums for that interval will be displayed as shown in the following diagram.



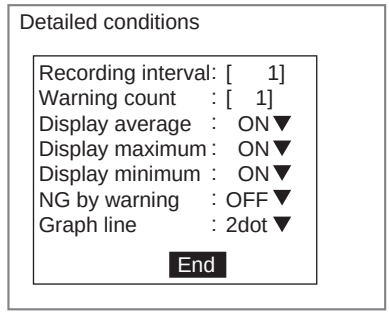
2. If the warning count is set to 2 or higher, *Warning* will appear on the screen if the measurement result enters the warning range continuously that number of times or more.



1. Select ***Detailed conditions***.



The Detailed Conditions Settings Screen will be displayed.



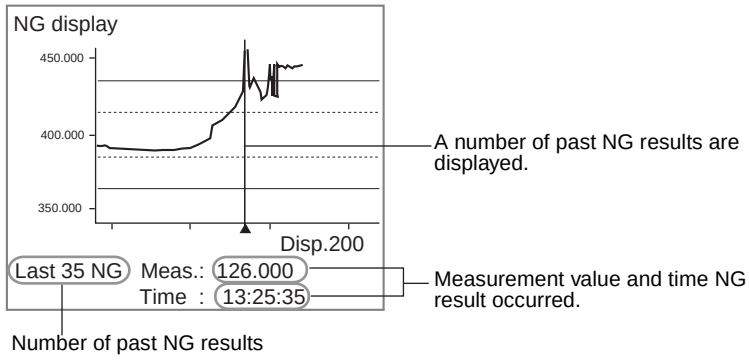
2. Set the detailed conditions.
3. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

2-34-6 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.



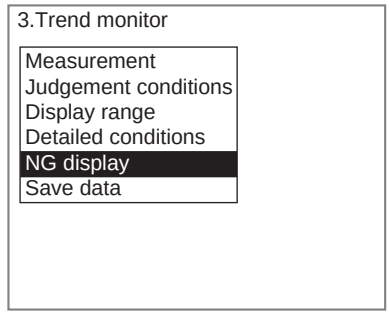
CHECK To View the Trend Monitor NG Image

Set the conditions as described below to save measurement images on the Trend Monitor only when NG results are returned.

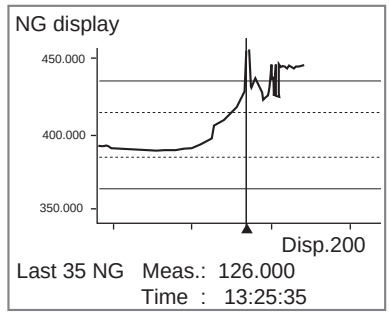
- Set *System/Measurement control/Save image* to *NG only*.
- Set all units other than Trend Monitor unit to *OK*.

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.

1. Select ***NG display***.



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.

SeeAlso

Refer to page 2-34-(11).

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.

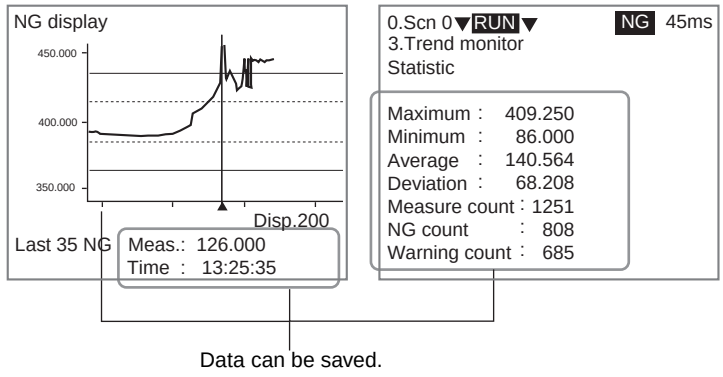
   The screen in (1.) will return.

2-34-7 Saving Measurement Data

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.

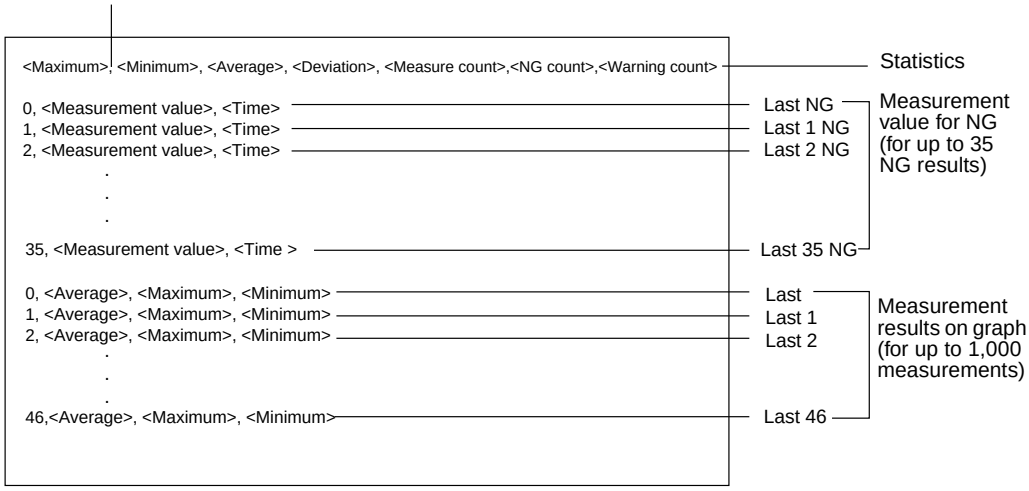
All the statistical data, the measurement values and times for up to 36 NG results, and up to 1,000 measurement results on the graph are saved.

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.

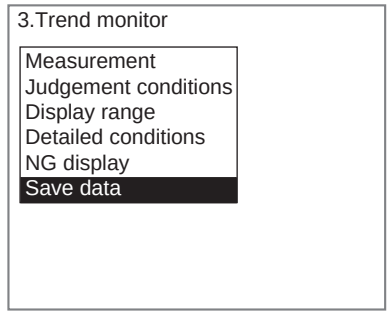


CSV Data Format

Data delimited by commas.

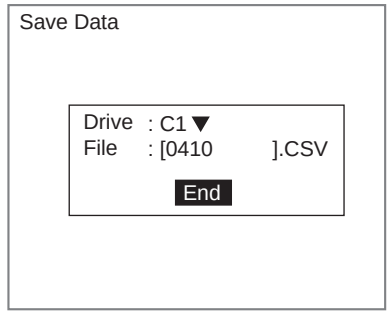


1. Mount a Memory Card.



2. Select ***Save data***.

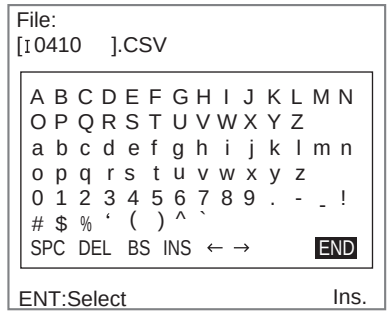
   The Save Data Settings Screen will be displayed.



3. Select the drive to which the Memory Card is mounted (either ***CO*** or ***C1***).
4. 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.

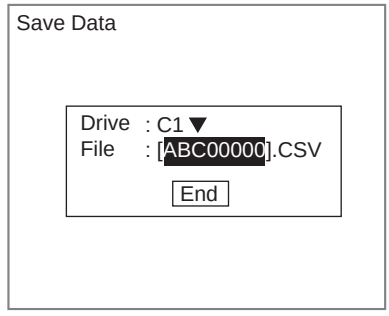


5. Set a file name of up to 8 characters.

CHECK Periods (.) cannot be used in file names.

6. Move the cursor to ***END*** and press the **ENT** Key.

   The screen in (2.) will return.



7. Select ***End***.

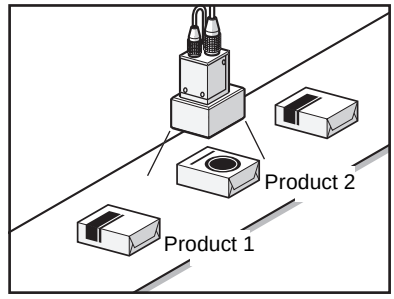
   The data will be saved to the TRENDMON directory and the screen in (1.) will return.

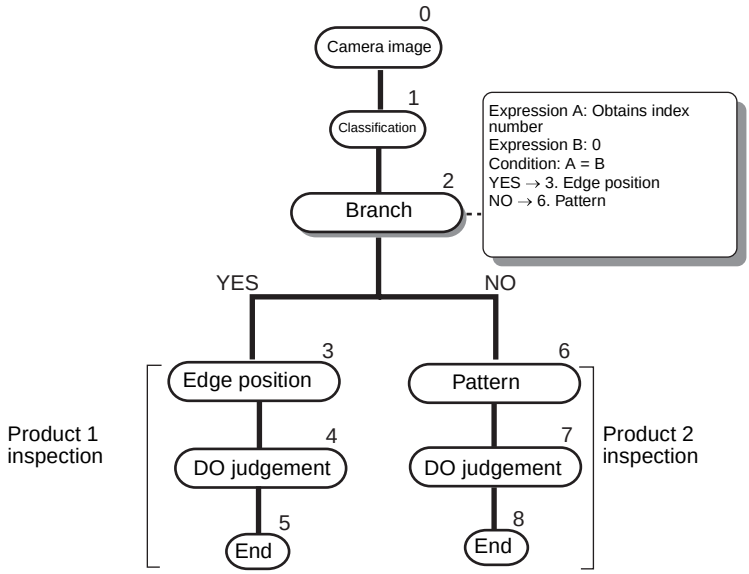
2-35 Conditional Branching

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.

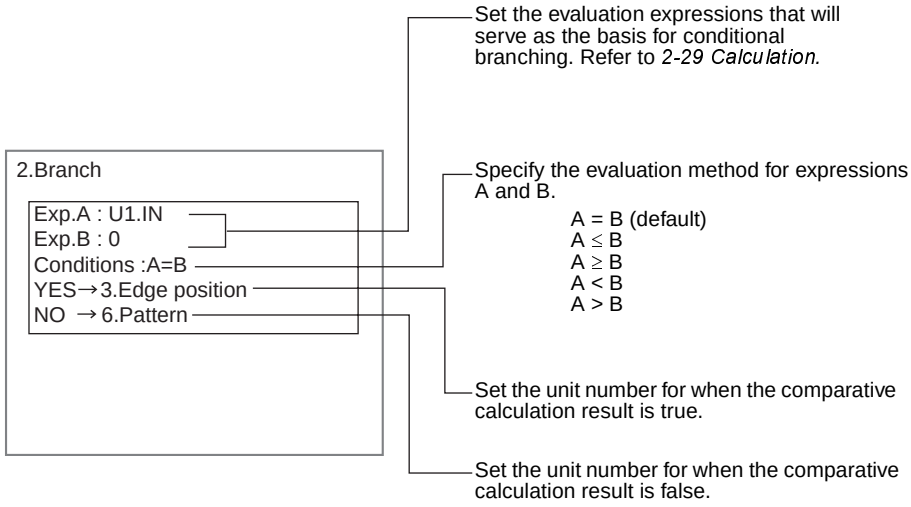
This processing item is used, for example, when two or more products are being processed on the same production line and a different inspection is required for each.

Example: Inspecting Printing on Confectionery Packaging

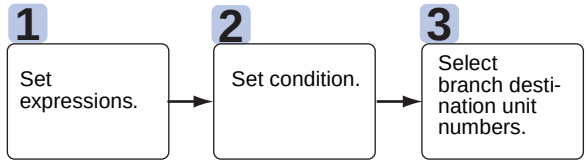




The settings details are shown below.



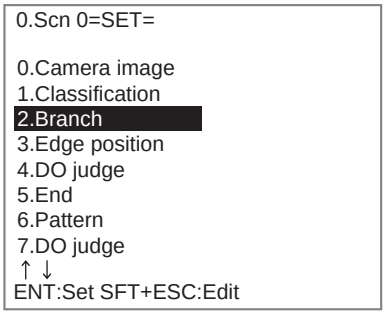
Operational Flow



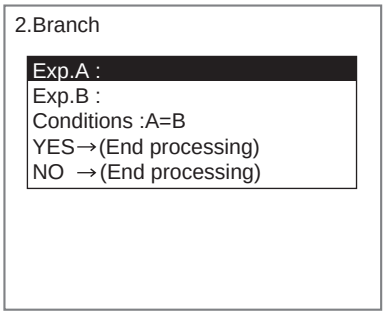
2-35-1 Setting Expressions

Set the evaluation expression for conditional branching. Set two expressions, A and B.

1. Select ***Branch***.

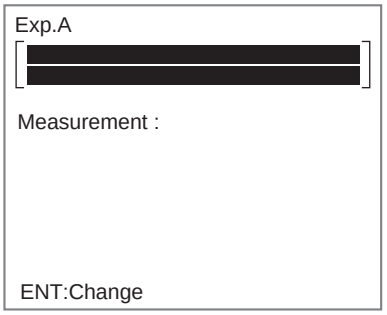


The Branch Settings Screen will be displayed.



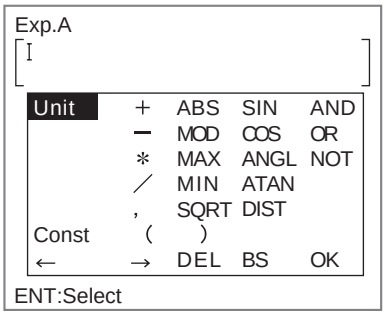
2. Select ***Exp A***.

The Expression A Settings Screen will be displayed.



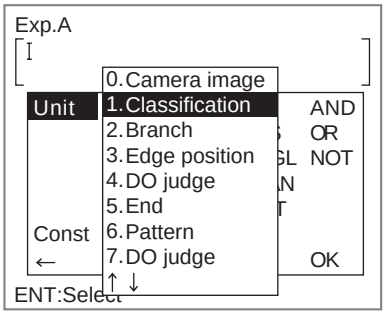
3. Move the cursor to the square brackets for expression A and press the **ENT** Key.

The expression items will be displayed.



4. 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.

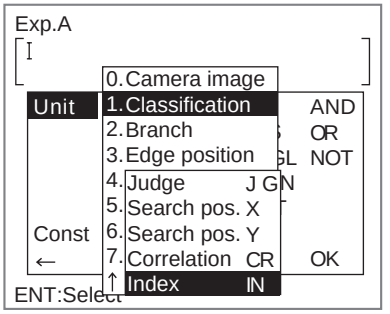


5. Select the unit number to be set.

   A submenu will be displayed.

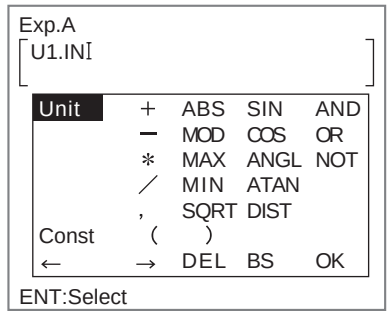
   The displayed submenu will differ depending on the processing item.

SeeAlso Refer to *2-29 Calculation* for a list of submenus.

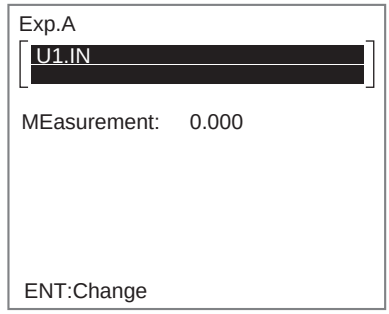


6. Select an item from the submenu.

The selected item will be set to the expression.



7. Create the expression.
8. Once the expression has been set, select ***OK***.
   Expression A will be registered.

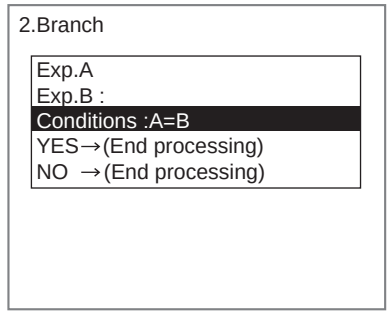


9. Repeat steps 2 to 8 to set expression B.
   Move to the next operation, setting conditions.

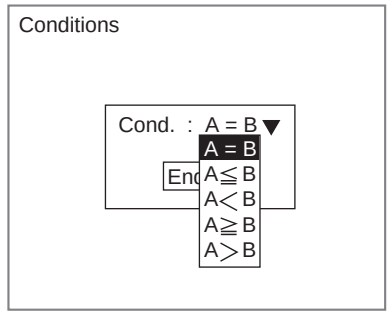
2-35-2 Setting Conditions

Select the method for comparing the two pieces of data obtained by expressions A and B.

1. Select ***Conditions***.



The conditions selections will be displayed.



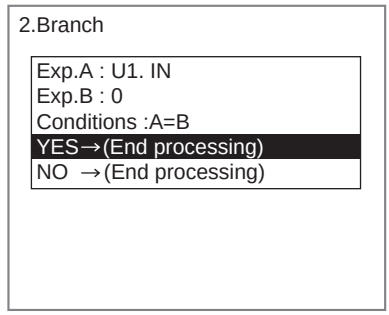
2. Select the evaluation method.
3. Select ***End***.

   The evaluation method will be registered and the screen in (1.) will return.

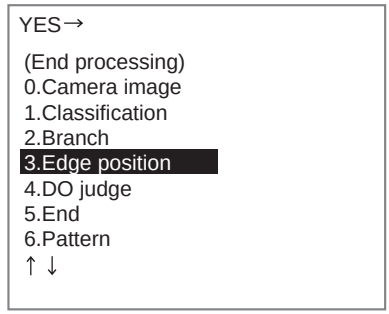
2-35-3 Selecting the Branch Destination Unit Numbers

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).

1. Select ***Yes*** → ***(End processing).***



The list of units for the current scene will be displayed.

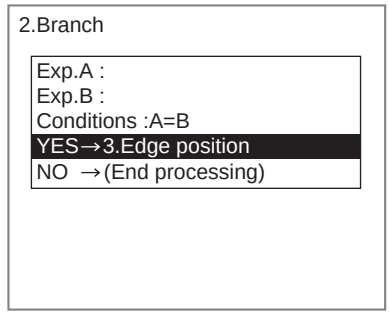


2. Select the branch destination unit and press the **ENT** Key.

   Up/Down Keys: Scroll through the unit numbers.

CHECK 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. Set the ***No*** → ***(End processing)*** destination unit in the same way.

CHECK Always register ***End*** as the last of the processing items for the branch destination units for both *Yes* → and *No* → to indicate that the branch has ended.

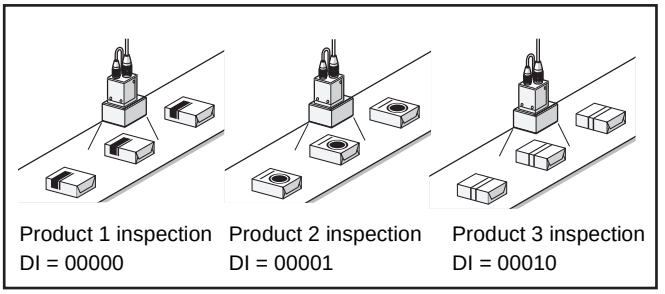
SeeAlso Refer to *2-37 End*.

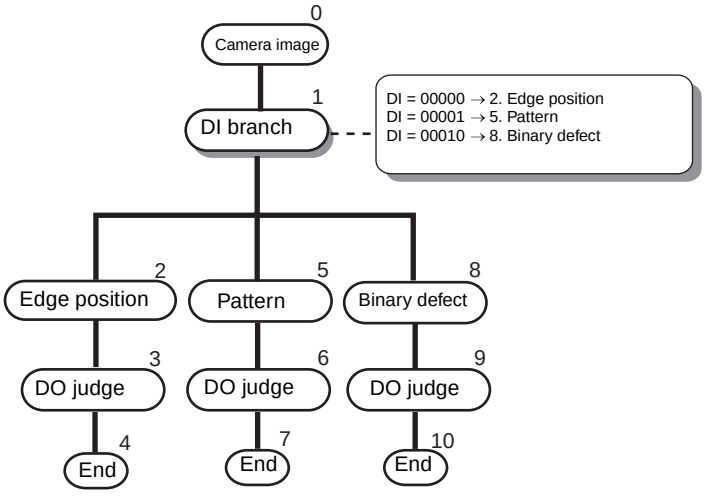
2-36 DI Branch

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.

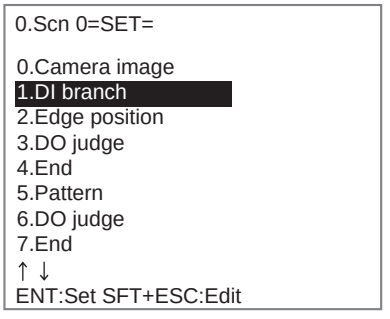
Example: Different Product Inspections for Confectionery Based on Time



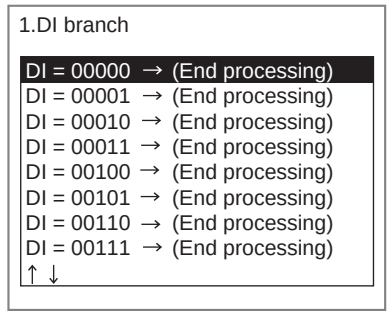


Select the branch destination unit. Set a unit for each DI input data.

1. Select ***DI branch***.



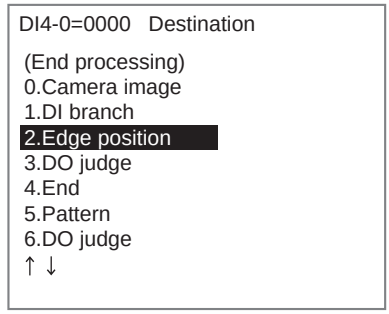
The DI Branch Settings Screen will be displayed.



2. Select the DI input to be used.

   Up/Down Keys: Scroll through the DI inputs.

   A list of units for the current scene will be displayed.

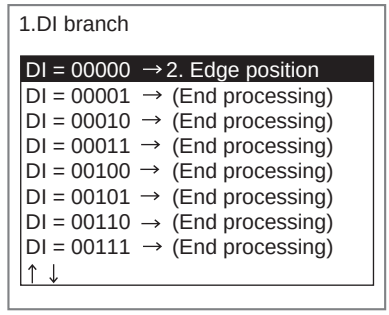


3. Select the branch destination unit.

   Up/Down Keys: Scroll through the units.

CHECK Set a unit number after the *DI branch* unit number. If an earlier unit number is set, the processing may continue in a loop.

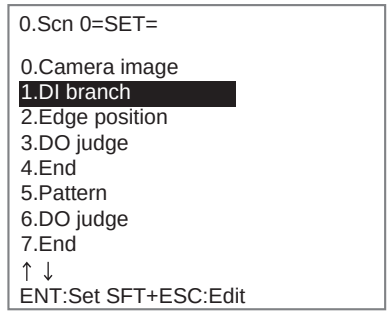
The settings will be registered.



4. Set the branch destination units for other DI input numbers in the same way.

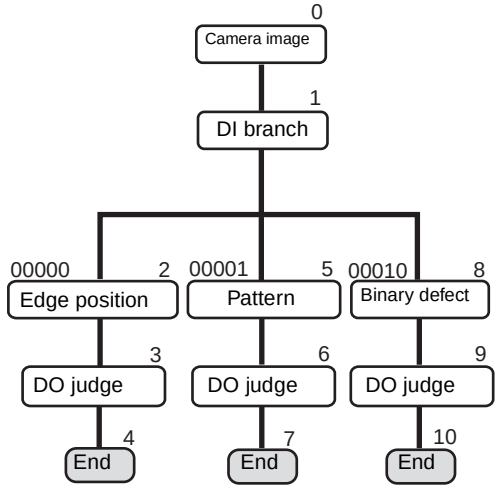
5. Press the **ESC** Key.

   The settings will be registered and the screen in (1.) will return.



CHECK Always register **End** as the last of the processing items for the branch destination units to indicate that the branch has ended.

SeeAlso Refer to *2-37 End*.

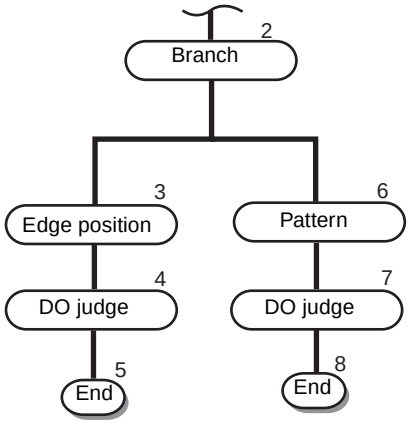


CHECK The status of the DI signal is referenced, and it is referenced when the DI Branch processing item is processed.

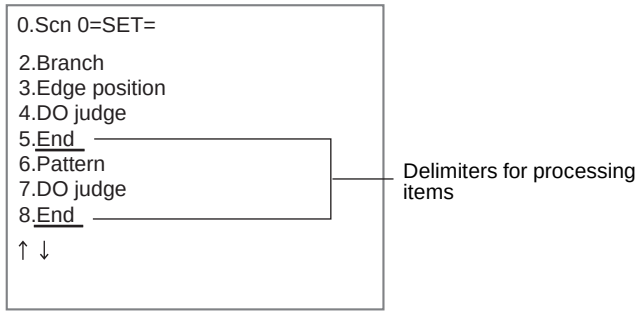
2-37 End

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.

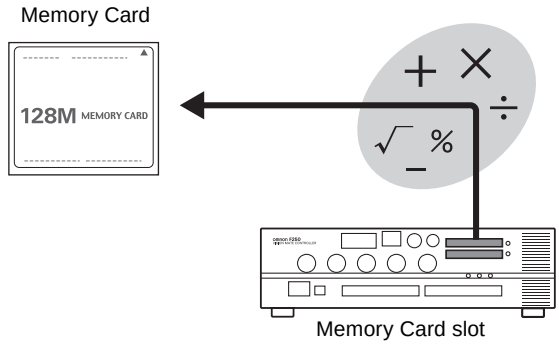


Screen image



2-38 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 Memory Card Data processing item is set.

2-38-1 Selecting Output Formats

Select the format for outputting data to the Memory Card.

ASCII Format

The following items can be set.

Item	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*. 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*.
Minus	Select what sign will be displayed for negative values. Select either – * or 8.
Field separator	Select the separator between data fields. Select none, comma*, tab, space, or CR+LF.
Record separator	Select the separator between data records. Select none, comma, tab, space, or CR+LF*.
0 Suppress	Select how to adjust any empty digits to the left of output data. Select either ON or 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*.
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.

Note The asterisk (*) indicates the default setting.

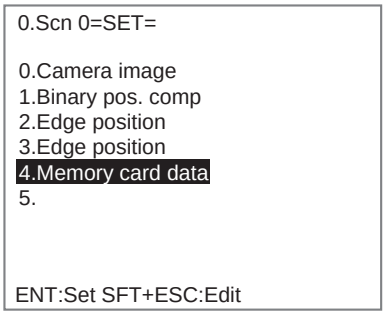
Binary Format

The measurement result multiplied by 1,000 is output as four consecutive bytes as one unit of data.

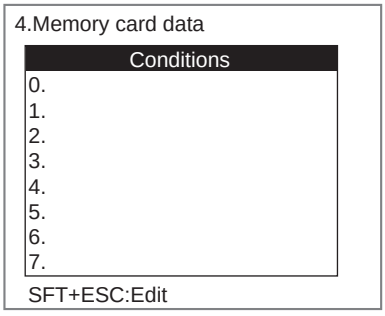
Item	Details
Output form	Select *Binary.*
Digits of integer	These settings are only for ASCII format. No settings are required for binary format.
Digits of decimal	
Minus	
Field separator	
Record separator	
0 Suppress	

Item	Details
Output drive	Select the number of the drive to which the Memory Card is mounted.
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.

1. Select ***Memory card data***.

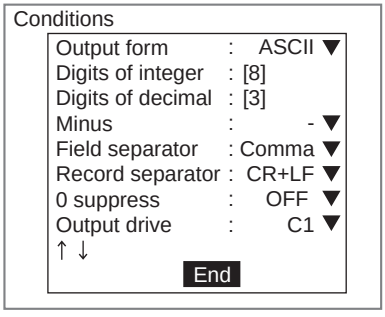


The list of set expressions will be displayed.



2. Select ***Conditions***.

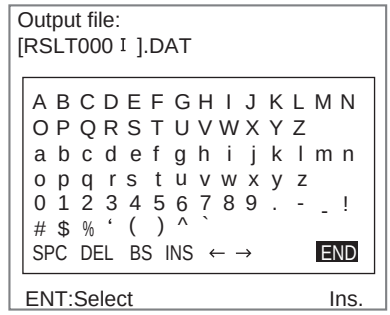
The Conditions Settings Screen will be displayed.



3. Change the settings for each item.
4. Move the cursor to the square brackets for the output file name and press the **ENT** Key.

Use the **Down** Key to scroll the cursor and display the output file name.

The software keyboard will be displayed.



5. Set up to 8 characters.
6. Move the cursor to ***END*** and press the **ENT** Key.

CHECK The output file will be saved in the OUTFILE directory in the root directory.

The screen in (2.) will return.

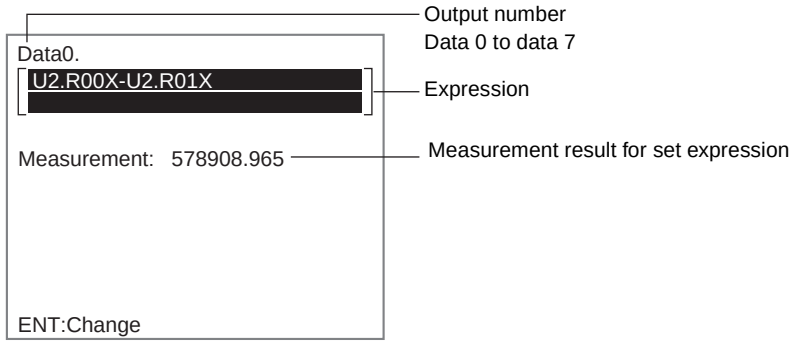
7. Select ***End***.

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

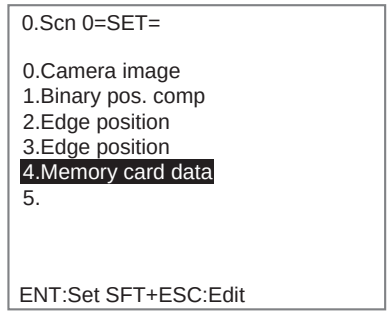
2-38-2 Setting Output Details

Use expressions to set the output data.

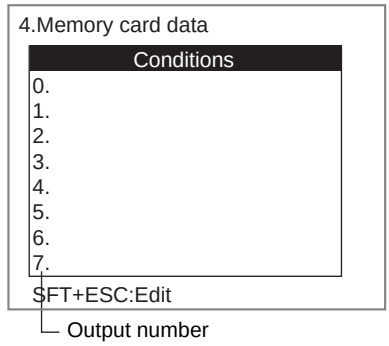
For each unit, 8 expressions (0 to 7) can be set.



1. Select ***Memory card data***.

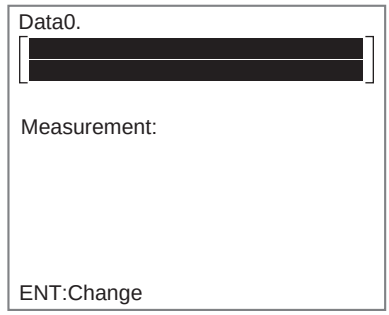


A list of set expressions will be displayed.

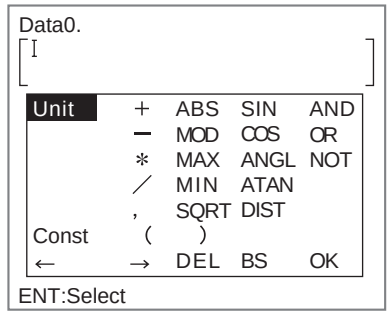


2. Select the output number to which the expression will be set.

The Expression Settings Screen will be displayed.



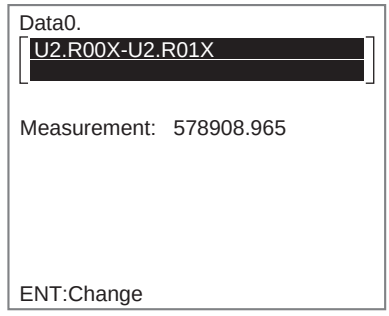
3. Move the cursor to the square brackets for *Data 0* and press the **ENT** Key.
   A list of expression items will be displayed.



4. Select the desired items and set the expression.

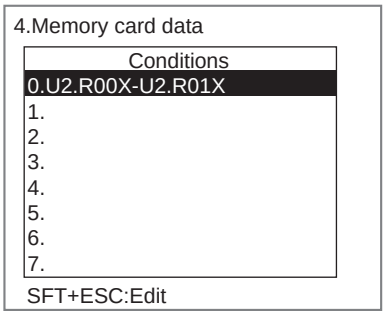
SeeAlso Refer to *2-29 Calculation.*

5. Once the expression has been set, select ***OK***.
   The settings will be registered and the screen in (2.) will return.



6. Press the **ESC** Key.

The Expression Settings Screen will return.



CHECK Press the **SHIFT+ESC** Keys in this screen to copy or clear the expression.

7. Repeat steps 2 to 6 and set the expressions.
8. Once the expressions have been set, press the **ESC** Key.

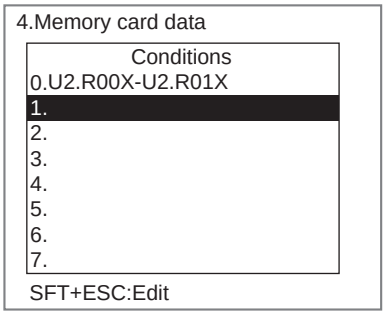
   The screen in (1.) will return.

Copying Expressions

The copy function is useful when using the expression again elsewhere or using the same expression with only one part changed.

If relative information is set for an expression, that information too will be copied.

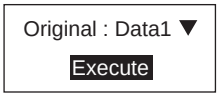
1. Use the **Up** and **Down** Keys in the screen in (6.) to select the output number for the copy destination then press the **SHIFT + ESC** Keys.



   The selections will be displayed.

2. Select ***Copy***.

   The Original Region Screen will be displayed.

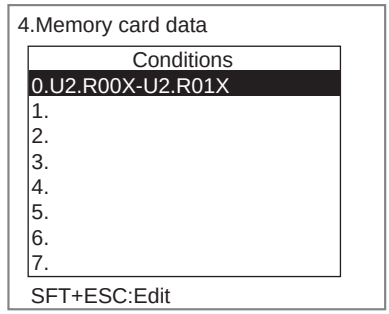


3. Select the output number to which the expression to be copied is set.
4. Select ***Execute***.

   The selected expression will be copied and the screen in (1.) will return.

Clearing Expressions

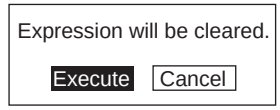
1. Use the **Up** and **Down** Keys in the screen in (6.) to select the output number of the expression to be cleared then press the **SHIFT + ESC** Keys.



The selections will be displayed.

2. Select ***Clear***.

A confirmation message will be displayed.



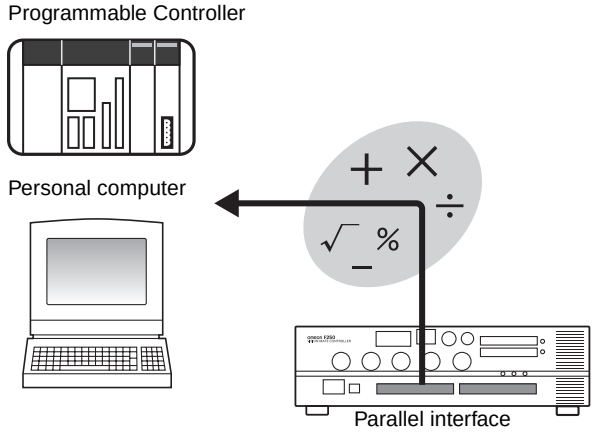
3. Select ***Execute***.

The expression will be cleared and the screen in (1.) will return.

2-39 DO Data

The DO Data processing item is used 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 DO Data processing item is set.

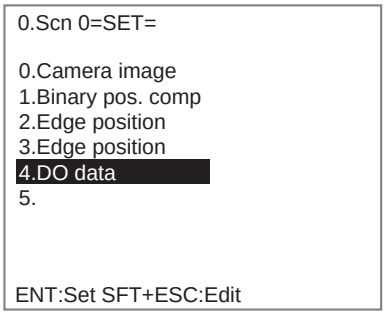
2-39-1 Selecting Output Formats

Select the format for outputting data.

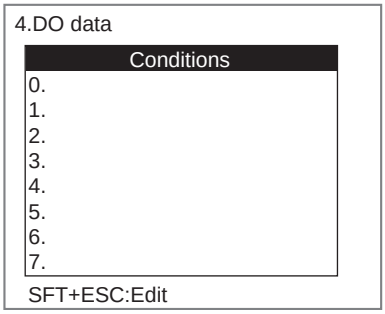
<table>
<tr><th>Format</th><th>Details</th></tr>
<tr><td>Binary*</td><td>Data is output in 32-bit 2's complement binary format.</td></tr>
<tr><td>BCD</td><td>Sign and 7-digit integer output using 4 bits per digit (32 bits).
Bits
<table>
<tr><th>28 to 31</th><th>24 to 27</th><th>...</th><th>4 to 7</th><th>0 to 3</th></tr>
<tr><td>Sign
(See note.)</td><td>1,000,000s digit</td><td>...</td><td>10s digit</td><td>1s digit</td></tr>
</table>
Note Positive: 0000
Negative: 1111</td></tr>
</table>

The asterisk (*) indicates the default setting.

1. Select ***DO data***.

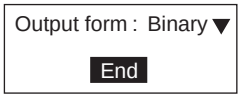


The list of set expressions will be displayed.



2. Select ***Conditions***.

   The Conditions Settings Screen will be displayed.



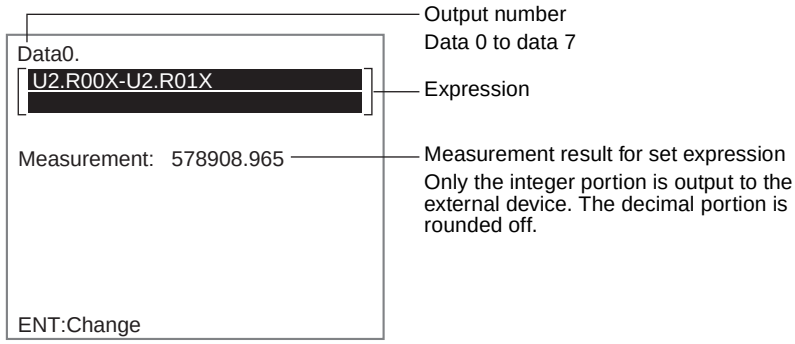
3. Select the output format.
4. Select ***End***.

   The settings will be registered and the screen in (1.) will return.

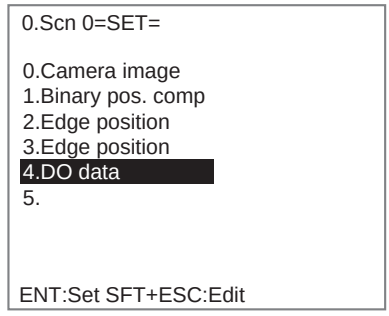
2-39-2 Setting Output Details

Use expressions to set the output data.

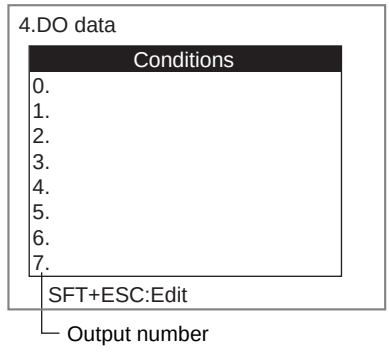
For each unit, 8 expressions (0 to 7) can be set.



1. Select ***DO data***.

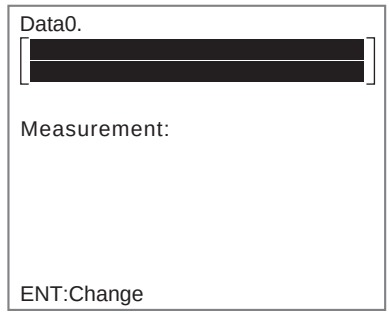


A list of set expressions will be displayed.

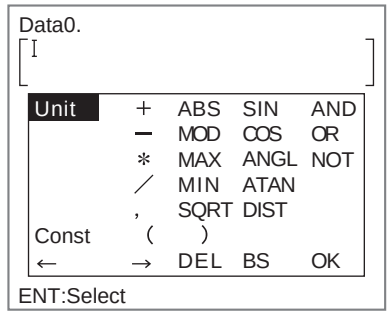


2. Select the output number to which the expression will be set.

The Expression Settings Screen will be displayed.



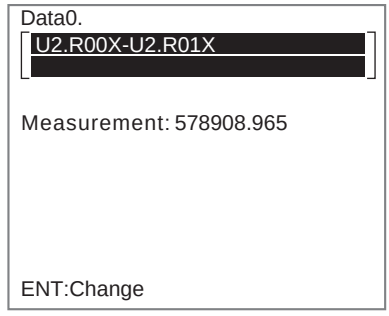
3. Move the cursor to the square brackets for *Data 0* and press the **ENT** Key.
   A list of expression items will be displayed.



4. Select the desired items and set the expression.

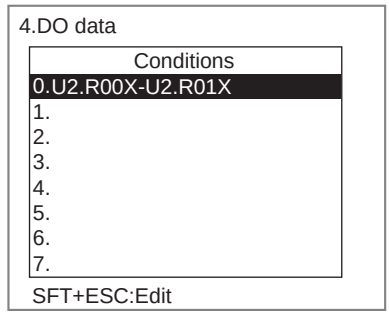
SeeAlso Refer to *2-29 Calculation.*

5. Once the expression has been set, select ***OK***.
   The settings will be registered and the screen in (2.) will return.



6. Press the **ESC** Key.

The Expression Settings Screen will return.



CHECK Press the **SHIFT+ESC** Keys in this screen to copy or clear the expression.

7. Repeat steps 2 to 6 and set the expressions.
8. Once the expressions have been set, press the **ESC** Key.

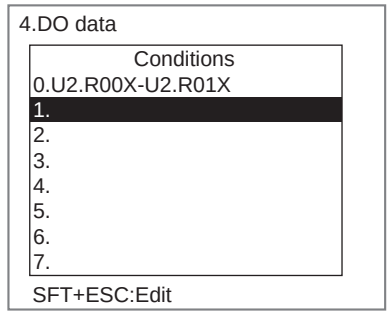
   The screen in (1.) will return.

Copying Expressions

The copy function is useful when using the expression again elsewhere or using the same expression with only one part changed.

If relative information is set for an expression, that information too will be copied.

1. Use the **Up** and **Down** Keys in the screen in (6.) to select the output number for the copy destination then press the **SHIFT + ESC** Keys.



   The selections will be displayed.

2. Select ***Copy***.

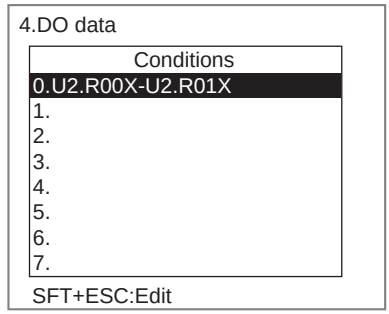
   The Original Region Screen will be displayed.

3. Select the output number to which the expression to be copied is set.
4. Select ***Execute***.

   The selected expression will be copied and the screen in (1.) will return.

Clearing Expressions

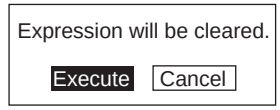
1. Use the **Up** and **Down** Keys in the screen in (6.) to select the output number of the expression to be cleared then press the **SHIFT + ESC** Keys.



The selections will be displayed.

2. Select ***Clear***.

   A confirmation message will be displayed.



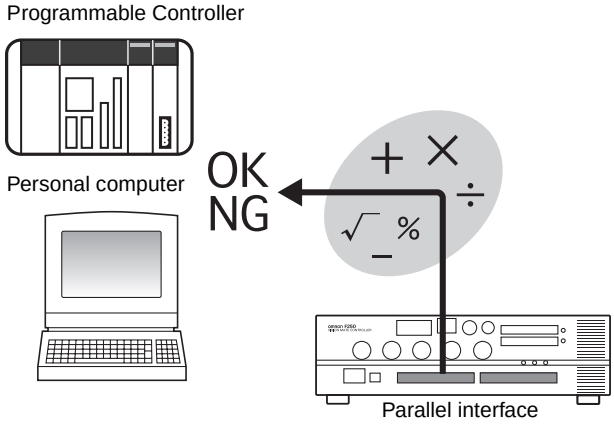
3. Select ***Execute***.

   The expression will be cleared and the screen in (1.) will return.

2-40 DO Judgement

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 DO Judgement processing item is set.

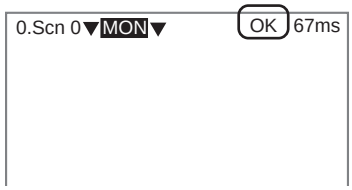
2-40-1 Selecting Reflection in Overall Judgement

Select whether or not to reflect the judgement result for this processing item in the overall judgement output to the parallel interface OR signal.

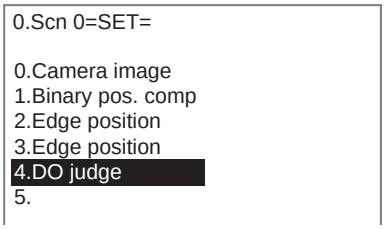
CHECK The overall judgement is also displayed on the Monitor and Measurement Screens.

The overall judgement can be set to not be displayed also by using the display settings.

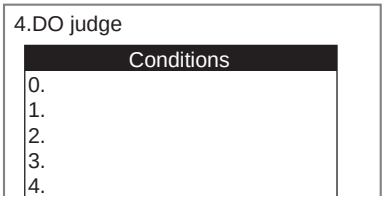
SeeAlso Refer to *5-3 Screen Display and Monitor*.



1. Select ***DO judge***.

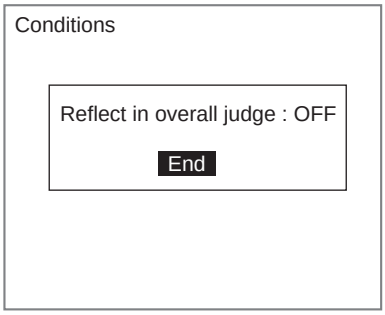


The list of set expressions will be displayed.



2. Select ***Conditions***.

The Conditions Settings Screen will be displayed.



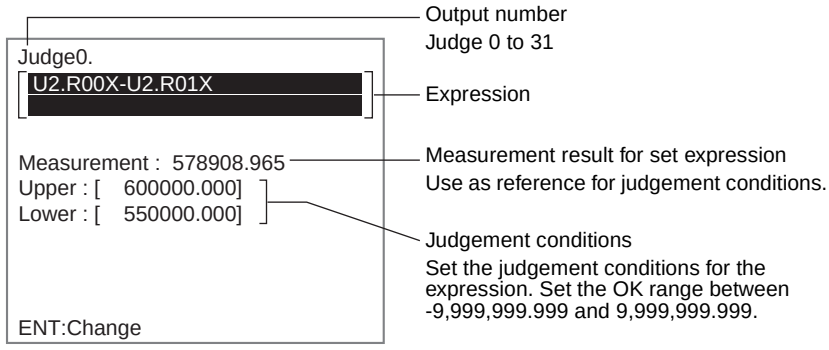
3. Change the setting.
4. Select ***End***.

The setting will be registered and the screen in (1.) will return.

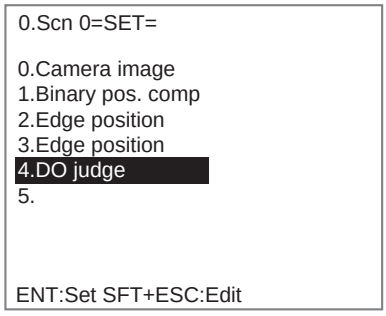
2-40-2 Setting Output Details

Use expressions to set the output data.

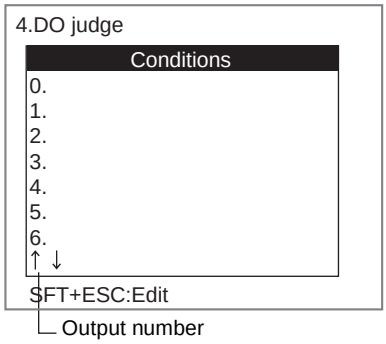
For each unit, 32 expressions (0 to 31) can be set.



1. Select ***DO judge***.

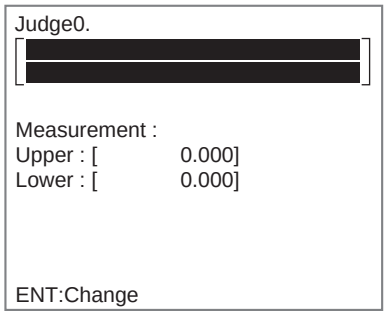


A list of set expressions will be displayed.

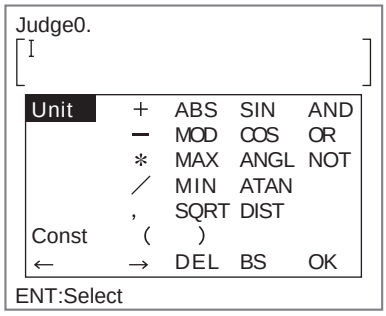


2. Select the output number to which the expression will be set.

The Expression Settings Screen will be displayed.



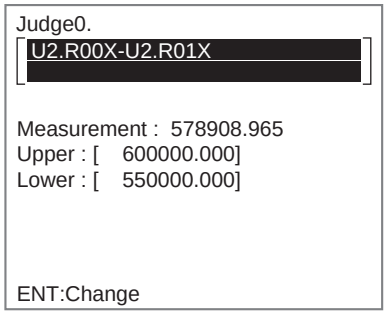
3. Move the cursor to the square brackets for *Judge 0* and press the **ENT** Key.
   A list of expression items will be displayed.



4. Select the desired items and set the expression.

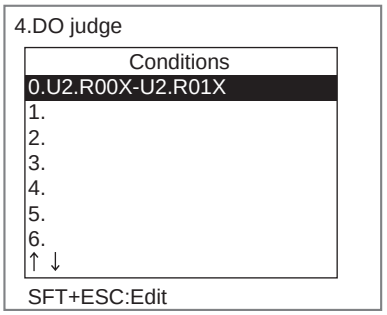
SeeAlso Refer to *2-29 Calculation.*

5. Once the expression has been set, select ***OK***.
   The expression will be set.



6. Set the upper and lower judgement limits.
7. Press the **ESC** Key.

The Expression Settings Screen will return.



CHECK Press the **SHIFT+ESC** Keys in this screen to copy or clear the expression.

8. Repeat steps 2 to 7 and set the expressions.
9. Once the expressions have been set, press the **ESC** Key.

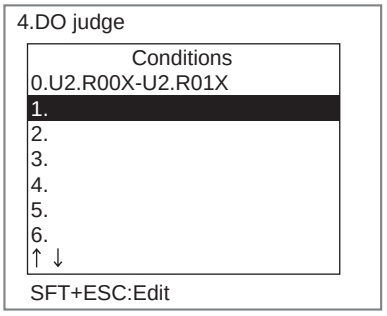
   The screen in (1.) will return.

Copying Expressions

The copy function is useful when using the expression again elsewhere or using the same expression with only one part changed.

If relative information is set for an expression, that information too will be copied.

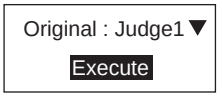
1. Use the **Up** and **Down** Keys in the screen in (7.) to select the output number for the copy destination then press the **SHIFT + ESC** Keys.



The selections will be displayed.

2. Select ***Copy***.

   The Original Region Screen will be displayed.

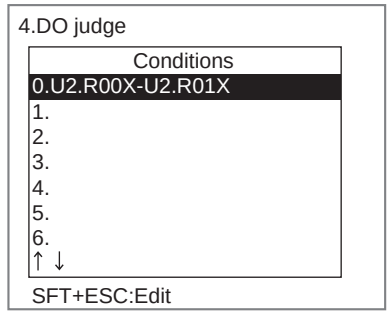


3. Select the output number to which the expression to be copied is set.
4. Select ***Execute***.

   The selected expression will be copied and the screen in (1.) will return.

Clearing Expressions

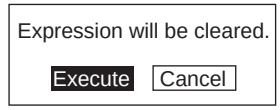
1. Use the **Up** and **Down** Keys in the screen in (7.) to select the output number of the expression to be cleared then press the **SHIFT + ESC** Keys.



The selections will be displayed.

2. Select ***Clear***.

   A confirmation message will be displayed.



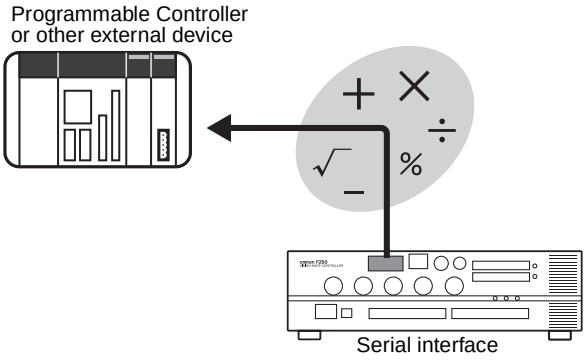
3. Select ***Execute***.

   The expression will be cleared and the screen in (1.) will return.

2-41 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.

Measurement values and calculations results can be output.

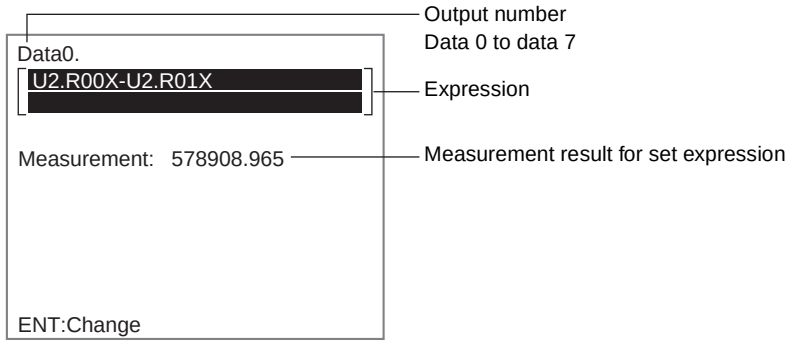


Data is output only when measurement is performed in Run Mode. Data will not be output if measurement is executed in Monitor Mode. The overall judgement for the set processing items will be output to the parallel interface OR signal, regardless of whether or not the Host Link Data processing item is set.

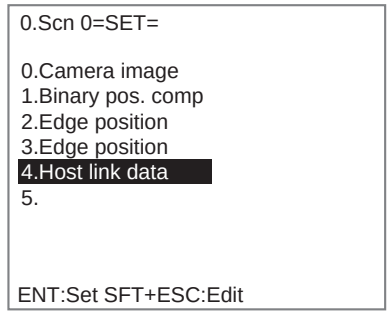
2-41-1 Setting Output Details

Use expressions to set the output data.

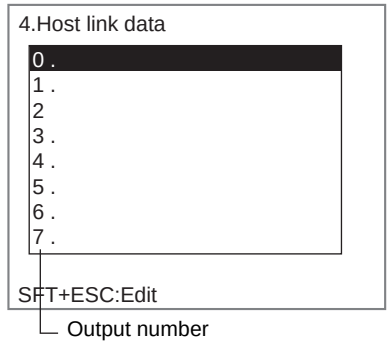
For each unit, 8 expressions (0 to 7) can be set.



1. Select ***Host link data***.

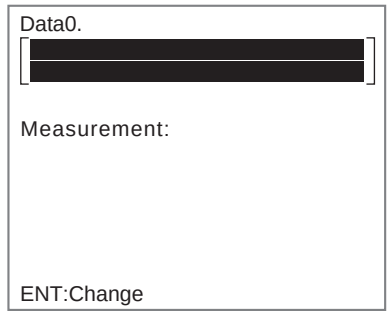


A list of set expressions will be displayed.

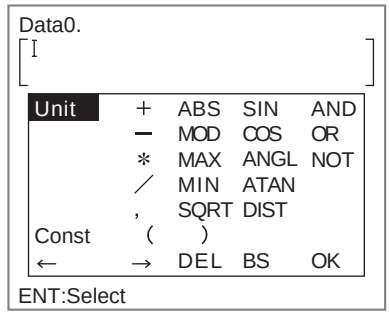


2. Select the output number to which the expression will be set.

The Expression Settings Screen will be displayed.



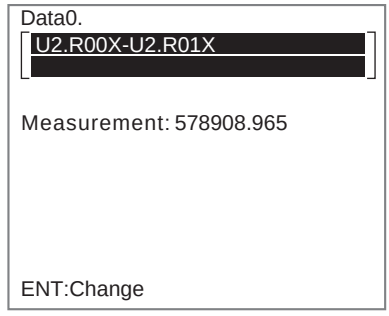
3. Move the cursor to the square brackets for *Data 0* and press the **ENT** Key.
   A list of expression items will be displayed.



4. Select the desired items and set the expression.

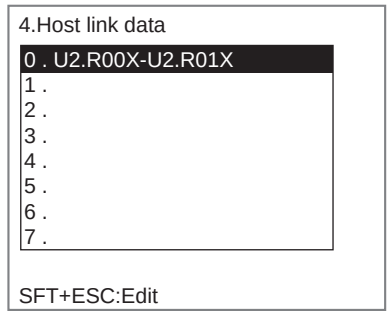
SeeAlso Refer to *2-29 Calculation.*

5. Once the expression has been set, select ***OK***.
   The settings will be saved and the screen in (2.) will return.



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 2 to 6 and set the expressions.
8. Once the expressions have been set, press the **ESC** Key.

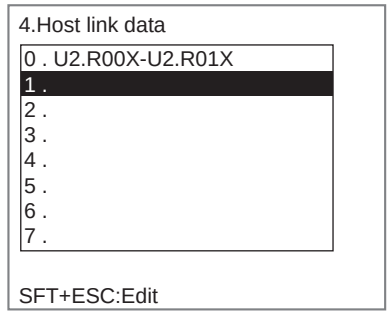
   The screen in (1.) will return.

Copying Expressions

The copy function is useful when using the expression again elsewhere or using the same expression with only one part changed.

If relative information is set for an expression, that information too will be copied.

1. Use the **Up** and **Down** Keys in the screen in (6.) to select the output number for the copy destination then press the **SHIFT + ESC** Keys.



The selections will be displayed.

2. Select ***Copy***.

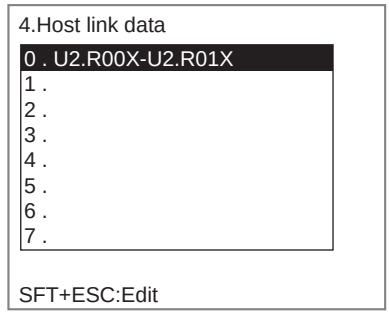
   The Original Region Screen will be displayed.

3. Select the output number to which the expression to be copied is set.
4. Select ***Execute***.

   The selected expression will be copied and the screen in (1.) will return.

Clearing Expressions

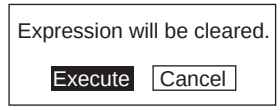
1. Use the **Up** and **Down** Keys in the screen in (6.) to select the output number of the expression to be cleared then press the **SHIFT + ESC** Keys.



The selections will be displayed.

2. Select ***Clear***.

   A confirmation message will be displayed.



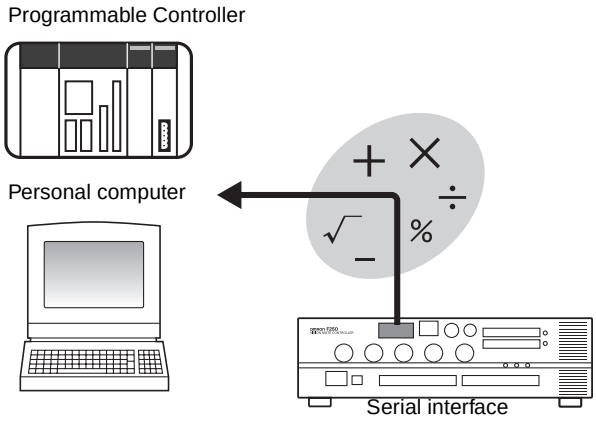
3. Select ***Execute***.

   The expression will be cleared and the screen in (1.) will return.

2-42 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.

2-42-1 Selecting Output Formats

Select the format for outputting data to a serial interface.

ASCII Format

The following items can be set.

Item	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*. 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*.
Minus	Select what sign will be displayed for negative values. Select either – * or 8.
Field separator	Select the separator between data fields. Select none, comma*, tab, space, or delimiter.
Record separator	Select the separator between data records. Select none, comma, tab, space, or delimiter*.
0 Suppress	Select how to adjust any empty digits to the left of output data. Select either ON or 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).

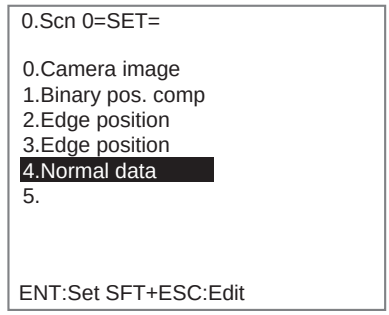
Note The asterisk (*) indicates the default setting.

Binary Format

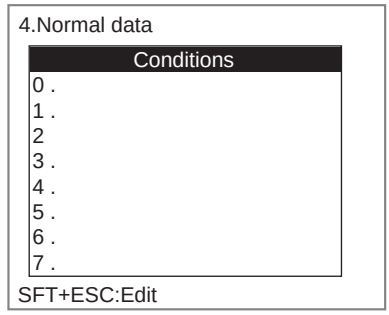
The measurement result multiplied by 1,000 is output as four consecutive bytes as one unit of data.

Item	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	

1. Select ***Normal data***.

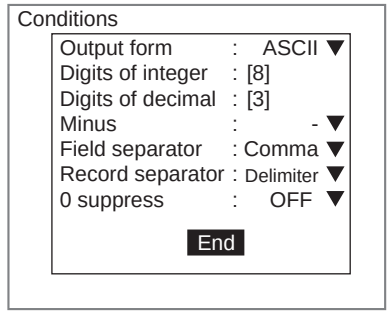


The list of set expressions will be displayed.



2. Select ***Conditions***.

The Conditions Settings Screen will be displayed.



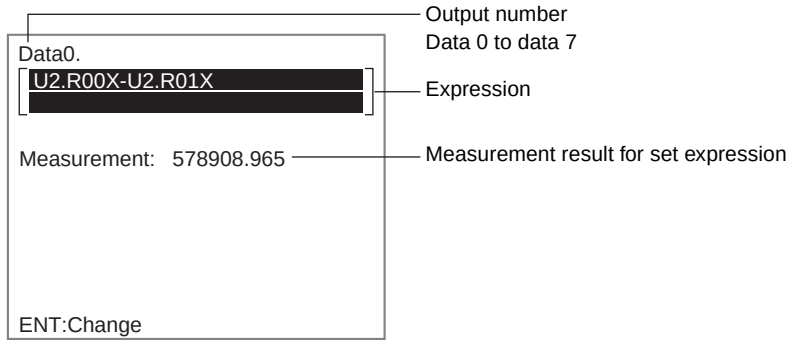
3. Change the settings for each item.
4. Select ***End***.

The settings will be registered and the screen in (1.) will return.

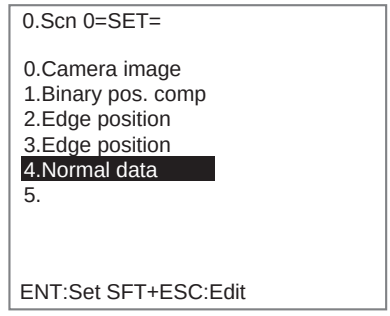
2-42-2 Setting Output Details

Use expressions to set the output data.

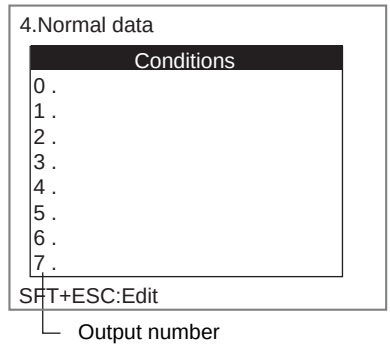
For each unit, 8 expressions (0 to 7) can be set.



1. Select ***Normal data***.

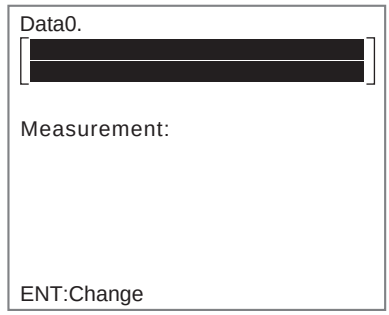


A list of the set expressions will be displayed.

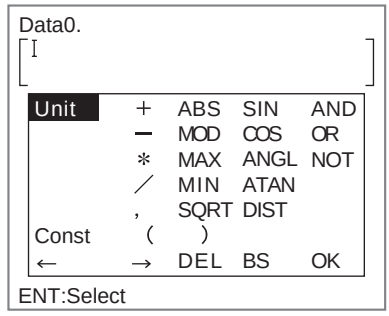


2. Select the output number to which the expression will be set.

The Expression Settings Screen will be displayed.



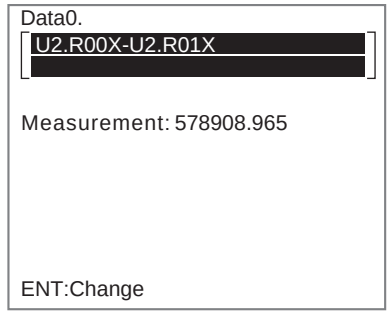
3. Move the cursor to the square brackets for *Data 0* and press the **ENT** Key.
   A list of expression items will be displayed.



4. Select the desired items and set the expression.

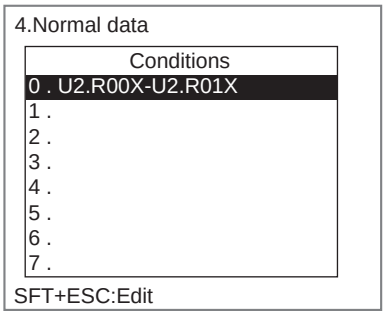
SeeAlso Refer to *2-29 Calculation.*

5. Once the expression has been set, select ***OK***.
   The settings will be saved and the screen in (2.) will return.



6. Press the **ESC** Key.

The Expression Settings Screen will return.



CHECK Press the **SHIFT+ESC** Keys in this screen to copy or clear the expression.

7. Repeat steps 2 to 6 and set the expressions.
8. Once the expressions have been set, press the **ESC** Key.

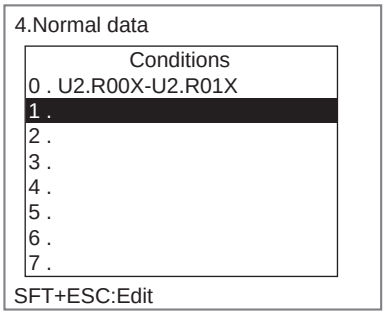
   The screen in (1.) will return.

Copying Expressions

The copy function is useful when using the expression again elsewhere or using the same expression with only one part changed.

If relative information is set for an expression, that information too will be copied.

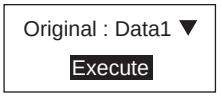
1. Use the **Up** and **Down** Keys in the screen in (6.) to select the output number for the copy destination then press the **SHIFT + ESC** Keys.



The selections will be displayed.

2. Select ***Copy***.

   The Original Region Screen will be displayed.

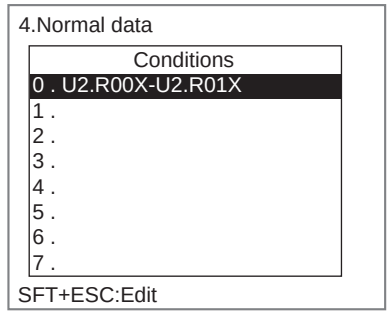


3. Select the output number to which the expression to be copied is set.
4. Select ***Execute***.

   The selected expression will be copied and the screen in (1.) will return.

Clearing Expressions

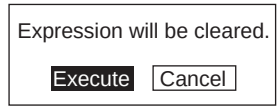
1. Use the **Up** and **Down** Keys in the screen in (6.) to select the output number of the expression to be cleared then press the **SHIFT + ESC** Keys.



The selections will be displayed.

2. Select ***Clear***.

A confirmation message will be displayed.



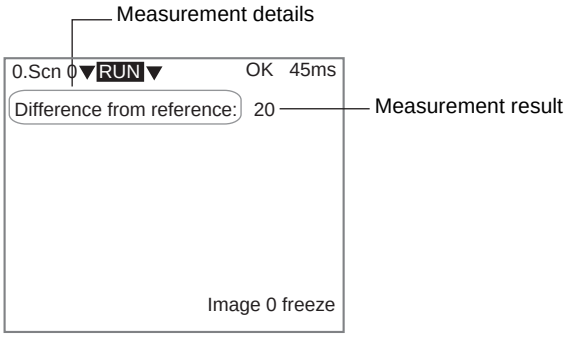
3. Select ***Execute***.

The expression will be cleared and the screen in (1.) will return.

2-43 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

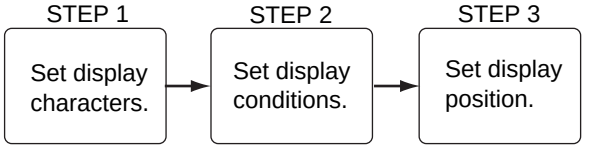


Use this processing item to display any alphanumeric characters in Run and Monitor Modes.

CHECK The data set here will be enabled when *None* or *Positions* is selected under *System/Display/Display settings/Display results*.

CHECK Even when the display image is set to be displayed as a reduced image, the characters will always be displayed in the specified position.

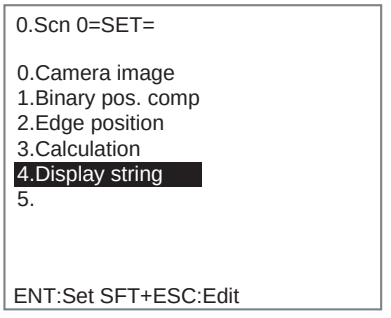
Operational Flow



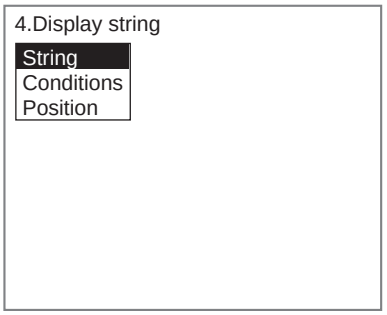
STEP 1: Setting Display Characters

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.

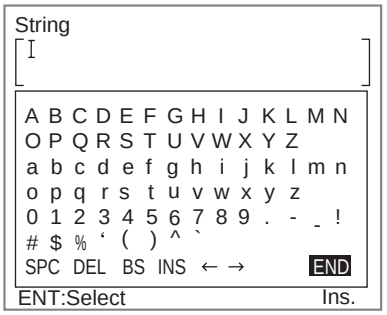
1. Select ***Display string***.



The setting selections will be displayed.



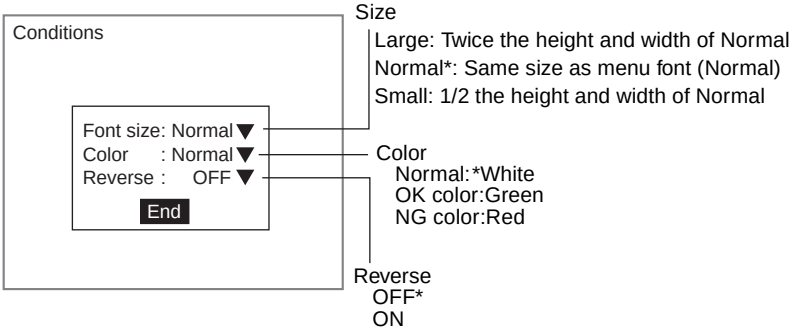
2. Select ***String***.
   The software keyboard screen will be displayed.



3. Select a character and press the **ENT** Key.
   The selected character will be set.
4. Repeat step 3 and set all characters to be displayed.
5. Once all characters have been selected, select ***END***.
   The settings will be registered and the screen in (1.) will return.

STEP 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.

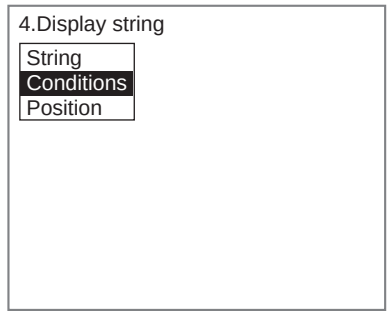


The asterisk (*) indicates the default setting.

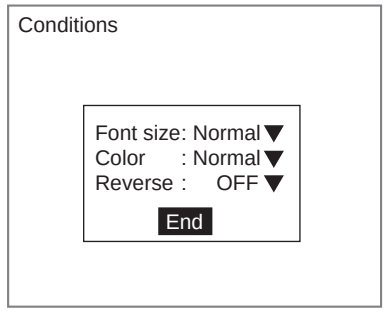
CHECK The font colors can be changed. Refer to *SECTION 5 System Settings*.

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 String has been executed as one of the branching control processing items.

1. Select ***Conditions***.



The Conditions Settings Screen will be displayed.



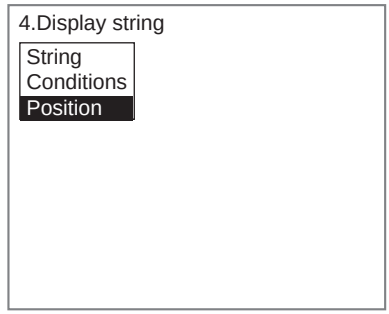
2. Make the settings for each item.
3. Select ***End***.
   The settings will be registered and the screen in (1.) will return.

STEP 3: Setting Display Position

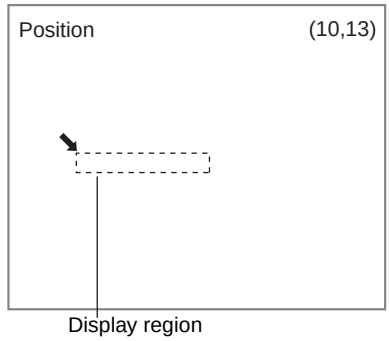
Set the position for character display. The size of the display region shown on the screen is the same as the actual size when the string is displayed. Use this as a reference for deciding positions.

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.

1. Select ***Position***.



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 to set the position.

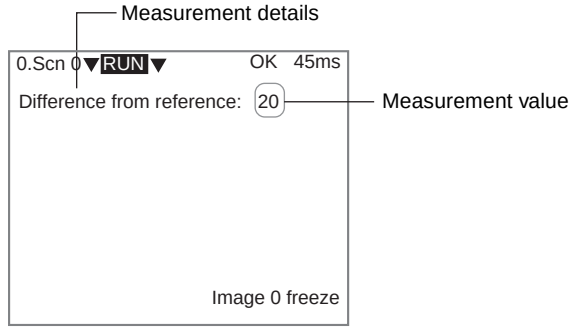
   The settings will be registered and the screen in (1.) will return.

2-44 Display Measurement

The Display Measurement processing item is used to display any measurement data on the screen 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

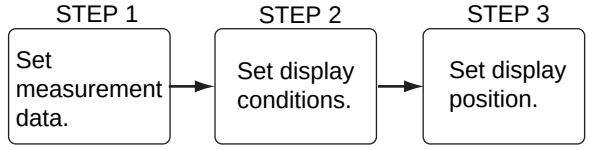


Use this processing item to display any measurement data on the screens in Run and Monitor Modes. The display is set using expression, so region measurements or calculations using measurement values can be displayed.

CHECK The data set here will be enabled when *None* or *Positions* are selected under *System/Display/Display settings/Display results*.

CHECK Even when the display image is set to be displayed as a reduced image, the characters will always be displayed in the specified position.

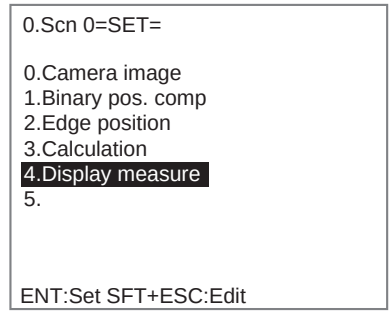
Operational Flow



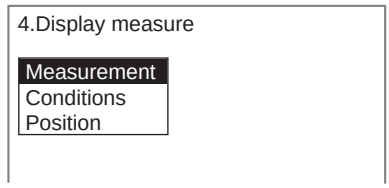
STEP 1: Setting Measurement Conditions

Use expressions to set the measurement data to be displayed.

1. Select ***Display measure***.

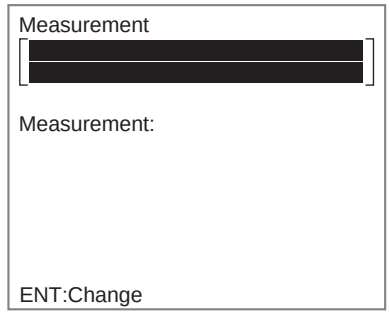


The setting selections will be displayed.



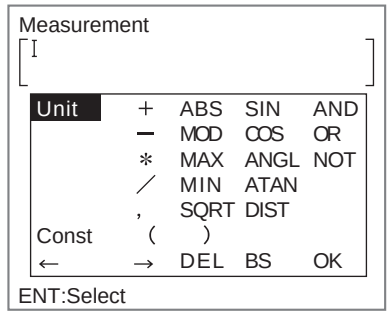
2. Select ***Measurement***.

   The Measurement Settings Screen will be displayed.



3. Move the cursor to the square brackets for the measurement data and press the **ENT** Key.

   A list of setting items will be displayed.

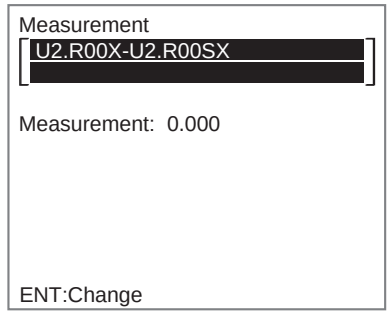


4. Select the items to be set and set the expressions.

SeeAlso Refer to *2-29 Calculation*.

5. Once the expression has been set, select ***OK***.

   The expression will be set and the screen in (2.) will return.

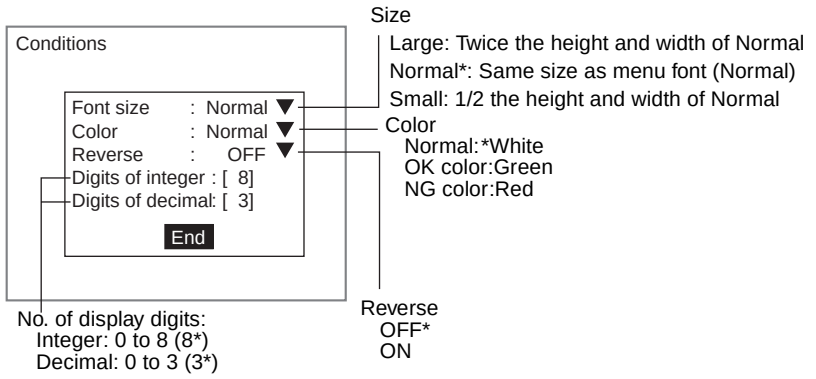


6. Press the **ESC** Key.

   The settings will be registered and the screen in (1.) will return.

STEP 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.

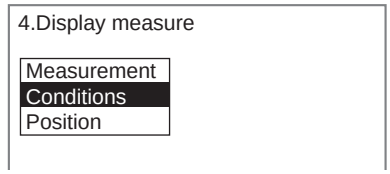


*The asterisk (*) indicates the default setting.

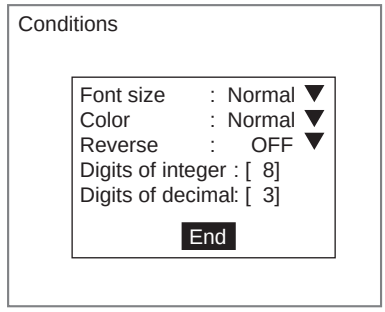
CHECK The font colors can be changed. Refer to *SECTION 5 System Settings*.

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.

1. Select ***Conditions***.



The Conditions Settings Screen will be displayed.



2. Make the settings for each item.
3. Select ***End***.

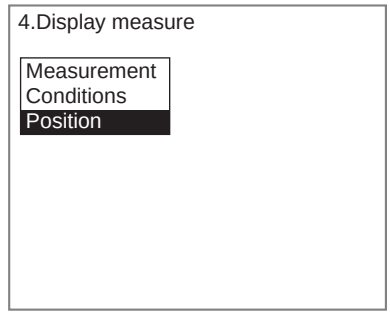
   The settings will be registered and the screen in (1.) will return.

STEP 3: Setting Display Position

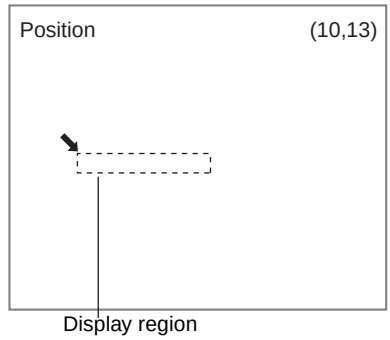
Set the position for character display. The size of the display region shown on the screen is the same as the actual size when the measurement is displayed. Use this as a reference for deciding positions.

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.

1. Select ***Position***.



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 to set the position.

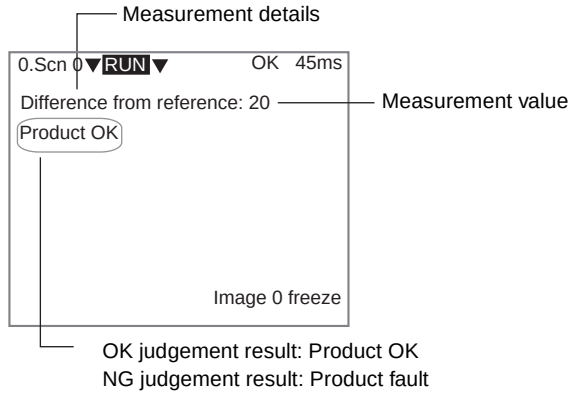
   The settings will be registered and the screen in (1.) will return.

2-45 Display Judgement

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 Characters in Combination with Display String and Display Measure.

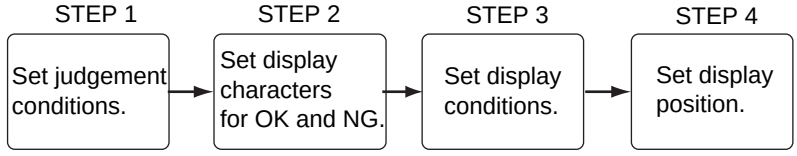


Use this processing item to display suitable characters in Run and Monitor Modes based on judgement results. Set the expressions as criteria and set the characters to be displayed for the different judgement results (OK, NG).

CHECK The data set here will be enabled when *None* or *Positions* is selected under *System/Display/Display settings/Display results*.

CHECK Even when the display image is set to be displayed as a reduced image, the characters will always be displayed in the specified position.

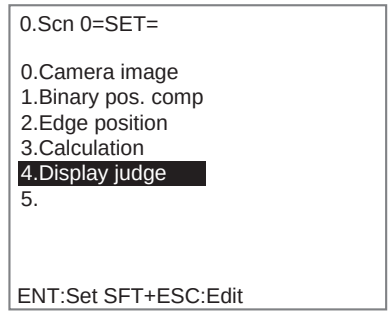
Operational Flow



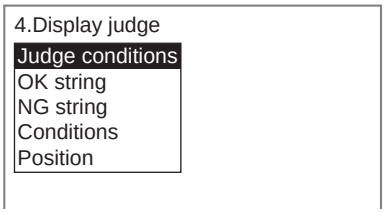
STEP 1: Setting Judgement Criteria

Use expressions to set the judgement criteria.

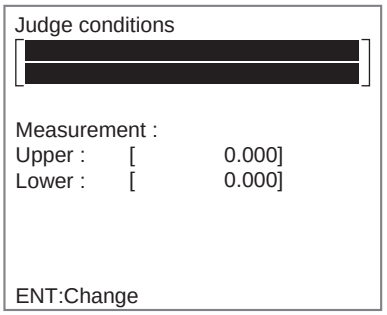
1. Select ***Display judge***.



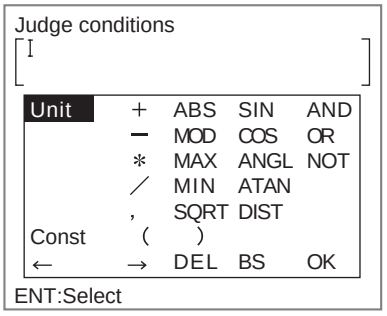
The setting selections will be displayed.



2. Select ***Judge conditions***.
   The Judge Conditions Settings Screen will be displayed.



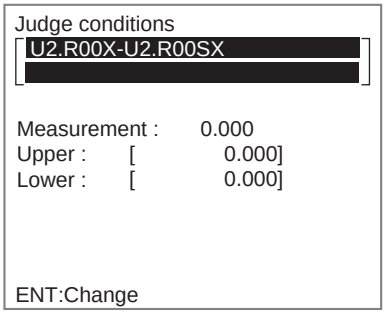
3. Move the cursor to the square brackets for the expression and press the **ENT** Key.
   A list of setting items will be displayed.



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

SeeAlso Refer to *2-29 Calculation.*

5. Once the expression has been set, select ***OK***.
   The expression will be set and the screen in (2.) will return.



6. Set the conditions for OK and NG judgements.

7. Press the **ESC** Key.

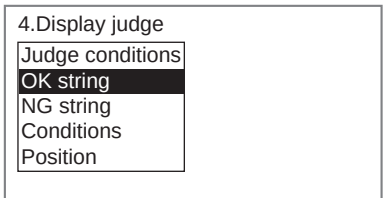
   The settings will be registered and the screen in (1.) will return.

STEP 2: Setting Display Characters for OK and NG Judgements

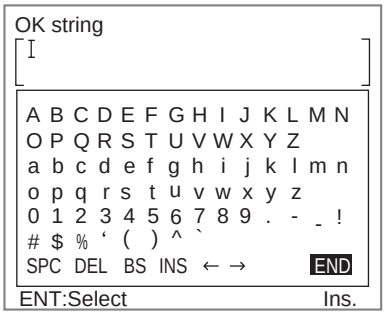
When the judgement result for the expression set in STEP 1: Setting Judgement Criteria is OK, set the characters to be displayed for a NG judgement. Up to 29 standard size alphanumeric characters can be set.

The characters can be selected from the list of characters on the displayed software keyboard.

1. Select either ***OK string*** or ***NG string***.



   The software keyboard screen will be displayed.



2. Select a character and press the **ENT** Key.

   The selected character will be set.

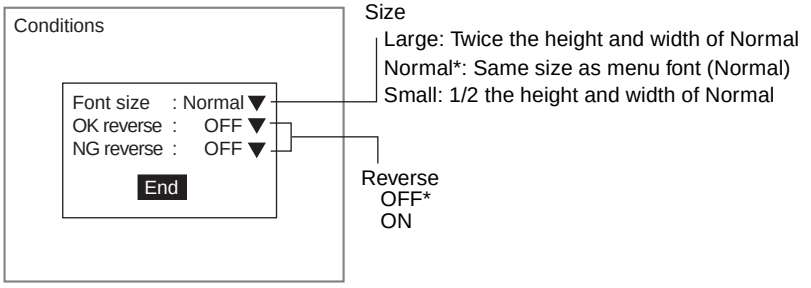
3. Repeat step 2 and set all characters to be displayed.

4. Once all characters have been selected, select ***END***.

   The settings will be registered and the screen in (1.) will return.

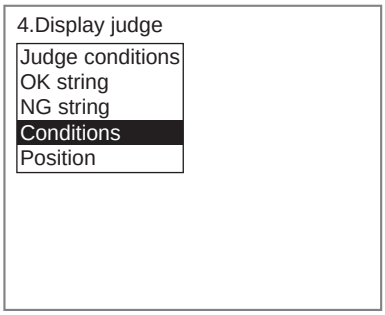
STEP 3: Setting Display Conditions

Set the conditions for display. The font cannot be specified. The display font will be the same as the menu font.

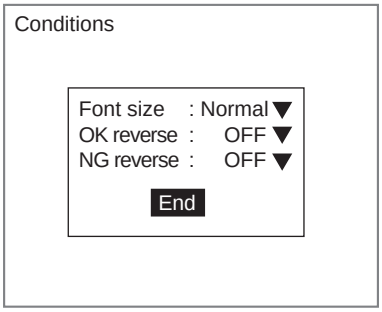


The asterisk (*) indicates the default setting.

1. Select ***Conditions***.



The Conditions Settings Screen will be displayed.



2. Make the settings for each item.
3. Select ***End***.

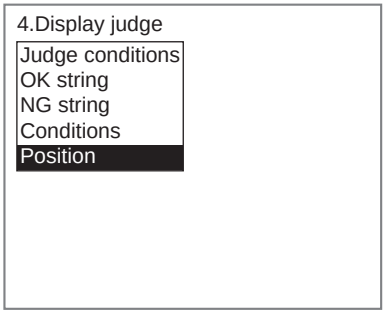
   The settings will be registered and the screen in (1.) will return.

STEP 4: Setting Display Position

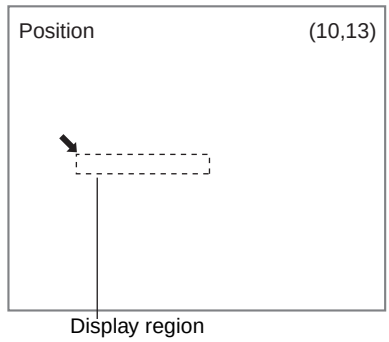
Set the position for character display. The size of the display region shown on the screen is the same as the actual size when the judgement is displayed. Use this as a reference for deciding positions.

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.

1. Select ***Position***.



The cursor for setting position and the display region will be displayed.



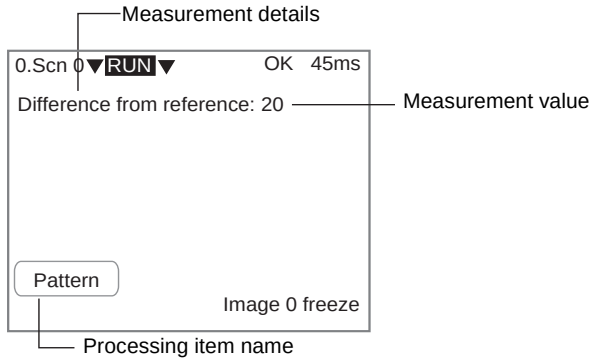
2. Use the **Up/Down** and **Right/Left** Keys to move the display region.
3. Press the **ENT** Key to set the position.
   The settings will be registered and the screen in (1.) will return.

2-46 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 comments are entered for the processing item, the comment will also be displayed.

Example: Displaying Names in Combination with Display String and Display Measure

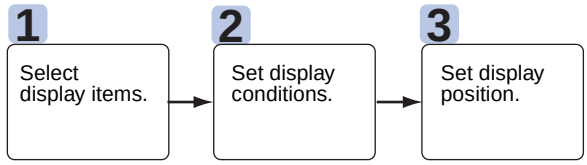


The name of one processing item set to the current scene is displayed on the screen in Run and Monitor Modes. If a comment is entered for the processing item, the comment will also be displayed.

CHECK The data set here will be enabled when *None* or *Positions* is selected under *System/Display/Display settings/Display results*.

CHECK Even when the display image is set to be displayed as a reduced image, the characters will always be displayed in the specified position.

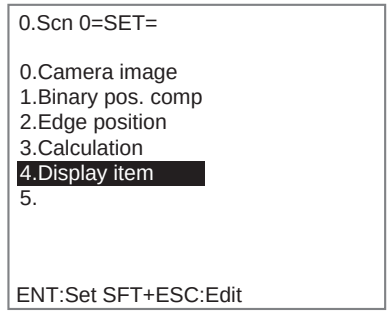
Operational Flow



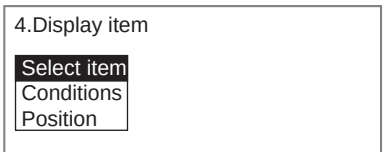
Selecting Display Items

Select the processing item names to be displayed.

1. Select ***Display item***.



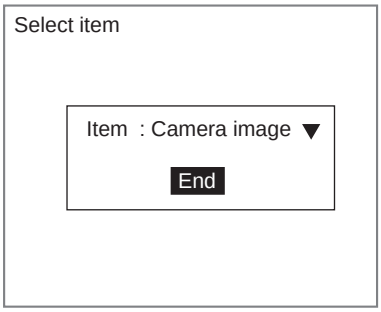
The selections will be displayed.



2. Select ***Select item***.

   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.

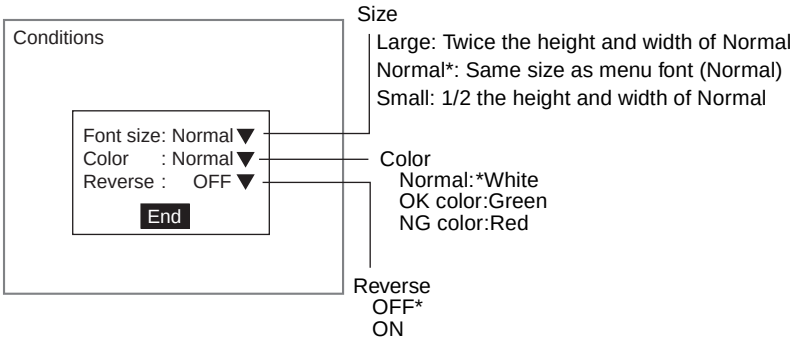


3. Select the processing item name and select ***End***.

   The settings will be registered and the screen in (1.) will return.

STEP 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.

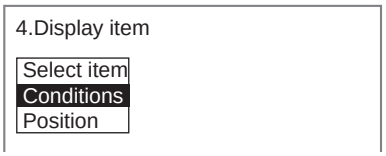


The asterisk (*) indicates the default setting.

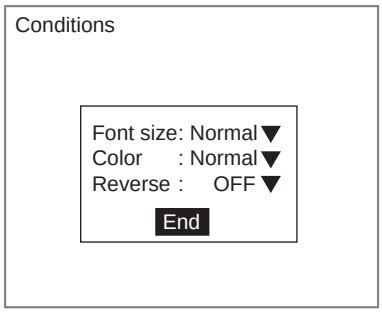
CHECK The font colors can be changed. Refer to *SECTION 5 System Settings*.

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.

1. Select ***Conditions***.



The Conditions Settings Screen will be displayed.



2. Make the settings for each item.
3. Select ***End***.

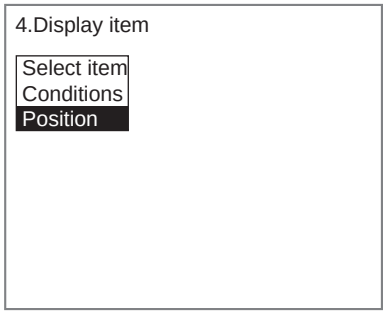
   The settings will be registered and the screen in (1.) will return.

STEP 3: Setting Display Position

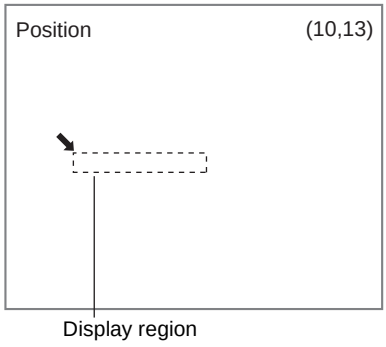
Set the position for character display. The size of the display region shown on the screen is the same as the actual size when the item is displayed. Use this as a reference for deciding positions.

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.

1. Select ***Position***.



The cursor for setting position and the display region will be displayed.



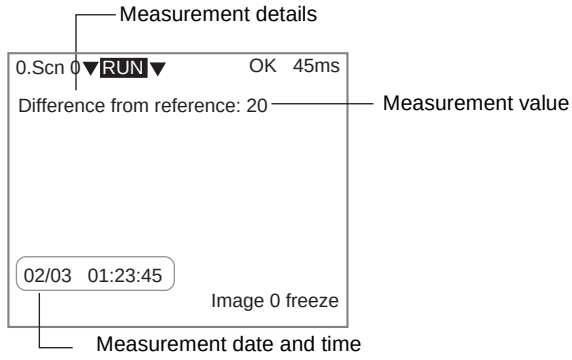
2. Use the **Up/Down** and **Right/Left** Keys to move the display region.
3. Press the **ENT** Key to set the position.

   The settings will be registered and the screen in (1.) will return.

2-47 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



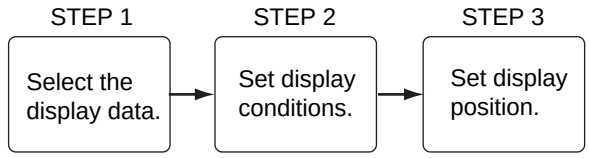
This processing item displays the date and time of the measurement on the screens in Run and Monitor Modes. The calendar in the Controller must be adjusted and set beforehand.

SeeAlso Refer to *SECTION 5 System Settings*.

CHECK The data set here will be enabled when *None* or *Positions* is selected under *System/Display/Display settings/Display results*.

CHECK 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



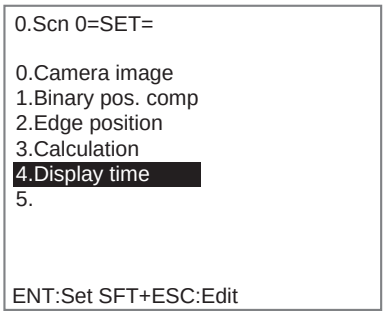
STEP 1: Selecting the Display Data

Select the format for the date and time display.

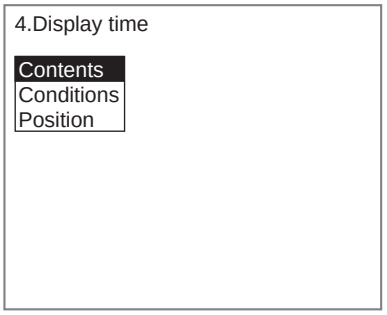
Format	Display
MM/DD hh:mm:ss*	10/01 01:23:45
MM/DD hh:mm	10/01 01:23
hh:mm:ss	01:23:45
hh:mm	01:23

*The asterisk (*) indicates the default setting.

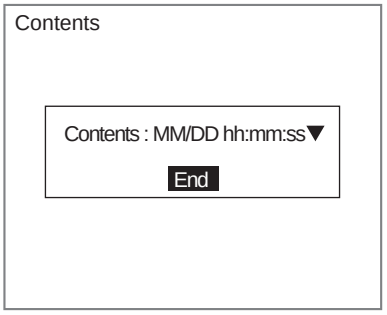
1. Select ***Display time***.



The setting selections will be displayed.



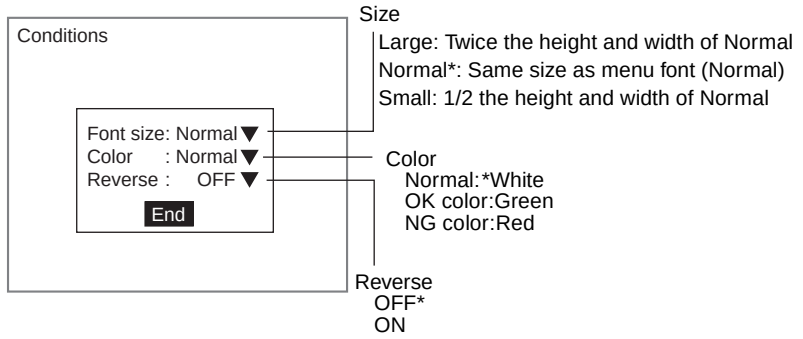
2. Select ***Contents***.
   The Contents Settings Screen will be displayed.



3. Select the display contents.
4. Select ***End***.
   The settings will be registered and the screen in (1.) will return.

STEP 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.

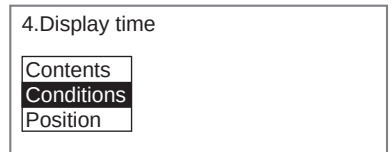


The asterisk (*) indicates the default setting.

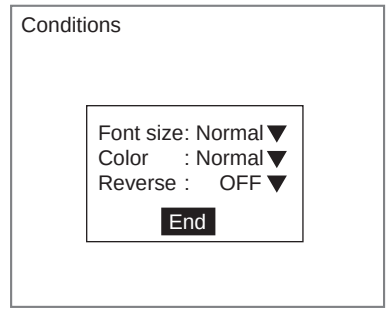
CHECK The font colors can be changed. Refer to *SECTION 5 System Settings*.

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.

1. Select ***Conditions***.



The Conditions Settings Screen will be displayed.



2. Make the settings for each item.
3. Select ***End***.

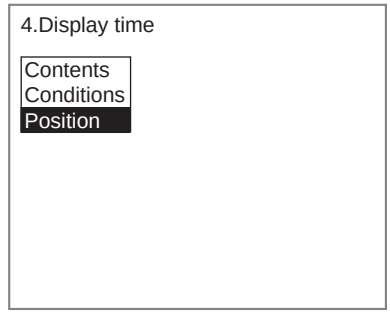
   The settings will be registered and the screen in (1.) will return.

STEP 3: Setting Display Position

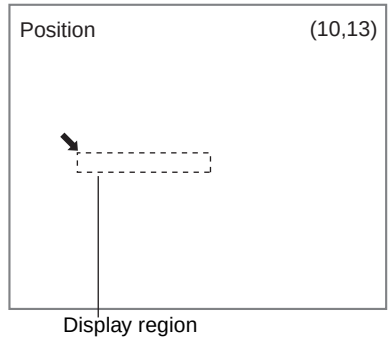
Set the position for character display. The size of the display region shown on the screen is the same as the actual size when the time is displayed. Use this as a reference for deciding positions.

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.

1. Select ***Position***.



The cursor for setting position and the display region will be displayed.



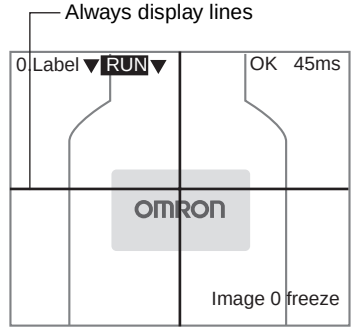
2. Use the **Up/Down** and **Right/Left** Keys to move the display region.
3. Press the **ENT** Key to set the position.

   The settings will be registered and the screen in (1.) will return.

2-48 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



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*.

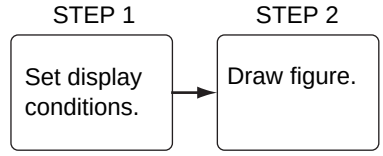
CHECK Even when the display image is set to be displayed as a reduced image, the reduced figure is displayed in the corresponding position.

CHECK 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.

CHECK Select *Display Line, Display Box, Display Circle*, or *Display Cursor* under displaying results to display figures using measurement results.

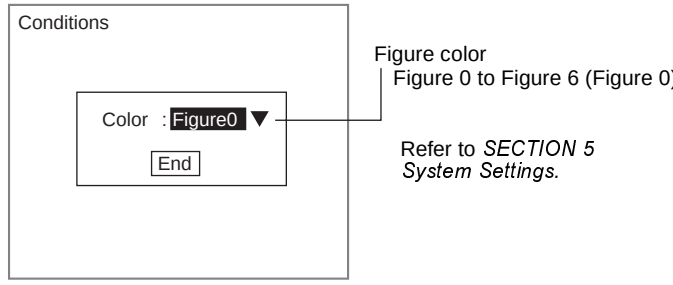
SeeAlso Refer to *2-49 Display Line, Display Box, Display Circle, and Display Cursor*.

Operational Flow

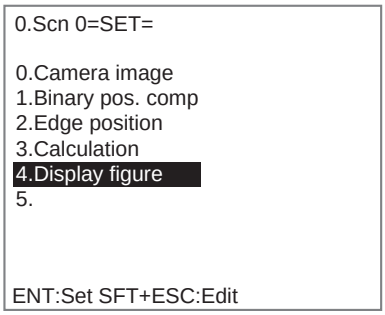


STEP 1: Setting Display Conditions

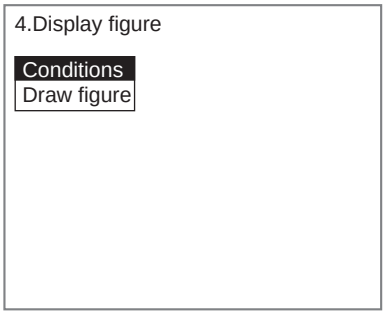
Set the conditions for display.



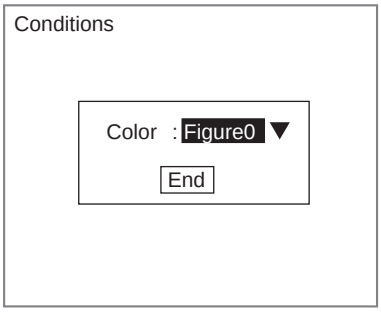
1. Select ***Display figure***.



The setting selections will be displayed.



2. Select ***Conditions***.
   The Conditions Settings Screen will be displayed.

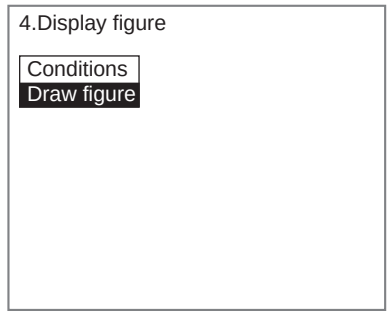


3. Make the settings for each item.
4. Select ***End***.
   The settings will be registered and the screen in (1.) will return.

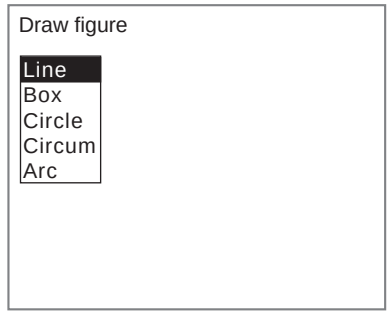
STEP 2: Drawing Figures

Select a line, box, circle, circumference, or arc.

1. Select ***Draw***.



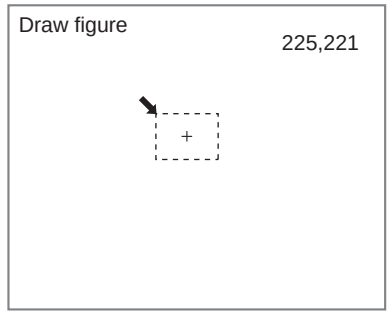
The setting selections will be displayed.



2. Select a figure.

   This explanation will use *Box* as an example.

   The Draw Screen will be displayed.



When ***Line*** has been selected, line options of ***Solid line*** and ***Dash line*** will be displayed. Choose one of these options.

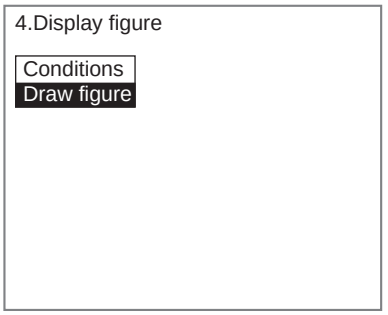
3. Draw the figure in the desired position.

   The setting will be registered and the screen in (1.) will return.

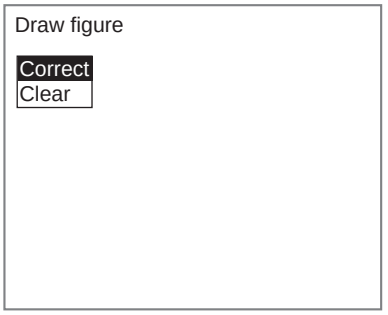
Correcting Figures

Select *Correct* to correct figures that have already been drawn.

1. Select ***Draw figure***.

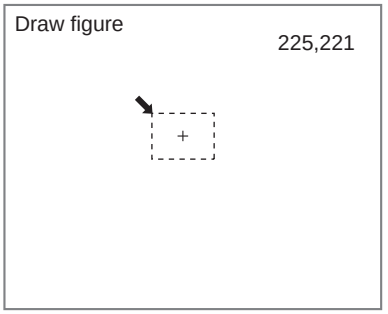


The *Correct* and *Clear* selections will be displayed.



2. Select ***Correct***.

   The Draw Figure Screen will be displayed.



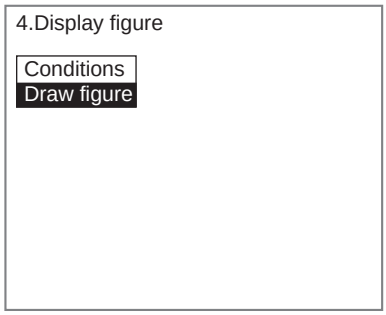
3. Draw the figure to be displayed.

   The setting will be registered, and the screen in (1.) will return.

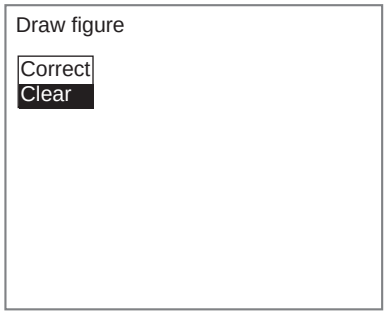
Clearing Figures

Select *Clear* to delete drawn figures.

1. Select ***Draw figure***.



The *Correct* and *Clear* selections will be displayed.



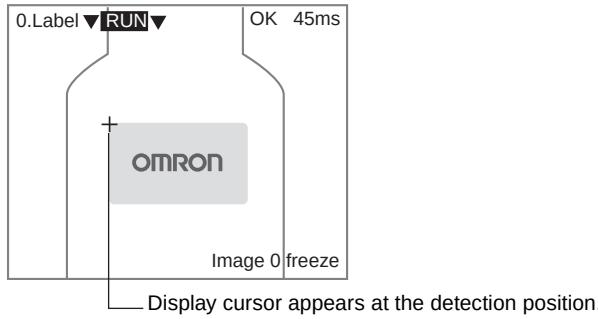
2. Select ***Clear***.

The figure will be cleared and the screen in (1.) will return.

2-49 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 Display Cursor at the Label Detection Position



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.

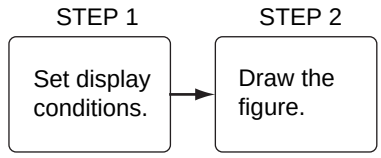
CHECK The data set here will be enabled when *None* or *Positions* is selected under *System/Display/Display settings/Display results*.

CHECK Even when the display image is set to be displayed as a reduced image, the reduced figure is displayed in the corresponding position.

CHECK Select *Results display/Display figure* to display figures in fixed positions.

SeeAlso Refer to *2-48 Display Figure.*

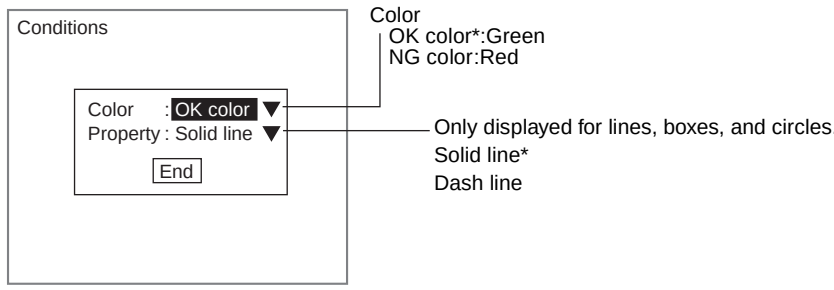
Operational Flow



The operational flow will be described here using *Display box* as an example. Make adjustments as necessary when other options are selected.

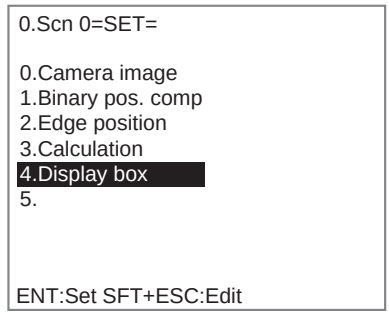
Setting Display Conditions

Set the conditions for display.

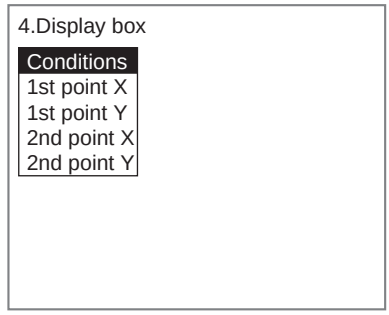


The asterisk (*) indicates the default setting.

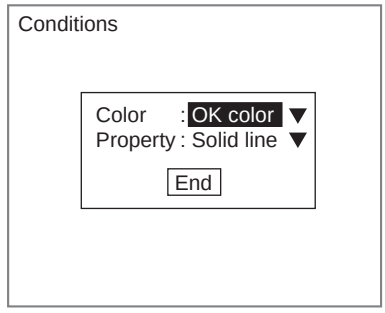
1. Select ***Display box***.



The setting selections will be displayed.



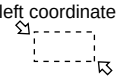
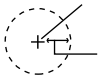
2. Select ***Conditions***.
   The screen for setting display conditions will be displayed.



3. Make the settings for each item.
4. Select ***End***.
   The settings will be registered and the screen in (1.) will return.

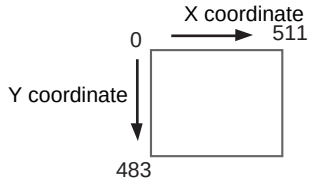
STEP 2: Drawing Figures

The coordinates for the figure are set using expressions.

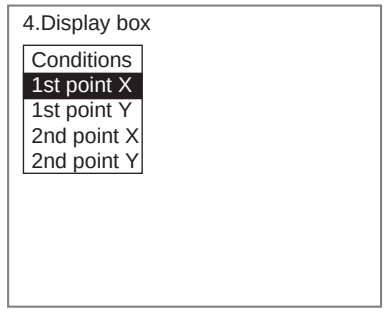
Display	Coordinate specification method
Box result	Upper left coordinate (1st point X, 1st point Y)  Lower right coordinate (2nd point X, 2nd point Y)
Circle result	Center coordinate (Center X, Center Y)  Radius
Line result	Start point (1st point X, 1st point Y)  End point (2nd point X, 2nd point Y)
Cursor result	X coordinate, Y coordinate 

Origin and Setting Range

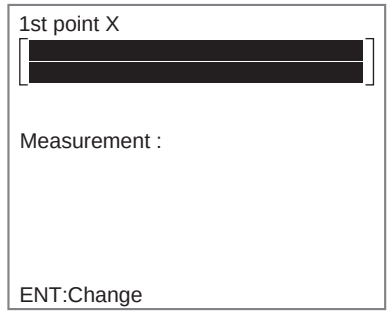
The defaults are shown below. (When calibration is set, the default will be the set coordinates for calibration.)



1. Select ***1st point X***.

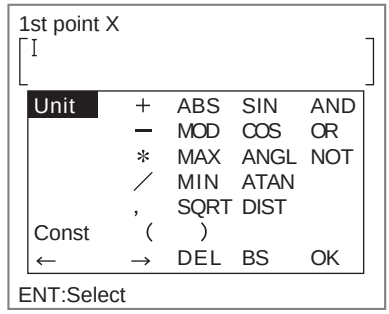


The 1st Point X Settings Screen will be displayed.



2. Place the cursor in the square brackets for 1st point X and press the **ENT** Key.

   The setting items will be displayed.

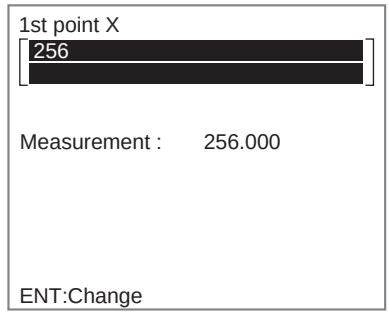


3. Select the item to be set and set the expression.

SeeAlso Refer to *2-29 Calculation*.

4. Once the expression has been set, select ***OK***.

   The expression will be registered and the screen in (1.) will return.



5. Press the **ESC** Key.

   The settings will be registered and the screen in (1.) will return.

   Repeat the above steps to set the 1st point Y, 2nd point X, and 2nd point Y.

SECTION 3
Monitor Mode and Run Mode

This section explains how to check if measurements are being correctly performed with the set measurement conditions using Monitor Mode, and how to make actual measurements using Run Mode.

3-1 Testing Measurements . . . . . 3-(2)
3-1-1 Entering Monitor Mode . . . . . 3-(2)
3-1-2 Test Measurement . . . . . 3-(3)
3-1-3 Changing Display Results . . . . . 3-(4)
3-2 Starting Measurement . . . . . 3-(5)
3-2-1 Entering Run Mode . . . . . 3-(5)
3-2-2 Performing Measurement . . . . . 3-(6)

3-1 Testing Measurements

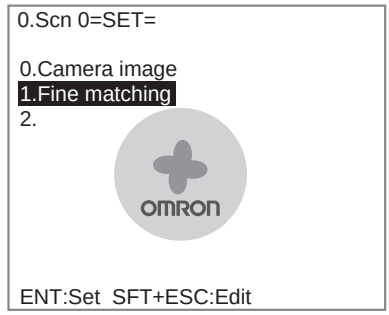
3-1-1 Entering Monitor Mode

Use the following procedure to check that measurements are being correctly performed with the set measurement conditions.

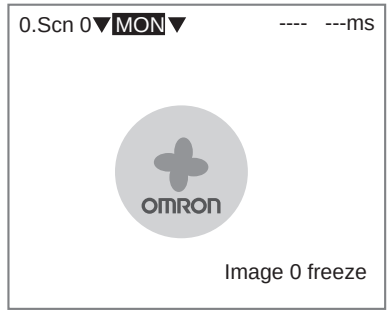
CHECK The key allocations for the Console Keys used to make input can be changed. In the following explanations, it is assumed that the key allocations are at the default settings. If they are not, adapt the procedure accordingly. Refer to *SECTION 5 System Settings*.

Entering Monitor Mode from Set Mode

1. Display the Set Mode Screen.

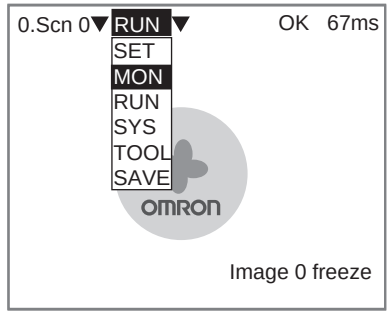


2. Press the **ESC** Key to leave Set Mode and enter Monitor Mode automatically.



Entering Monitor Mode from Run Mode

1. Move the cursor to ***RUN*** and press the **ENT** Key. The mode selections will be displayed.



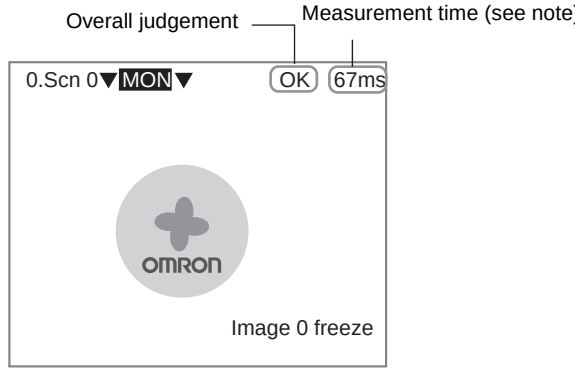
2. Select ***MON*** to enter Monitor Mode.

3-1-2 Test Measurement

Use the following procedure to execute measurements according to the conditions set for the scene currently displayed. The test is completed internally by the Controller and the measurement results are not output via serial or parallel interfaces. The measurement commands can be input, however, via serial or parallel interfaces.

SeeAlso Refer to *SECTION 6 Communicating with External Devices*.

1. Press the **TRIG** Key on the Console or input the measurement command from an external device.



Note Through display requires longer measurement time than freeze display.

- *Frame*: 16.7 ms max.
- *Field*: 8.3 ms max.

Measurement will be executed and the measurement results displayed on the screen.

CHECK When the image size is set to *All* and image input processing items such as *Camera image* and *Switch camera* are set to 2 or more units, use the Up and Down Keys to switch between input images.

CHECK Up to 35 measurement images can be saved. The oldest image will be overwritten first. Refer to*SECTION 5 System Settings*.

Measurement can be repeated for stored images. Display the desired stored image using the SHIFT+Up/Down Keys and press SHIFT+TRIG Keys to execute measurement. Measurement can also be repeated for freeze images without re-inputting the image using the SHIFT+TRIG Keys. This feature can be used after judgement conditions have been changed to check that the new conditions are appropriate.

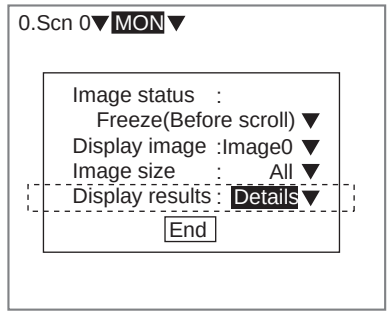
3-1-3 Changing Display Results

The information displayed on the screen can be changed. The judgement conditions can be changed while monitoring detailed measurement values.

This section gives an outline only. Refer to *SECTION 5 System Settings* for details.

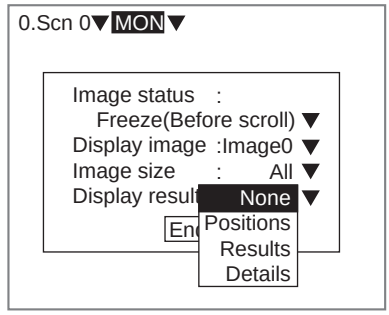
1. Press the **SHIFT+ESC** Keys.

   The display will change to the Measurement Screen settings.



2. Move the cursor to *Display results* and press the **ENT** Key.

   Change the settings as required.

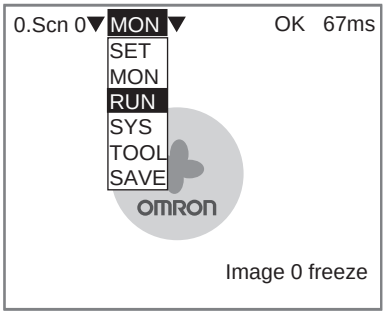


3-2 Starting Measurement

3-2-1 Entering Run Mode

CHECK The key allocations for the Console Keys can be changed from *MON* and *RUN* screens. In the following explanation, it is assumed that the key allocations are at the default settings. If they are not, adapt the procedure accordingly. Refer to *SECTION 5 System Settings*.

1. Move the cursor to ***MON*** and press the **ENT** Key.

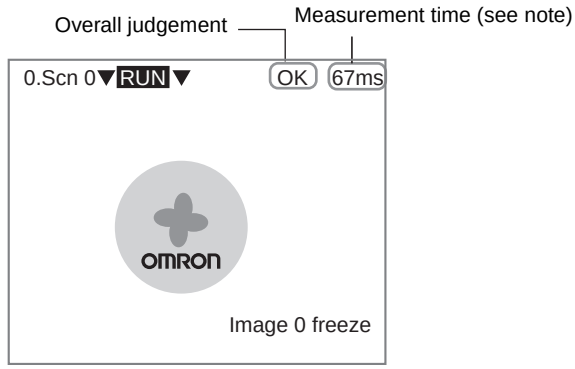


2. Select ***RUN***.
   Run Mode will be entered.

3-2-2 Performing Measurement

Use the following procedure to execute measurement according to the conditions set for the scene currently displayed. The measurement results will be output to external devices as well.

Press the **TRIG** Key on the Console or input the measurement command from an external device.



Note A through display requires longer measurement time than a freeze display.

- *Frame*: 16.7 ms max.
- *Field*: 8.3 ms max.

Measurement will be executed and the measurement results will be displayed on the screen.

CHECK The key operations are the same as for Monitor Mode.

SeeAlso Refer to *3-1-2 Test Measurement* for details.

CHECK The lighting will become progressively darker if used for long periods. Make periodic adjustments to the judgement conditions. When Intelligent Lighting is used, the lighting will lose approximately 20% illumination after 1,500 hours of use.

SECTION 4
Other Functions

This section describes additional functions such as changing the measurement setup or backing up data.

4-1 Changing Scenes and Scene Groups . . . . . 4-(2)
4-1-1 Setting Measurement Conditions for Different Models: Changing Scenes . . . . . 4-(3)
4-1-2 Copying Scene Data . . . . . 4-(5)
4-1-3 Initializing Measurement Conditions: Clearing Scenes . . . . . 4-(6)
4-1-4 Adding Comments to Scenes . . . . . 4-(7)
4-1-5 Using Scene Group Function . . . . . 4-(8)
4-2 Backing Up Data . . . . . 4-(9)
4-2-1 Backing Up to a Personal Computer . . . . . 4-(10)
4-2-2 Backing Up to Memory Cards . . . . . 4-(16)
4-2-3 Backing Up to Flash Memory . . . . . 4-(20)
4-2-4 Backing Up Flash Memory Data to a Memory Card . . . . . 4-(21)
4-3 Clearing Measurement Values . . . . . 4-(24)
4-4 Checking Image Density Distribution: Line Brightness . . . . . 4-(25)
4-5 Checking I/O Status with External Devices . . . . . 4-(28)
4-5-1 Serial Interface . . . . . 4-(28)
4-5-2 Parallel Interface . . . . . 4-(31)
4-6 Memory Card Operations . . . . . 4-(33)
4-6-1 Creating Directories . . . . . 4-(33)
4-6-2 Copying Files . . . . . 4-(36)
4-6-3 Checking File Properties . . . . . 4-(38)
4-6-4 Changing File Names . . . . . 4-(39)
4-6-5 Deleting Files and Directories . . . . . 4-(41)
4-6-6 Changing Drives . . . . . 4-(42)
4-6-7 Turning OFF the Power Supply to the Memory Card . . . . . 4-(43)

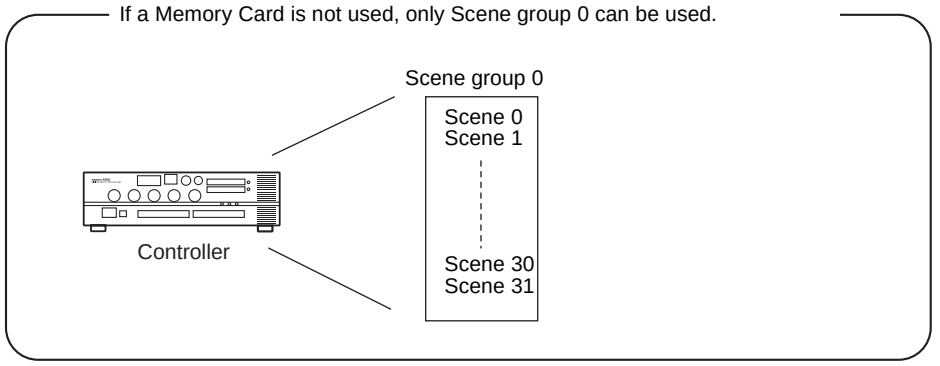
4-1 Changing Scenes and Scene Groups

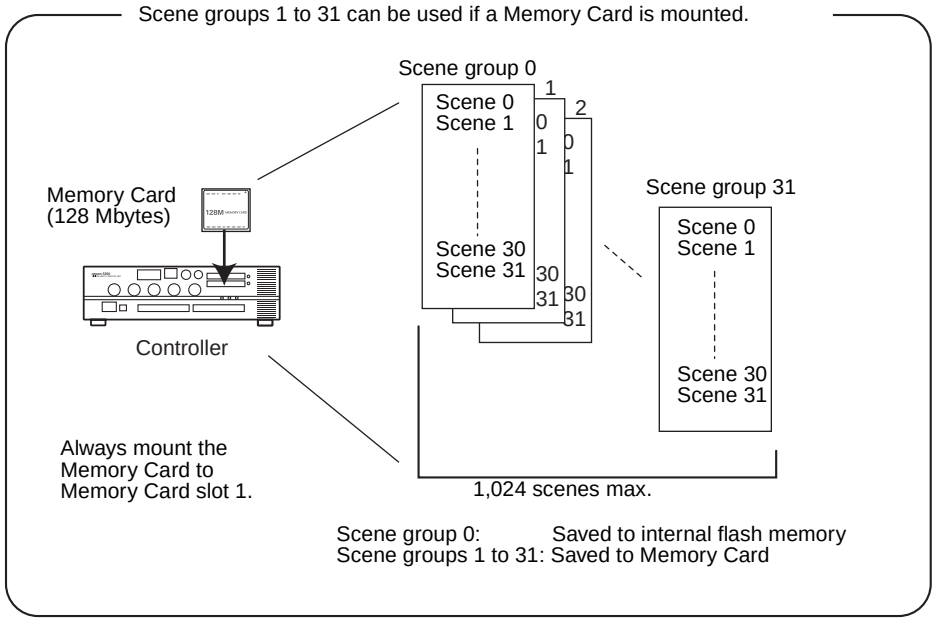
The different situations (types of measurement object and types of measurements required) in which measurements are performed are called “scenes” and the measurement conditions set in Set Mode are called “scene data.” The scene function can be used to set 32 types of measurement conditions. If detection conditions change, simply switch scenes to change to a different measurement setup.

The normal limit of 32 scenes may not be possible for some settings if there is insufficient memory. A message will appear on the screen if there is insufficient memory. Make the region smaller or delete unnecessary regions or models.

CHECK Up to 1,024 scenes can be stored if a 128-Mbyte Memory Card is inserted into Memory Card slot 1. Up to 32 scenes make up a scene group and up to 32 scene groups can be set, i.e., 32 scenes x 32 scene groups = 1,024.

Scene group 0 will be saved in the internal flash memory and scene groups 1 to 31 will be saved to the Memory Card.



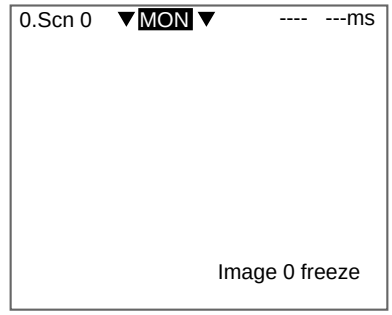


4-1-1 Setting Measurement Conditions for Different Models: Changing Scenes

Use the scene changing function to switch between different measurement conditions for different measurement setups or measurement objects. Scene 0 will be displayed by default when the power is turned ON, however, the Controller also accommodates scenes 1 to 31. If a Memory Card is inserted and the scene group function used, up to 1,024 scenes can be set.

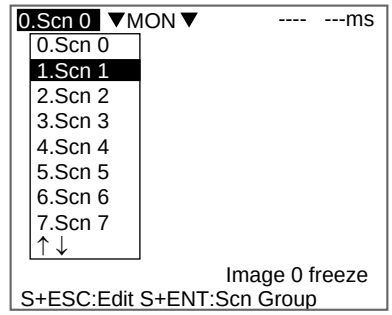
The command for changing scenes or scene groups can be input from an external device via a parallel or serial interface.

1. Display the Basic Screen for Monitor Mode or Run Mode.



2. Move the cursor to ***Scn*** and press the **ENT** Key.

   The Scn 0 to Scn 7 options will be displayed.
   Use the **Down** Key to display scene numbers 8 to 31.



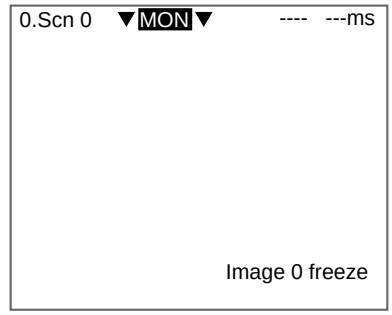
3. Move the cursor to the scene number to be switched to and press the **ENT** Key.

   The selected scene will be displayed.

Using Scene Group Function

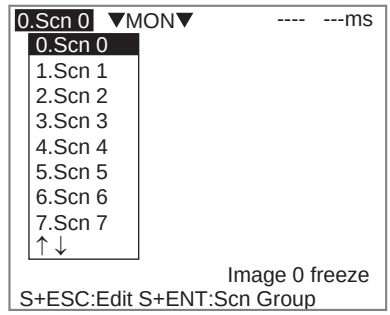
CHECK Always mount the Memory Card for storing scene group data into slot 1. If scene groups 1 to 31 are switched to, a directory called DEFSCNGR will be automatically created in the root directory of the Memory Card. The scene group data will be stored in that directory in files called *SGR_00**.SGR* (where ** is the scene group number).

1. Insert a Memory Card.



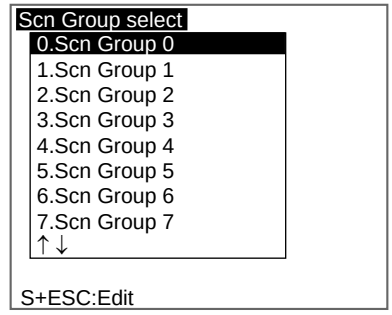
2. Display the Basic Screen for Monitor Mode or Run Mode.
3. Move the cursor to ***Scn*** and press the **ENT** Key.

   The Scn 0 to Scn 7 options will be displayed.



4. Press the **SHIFT+ENT** Keys.

   The Scene Group 0 to Scene Group 7 options will be displayed. Use the **Down** Key to display scene group numbers 8 to 31.



5. Move the cursor to the scene group number to be switched to and press the **ENT** Key.

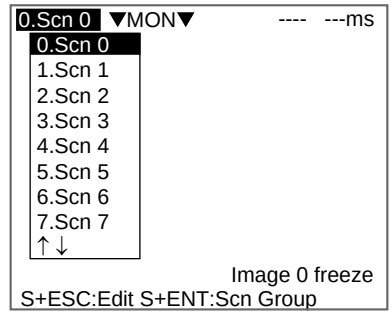
   The selected scene group will be displayed.

4-1-2 Copying Scene Data

This function is useful for creating new scenes by copying scene data from another scene and changing some settings to suit the new requirements.

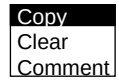
CHECK Scene data can be copied only within the same scene group. To copy data between scene groups, copy the whole scene group. Refer to *4-1-5 Using Scene Group Function*.

1. Move the cursor to ***Scn*** and press the **ENT** Key.



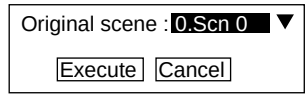
2. Move the cursor to the scene number where the copy is to be placed.
3. Press the **SHIFT**+**ESC** Keys.

   The Copy/Clear/Comment Menu will be displayed.



4. Select ***Copy***.

   The screen for copying will be displayed.



5. Enter the number of the scene to be copied (Original scene), and select ***Execute***.

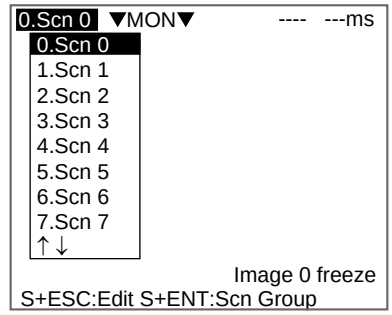
   The data will be copied.

4-1-3 Initializing Measurement Conditions: Clearing Scenes

Use the following procedure to clear measurement conditions set in Set Mode, and to return scenes to their default settings. This section explains the procedure performed separately for each scene.

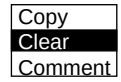
SeeAlso Refer to *4-1-5 Using Scene Group Function* for information on initializing whole scene groups.

1. Move the cursor to ***Scn*** and press the **ENT** Key.



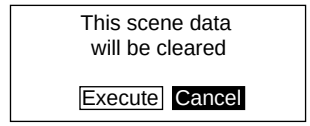
2. Move the cursor to the number of the scene to be cleared.
3. Press the **SHIFT**+**ESC** Keys.

   The Copy/Clear/Comment Menu will be displayed.



4. Select ***Clear***.

   A confirmation message will be displayed.



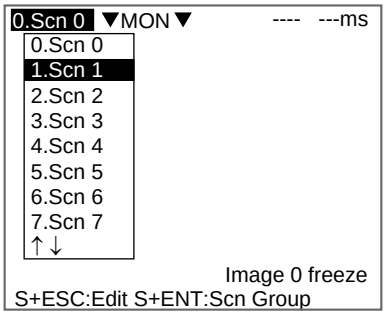
5. Select ***Execute***.

   The scene will be cleared.

4-1-4 Adding Comments to Scenes

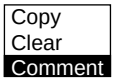
Any comment can be added to each scene. This is useful for understanding settings when many regions have been registered.

1. Move the cursor to ***Scn*** and press the **ENT** Key.



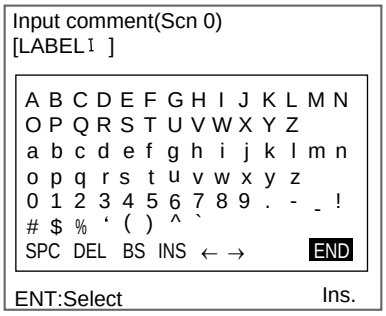
2. Move the cursor to the number of the scene for the name change.
3. Press the **SHIFT**+**ESC** Keys.

   The Copy/Clear/Comment Menu will be displayed.



4. Select ***Comment***.

   A software keyboard will be displayed.



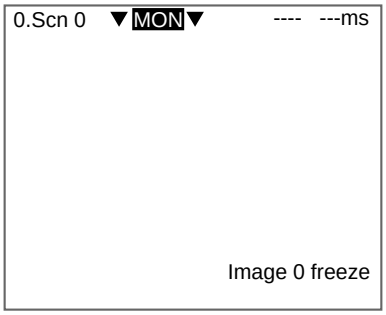
5. Set up to 8 characters.
6. Move the cursor to ***END*** and press the **ENT** Key.

   The scene name will be changed.

4-1-5 Using Scene Group Function

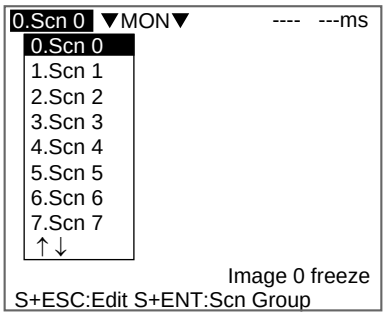
Use the scene group function to copy and clear whole scene groups and change the scene group name to any 11 standard characters.

1. Insert a Memory Card.



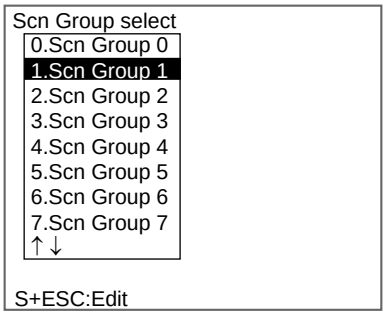
2. Display the Basic Screen for Monitor Mode or Run Mode.
3. Move the cursor to ***Scn*** and press the **ENT** Key.

   The Scene 0 to Scene 7 options will be displayed.



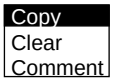
4. Press the **SHIFT+ENT** Keys.

   The Scene Group 0 to Scene Group 7 options will be displayed.



5. Move the cursor to the desired scene group number.
6. Press the **SHIFT** + **ENT** Keys.

   The Copy/Clear/Comment Menu will be displayed.



   The rest of the operations are the same as when using the scene function.

4-2 Backing Up Data

This section explains how to make backup copies of data to flash memory or a computer.

When the power to the Controller is turned OFF, all data settings are cleared. The Controller loads data saved to flash memory at startup. Therefore, when settings are changed, in order not to lose these settings, be sure to save them to flash memory.

The 5 types of system and scene data listed below can be backed up on a computer or Memory Card. This function is convenient for using the same settings on another Controller.

It is recommended that data is backed up in case data is lost or the Controller malfunctions.

Data	Contents
System data	Settings under *SYS* are backed up to a computer or Memory Card.
Scene group data	Scene data (scenes 0 to 31) for specified scene group are backed up to a computer or Memory Card.
Scene data	Settings under *SET* are backed up to a computer or Memory Card.
System data and scene group data	Both the system data and scene group data (for the scene group currently displayed) are backed up together to a computer or Memory Card.
Image data	Saved measurement images in BMP format are backed up to a computer or Memory Card. This is the basic image format for Windows and so the images can be displayed on a personal computer.

CHECK When backing up images saved when *Frame* was selected for the Frame/Field mode, save those images while displaying frame images.

When backing up images saved when *Field* was selected for the Frame/Field mode, save those images while displaying field images.

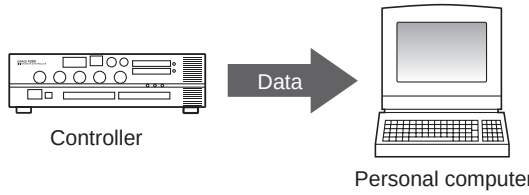
Precaution Do not turn OFF the power or input a RESET signal while a message is being displayed in any save or load operation. Data in memory will be destroyed, and the Controller may not operate correctly the next time it is started.

4-2-1 Backing Up to a Personal Computer

This section describes the procedure for data transfer using Hyper Terminal, which is standard software in Windows.

If other communications software is being used, refer to the relevant manual. Data communications are performed in XMODEM (-CRC or -SUM) or ZMODEM protocols. XMODEM (-1K) is not supported.

Saving Data to the Computer



1. Connect the personal computer and the Controller.
2. Make the Controller communications settings (serial).

   The default communications settings are as shown in the following table. These settings can normally be used.

Item	Setting
Interface	RS-232C
Baud rate	38,400 (bps)
Data length	8 (bits)
Parity bits	None
Stop bits	1 (bit)
Protocol	XMODEM (See note.)

   Note XMODEM and ZMODEM transfer protocols are available. Use the protocol that matches the personal computer settings.

3. Start the Hyper Terminal program on the computer and make the following communications settings. The same communications settings must be used on both the Controller and the modem on the computer.

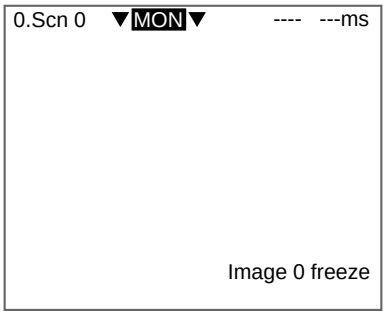
For RS-232C and RS-422 Connections

Item	Setting
Connection method	COM* (*: COM number to which the cable is connected)
Baud rate	38,400 (bps)
Data length	8 (bits)
Parity bits	None
Stop bits	1 (bit)
Flow control	None

For Ethernet Connections

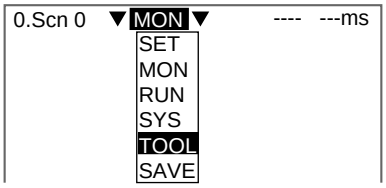
Item	Setting
Connection method	TCP/IP (Winsock)
Host address	IP address of Controller
Port number	23 (TELNET)

4. Once the communications settings have been made on the computer, display the Basic Screen for Monitor Mode or Run Mode.



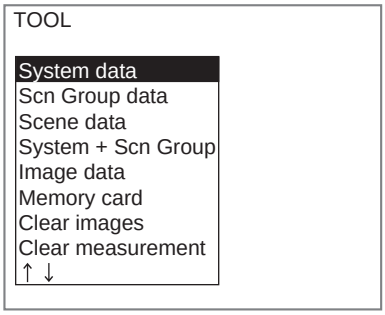
5. Move the cursor to ***MON*** (or ***RUN***) and press the **ENT** Key.

   The mode selections will be displayed.



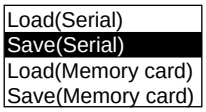
6. Select ***TOOL***.

   The data selections will be displayed.



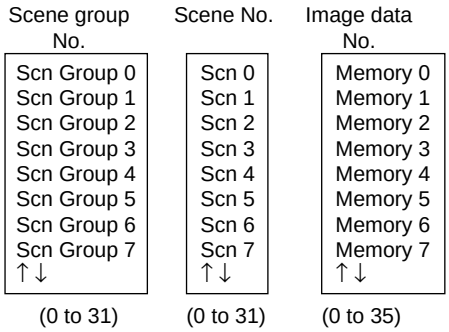
7. Select the data to be saved.

   The destination selections for load and save will be displayed.



8. Select ***Save (Serial)***.

9. Select the desired number for scene group, scene, or image data.

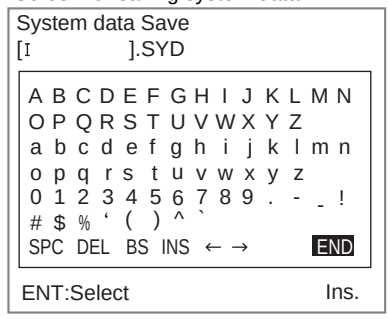


CHECK When backing up system and scene group data, the currently displayed scene group will be saved.

When Communicating with ZMODEM Protocol, set a data file name of up to 8 characters.

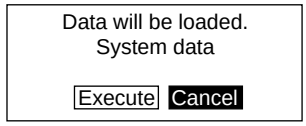
Example

Screen for saving system data

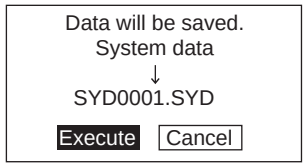


A confirmation message will be displayed.

For XMODEM communications

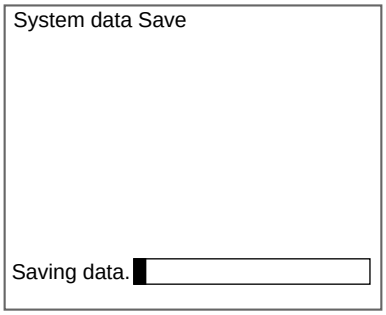


For ZMODEM communications



10. Select ***Execute***.

    A screen showing the transfer progress will be displayed.



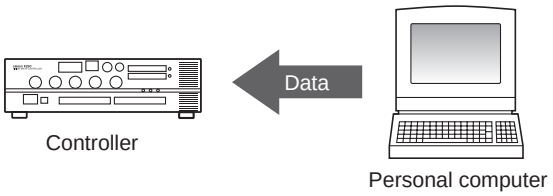
11. Select ***Transfer/Receive File*** from the Hyper Terminal menu on the computer.
12. Specify where the file is to be saved.
13. Set the protocol to ***Xmodem*** or ***Zmodem***.
14. Select ***Receive***.

    When *XModem* is selected, enter the file name.

    The data will be transferred from the Controller to the computer.

    When the transfer has been completed, the screen in (7.) will return.

Loading Data from the Computer



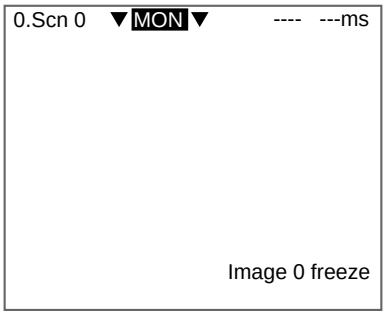
1. Follow steps 1 to 3 in the above procedure to connect the Controller and the computer.

SeeAlso Refer to *4-2-1 Backing Up to a Personal Computer*.

2. Select ***Transfer/Send File*** from the Hyper Terminal menu.
3. Select the file to be sent.
4. Set the protocol to ***Xmodem*** or ***Zmodem***.
5. Select ***Send***.

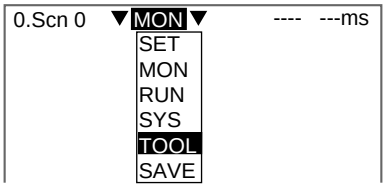
   The data transfer screen will be displayed.

6. Once the preparations have been completed on the computer, display the Basic Screen for Monitor Mode or Run Mode.



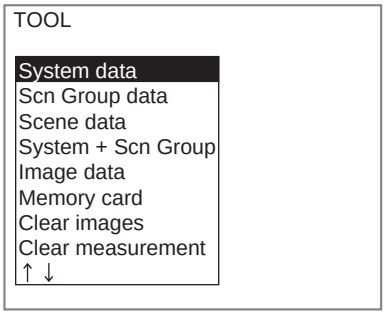
7. Move the cursor to ***MON*** (or ***RUN***) and press the **ENT** Key.

   The mode selections will be displayed.



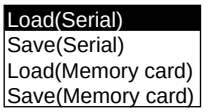
8. Select ***TOOL***.

   The data selections will be displayed.



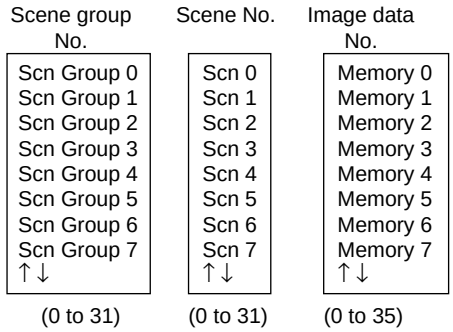
9. Select the data to be loaded.

   The destination selections for load and save will be displayed.



10. Select ***Load (Serial)***.

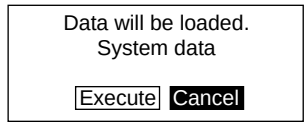
11. Select the desired number for scene group, scene, or image data.



CHECK When backing up system and scene group data, the currently displayed scene group will be loaded.

A confirmation message will be displayed.

Example: Screen when loading system data.



12. Select ***Execute***.

The data will be transferred from the computer to the Controller.

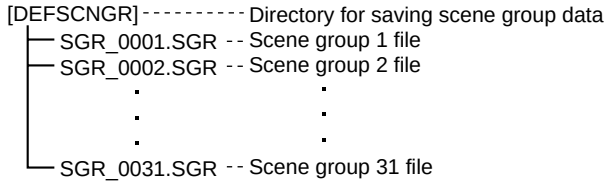
When loading has been completed, the screen in (9.) will return.

4-2-2 Backing Up to Memory Cards

This section describes inserting a Memory Card and backing up settings data to the Memory Card.

CHECK Data can be backed up to Memory Cards inserted for scene group data.

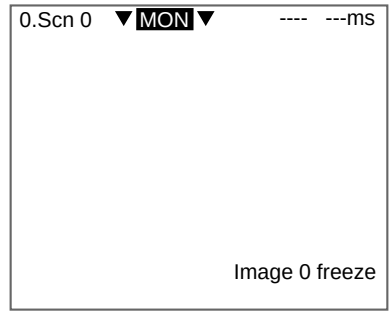
Data for scene groups 1 to 31 will be saved in the files listed below. Do not overwrite these files.



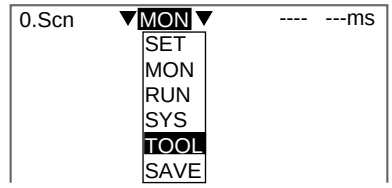
Precaution Turn OFF the power supply to the Memory Card before removing the Memory Card. Refer to *4-6-7 Turning OFF the Power Supply to the Memory Card*.

Saving from the Controller to the Memory Card

1. Insert the Memory Card.

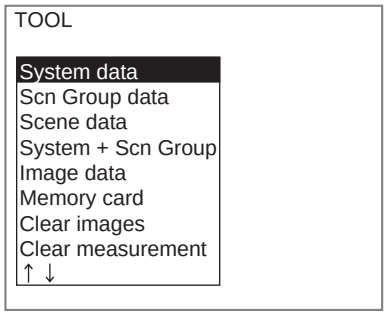


2. Display the Basic Screen for Monitor Mode or Run Mode.
3. Move the cursor to ***MON*** (or ***RUN***) and press the **ENT** Key.
   The mode selections will be displayed.



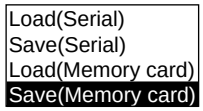
4. Select ***TOOL***.

The data selections will be displayed.

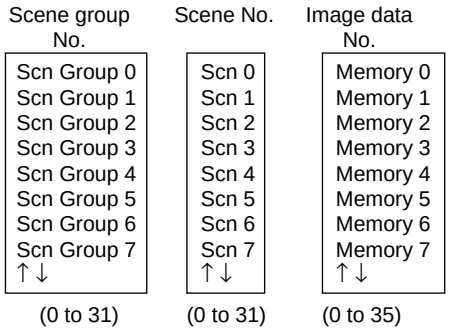


5. Select the data to be saved.

   The destination selections for load and save will be displayed.

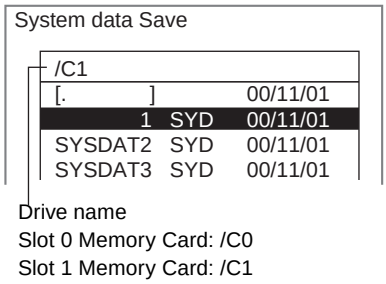


6. Select ***Save (Memory card)***.
7. Select the desired number for scene group, scene, or image data.



CHECK When backing up system and scene group data, the currently displayed scene group will be saved.

A list of files in the Memory Card root directory will be displayed.



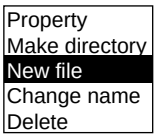
SeeAlso Refer to *4-6-6 Changing Drives* for information on how to change drives.

CHECK To overwrite existing files, select the file by pressing the ENT Key and then go to step 12.

To specify a new file name, perform steps 8 to 11.

8. Press the **SHIFT+ESC** Keys.

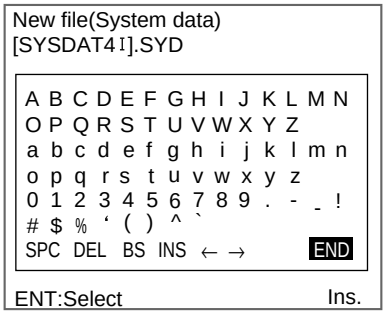
The edit menu will be displayed.



9. Select ***New file***.

CHECK If *Make directory* is selected, the screen for creating new directories will be displayed. Files can be saved in the newly created directory.

The software keyboard will be displayed.



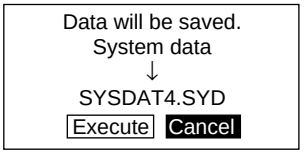
10. Set the file name with up to 8 characters.

CHECK Periods (.) cannot be used in file names.

11. Move the cursor to ***END*** and press the **ENT** Key.

A confirmation message will be displayed.

Example:
Confirmation message when saving system data



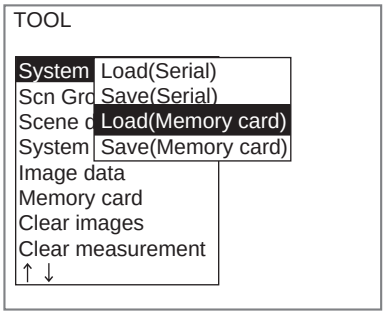
12. Select ***Execute***.

When saving has been completed, the screen in (5.) will return.

Loading from the Memory Card to the Controller

1. Follow steps 1 to 5 for *Saving from the Controller to the Memory Card* and move to the screen for selecting load destinations.

SeeAlso Refer to page 4-(9).



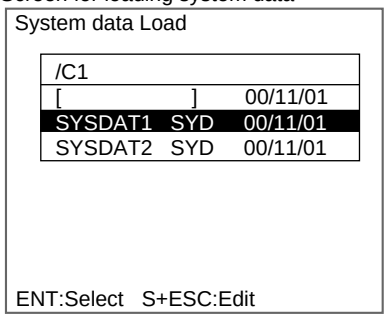
2. Select ***Load (Memory card)***.
3. Select the desired number for scene group, scene, or image data.

Scene group No.	Scene No.	Image data No.
Scn Group 0	Scn 0	Memory 0
Scn Group 1	Scn 1	Memory 1
Scn Group 2	Scn 2	Memory 2
Scn Group 3	Scn 3	Memory 3
Scn Group 4	Scn 4	Memory 4
Scn Group 5	Scn 5	Memory 5
Scn Group 6	Scn 6	Memory 6
Scn Group 7	Scn 7	Memory 7
↑↓	↑↓	↑↓
(0 to 31)	(0 to 31)	(0 to 35)

CHECK When backing up system and scene group data, the currently displayed scene group will be loaded.

The screen for selecting files will be displayed.

Example:
Screen for loading system data

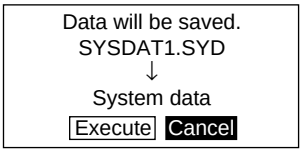


SeeAlso Refer to *4-6-6 Changing Drives* for information on changing drives.

4. Select the file to be loaded.

   A confirmation message will be displayed.

Example:
Screen when loading system data



5. Select ***Execute***.

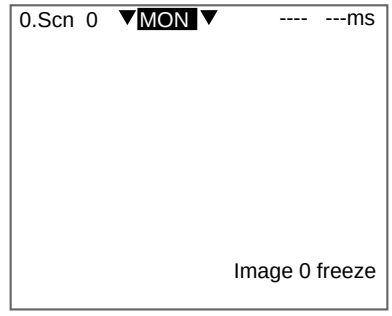
   When the loading has been completed, the screen in (1.) will return.

4-2-3 Backing Up to Flash Memory

The scene data set to scene group 0 and system data will be saved to the Controller internal flash memory. If this save operation is performed for scene groups 1 to 31, the data will overwrite the contents of the files on the Memory Card.

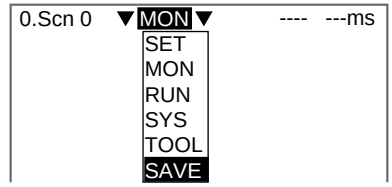
Precaution Flash memory and Memory Card data is loaded each time the Controller is started up. Therefore, when settings have been changed, be sure to save to flash memory before turning the power OFF. If the power is turned OFF without saving, all of the setting changes will be lost.

1. Display the Basic Screen for Monitor Mode or Run Mode.



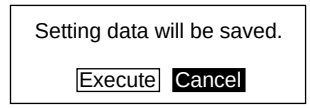
2. Move the cursor to ***MON*** (or ***RUN***) and press the **ENT** Key.

   The mode selections will be displayed.



3. Select ***SAVE***.

   A confirmation message will be displayed.



4. Select ***Execute***.

Precaution Do not turn OFF the power or input a RESET signal while a message is being displayed in any save or load operation. Data in memory will be destroyed, and the Controller may not operate correctly the next time it is started.

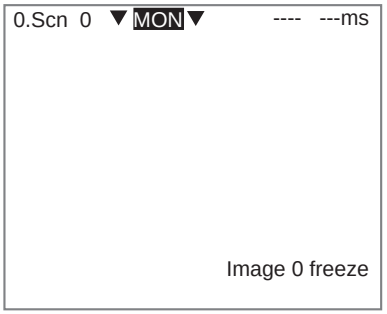
When saving has been completed, the screen for step 1 will return.

4-2-4 Backing Up Flash Memory Data to a Memory Card

Data saved to flash memory can be backed up to a Memory Card. This function enables saving both the installed processing items and settings data (including system data and scene data for scene group 0) on a Memory Card. This function is also useful for copying the same settings to a different Controller when more than one Controller is being used.

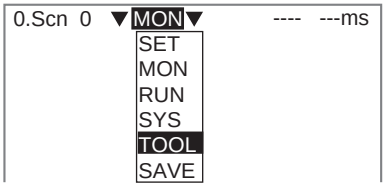
It is recommended that data is backed up in case data is lost or the Controller malfunctions.

1. Display the Basic Screen for Monitor Mode or Run Mode.



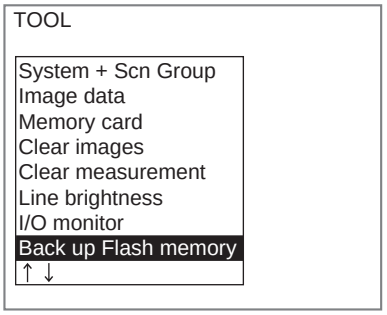
2. Move the cursor to ***MON*** (or ***RUN***) and press the **ENT** Key.

   The mode selections will be displayed.



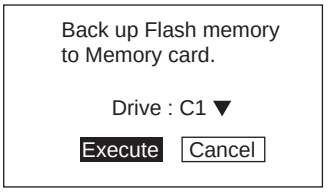
3. Select ***TOOL***.

   The tool selections will be displayed.



4. Select ***Back up Flash memory***.

   A confirmation screen will be displayed.



5. Select the drive to which the Memory Card to be used for backup is mounted.
6. Select ***Execute***.

Precaution Do not turn OFF the power or input a RESET signal executing backup. Data in memory will be destroyed, and the Controller may not operate correctly the next time it is started.

When the save operation has been completed, the screen in (4.) will return.

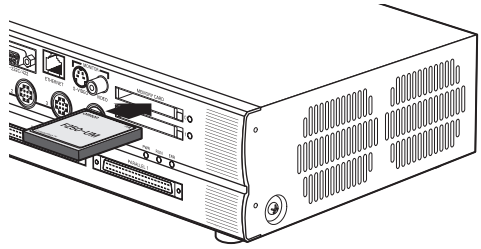
CHECK Once backup has been completed, two files, *bkupdata* and *bkupprog*, will be created in the root directory of the Memory Card. These files are the flash memory backup data. Do not change the file names.

Loading Data

The load operation is performed using the Setup Menu.

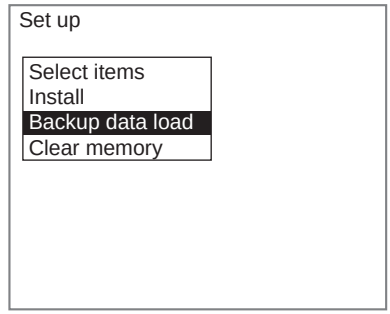
The Memory Card used to install the F250-UME Application Software is needed to start the Setup Menu.

1. Turn OFF the Controller power supply.
2. Mount the F250-UME to Memory Card slot 0.



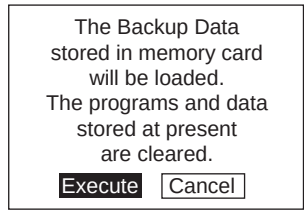
3. Mount the Memory Card with the backup data into Memory Card slot 1.
4. Turn ON the Controller power supply.

   The Setup Menu will be displayed.



5. Select ***Backup data load***.

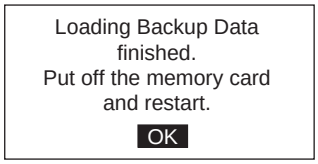
   A confirmation message will be displayed.



6. Select ***Execute***.

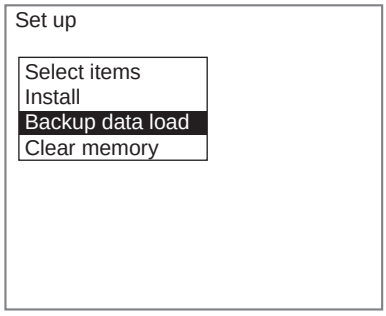
Precaution Do not turn OFF the power or input a RESET signal executing backup. Data in memory will be destroyed, and the Controller may not operate correctly the next time it is started.

When the save operation has been completed, a confirmation message will be displayed.



7. Press the **ENT** Key.

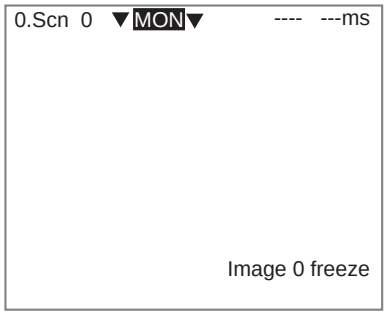
   The display will return to the main setup menu.



8. Turn OFF the Controller power supply.
9. Remove the F250-UME from Memory Card slot 0.
10. Turn ON the Controller power supply.

CHECK If the power supply is turned ON while the F250-UME is still mounted, the Setup Menu will be started again. Always remove the F250-UME before starting the Controller.

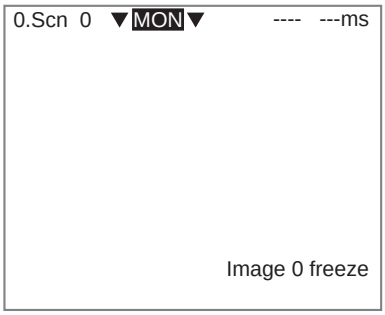
The Main Menu will start.



4-3 Clearing Measurement Values

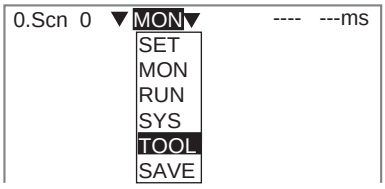
All the measurement values for the scene currently displayed can be cleared. This function is useful, for example, for clearing the measurement count when setting an expression to count the number of measurements.

1. Display the Basic Screen for Monitor Mode or Run Mode.



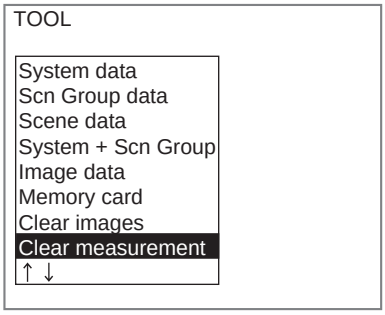
2. Move the cursor to ***MON*** (or ***RUN***) and press the **ENT** Key.

   The mode selections will be displayed.



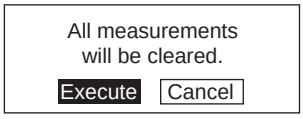
3. Select ***TOOL***.

   The tool selections will be displayed.



4. Select ***Clear measurement***.

   A confirmation message will be displayed.

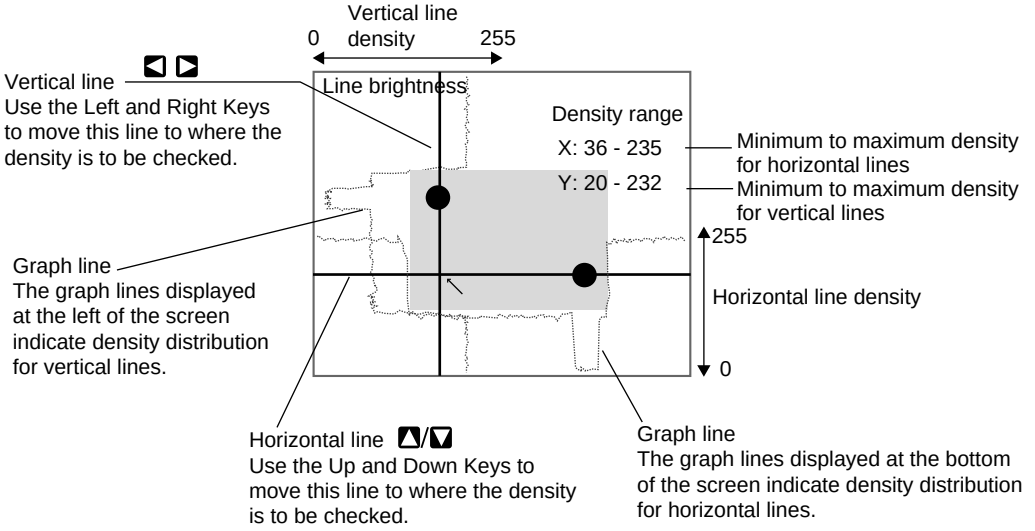


5. Select ***Execute***.

   The measurement values will be cleared and the screen in (3.) will return.

4-4 Checking Image Density Distribution: Line Brightness

The graph showing the density distribution for 1 line in an image is called the line brightness graph. The line brightness can be shown for any line in a horizontal or vertical direction.



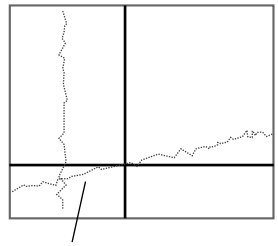
CHECK Line brightness cannot be shown in the following circumstances:

- When the image is either *Last NG (before scroll)* or *Last NG (after scroll)*
- When the image size is set to *Reduced*

SeeAlso Refer to *SECTION 5 System Settings*.

CHECK Using Line Brightness

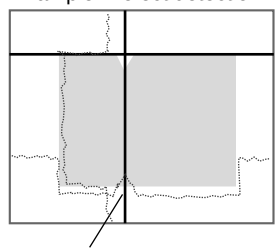
- Use to check if the light distribution is uneven.



If a homogeneous color is being displayed but the graph has an incline, it indicates that the lighting is uneven.

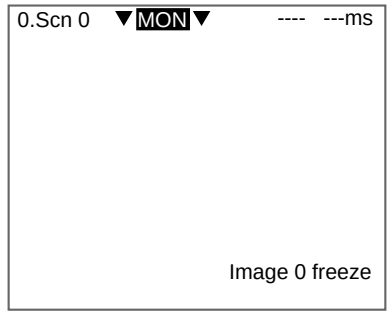
- Use to find how great the density difference is between the location to be measured and the background.

Example: Defect detection

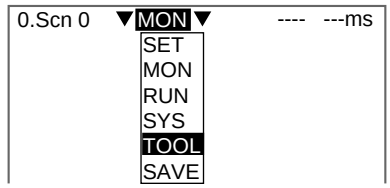


Observe the bumps in the graph line to determine how much difference in density can be detected in what areas.

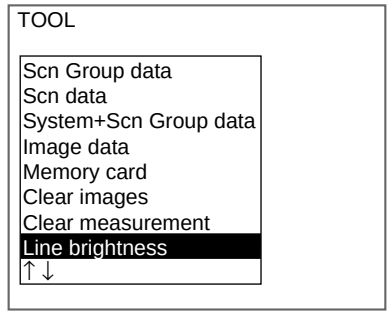
1. Display the Basic Screen for Monitor Mode or Run Mode.



2. Move the cursor to ***MON*** (or ***RUN***) and press the **ENT** Key.
   The mode selections will be displayed.

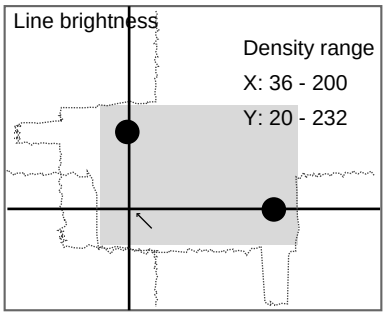


3. Select ***TOOL***.
   The tool selections will be displayed.



4. Select ***Line brightness***.

The Line Brightness screen will be displayed.



5. Move the solid line to the desired position for observing density distribution.
   Use the **Up/Down** Keys to move the horizontal line.
   Use the **Right/Left** Keys to move the vertical line.
6. Press the **ESC** Key to exit this screen.
   The screen in (3.) will return.

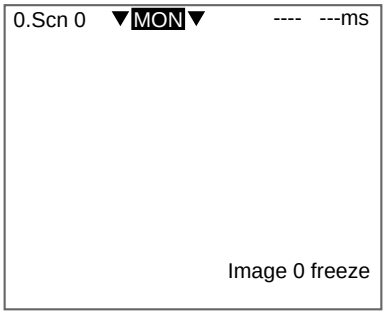
4-5 Checking I/O Status with External Devices

Use the I/O monitor function to check the communications status via serial or parallel interfaces. Wiring and communications settings can be checked to see if they are correct.

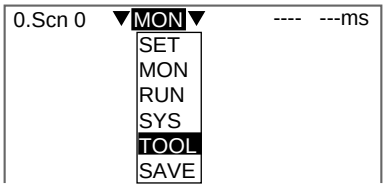
4-5-1 Serial Interface

The communications status via the serial interface can be checked.

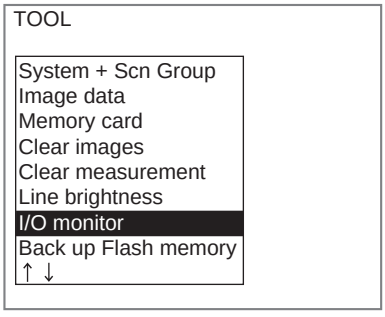
1. Display the Basic Screen for Monitor Mode or Run Mode.



2. Move the cursor to ***MON*** (or ***RUN***) and press the **ENT** Key.
   The mode selections will be displayed.

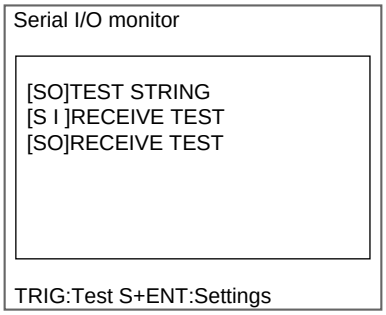


3. Select ***TOOL***.
   The tool selections will be displayed.
   Down Key: Scrolls through the menu.



4. Select ***I/O monitor***.
   The interface selections will be displayed.

5. Select ***Serial***.
   The Serial I/O Monitor Screen will be displayed.



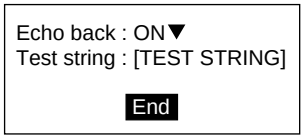
CHECK Display Details

Display	Meaning
SO	Output to external device. Press the TRIG Key once to send a test character string "TEST STRING" from the Controller to the external device. The contents of the test character string can be changed. Refer to *Changing Test Character String and Echo Back*, below.
SI	Input from external device. If more than 26 characters are received, only the first 26 characters will be displayed. If *Echo back* is set to ON, the received data will be returned as is to the external device. Refer to *Changing Test Character String and Echo Back*, below.

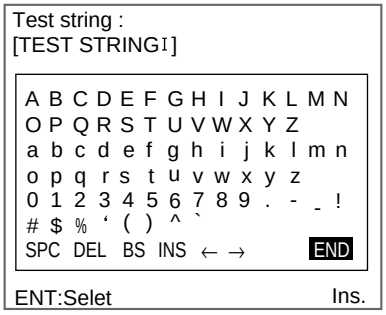
6. Press the **ESC** Key to exit this screen.
   The screen in (4.) will return.

Changing Test Character String and Echo Back

1. Display the Serial I/O Monitor Screen and press the **SHIFT+ENT** Keys.
   The screen for making detailed settings will be displayed.



2. Select ***ON*** or ***OFF*** for ***Echo back***.
3. Move the cursor to the square brackets and press the **ENT** Key.
   The software keyboard will be displayed.



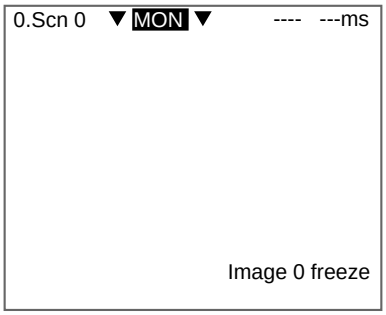
4. Change the test string. Up to 12 characters can be inserted.

5. Select ***END*** and the screen in (1.) will return.
6. Move the cursor to ***End*** and press the **ENT** Key.
   The Serial I/O Monitor Screen will return.

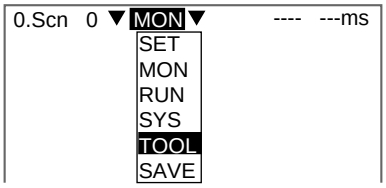
4-5-2 Parallel Interface

The communications status via the parallel interface can be checked.

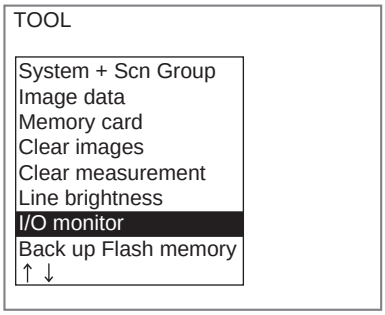
1. Display the Basic Screen for Monitor Mode or Run Mode.



2. Move the cursor to ***MON*** (or ***RUN***) and press the **ENT** Key.
   The mode selections will be displayed.



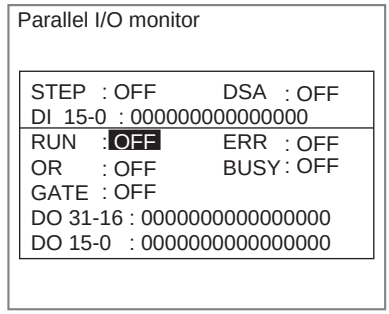
3. Select ***TOOL***.
   The tool selections will be displayed.
   Down Key: Scrolls through the menu.



4. Select ***I/O monitor***.
   The interface selections will be displayed.

5. Select ***Parallel***.

   The Parallel I/O Monitor Screen will be displayed.



CHECK Display Details

Display	Meaning
STEP	Displays the input status for each signal from the external device to the Controller.
DSA	
DI	
RUN	Displays the output status for each signal from the Controller to the external device. These displays can be changed to ON/OFF or 0/1 even if measurements are not executed. Move the cursor to the display item. The display will change each time the ENT Key is pressed.
ERR	
OR	
BUSY	
GATE	
DO	

6. Press the **ESC** Key to exit this screen.

   The screen in (4.) will return.

4-6 Memory Card Operations

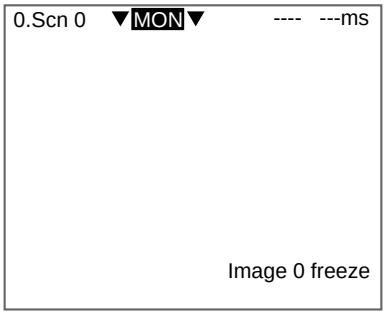
Data settings and measurement images can be saved from the Controller to a Memory Card. The files on the Memory Card can be copied and the file names changed. This section explains these operations for Memory Cards.

Precaution Turn OFF the power supply to the Memory Card before removing the Memory Card. If the power is not turned OFF before the Memory Card is removed, the Memory Card and the Controller may be damaged. Refer to *4-6-7 Turning OFF the Power Supply to the Memory Card*.

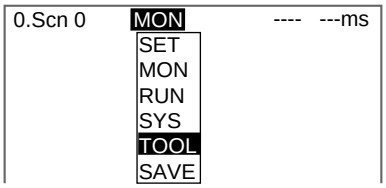
4-6-1 Creating Directories

Directories can be created in the Memory Card and files can be stored in those directories. It is easier to find files if separate directories are created for related files.

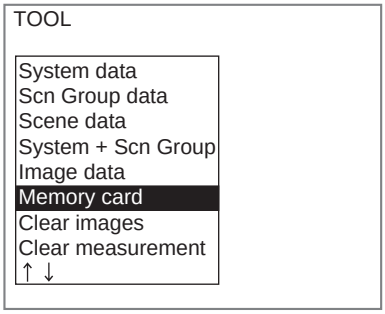
1. Insert the Memory Card.
2. Display the Basic Screen for Monitor Mode or Run Mode.



3. Move the cursor to ***MON*** (or ***RUN***) and press the **ENT** Key.
   The mode selections will be displayed.

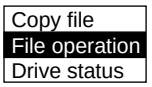


4. Select ***TOOL***.
   The tool selections will be displayed.

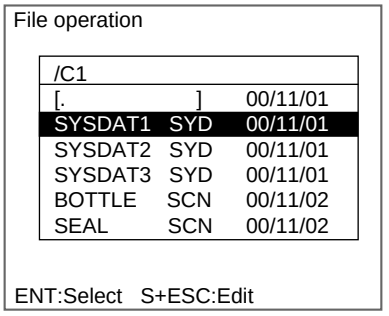


5. Select ***Memory card***.

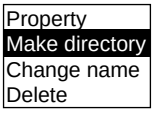
The Copy file/File operation/Drive status Menu will be displayed.



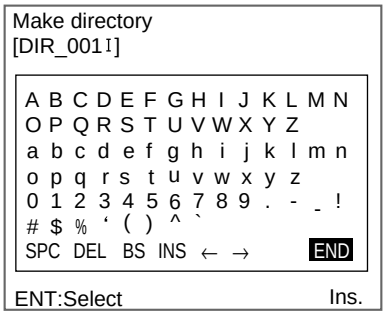
6. Select ***File operation***.
   A list of files in the Memory Card root directory will be displayed.
   Refer to *4-6-6 Changing Drives* for information on changing drives.



7. Press the **SHIFT+ESC** Keys.
   The edit menu will be displayed.



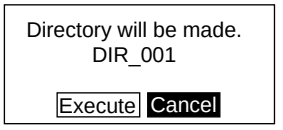
8. Select ***Make directory***.
   A software keyboard will be displayed.



9. Input the directory name, using up to 8 characters.

CHECK Periods (.) cannot be used in directory names.

10. Move the cursor to ***END*** and press the **ENT** Key.
    A confirmation message will be displayed.



11. Select ***Execute***.

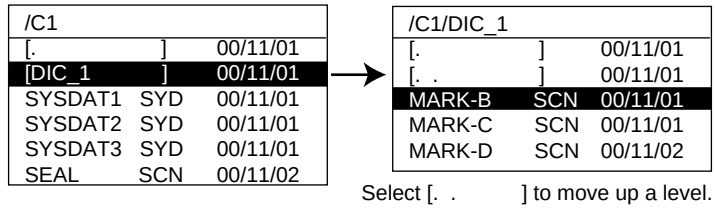
    The directory will be created and the screen in (6.) will return.

CHECK

The directory is displayed in the list of files, encased in square brackets. Move the cursor to the directory and press the **ENT** Key to display a list of files in that directory.

Example

When directory [DIC_1] is selected... The files in [DIC_1] will be displayed.



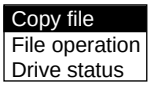
Select [. .] to move up a level.

4-6-2 Copying Files

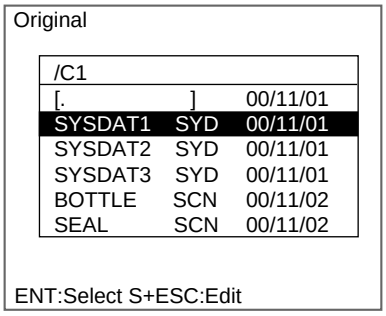
1. Perform steps 1 to 5 for *Creating Directories* and display the Copy file/File operation/Drive status Menu.

SeeAlso Refer to *4-6-1 Creating Directories*.

2. Select ***Copy file***.



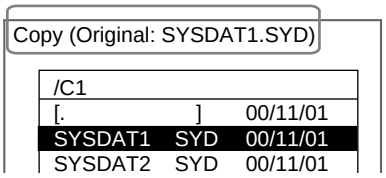
A list of files in the Memory Card root directory will be displayed.



SeeAlso Refer to *4-6-6 Changing Drives* for information on changing drives.

3. Move the cursor to the file to be copied and press the **ENT** Key.

A screen for specifying the copy destination will be displayed.

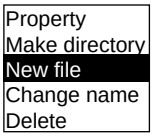


CHECK To overwrite existing files, select the file by pressing the ENT Key and then go to step 8.

To specify a new file name, perform steps 4 to 8.

4. Press the **SHIFT+ESC** Keys.

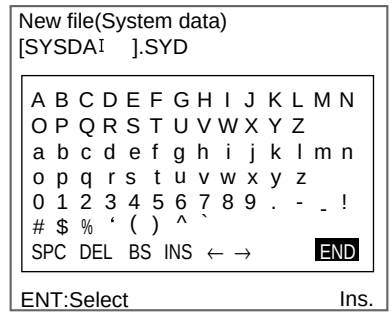
The edit menu will be displayed.



5. Select ***New file***.

CHECK If *Make directory* is selected, the screen for creating new directories will be displayed. Files can be saved in the newly created directory.

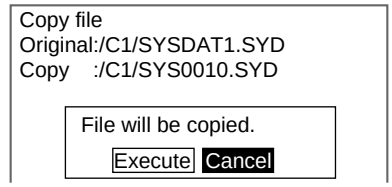
The software keyboard will be displayed.



6. Set the file name with up to 8 characters.

CHECK Periods (.) cannot be used in file names.

7. Move the cursor to ***END*** and press the **ENT** Key.
   A confirmation message will be displayed.



8. Select ***Execute***.
   The file will be copied and the screen in (2.) will return.

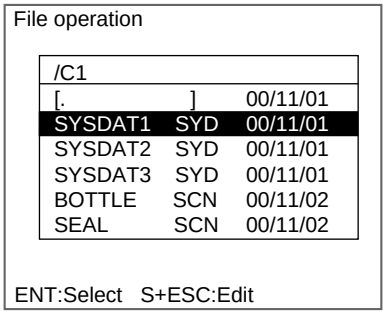
4-6-3 Checking File Properties

The size, type, or date a file was created can be checked.

1. Perform steps 1 to 6 for *Creating Directories* and display the list of file names.

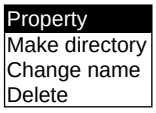
SeeAlso Refer to *4-6-1 Creating Directories*.

2. Move the cursor to the file for which the information is to be checked and press the **SHIFT** + **ENT** Keys.



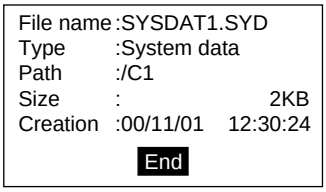
SeeAlso Refer to *4-6-6 Changing Drives* for information on changing drives.

The edit menu will be displayed.



3. Select ***Property***.

The properties of the selected file will be displayed.



4. Select ***End***.

The screen in (2.) will return.

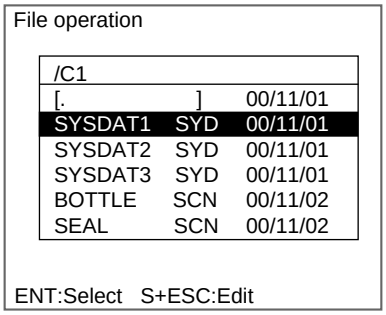
4-6-4 Changing File Names

CHECK Only the file name can be changed. The directory name cannot be changed.

1. Perform steps 1 to 6 for *Creating Directories* and display the list of file names.

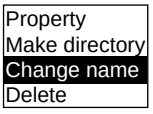
SeeAlso Refer to *4-6-1 Creating Directories*.

2. Move the cursor to the file for which the name is to be changed and press the **SHIFT** + **ESC** Keys.



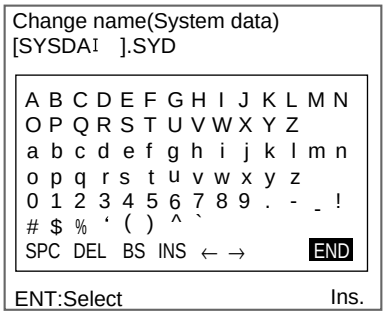
SeeAlso Refer to *4-6-6 Changing Drives* for information on changing drives.

The edit menu will be displayed.



3. Select ***Change name***.

A software keyboard will be displayed.

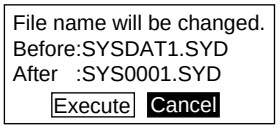


4. Set the file name with up to 8 characters.

CHECK Periods (.) cannot be used in file names.

5. Move the cursor to ***END*** and press the **ENT** Key.

A confirmation message will be displayed.

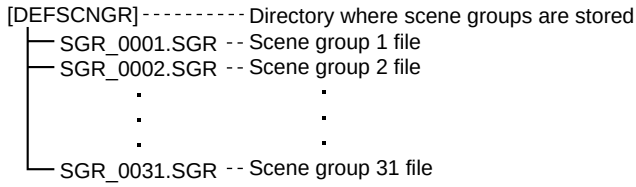


6. Select ***Execute***.

The file name will be changed and the screen in (2.) will return.

CHECK When the scene group function is used, scene groups 1 to 31 are saved in the C1 Memory Card (Memory Card in Memory Card slot 1) under the file names shown below.

Do not change these file names. If these file names are changed, measurement setups will no longer be able to be changed by switching scene groups.

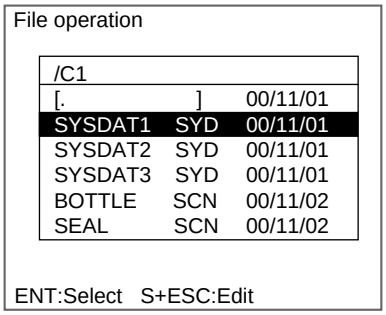


4-6-5 Deleting Files and Directories

1. Perform steps 1 to 6 for *Creating Directories* and display the list of file names.

SeeAlso Refer to *4-6-1 Creating Directories*.

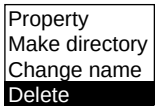
2. Move the cursor to the file or directory to be deleted and press the **SHIFT** + **ESC** Keys.



SeeAlso Refer to *4-6-6 Changing Drives* for information on changing drives.

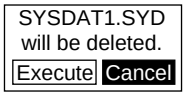
CHECK A directory can be deleted only when there are no files in that directory.

The edit menu will be displayed.



3. Select ***Delete***.

A confirmation message will be displayed.

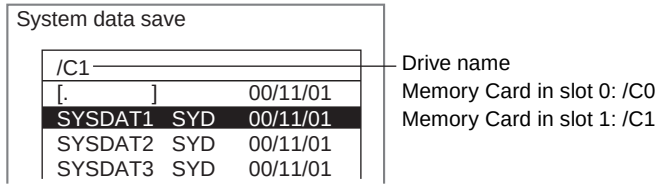


4. Select ***Execute***.

The file or directory will be deleted and the screen in (2.) will return.

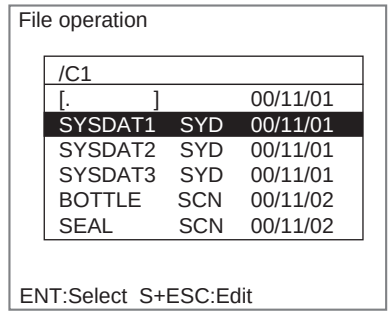
4-6-6 Changing Drives

The Controller has two Memory Card slots and the drive name is displayed as shown below when the list of files is displayed.



If there are Memory Cards mounted in both slots 0 and 1, use the following procedure to switch between drives.

1. Press the **SHIFT+ESC** Keys on the screen where the list of files is displayed.

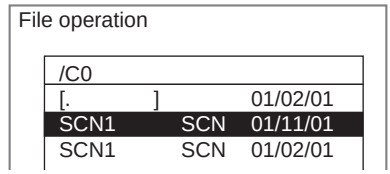


The edit menu will be displayed.

2. Select ***Switch Drive***.

CHECK The *Switch Drive* option will not be displayed if only one Memory Card is mounted in either slot 0 or slot 1.

Switch to the other drive.



4-6-7 Turning OFF the Power Supply to the Memory Card

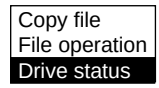
Turn OFF the power supply to the Memory Card before removing the Memory Card. If the power is not turned OFF before the Memory Card is removed, the Memory Card and the Controller may be damaged.

CHECK The total space and free space on the Memory Card will be displayed on this screen.

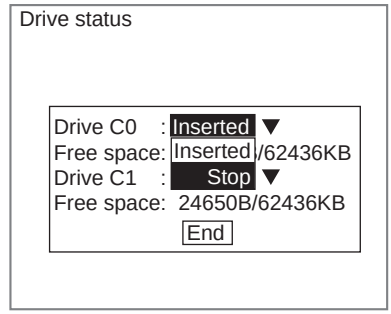
1. Perform steps 1 to 5 for *Creating Directories* and display the Copy file/File operation/Drive status Menu.

SeeAlso Refer to *4-6-1 Creating Directories*.

2. Select ***Drive status***.



The Drive Status Screen will be displayed.

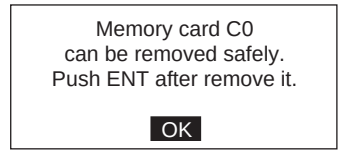


3. If a Memory Card is inserted, “Inserted” will be displayed. Change the display to ***Stop***.

CHECK If a Memory Card is not inserted, the display will be “Not inserted.”

4. Select ***End***.

A confirmation message will be displayed.



5. Remove the Memory Card and press the **ENT** Key.

The screen in (2.) will return.

SECTION 5
System Settings

This section describes how to set conditions related to the system environment. Refer to *SECTION 6 Communicating with External Devices* for information on communications specifications.

5-1 Entering System Mode . . . . . 5-(2)
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5-8 Setting the Calendar Date and Time (Date/Time) . . . . . 5-(34)
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5-9-2 Checking the Software Version . . . . . 5-(36)

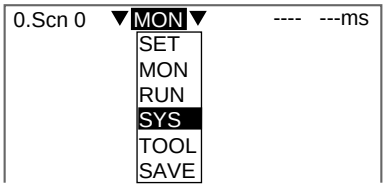
5-1 Entering System Mode

To set conditions related to the system environment it is necessary to enter System Mode.

1. Display the Basic Screen for Monitor Mode or Run Mode.

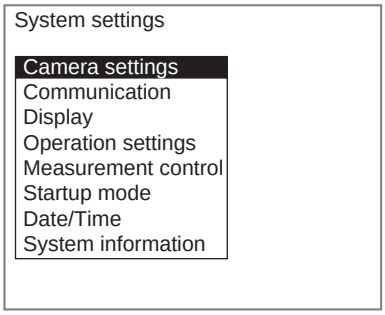
2. Move the cursor to ***MON*** and press the **ENT** Key.

   The mode selections will be displayed.



3. Select ***SYS***.

   The System Settings Screen will be displayed.



5-2 Camera Settings

Specify the model of the connected Camera and Intelligent Lighting (if using any). The model is written on each unit.

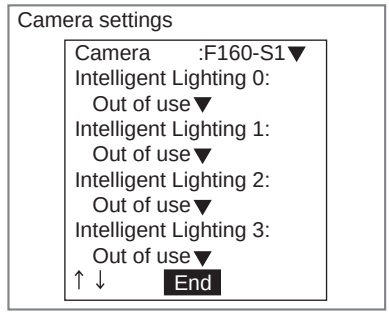
Menu item	Models	Details
Camera	F150-S1A F160-S1* Others	Select the model of the connected Camera.
Intelligent Lighting 0 Intelligent Lighting 1 Intelligent Lighting 2 Intelligent Lighting 3	Out of use* LTC20 LTC50	If a Camera with Intelligent Lighting is connected, select the model of the Intelligent Lighting. Always set the DIP switch on the Intelligent Lighting to 0, regardless of the Camera number. Refer to the *Setup Manual*.

Note The asterisk (*) indicates the default setting.

1. Enter System Mode and select ***Camera settings***.

SeeAlso Refer to *5-1 Entering System Mode*.

The Camera Settings Screen will be displayed.



2. Select the model of the connected Camera.
3. If using Intelligent Lighting, select the model.

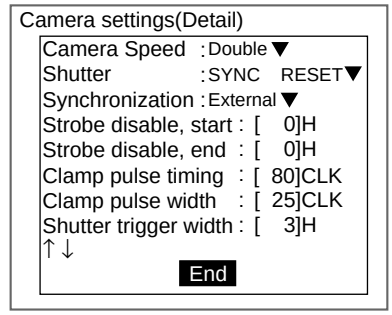
4. Select ***End***.

   The settings will be registered and the System Settings Screen will return.

CHECK If *Others* is selected under *Camera*, the Camera Settings (Detail) Screen will be displayed.

The settings for F200/F300 Cameras are listed in the *Setup Manual*.

SeeAlso Refer to the *Setup Manual*.



Precaution When changing the Camera model, save settings data in flash memory. Set the measurement conditions after starting the Controller again.

5-3 Screen Display and Monitor

5-3-1 Changing Font Sizes

Select the size of the font for screen display.

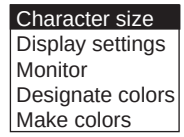
Selections	Details
Normal	Default font size.
Small	Half the normal font size.

CHECK The font sizes set for each results display processing item will be enabled for any results data being displayed under those items.

1. Enter System Mode and select ***Display***.

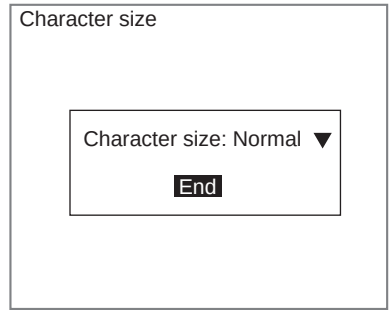
SeeAlso Refer to *5-1 Entering System Mode*.

The selections menu will be displayed.



2. Select ***Character size***.

The Character Size Selection Screen will be displayed.

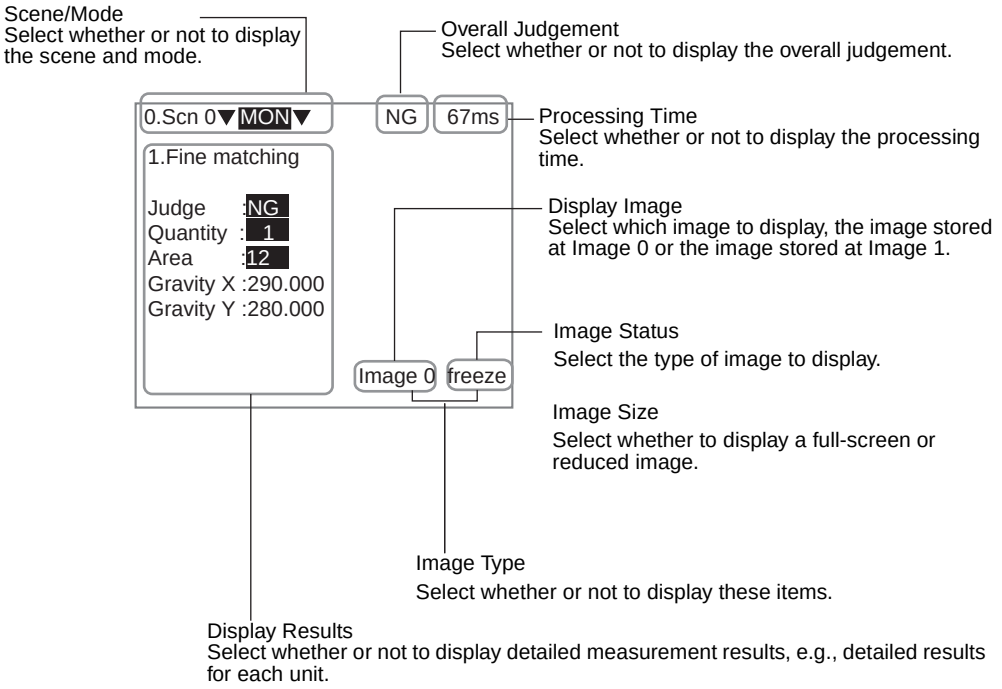


3. Change the setting as required.
4. Select ***End***.

The setting will be registered and the screen in (1.) will return.

5-3-2 Measurement Screen Settings

Set the items below to determine the information displayed in Run Mode and Monitor Mode. The display settings made here will be reflected in all scenes.



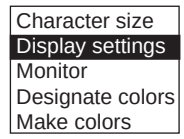
CHECK Scene/Mode

Even if Scene/Mode is set to not be displayed, the scene or mode can be displayed temporarily by pressing the ENT Key. However, measurement cannot be performed while the scene or mode is being displayed this way. Press the ESC Key again to turn OFF the display.

1. Enter System mode and select ***Display***.

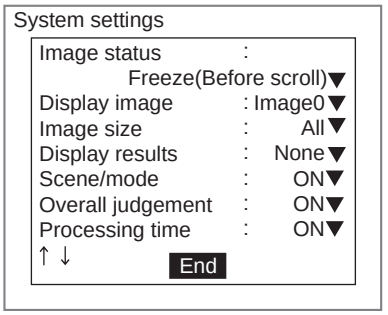
SeeAlso Refer to *5-1 Entering System Mode*.

The Display Settings/Monitor/Designate Colors/Make Colors Menu will be displayed.



2. Select ***Display settings***.

The Display Settings Screen will be displayed.



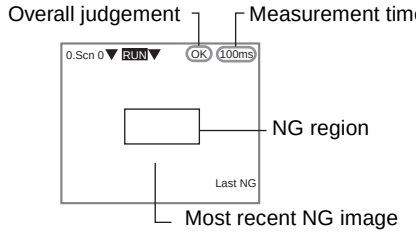
3. Change the settings for each item.
4. Select ***End***.

   The settings will be registered and the screen in (2.) will return.

Image Status

Select the type of itmage to be displayed in the background.

Selection	Details
Through	The latest image taken by the Camera is displayed directly. If measurement is performed using a Through display, the measurement time will be increased by the amount of time from when the measurement command is input until the image input starts. This delay is included in the measurement time shown on the Monitor and Run Mode screens.
Freeze* (before scroll)	A still of the image taken by the Camera is displayed. This image is updated when measurement is performed. Select *Freeze* when measuring moving objects. If position displacement compensation is set, an unscrolled image is displayed. The region will be scrolled by the position displacement amount.
Freeze (after scroll)	A still of the image taken by the Camera is displayed. This image is updated when measurement is performed. Select *Freeze* when measuring moving objects. If position displacement compensation is set, an image scrolled the position displacement amount will be displayed.

Selection	Details
Last NG (before scroll)	The image of the latest image to receive an overall judgement of NG is displayed. If position displacement compensation is set, an unscrolled image will be displayed. The region will be scrolled the position displacement amount. The latest measurement results are always displayed for overall judgement and measurement time. Be careful, because the display image and the overall judgement will not match when this image type is selected if the latest measurement gave an OK judgement.  The following operations cannot be performed, while the last NG image is being displayed. • Re-measurement • Display capture • Line Brightness display • Stored image display When operations other than measurement are performed, the latest NG image will be cleared and the display will remain clear until the next NG result is returned.
Last NG (after scroll)	The image of the latest image to receive an overall judgement of NG is displayed. If position displacement compensation is set, an image scrolled the position displacement amount will be displayed. All other operations are the same as for Last NG (before scroll).

Note *The asterisk (*) indicates the default setting.

CHECK When *After scroll* is selected, the measurement times will be lengthened by the following amounts:

Frame images: (No. of displayed images) × 16.7 ms

Field images: (No. of displayed images) × 8.3 ms

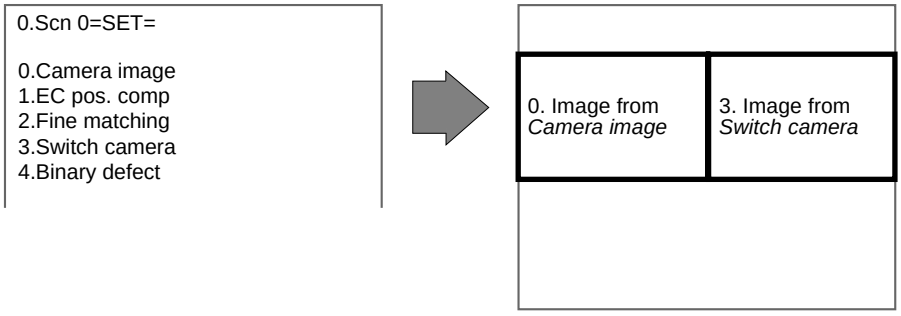
Image Size

Select the size of the image in relation to the screen.

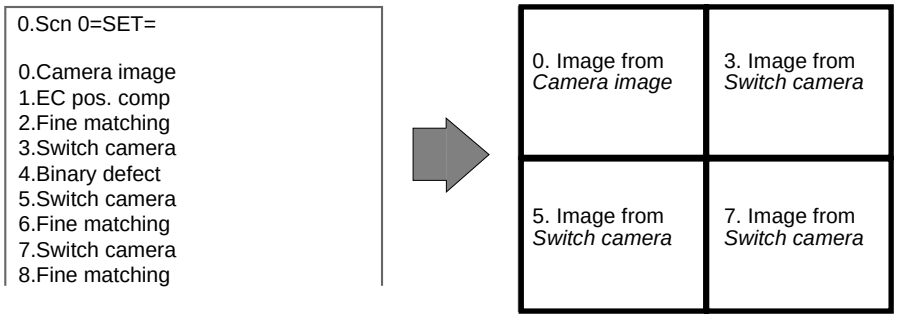
All One image will cover the whole screen. This is the default setting.

Reduced Depending on the number of units set for the displayed scene under *Camera image/Switch camera*, 1 to 4 screens will be reduced and displayed.

Example: When *Camera Image* Set to 1 and *Switch Camera* Set to 1



Example: When *Camera Image* Set to 1 and *Switch Camera* Set to 3



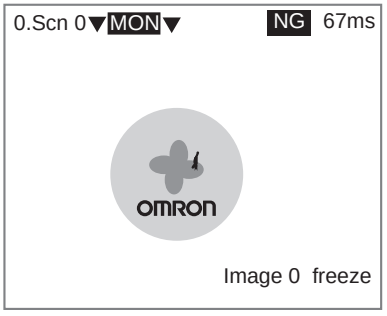
CHECK Light brightness cannot be displayed for reduced images.

Display Results

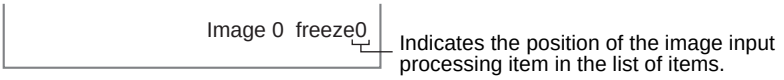
Detailed measurement results can be displayed on the screen. Judgement conditions can also be set while monitoring measurement values.

CHECK The description given here is based on default key allocations. Be careful if the key allocations have been changed.

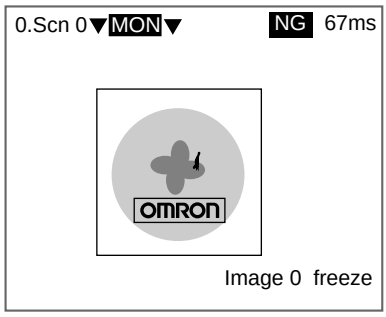
None (default) Only the overall judgement will be displayed.



CHECK If the image size is set to *All* and the *Camera image* or *Switch camera* settings in the image input-related processing items are set to 2 or more, use the Up and Down Keys to switch between images.



Positions Displays all the regions set to the unit that executed the measurement. Figures drawing using OR are shown in solid lines and figures drawn using NOT are shown in dash lines.

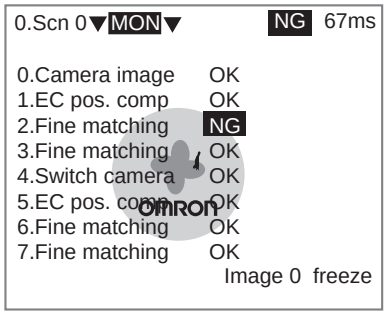


CHECK If the image size is set to *All* and the *Camera image* or *Switch camera* settings in the image input-related processing items are set to 2 or more, use the Up and Down Keys to switch between images.

Results Displays a list of judgement results for the set unit.

If the character size is set to *Normal*, 8 sets of results will be shown on one screen. If the character size is set to *Small*, 32 sets of results will be shown on one screen.

SHIFT + Right/Left Keys: Scroll through the unit numbers.



CHECK If the image size is set to *All* and the *Camera image* or *Switch camera* settings in the image input-related processing items are set to 2 or more, use the Up and Down Keys to switch between images.

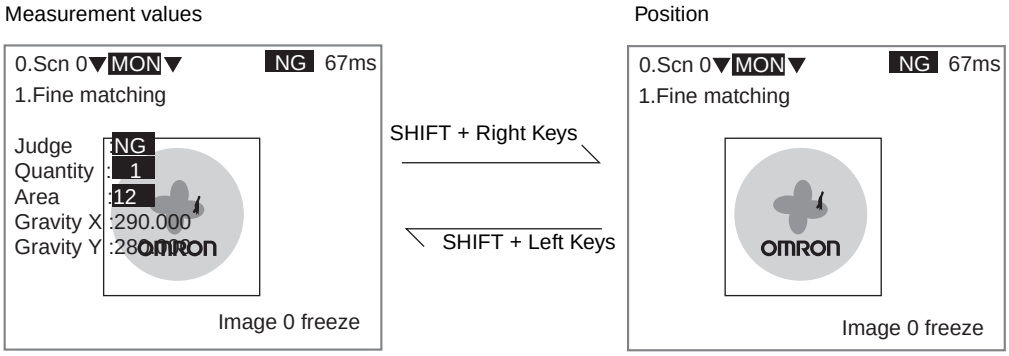
Details Displays detailed information for each unit. Use the Up and Down Keys to switch between units. The displayed data differs depending on the processing item and some processing items have multiple Details Screens.

Use the SHIFT + Left/Right Keys to switch between Details Screens.

Refer to the explanation for each processing item for information on the respective Details Screens.

SeeAlso Refer to *SECTION 2 Processing Items Setting Procedures*.

Example: Details Screen for fine matching



CHECK Press the SHIFT + ENT Keys in the Details Screen to display the menu for changing settings. The measurement conditions can be changed while in Run Mode or Monitor Mode. However, measurement will not be performed while in the screen to change the settings, even if the measurement command is input.

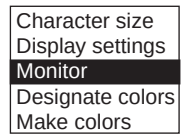
5-3-3 Selecting Color or Monochrome Monitors

Select the type of monitor to be connected. When color monitors are used, characters and figures can be color-coded and displayed in color.

1. Enter System mode and select ***Display***.

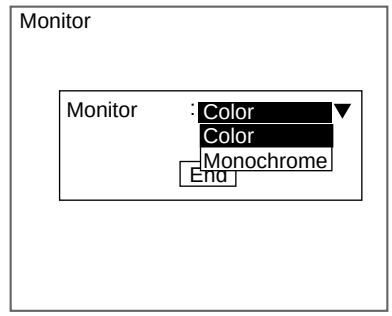
SeeAlso Refer to *5-1 Entering System Mode*.

The Display Settings/Monitor/Designate Colors/Make Colors Menu will be displayed.



2. Select ***Monitor***.

The Monitor Settings Screen will be displayed.



3. Select the monitor type.
4. Select ***End***.

The settings will be registered and the screen in (1.) will return.

5-3-4 Changing Character or Figure Colors

The color for characters or added figures can be set. Change the color when it is difficult to see the character or figure on the image. The display color set here, however, will be reflected in all scenes.

For color monitors, select white, black, red, green, blue, yellow, or original. (A combination of up to any 7 colors can be set.)

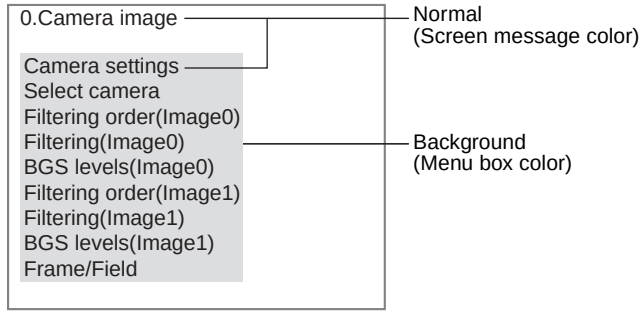
For monochrome monitors, select white or black.

SeeAlso Refer to page 5-(15) for information on creating original colors.

The positions where color can be changed are described below.

Normal and Background Colors

Messages displayed on the screen will be appear in the color set under *Normal*. Menu boxes will shaded in the color set under *Background*.



OK and NG Colors

The judgement display, all measurement values, and the measurement region will be displayed in the color set under *OK color* or *NG color*, depending on the measurement result.

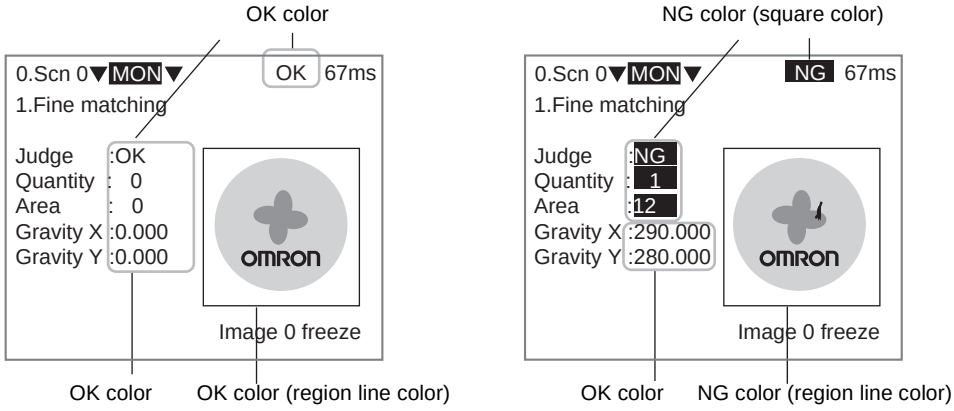


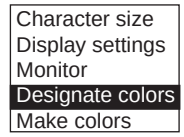
Figure Colors 0 to 6

The figure color is the color for figures or characters displayed on the screen using the results display-related processing items.

1. Enter System mode and select ***Display***.

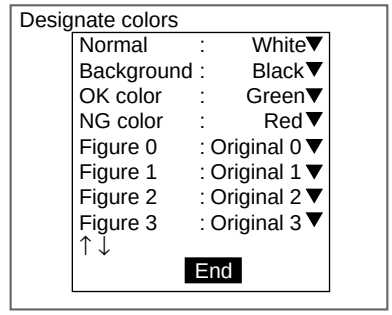
SeeAlso Refer to *5-1 Entering System Mode*.

The Display Settings/Monitor/Designate Colors/Make Colors Menu will be displayed.



2. Select ***Designate colors***.

The Designate Colors Screen will be displayed.



3. Make the settings for each item.
4. Select ***End***.

The settings will be registered and the screen in (1.) will return.

5-3-5 Creating Original Colors

Up to 7 original colors can be created for displaying characters or figures, using a combination of red, green, and blue.

SeeAlso Refer to *5-3-4 Changing Character or Figure Colors* for information on how to display the original color.

The default settings are shown below.

Display item	R (red)	G (green)	B (blue)
Original 0	32	32	32
Original 1	64	64	64
Original 2	96	96	96
Original 3	128	128	128
Original 4	160	160	160
Original 5	196	196	196
Original 6	224	224	224

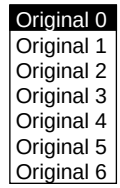
1. Enter System mode and select ***Display***.

SeeAlso Refer to page 5-(2).

The Display Settings/Monitor/Designate Colors/Make Colors Menu will be displayed.

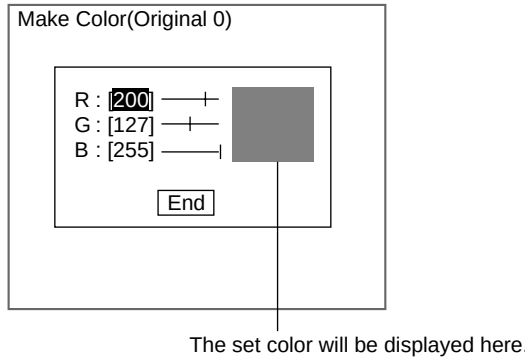
2. Select ***Make colors***.

The menu for selecting color numbers will be displayed.



3. Select a color number to set for the new color.

The Make Color Screen will be displayed.



4. Make the settings for each item.

Up and Down Keys: Moves the cursor

Left and Right Keys: Increases or reduces the color at the cursor position by one.

SHIFT+Left/Right Keys: Increases or reduces the color at the cursor position by ten.

5. Select ***End***.

   The settings will be saved and the screen in (2.) will return.

5-4 Customizing Operations

5-4-1 Changing Console Key Allocations

It is possible to change the allocations for Console key operations.

CHECK The set allocations are only enabled in Monitor Mode or Run Mode.

Default Key Allocations

Key	Allocation
ESC	None
SHIFT + ESC	Measurement display
SHIFT + ENT	Judgement conditions
SHIFT + ▶	Next sub-display
SHIFT + ◀	Previous sub-display
SHIFT + ▲	Previous image
SHIFT + ▼	Next image
F1 to F8 (See note 1.)	None

Note 1 Function keys are suppported only for F160-KP.
If the F150-KP is being used, input will not be possible using these keys, even if key allocations are made.

Note 2 Changing display capture key allocations

Inputs based on the key allocations made here will be accepted in Monitor or Run Mode, even if *SYS/Operation settings/Display capture* is set to OFF.

Allocatable functions
None
Measurement display
Previous image
Next image
Judgement conditions
Previous scene
Next scene
Previous scene group
Next scene group
Clear image
Erase characters
Save
Through/Freeze
Measurement control
Monitor
Designate Color
Thumbnail
Drive status
Scene/mode
Line Brightness
Display capture (Note 2.)
Previous sub-display
Next sub-display
Clear measurement
Switch nonstop (Note 3.)
Proc. data transfer (Note 3.)
Switch Proc. monitor (Note 3.)

Refer to *5-4 Customizing Operations* for information on the role of each function.

Note 3 These functions cannot be used with the F250-C50/C55.

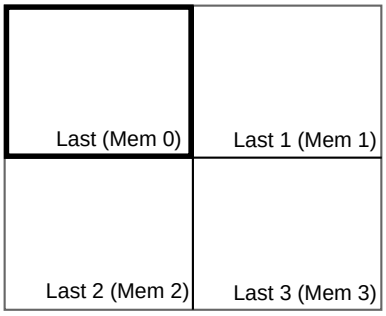
Function of Allocated Functions

Item	Function
None	Nothing allocated.
Measurement display	Displays the *SYS/Conditions/Display settings* screen.
Previous image (See note 1.)	Displays the previous memory image.
Next image (See note 1.)	Displays the next memory image.
Judge conditions	Displays the screen for setting evaluation criteria.
Previous scene	Displays the previous scene.
Next scene	Displays the next scene.
Previous scene group	Displays the previous scene group.
Next scene group	Displays the next scene group.
Clear image	A message confirming whether all stored images are to be cleared is displayed. Images stored in memory are cleared when power is turned OFF. By allocating this function to a Console Key, stored images can be cleared without turning power OFF.
Erase characters	Displays the menu for character display settings. To prevent scorching of the monitor screen, it is possible to delete screen characters.
Save	Displays a confirmation message for saving to flash memory or Memory Card.
Through/Freeze (See note 1.)	Switches to Freeze (before scroll) display if currently on Through display. Switches to Through display if currently on Freeze □/ Last NG display.
Measurement control	Displays the *SYS/Measurement control* screen.
Monitor	Displays the *SYS/Display/Monitor* screen.
Designate colors	Displays the *SYS/Display/Designate colors* screen.
Thumbnail (See note 2.)	The saved measurement images are displayed 4 at a time.
Drive status	Displays the *Tool/Memory card/Drive status* screen.
Scene/mode	The scene number and mode display shown at the top left corner of the Basic Screen in Monitor and Run Modes is deleted. Press the ENT Key to display the scene number and mode display temporarily. Measurement cannot be performed, however, during this display. Press the ESC Key to make the display disappear.
Line Brightness	Displays the *Tool/Line brightness* screen. Line brightness cannot be displayed, however, when *Last NG* is set for *Image status* or *Image size* is set to *Reduced*.
Display capture	Saves the displayed image to the Memory Card. Refer to *5-4-2 Capturing and Saving Images*.
Previous sub-display	When results display is set to *Detail*, the display will switch to the previous Details Screen for the displayed unit. The unit number will be switched when set to *Results*.
Next sub-display	When results display is set to *Detail*, the display will switch to the next Details Screen for the displayed unit. The unit number will be switched when set to *Results*.
Clear measurements	Clears all measurement values for the currently displayed scene.
Switch nonstop (See note 3.)	These functions cannot be used with the F250-C50/C55.

Item	Function
Proc. data transfer	These functions cannot be used with the F250-C50/C55.
Switch Proc. monitor	These functions cannot be used with the F250-C50/C55.

Note

1. Previous image, Next image, and Through/Freeze
   When the image display is set to *Last NG (before scroll)* or *Last NG (after scroll)*, the display will not switch even if this allocated key is input.
2. Thumbnail Display
   Stored images are displayed 4 at a time, making it faster to find a particular measurement image.



SHIFT+Up/Down Keys: Switches to the last four or next four images.

Up/Down and Left/Right Keys: Moves the thick frame for selecting images.

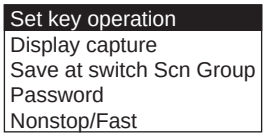
ENT Key: Selects the image inside the thick frame and returns to the previous screen.

CHECK Measurement cannot be performed during thumbnail display.

1. Enter System mode and select ***Operation settings***.

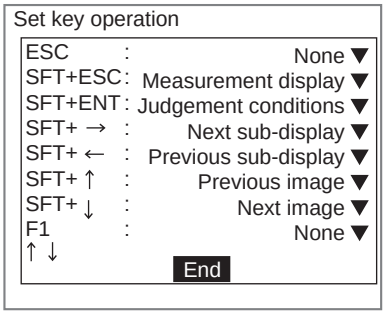
SeeAlso Refer to *5-1 Entering System Mode*.

The menu will be displayed.



2. Select ***Set key operation***.

The Set Key Operation Screen will be displayed.



3. Make the settings for each item.
4. Select ***End***.
   The settings will be registered and the screen in (1.) will return.

5-4-2 Capturing and Saving Images

Turn ON the display capture function to capture the image displayed on the monitor screen and save it to the Memory Card.

Stored images can be pasted to documents on a personal computer or loaded to the Controller and re-measured.

The default setting is OFF.

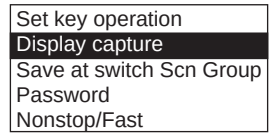
CHECK

- The capture operation takes several seconds, during which measurement cannot be performed. To prevent incorrect operation, set this function to OFF.
- When the image display is set to *Last NG*, captured images are not accepted.

1. Enter System mode and select ***Operation settings***.

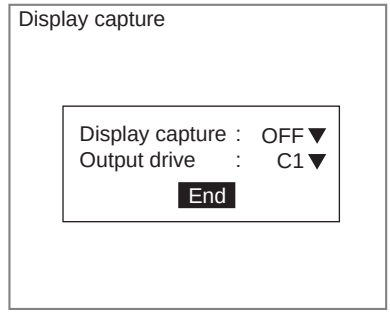
SeeAlso Refer to *5-1 Entering System Mode*.

The Menu will be displayed.



2. Select ***Display capture.***

The Display Capture Screen will be displayed.



3. Set the display capture function to either ***ON*** or ***OFF***.
4. Select the destination output Memory Card drive.
5. Select ***End***.

The settings will be registered and the screen in (1.) will return.

Execution Keys

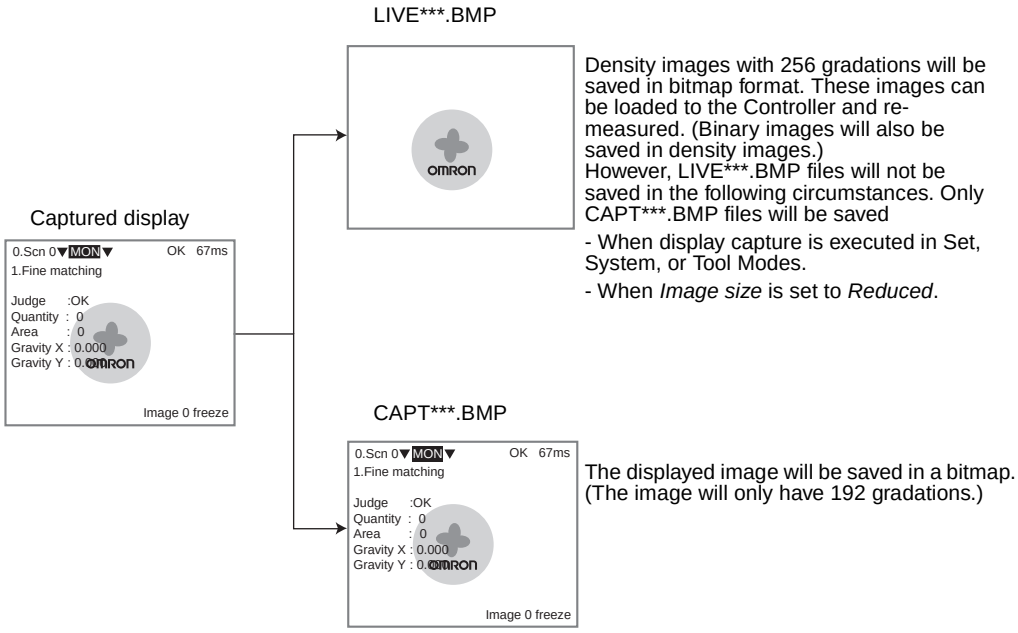
The following keys execute display capture when the display capture function is turned ON.

- For F160-KP: F9 Key
- For F150-KP: SHIFT+Left+Right Keys (Press 3 keys at the same time.)

CHECK In Monitor and Run Modes only, the display capture function can be allocated to another key. For example, the key allocation can be changed when the F150-KP is being used to enable one-touch operation, rather than having to press three keys at the same time. However, if display capture is allocated to another key, care must be taken because that key will be enabled in Monitor and Run Modes even if *Display capture* is set to OFF. Refer to *5-4 Customizing Operations*.

Display Capture Results

When display capture is executed, a directory called IMAGE will automatically be created in the root directory of the Memory Card and the following two types of files will be stored in that directory.



Density images with 256 gradations will be saved in bitmap format. These images can be loaded to the Controller and re-measured. (Binary images will also be saved in density images.)
However, LIVE***.BMP files will not be saved in the following circumstances. Only CAPT***.BMP files will be saved

- When display capture is executed in Set, System, or Tool Modes.
- When *Image size* is set to *Reduced*.

The displayed image will be saved in a bitmap. (The image will only have 192 gradations.)

A serial number starting from 000 will be automatically allocated to ***. The same number is used for both files.

5-4-3 Shortening Scene Group Switching Time

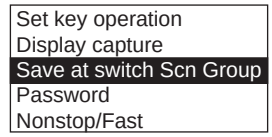
Normally, settings data is saved to flash memory and the Memory Card when scene groups are changed. The time taken to save is, therefore, added to the time taken to change scene groups. The time to change scene for changes in measurement setups can be reduced by omitting the save process.

Precaution If this function is set to OFF and settings data changed, always save the data before changing scene groups. When scene groups are changed, data from the flash memory or the Memory Card is loaded. So if the changed settings data is not saved, the data will be replaced by the loaded data. Refer to *SECTION 4 Other Functions*.

1. Enter System mode and select ***Operation settings***.

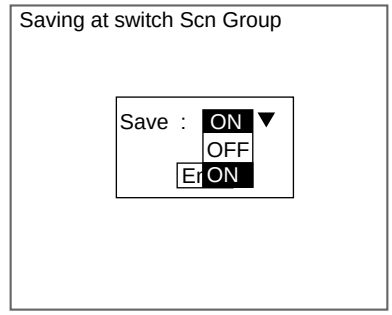
SeeAlso Refer to *5-1 Entering System Mode*.

The Menu will be displayed.



2. Select ***Save at switch Scn Group***.

The Saving at Switch Scn Group Settings Screen will be displayed.



3. Select ***ON*** or ***OFF***.

ON: Saves the data (default)

OFF: Does not save the data

4. Select ***End***.

The setting will be saved and the screen in (1.) will return.

5-4-4 Setting Passwords

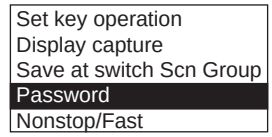
Passwords can be set to prevent settings being changed through incorrect operation. Set whether or not a password is required for the following two operations.

- When moving from Run Mode to Set, Monitor, or other modes
- When changing scenes in Run Mode

1. Enter System mode and select ***Operation settings***.

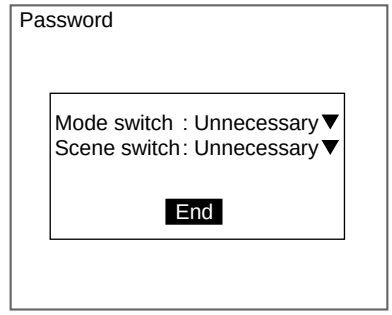
SeeAlso Refer to *5-1 Entering System Mode*.

The Menu will be displayed.



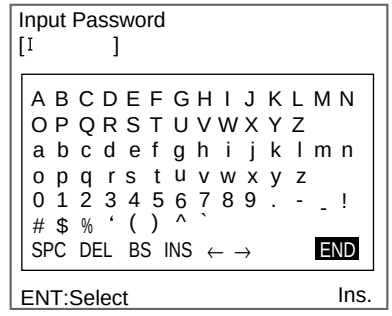
2. Select ***Password***.

The Password Settings Screen will be displayed.



3. Set ***Necessary*** or ***Unnecessary***.
4. Select ***End***.

If ***Necessary*** has been selected, the Input Password Settings Screen will be displayed.



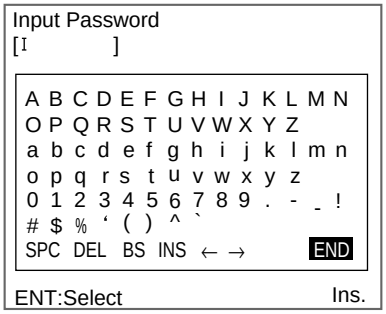
5. Set a password of 6 to 8 characters.
6. Select ***END***.

The settings will be registered and the screen in (1.) will return.

Example: Password Set for Mode Switching

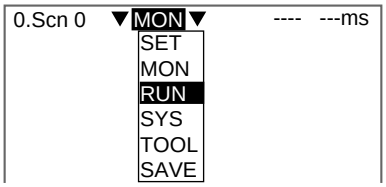
1. Move the cursor to the mode and press the **ENT** Key.

The Input Password Settings Screen will be displayed.

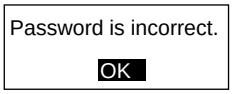


2. Enter the password.
3. Select ***END***.

If the entered password is correct, the mode selections will be displayed.



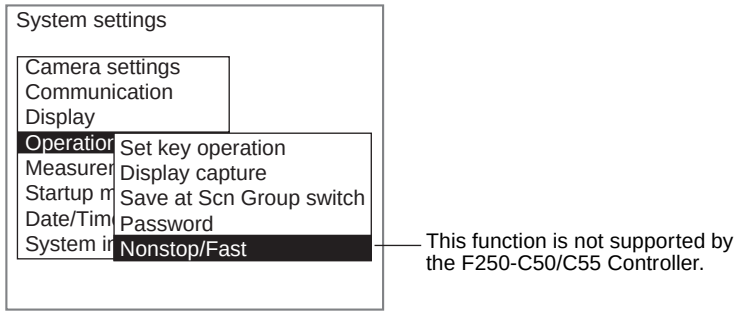
If the entered password is incorrect, an error message will be displayed.



CHECK Forgotten Passwords

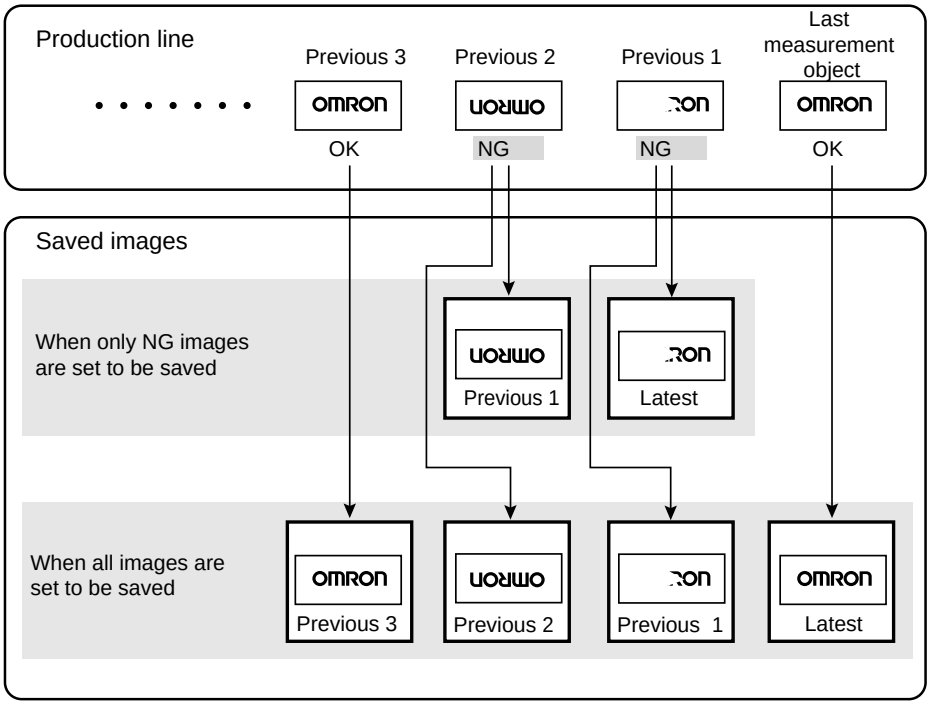
The password can be checked by inputting a password confirmation command from the serial interface. Refer to *6-2 Normal Serial Interface.*

5-4-5 Nonstop Adjustment



5-5 Setting Conditions for Saving Measurement Images

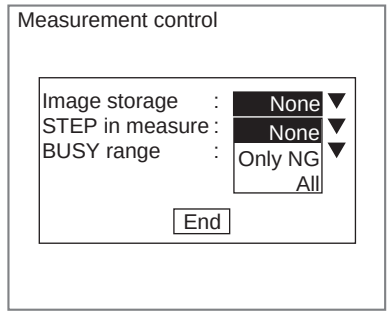
The Controller can save up to 35 measured images. These 35 images are shared by 32 scenes. The condition for saving the images can be selected from saving only when the measurement result is NG or saving all images regardless of the measurement result. When 35 images have been stored, new images will be stored by overwriting old images, starting with the oldest.



Precaution Stored images will be cleared when the power is turned OFF. Images to be kept must be backed up to a personal computer or Memory Card.

SeeAlso Refer to *SECTION 4 Other Functions*.

1. Enter System mode and select ***Measurement control***.
   The Measurement Control Settings Screen will be displayed.

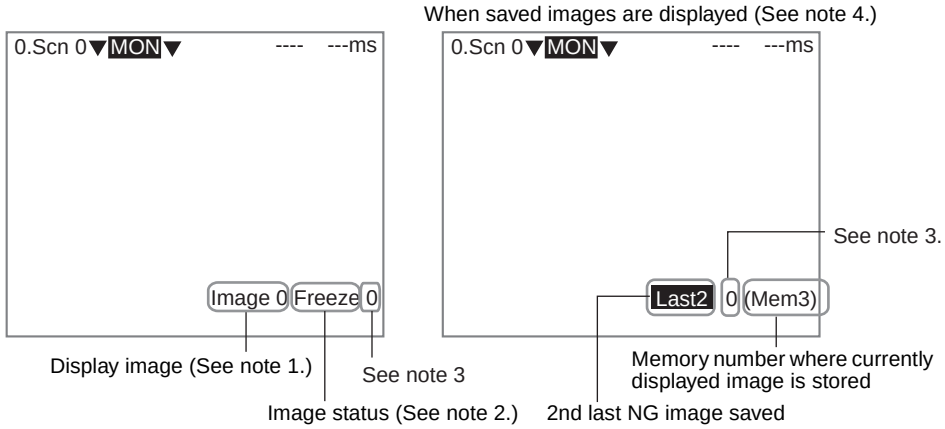


2. Change the conditions under ***Image storage***.
3. Select ***End***.
   The settings will be recorded and the System Mode Screen will return.

5-5-1 Displaying Stored Images

By displaying a stored image on the screen, the reason for a previous NG judgement can be checked. Also, measurement can be re-performed on the stored image with different evaluation criteria. The current image is displayed in the lower-right corner of the screen. However, the current image will not be displayed if *Image type* is set to OFF under *Conditions*.

SeeAlso Refer to *5-3-2 Measurement Screen Settings*.



	Display	Details
Note 1	Image 0	The image stored at Image 0 is displayed.
	Image 1	The image stored at Image 1 is displayed.
Note 2	Freeze	The image immediately after measurement is displayed.
	Through	
	Last NG	
Note 3	(Number)	If the image input processing items *Camera image* or *Switch camera* are set to 2 or more units, a number will be displayed to show the position of the item in the list. The number will not be shown, however, if the screen size is set to *Small*.
Note 4	——— (Memory ☐)	Past saved measurement images are displayed. The images that match the image save conditions (*Only NG/All*) will be stored in Memory 0 to Memory 35. Specify a number for Memory ☐ when backing up saved images to a personal computer or Memory Card.

Types of saved images

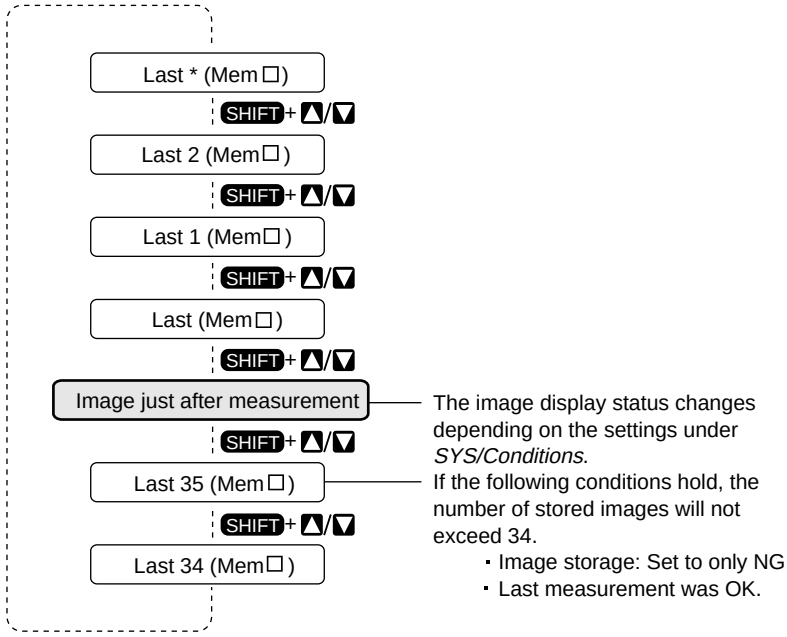
Last	The measured image most recently stored is displayed. If this image had an NG judgement, "Last" will be highlighted.
Last *	The * after "Last" contains the number of screens stored before the image. Up to 35 previous images can be displayed. "Last *" will be highlighted for NG images.
———	Either no image is stored in memory, or an image other than a measurement image (an image loaded from a personal computer) is displayed.

The display image and image status will change depending on the settings under *SYS/Display/Display settings*.

SeeAlso Refer to *Image Status on page 5-(7)*.

Switching Method

In Monitor Mode or Run Mode, press the SHIFT+Up/Down Keys to switch between images.



CHECK

- When *Display* is set to *Last NG*, the display cannot be switched to stored images. Change the display to *Freeze* or another display mode and then use the SHIFT+Up/Down Keys to switch between images.
- When the image input processing items *Camera image* or *Switch camera* are set to 2 or more units, use the Up and Down Keys to switch between images.

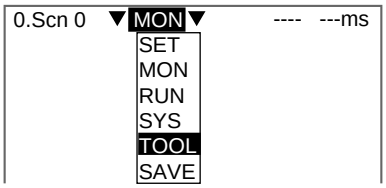
5-5-2 Clearing All Stored Images

All images are automatically cleared when the power is turned OFF, but the images can also be cleared without turning OFF the power by using the following procedure.

1. Display the Basic Screen in Monitor or Run Modes.

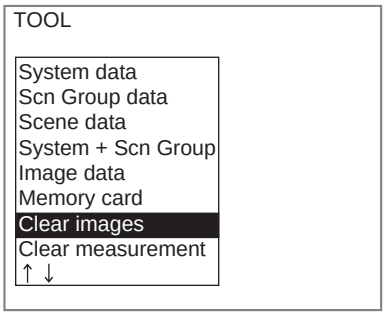
2. Move the cursor to ***MON*** (or ***RUN***) and press the **ENT** Key.

   The mode selections will be displayed.



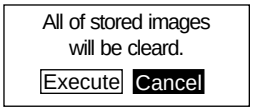
3. Select ***TOOL***.

   The data selections will be displayed.



4. Select ***Clear image***.

   A confirmation message will be displayed.



5. Select ***Execute***.

   The stored images will be cleared and the screen in (3.) will return.

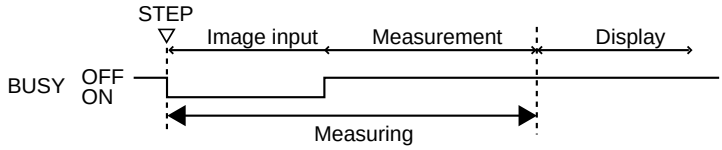
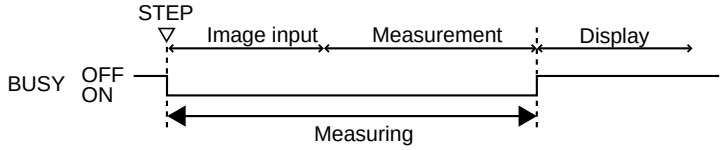
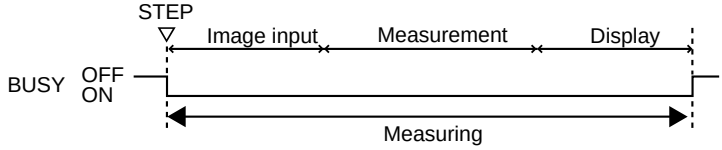
CHECK Change the Console Key allocations to clear the stored images with a one-touch key operation. Refer to *5-4 Customizing Operations*.

5-6 Using BUSY Signals

The BUSY signal is a control signal used to show that the Controller is busy processing. The ON/OFF timing of this BUSY signal is monitored at the external device to time communications. The handling of the BUSY signal can be changed to create a smoother system.

BUSY Range

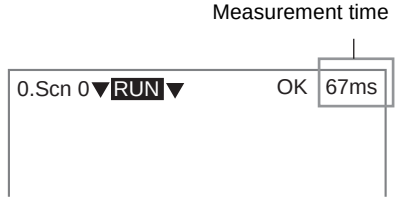
Select at what point in the processing that the BUSY signal will turn OFF.

Selection	Details
Input image completed	The BUSY signal turns OFF when the image input has been completed. This can be used as a guide as to whether or not the workpiece can be moved. If *Camera image* is set to multiple units, the BUSY signal turns OFF when the first Camera image input has been completed.  When this selection is made, do not enter the next command until measurement has been completed, even if the BUSY signal has turned OFF. If the next command is input before the measurement has been completed, the current processing and the input command may not be executed correctly.
Measurement completed*	The BUSY signal turns OFF when the measurement has been completed. 
Display completed	The BUSY signal turns OFF when the display of the measurement result has been completed. The busy signal remains ON and the Controller is treated as “measuring” until the display has been completed. 

Note *The asterisk (*) indicates the default setting.

CHECK The measurement times shown in Monitor and Run Modes will change depending on the settings for the BUSY range.

The time taken for “Measuring” indicated in the above table is displayed as the measurement time.



STEP in Measure

Measurement will not be performed by the Controller during another measurement, even if the STEP signal turns ON. Set whether or not the ERR signal will turn ON to notify the external device that the STEP signal was not accepted.

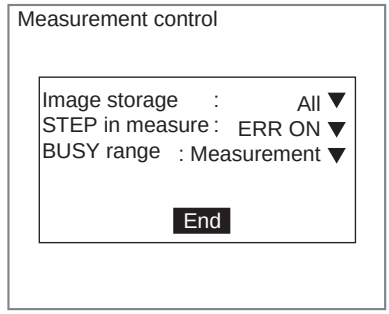
Selection	Details
ERR ON* (See note.)	Measurement will not be performed and the ERR signal will turn ON if the STEP signal turns ON during processing. The ERR signal will turn OFF when the next STEP signal is input at the correct timing.
OFF	The ERR signal will not turn ON even if the STEP signal turns ON during processing. Measurement will not be performed.

Note *The asterisk (*) indicates the default setting.

1. Enter System mode and select ***Measurement control***.

SeeAlso Refer to *5-1 Entering System Mode*.

The Measurement Control Settings Screen will be displayed.



2. Change the ***STEP in measure*** and ***BUSY range*** settings.
3. Select ***End***.

The settings are registered and the System Mode Screen will return.

5-7 Setting Startup Conditions

Use the following procedure to set the status when the power is turned ON. If the Controller is set to start in Run Mode for the scene where the desired measurement conditions are registered, measurement of objects can be started by simply turning the power ON.

Also, unnecessary menu selection screens and Camera setting screens that are always displayed at startup can be set to not be displayed.

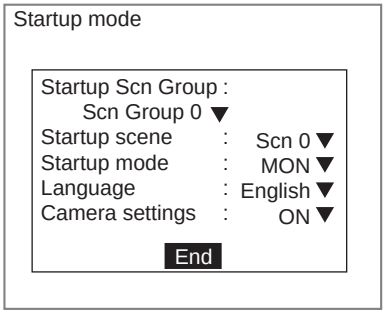
Item	Details
Startup scene group	Selections: 0* to 31 When a scene group between 1 and 31 is selected, make sure the Memory Card where that scene group is stored is inserted.
Startup scene	Selections: 0* to 31, OFF(scene number when saved to flash memory)
Startup mode	Selections: Set, Monitor*, Run, OFF(mode when saved to flash memory)
Startup language	Select the language for screen messages. Selections: Japanese, English*
Camera settings at startup	Select whether or not to display the Camera Settings Screen. Selections: ON* (display), OFF (no display)

Note *The asterisk (*) indicates the default setting.

1. Enter System mode and select ***Startup mode***.

SeeAlso Refer to *5-1 Entering System Mode*.

The Startup Mode Settings Screen will be displayed.



2. Change the settings.
3. Select ***End***.

The settings will be saved and the System Mode Screen will return.

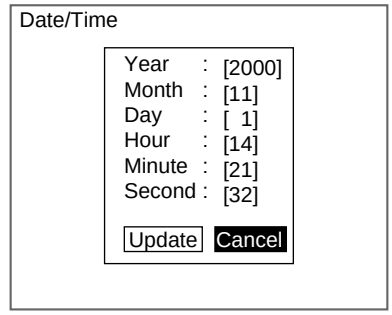
5-8 Setting the Calendar Date and Time (Date/Time)

Check if the internal calendar is set to the correct date and time and adjust if necessary.

1. Enter System mode and select ***Date/Time***.

SeeAlso Refer to *5-1 Entering System Mode*.

The Date/Time Settings Screen will be displayed.



2. Check if the date and time is correct. Adjust if necessary.
3. If the settings do not require adjustment, select ***Cancel*** to exit this screen.

   Select ***Update*** to save changes to the date and time.

   The settings will be registered and the System Mode Screen will return.

5-9 Checking System Information

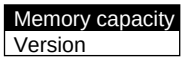
5-9-1 Checking Remaining Memory Space and Battery Status

Use the following procedure to check the remaining work memory and internal flash memory and the status of the battery mounted for date and time data backup.

1. Enter System mode and select ***System information***.

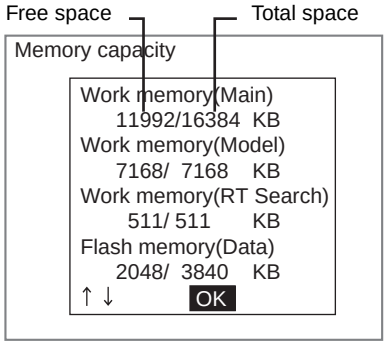
SeeAlso Refer to *5-1 Entering System Mode*.

The Memory capacity/Version Menu will be displayed.

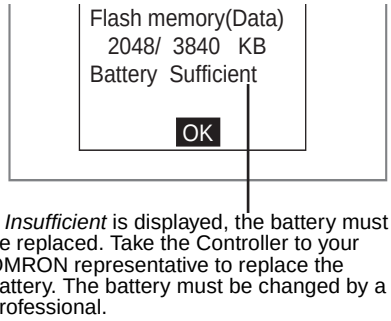


2. Select ***Memory capacity***.

The memory capacity will be displayed.



Press the **Down** Key to scroll down and display the rest of the information. The battery status will be displayed at the bottom of the list.



3. Select ***OK*** to exit this screen.

The screen in (1.) will return.

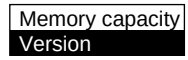
5-9-2 Checking the Software Version

Use the following procedure to check the software system version.

1. Enter System mode and select ***System information***.

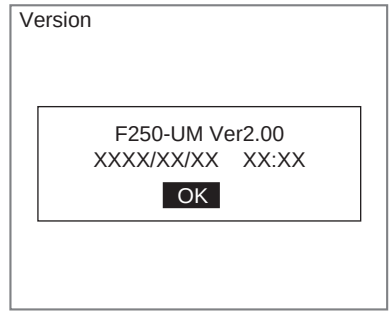
SeeAlso Refer to *5-1 Entering System Mode*.

The Memory Capacity/Version Menu will be displayed.



2. Select ***Version***.

The version information will be displayed.



3. Select ***OK*** to exit this screen.

The screen in (1.) will return.

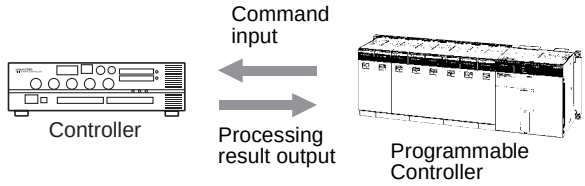
SECTION 6
Communicating with External Devices

This section describes the methods for communications with external devices, such as personal computers and Programmable Controllers, via parallel or serial interfaces.

6-1 Parallel Interface . . . . . 6-1-(1)
6-1-1 Setting Communications Specifications . . . . . 6-1-(2)
6-1-2 I/O Format . . . . . 6-1-(5)
6-1-3 Timing Charts . . . . . 6-1-(8)
6-2 Normal Serial Interface . . . . . 6-2-(1)
6-2-1 Setting Communications Specifications . . . . . 6-2-(2)
6-2-2 Input Format (Normal) . . . . . 6-2-(11)
6-2-3 Output Format (Normal) . . . . . 6-2-(105)
6-3 Host Link Serial Interface . . . . . 6-3-(1)
6-3-1 Setting Communications Specifications . . . . . 6-3-(2)
6-3-2 Input Format (Host Link) . . . . . 6-3-(9)
6-3-3 Output Format (Host Link) . . . . . 6-3-(14)
6-3-4 Sample Ladder Program . . . . . 6-3-(17)
6-4 Serial Interface Menu Operations . . . . . 6-4-(1)
6-4-1 Setting Communications Specifications . . . . . 6-4-(2)
6-4-2 Inputting Characters from the Computer . . . . . 6-4-(5)

6-1 Parallel Interface

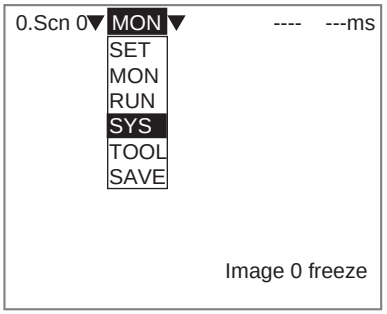
This section explains the I/O format and the required communications settings when using the Controller's parallel interface to communicate with external devices.



6-1-1 Setting Communications Specifications

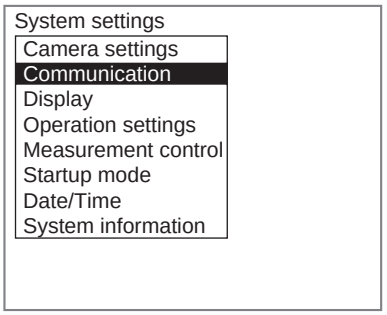
This section explains how to set the communications specifications. Set the same communications specifications in the Controller and the external device.

1. Move the cursor to ***MON*** or ***RUN*** and press the **ENT** Key.



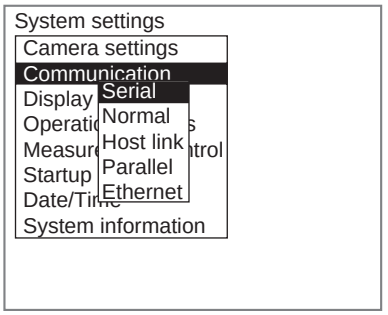
2. Select ***SYS***.

   The *System settings* menu will be displayed.



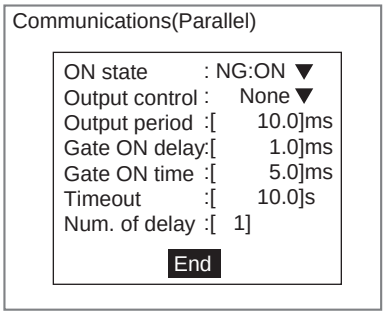
3. Select ***Communications***.

The communications menu will be displayed.



4. Select ***Parallel***.

   The *Communications (Parallel)* window will be displayed.



5. The Communications (Parallel) window will be displayed.
6. Select ***End***.

   The displayed settings will be registered and the screen in (3.) will return.

   The following table shows the possible communications settings.

Item		Settings
ON state		Select whether the OR and DO0 to DO31 signals will go ON when the judgement is OK or NG. (The default setting is ON for an NG judgement.)
Output control	None	The Controller outputs the measurement results without synchronizing with the external device. (This is the default setting.)
	Hand-shaking	The Controller outputs the measurement results while synchronizing the transmission with the external device.
	Sync. output	The Controller outputs the measurement results while synchronizing with processing on the line. The number of STEP signals specified for the *Number of delays* setting is ignored and measurement results are output on the next STEP signal.
Output period (Effective only when output control is set to *None*.)		Set the period for outputting the measurement result. Set a value between 2.0 and 10,000.0 ms that is greater than the “Gate ON delay + Gate ON time,” and less than the measurement interval. If the period is longer than the measurement interval, the output timing will fall behind as the measurements are repeated. The default setting is 10.0 ms.

Item	Settings
Gate ON delay	Set the time from when the result is output to the parallel interface to when the GATE signal is turned ON. This time is used to wait until the data output becomes stable. Set a time between 1.0 and 1,000 ms that is longer than the external device's delay time. The default setting is 1.0 ms.
Gate ON time (Effective only when output control is set to *None* or *Sync.output*.)	Set the length of time that the GATE signal remains ON. Set a value between 1.0 and 1,000 ms so that the external device can read the measurement result. The default setting is 5.0 ms.
Timeout (Effective only when handshaking is used.)	A timeout error will occur if there is no response from the external device within the timeout time. Set a value between 0.5 and 120.0 s. The default setting at 10.0 s.
Num. of delays (Effective only with Sync. output.)	Set the number of times the STEP signal turning ON will be ignored from the time the STEP signal first turns ON until that measurement result is output.

6-1-2 I/O Format

Input Format

The following commands can be input when the Controller is in Monitor or Run mode.

STEP Signal

A one-time measurement is performed if the STEP signal is turned ON.

DI Signals

DI signals can input the following commands. After the command information is set, allow at least 1 ms before turning ON DI7 (execution trigger). Signals DI8 to DI15 are used only when units 31 and later are specified using the model re-registration command.

(In the following table, 0 indicates the signal is OFF, and 1 indicates the signal is ON. An asterisk indicates that the Controller does not read the bit status, so the bit status can be either 0 or 1.)

Command	Input command (DI)								Operation
	Execute	Command		Information					
	7	6	5	4	3	2	1	0	
Continuous measurement	1	0	0	*	*	*	*	*	Measurements continue while the command is being input.
Switch scene	1	0	1	Scene number					Switches the scene to measure.
Example	1	0	1	0	0	0	1	0	Switches to scene 2.
Switch scene group	1	1	1	Scene group number					Switches the scene group data.
Example	1	1	1	0	0	0	1	0	Switches to scene group 2.

- Model Re-registration Command

Re-register model	1	1	0	Unit number					Registers the models again for all regions for the specified unit number. (When the through display is being used, the models will be registered based on the last image that was measured.) (This command is enabled only if model position compensation, circle position compensation, fine matching, pattern inspection, rotation positioning, or ECM search unit numbers are specified. Other unit numbers will be ignored if they are specified.) (See note.)
Example	1	1	0	0	0	1	1	0	Re-registers the model of unit 6.

CHECK Use I/O connectors DI0 to DI4 and DI8 to DI10 when specifying units 31 and later.

Example: To Re-register Model for Unit 50

Input command (DI)								
Information	Execute	Command		Information				
8	7	6	5	4	3	2	1	0
1	1	1	0	1	0	0	1	0

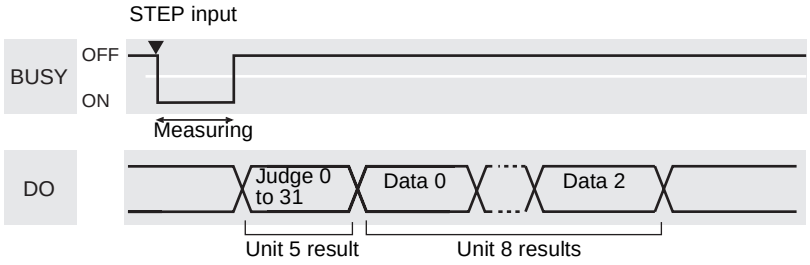
110010 = Unit 50

CHECK The ERR signal will turn ON if the input command was not received correctly.

Note Model re-registration is executed for the currently displayed Camera image. Therefore, change to the Camera image for the unit to be re-registered before executing this command. Use the Up and Down Keys on the Console to switch Camera images.

Output Format

Measurement results are output each time a measurement is made. Data is output only when the Controller is in Run Mode; data is not output when the Controller is in Monitor Mode. The user can select whether a signal is output when the judgement result is OK or when it is NG. The default setting is for a signal to be output when the judgement result is NG. Refer to *6-1-1 Setting Communications Specifications* for details.

Signal	Output function
OR	Outputs the overall judgement result.
DO0 to DO31	DO Judgement Output The judgement results for expressions 0 to 31 set using the results output processing item *DO judge* will be output to DO0 to DO31. (DO0 to DO15 will be output to connector 0 and DO16 to DO31 will be output to connector 1.) Refer to *2-40 DO Judgement*.
	DO Data Output The measurement values set to expressions 0 to 31 set using the results output processing item *DO data* will be output. Refer to *2-39 DO Data*. Only the integer values will be output. Decimal values will be rounded off. The value range that can be output is -9,999,999 to 9,999,999. The output for measurement values less than -9,999,999 will be -9,999,999. The output for measurement values greater than 9,999,999 will be 9,999,999. Select either 2's complement binary format or BCD format. Refer to *7-4 Terminology* for a definition of "2's complement"
	Output Order The measurement results will be output in order from the smallest unit number. Example: *DO judge* set for unit 5 and *DO data* set for unit 8 

CHECK After measurements have been made in Run Mode, the data that is output to the OR and DO signals is retained until new measurements are made in Run Mode. The status of these output is retained even if the Controller is switched from Run Mode to another Mode.

Output signals will return to OFF if *TOOL/Clear measurement* is executed.

SeeAlso Refer to *SECTION 4 Other Functions*.

CHECK The initial value for output signals is OFF, but the signals may go ON about 0.5 seconds after the power is turned ON. Take any necessary precautions when these signals are read by externals devices.

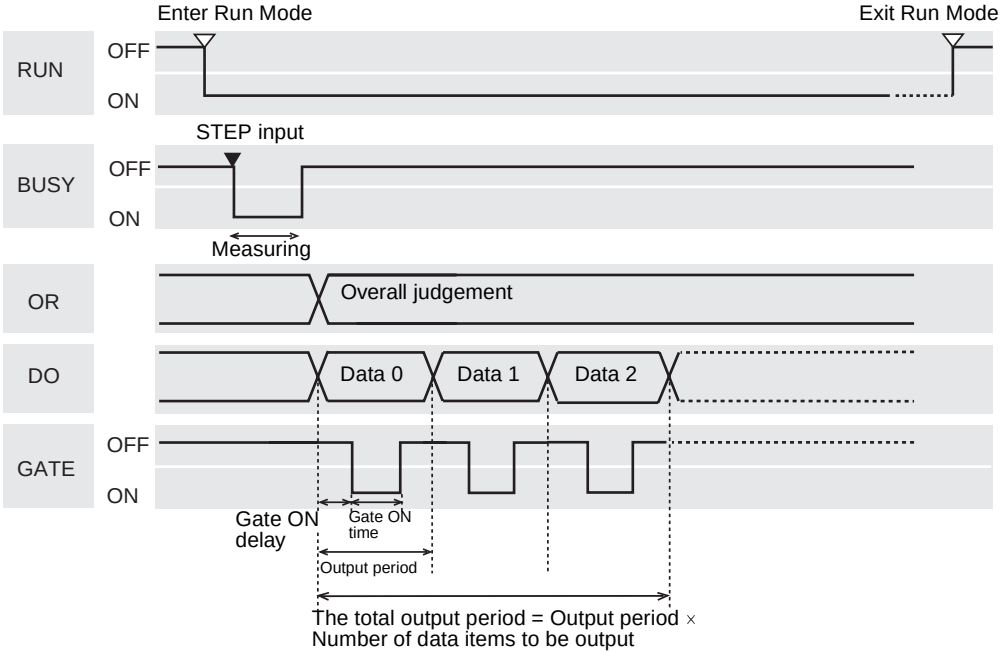
6-1-3 Timing Charts

No Output Control

The Controller outputs measurement results to the external device without synchronizing communications. Monitor the Controller's GATE signal from the external device and read the measurement results at the external device while the Controller's GATE signal is ON.

Using the STEP Signal as the Measurement Trigger

Example: When 3 Expressions Are Set for *DO data*



Output Signals

Signal	Function
RUN	ON while the Controller is in Run Mode.
BUSY	Indicates that the Controller is performing an operation such as measuring or switching scenes. Do not input the next command while the BUSY signal is ON. If another command is input while the BUSY signal is ON, either the operation being performed or the command that was input may not be properly executed. When the BUSY signal's OFF timing is changed to **Image Input Completed**, the Controller will continue measuring even though the BUSY signal is OFF. Do not input the next command until the measurement is completed. Refer to the *SECTION 5 System Settings* for more details.
OR	Outputs the overall judgement. There is a parameter in the communications settings window that allows the user to select whether the ON signal is output when the judgement result is OK or NG. Refer to *6-1-1 Setting Communications Specifications* for details.

Signal	Function
DO	Outputs the results of the expressions that were set in *Do judge* and *DO data*. There is a parameter in the communications settings window that allows the user to select whether the ON signal is output when the judgement result is OK or NG. Refer to *6-1-1 Setting Communications Specifications* for details.
GATE	Use the GATE signal to control the timing for the external device to read measurement results. Set a GATE ON time that is long enough for the external device to read the measurement results properly. Set the output period so that the total output time is shorter than the measurement interval (STEP input interval.)

Input Signals

Signal	Function
STEP	Input a measurement trigger from an external source such as a Photoelectric Sensor. Synchronize the STEP signal's rising edge (OFF-to-ON) transition and make one measurement. Keep the STEP signal ON for at least 0.5 ms.

CHECK **Busy Signal Operation**

The operation of the BUSY signal can be changed in the ***SYS/Measurement control*** window.

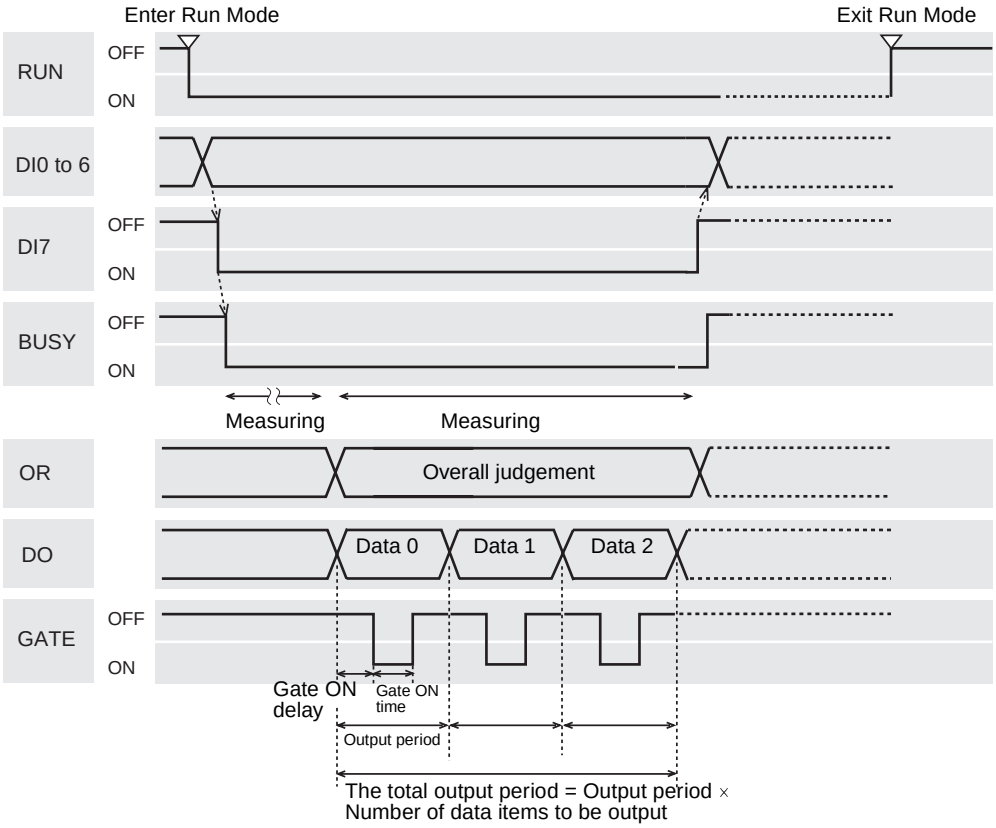
- Set the point in processing when the BUSY signal is turned OFF. The BUSY signal can be set to go OFF when the image input is completed, the measurement is completed (default setting), or the display is completed.
- Set whether or not the ERR signal will be turned ON if another STEP signal is input while the Controller is still measuring.

SeeAlso Refer to the *SECTION 5 System Settings* for details.

Continuous Measurement

CHECK Set the output period so that the total output time is shorter than the measurement interval. If the output cycle is longer than the measurement cycle, the output will gradually fall behind as measurements are repeated.

Example: When 3 Expressions Are Set for *DO data*



Output Signals

The functions of the output signals are the same as they are when the STEP signal is used as the measurement trigger. (Refer to the tables on the preceding pages.)

Input Signals

Signal	Function
DI0 to DI4	OFF
DI5	OFF
DI6	OFF
DI7	DI7 is the execution trigger. After DI0 to DI6 are set, allow at least 1 ms before turning ON DI7. The BUSY signal will be ON while continuous measurement is being performed.

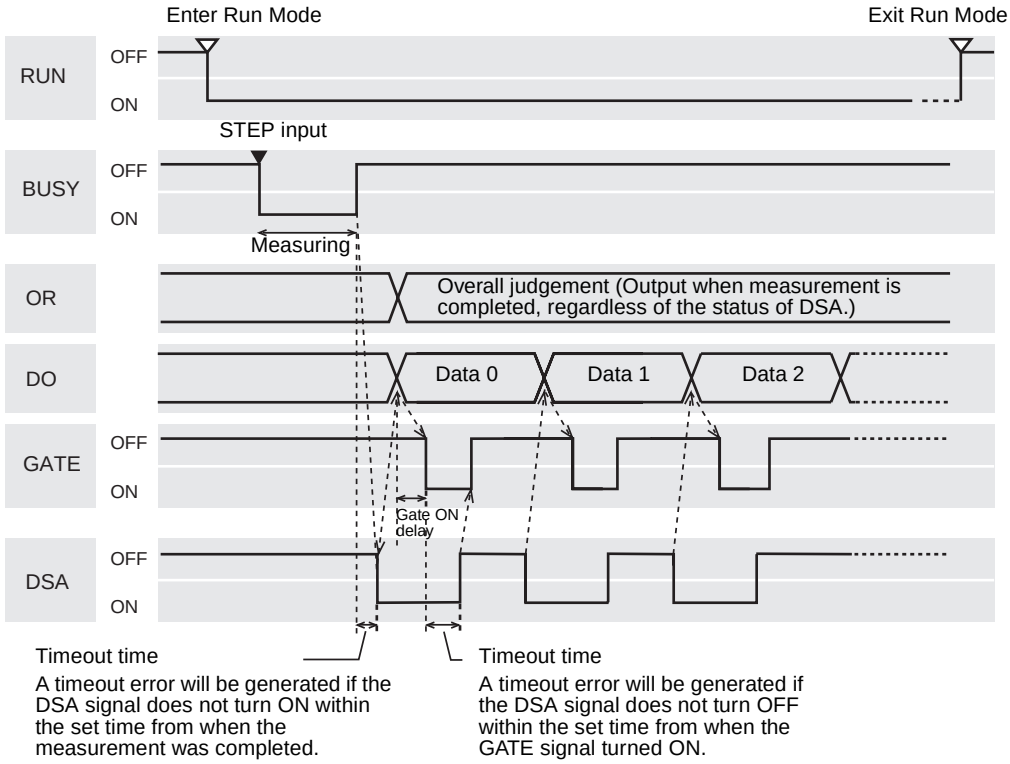
CHECK The ERR signal will turn ON if the input command was not received correctly.

Handshaking

When handshaking is set, the Controller outputs measurement results to the external device while synchronizing communications. Handshaking is effective when multiple measurement results are output in numerical order and the handshaking function transfers data with more certainty.

Using the STEP Signal as the Measurement Trigger

Example: When 3 Expressions Are Set for *DO data*



CHECK With the exception of DSA, the functions of the I/O signals are the same as when output control is set to *None*.

I/O Signals

Signal	Function
DSA	DSA is the signal from the external device that requests transmission of the next batch of data. The Controller does not output data until DSA goes ON. Turn ON the DSA signal when the following conditions are met: • The external device's data receiving system is ready to receive more data. • The Controller has completed measurements. Generally, the BUSY signal will be ON while the Controller is measuring and the BUSY signal can be used to indicate when measurements are completed. If the BUSY signal's OFF timing has been changed to go OFF when image inputting is completed, the Controller may still be measuring even though the BUSY signal has gone OFF. (The BUSY signal's OFF timing is set in ***SYS/Measurement control***.) Refer to the *SECTION 5 System Settings* for more details.

Synchronous Output

The synchronous output function is used to synchronize the results output timing and the processing timing on the production line. The measurement results are output when the next STEP signal turns ON after the number of STEP signals set under *Num. of delays* in the communications settings have turned ON.

CHECK When *Sync. output* is set, the delay is calculated by the number of times the STEP signal turns ON. Therefore, set the measurement results output so that the result is output only once for each measurement.

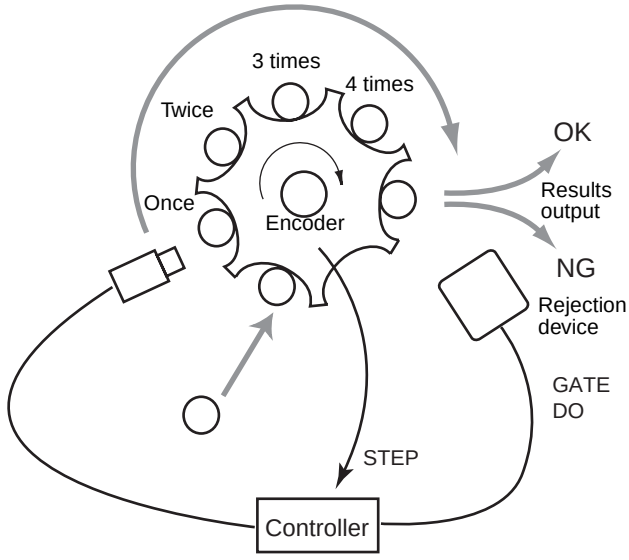
Set one unit for *DO judge* and one expression for *DO data*.

CHECK Set measurement command input to STEP signals only.

If TRIG or serial command measurement or continuous measurement are performed, the output timing will no longer match and the Controller may malfunction.

Example: For Process-feed Production Lines Using a Star Wheel

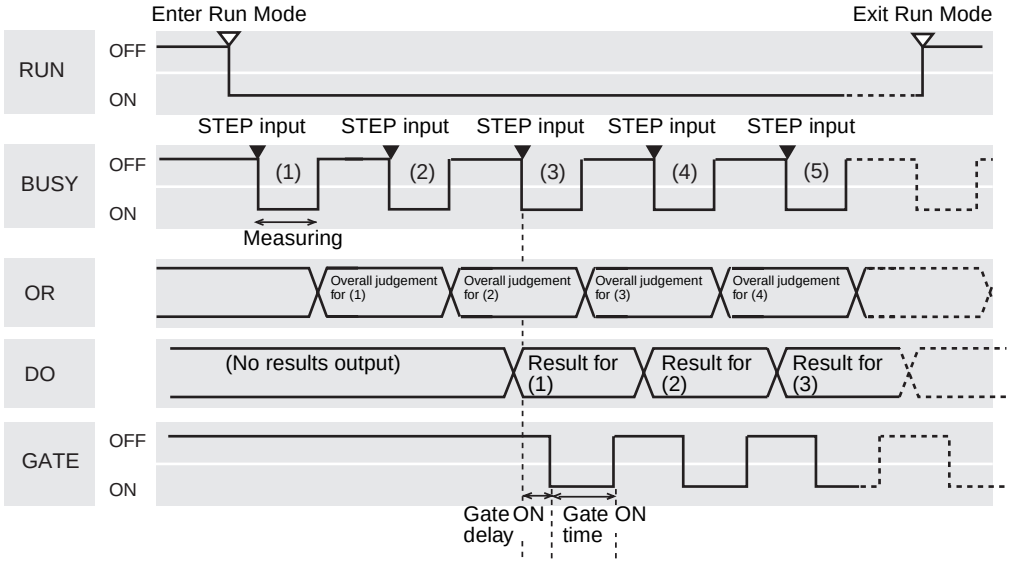
The timing of the rejection of NG products and measurement results output can be synchronized.



If *Num. of delays* is set to 4, the measurement result will be output after 4 STEP signals have been detected.

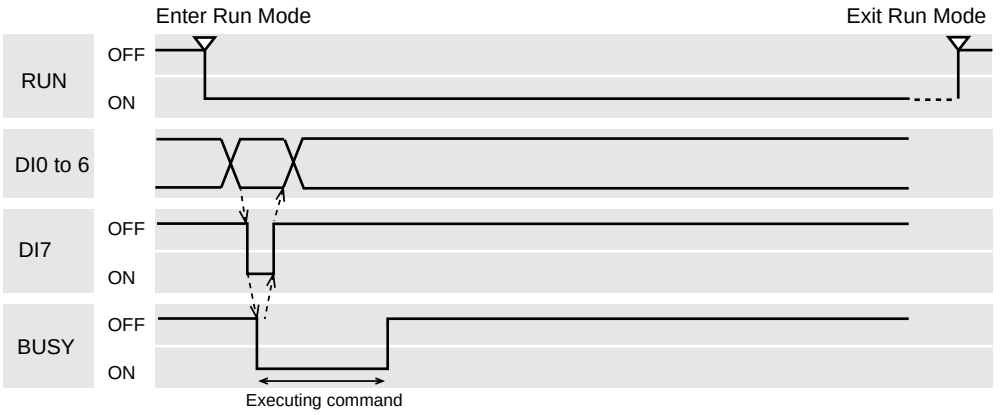
Inputting Measurement Triggers to STEP Signal

Example: When *Num. of delays* is Set to 2



CHECK The functions of the I/O signals are the same as when output control is set to *None*.

Switching Scenes or Scene Groups



Output Signals

Signal	Function
RUN	ON while the Controller is in Run Mode.
BUSY	Indicates that the Controller is switching scenes or scene groups. Do not input the next command while the BUSY signal is ON. If another command is input while the BUSY signal is ON, either the operation being performed or the command that was input may not be properly executed.

Input Signals: Switching the Scene

Signal	Function
DI0 to DI4	Set the scene number (0 to 31).
DI5	ON

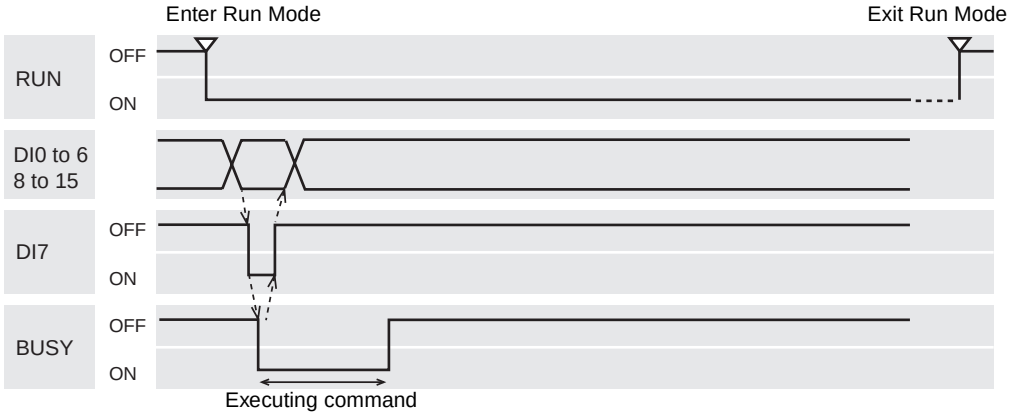
Signal	Function
DI6	OFF
DI7	DI7 is the execution trigger. After DI0 to DI6 are set, allow at least 1 ms before turning ON DI7. The BUSY signal will be ON while the command is being executed. After confirming that the BUSY signal is ON, turn OFF DI7, and finally turn OFF DI0 to DI6.

Input Signals: Switching the Scene Group

Signal	Function
DI0 to DI4	Set the scene group number (0 to 31).
DI5	ON
DI6	ON
DI7	DI7 is the execution trigger. After DI0 to DI6 are set, allow at least 1 ms before turning ON DI7. The BUSY signal will be ON while the command is being executed. After confirming that the BUSY signal is ON, turn OFF DI7, and finally turn OFF DI0 to DI6.

CHECK The ERR signal will turn ON if the command to switch scene groups is input while there is no Memory Card mounted to the Memory Card slot 1.

Re-registering Models



Output Signals

Signal	Function
RUN	ON while the Controller is in Run Mode.
BUSY	Indicates that the Controller is re-registering models. Do not input the next command while the BUSY signal is ON. If another command is input while the BUSY signal is ON, either the operation being performed or the command that was input may not be properly executed.

Input Signals: Registering the Model Again

Signal	Function
DI0 to DI4 DI8 to DI15	Set the unit number (0 to 31). (See note.)
DI5	OFF

Signal	Function
DI6	ON
DI7	DI7 is the execution trigger. After DI0 to DI6 and DI8 to DI15 are set, allow at least 1 ms before turning ON DI7. The BUSY signal will be ON while the command is being executed. After confirming that the BUSY signal is ON, turn OFF DI7, and finally turn OFF DI0 to DI6 and DI8 to DI15.

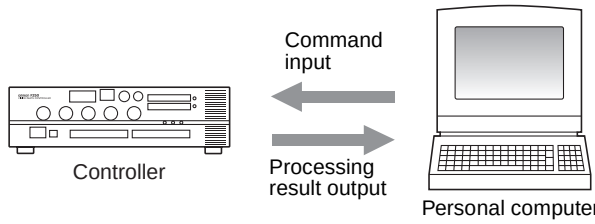
Note Use DI8 to DI15, in addition to DI0 to DI4, when setting re-registration of models for units 31 and later.

SeeAlso Refer to *6-1-2 I/O Format*.

CHECK The ERR signal will turn ON if the input command was not received correctly.

6-2 Normal Serial Interface

This section explains how to set the required communications specifications and the I/O format for using the Controller's serial interface (with a RS-232C/ RS-422 connection or Ethernet connection) to communicate with an external device, such as a personal computer.



Note RS-232C/RS-422 and Ethernet connections cannot be used at the same time. Use only one of these type of connections for the serial interface.

6-2-1 Setting Communications Specifications

If the communications mode is set to *Normal*, the Controller can communicate with an external device such as a personal computer through its serial interface (with a RS-232C/RS-422 connection or Ethernet connection) using the normal (no-protocol) format.

CHECK Set the output data under the *Normal data* results output processing item.

- Setting Mode
  Command inputs are not received.
- Monitor Mode
  Command inputs are received, but the measurement results are not output to external devices. Only the command execution result (OK or ER) is output.
  When a command is input to read a set value, the appropriate value will be output.
- Run Mode
  Command inputs are received and measurement results are output.

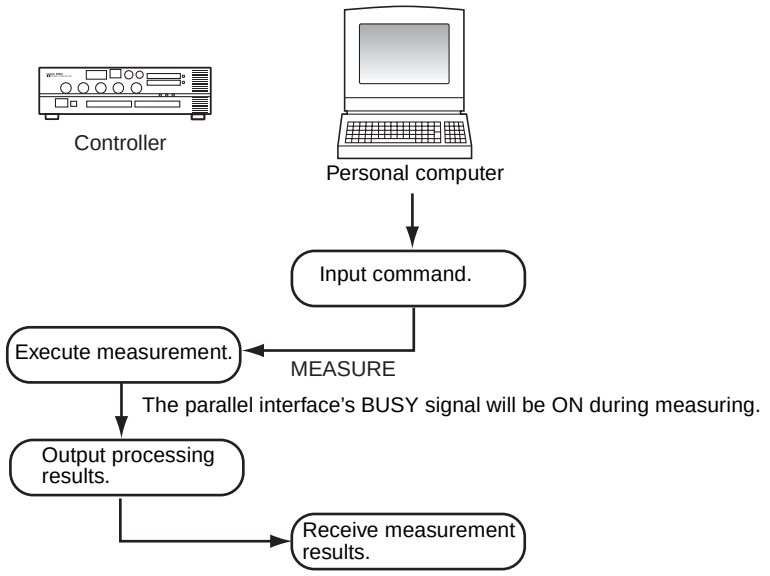
CHECK After measurements have been made in Run Mode, the data up through the last measurement will be output even if the mode is changed to another mode. The data output will not be interrupted midway.

Operational Flowcharts

RS-232C and RS-422 Connections

1:1 Connection

In the following example, a measurement command is input and those results are read.



Note When the ***Flow control*** is set to ***Xon/off*** and a response is not received from the computer within the specified timeout time, a timeout error will occur because the computer may be disconnected or malfunctioning. An error message will be displayed on the Controller's screen and the parallel interface's ERR signal will be turned ON.

Multi-drop Connection (1:N)

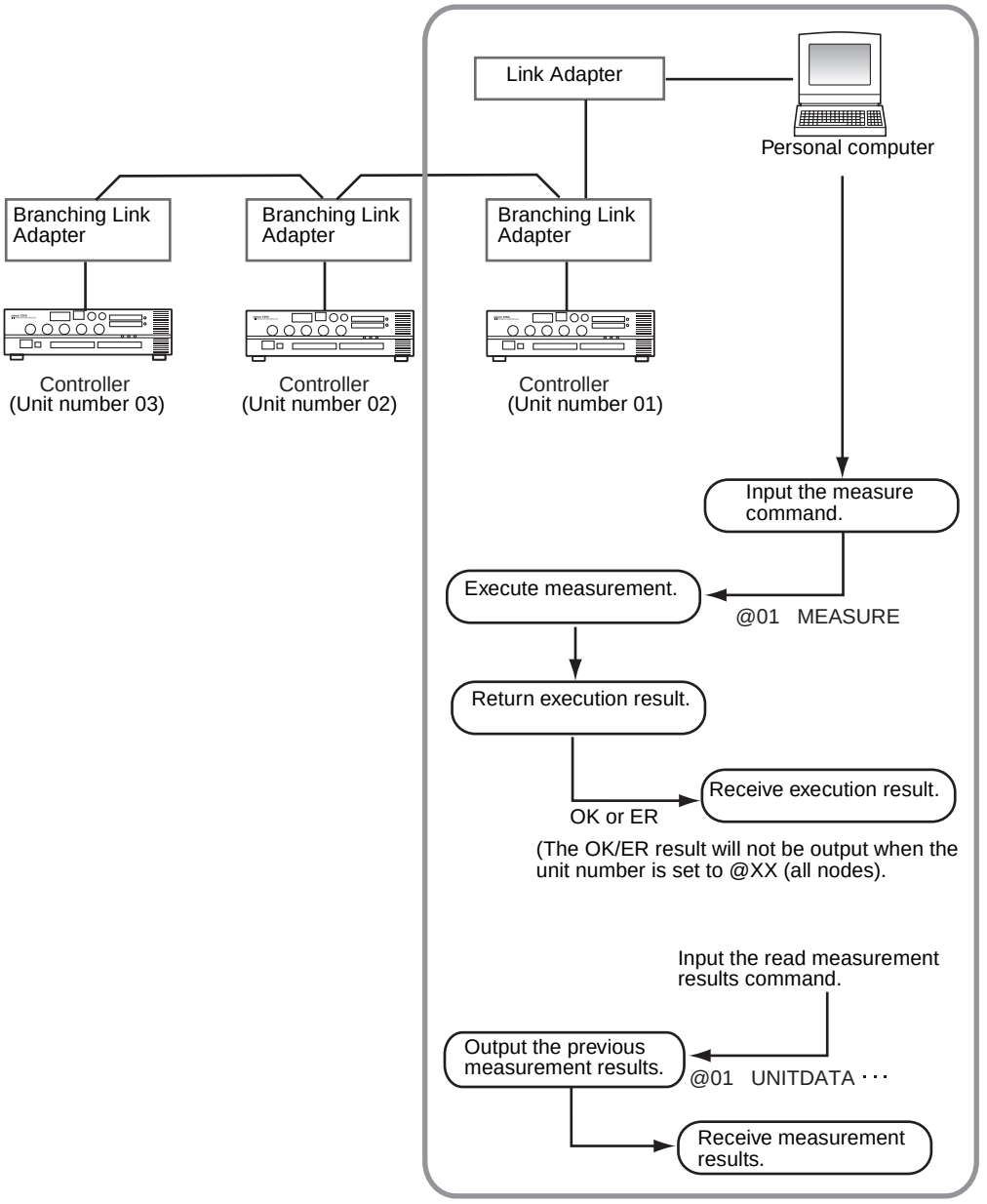
Branching Link Adapters can be used to connect up to 31 Controllers to a single host computer.

CHECK When a multi-drop connection is used, the Controller will not output measurement results until a command to get measurement results is received from the host. Specify the Controller from which data is to be obtained from the host. Use the following communications settings for multi-drop connections.

Item	Setting
Multi-drop	ON
Unit number	1 to 31 (Set a unique number for each Controller.)

SeeAlso Refer to *Normal Communications on page 6-2-(8)* for details on setting the unit number.

In the following example, a measurement command is input for the Controller with unit number 01 and those results are read.

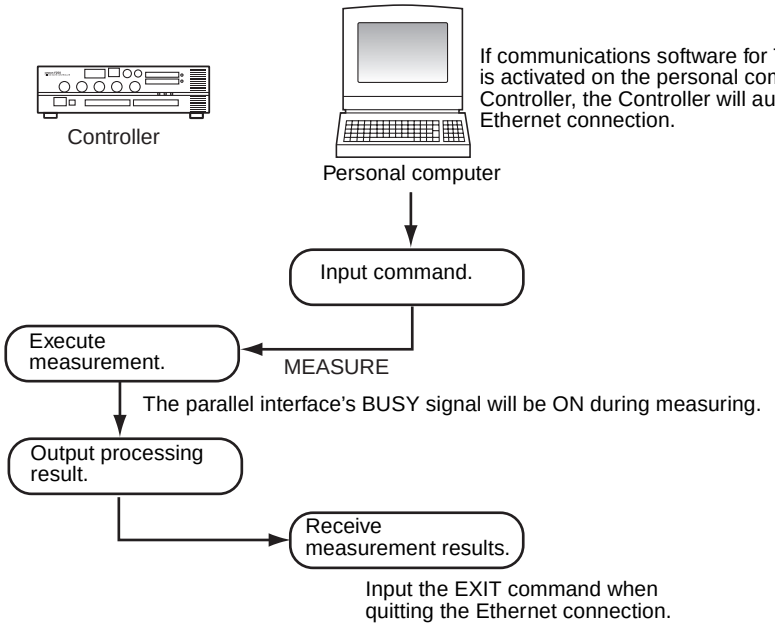

Link Adapter
Personal computer
Branching Link Adapter
Branching Link Adapter
Branching Link Adapter
Controller (Unit number 03)
Controller (Unit number 02)
Controller (Unit number 01)
Input the measure command.
Execute measurement.
@01 MEASURE
Return execution result.
Receive execution result.
OK or ER
(The OK/ER result will not be output when the unit number is set to @XX (all nodes).
Input the read measurement results command.
Output the previous measurement results.
@01 UNITDATA ···
Receive measurement results.

Ethernet Connections

CHECK Communications with the Controller from outside the LAN and communications between multiple personal computers and the Controller may not function properly. Also, communications cannot be performed between two Controllers or between a Programmable Controller and the Controller.

1:1 Connection

In the following example, a measurement command is input and those results are read.

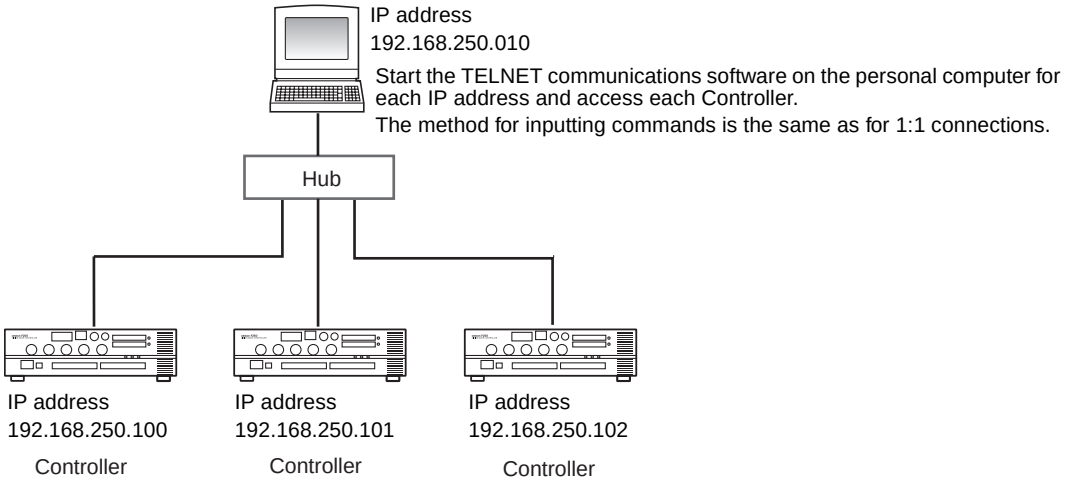


1:N Connections

With this connection format, one personal computer can communicate with multiple Controllers via a hub.

Make sure the IP addresses set for the Controllers are not duplicated.

Example:

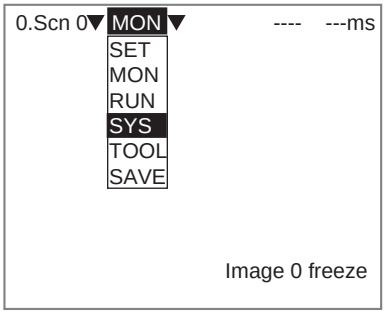


Controller Settings for RS-232C and RS-422 Connections

Serial Communications

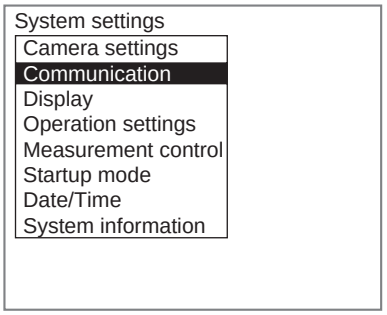
Use the following procedure to set communications specifications such as the baud rate and data length. Set the same communications specifications in the Controller and the external device.

1. Move the cursor to ***MON*** or ***RUN*** and press the **ENT** Key.



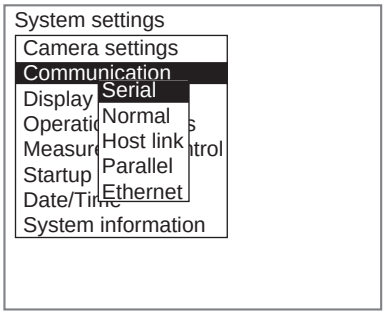
2. Select ***SYS***.

   The *System settings* menu will be displayed.



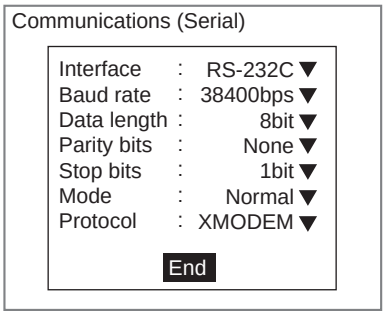
3. Select ***Communications***.

   The communications menu will be displayed.



4. Select ***Serial***.

The *Communications (Serial)* window will be displayed.



5. Set each parameter to the desired setting.
6. Select ***End***.

   The displayed settings will be registered and the *System settings* menu (from step 3) will be displayed.

   The following table shows the possible communications settings. The asterisk (*) indicates the default setting.

Item	Possible settings	
Interface	RS-232C* or RS-422	
Baud rate (See note a.)	2,400, 4,800, 9,600, 19,200, 38,400*, 57,600, 115,200 (bps)	Set the same settings that are set in the personal computer.
Data length	7 or 8* (bits)	
Parity bits	None*, Odd, or Even	
Stop bits	1* or 2 (bits)	
Mode	Select ***Normal.***	
Transfer protocol (See note b.)	XMODEM*, ZMODEM	Set the same settings that are set in the personal computer.

Note a) RS-232C standards are not defined for speeds over 20 kbps. Depending on the cable length, communications may be unreliable at speeds of 38,400 bps and higher when *RS-232C* is selected. If there are problems with communications, reduce the baud rate to 19,200 bps.

b) XMODEM (-1K) is not supported.

CHECK Make the following settings when saving or loading with commands such as SCNLOAD and SCNSAVE.

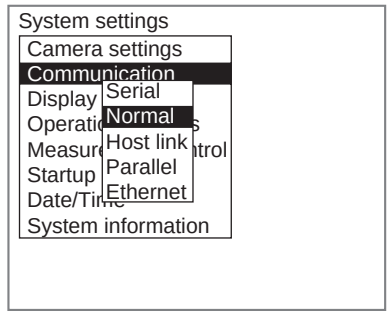
Item	Possible settings
Data length	8 bits
Parity bits	None
Stop bits	1 bit
Flow control	None

SeeAlso Refer to *Normal Communications on page 6-2-(8)* for details on setting the flow control.

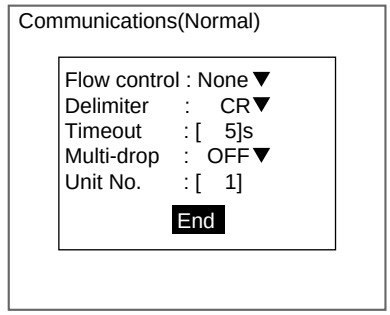
Normal Communications

Make the settings for flow control and multi-drop connections.

1. Select ***Normal*** communications



The *Communications (Normal)* window will be displayed.



2. Set the various communications parameters.
3. Select ***End***.

   The new settings will be registered and the screen in (1.) will return.

   The following table shows the possible communications settings. The asterisk (*) indicates the default setting.

Item	Possible settings	
Flow control	None*	Flow control is not performed. Use this setting when saving or loading with commands such as SCNLOAD and SCNSAVE.
	Xon/Xoff	Flow control is performed by software. Data is transmitted according to the Xon/Xoff codes sent from the external device.
Delimiter	CR*	Use the same setting that is being used in the personal computer.
	LF	
	CR + LF	
Timeout	Sets the time (in seconds) allowed before a timeout error is generated. (1 to 120 s, default setting: 5 s)	

Item	Possible settings	
Multi-drop	OFF*	Multi-drop connections are not used. If a unit number is set, it will be ignored.
	ON	Multi-drop connections are used. With multi-drop connections, results are not output even in Run Mode. To output measurement results, a command to get the measurement results must be input from the external device. Refer to *6-2-2-31 UNITDATA* for details.
Unit No.	When multi-drop connections are used, set the Controller's unique unit number. (1 to 31, default setting: 1)	

HELP Flow control checks the conditions of the external device during communications. If a response is not received from the external device within the timeout time, a timeout error is generated and an error message is displayed on the Controller. The parallel interface's ERR signal is also turned ON.

SeeAlso Refer to *7-4 Terminology*.

Controller Settings for Ethernet Connections

Serial Communications

The settings operations are the same as for RS-232C and RS-422 connections.

SeeAlso Refer to page 6-2-(6) for details.

The following table shows the possible communications settings.

The asterisk (*) indicates the default setting.

Item	Possible settings	
Interface	Cannot be used with Ethernet connections. These settings will be ignored.	
Baud rate		
Data length		
Parity bits		
Stop bits		
Mode	Select ***Normal.***	
Transfer protocol (See note.)	XMODEM*, ZMODEM	Set the same settings that are set in the personal computer.

Note XMODEM (-1K) is not supported.

Normal Communications

The settings operations are the same as for RS-232C and RS-422 connections.

SeeAlso Refer to page 6-2-(8) for details.

The following table shows the possible communications settings. The asterisk (*) indicates the default setting.

Item	Possible settings	
Flow control	Cannot be used with Ethernet connections. This setting will be ignored.	
Delimiter	CR*	Set the same settings that are set in the personal computer.
	LF	
	CR + LF	
Timeout	Cannot be used with Ethernet connections. The setting will be ignored.	

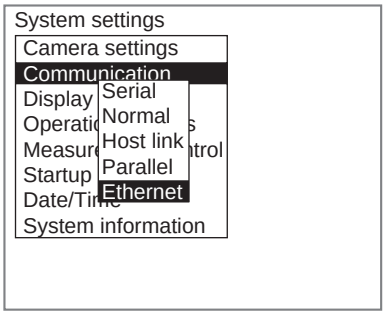
Item	Possible settings
Multi-drop	Set to *OFF*.
Unit No.	Cannot be used with Ethernet connections. The setting will be ignored.

Ethernet Settings

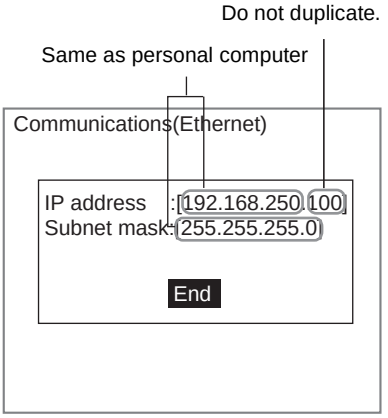
Set the IP address and the subnet mask.

Consult with the network administrator to make sure that the IP addresses are not duplicated in the network.

1. Select *Ethernet*.



The Communication (Ethernet) Settings Screen will be displayed.



2. Make the IP address and subnet mask settings.

CHECK Make the IP address and subnet mask settings as follows:

IP address: For all except the rightmost part of the address, set the same address as the connected computer.

Set a value for the rightmost part of the address that is not duplicated in the network.

Subnet mask: Make the same setting as the connected computer.

3. Select ***End***.

The settings will be registered.

6-2-2 Input Format (Normal)

The following commands can be input from the host computer to the Controller. Common commands have abbreviations that are shown in parentheses. Unify the communications specifications in the Controller and external device before initiating communications.

CHECK Input commands from either the RS-232C/RS-422 or Ethernet connection. Commands from both cannot be input at the same time.

Commands that Control Controller Operations

Use the following commands to execute operations in the Controller, such as executing measurements and switching scenes.

Command	Function	Page
CLRMEAS	Clears the measurement values for the current scene.	page 6-2-(13)
DISPCOND	Reads the current image display conditions.	page 6-2-(14)
	Changes the current image display conditions.	page 6-2-(14)
DISPIMG	Reads the memory number containing the image being displayed.	page 6-2-(15)
	Changes the display image.	page 6-2-(15)
EXIT	Ends the Ethernet (TELNET) connection and disconnects the line.	page 6-2-(16)
MEASOUT	Confirms the Controller mode (Monitor/Run).	page 6-2-(18)
	Changes the Controller mode (Monitor/Run).	page 6-2-(18)
MEASURE(M)	Executes one measurement.	page 6-2-(18)
	Executes one measurement on the image being displayed.	page 6-2-(19)
	Starts continuous measurement.	page 6-2-(19)
	Stops continuous measurement.	page 6-2-(19)
MENUKEY	Switches the serial interface input to Menu Operation.	page 6-2-(19)
MODELSET	Registers the specified unit's model again.	page 6-2-(20)
RESET	Resets the Controller.	page 6-2-(21)
SCENE(S)	Reads the scene number being used.	page 6-2-(21)
	Switches the scene number.	page 6-2-(21)
SCNGROUP	Reads the scene group number being used.	page 6-2-(23)
	Switches the scene group number.	page 6-2-(24)

Commands that Read or Change Current Settings

Use the following commands to change settings or specify operations while reading the Controller settings on the host side.

Settings conditions can be read or reset and measurement results can be obtained.

Command	Function	Page
DATE	Reads the current date and time.	page 6-2-(13)
	Sets the date and time.	page 6-2-(14)
PASSWORD	Reads the password.	page 6-2-(20)
UNITDATA	Reads or sets data for units set for the current scene.	page 6-2-(27)
UNITDAT2	Reads or sets character strings for QUEST character verification.	page 6-2-(103)
VERGET	Reads the system's version information.	page 6-2-(104)

Commands that Save and Load Data

Use the following commands to backup data set in the Controller and stored images.

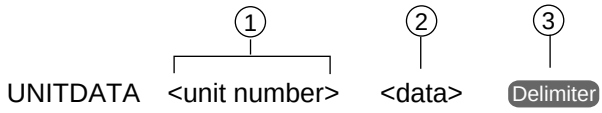
Command	Function	Page
DATASAVE	Saves the current scene group data and system data being used.	page 6-2-(13)
IMGLOAD	Loads image data from an external device.	page 6-2-(16)
IMGLOADM	Loads image data from a Memory Card.	page 6-2-(16)
IMGSAVE	Saves image data to an external device.	page 6-2-(17)
IMGSAVEM	Saves image data to a Memory Card.	page 6-2-(17)
SCNLOAD	Loads scene data from an external device.	page 6-2-(22)
SCNLOADM	Loads scene data from a Memory Card.	page 6-2-(22)
SCNSAVE	Saves scene data to an external device.	page 6-2-(22)
SCNSAVEM	Saves scene data to a Memory Card.	page 6-2-(23)
SGRLOAD	Loads scene group data from an external device.	page 6-2-(24)
SGRLOADM	Loads scene group data from a Memory Card.	page 6-2-(24)
SGRSAVE	Saves scene group data to an external device.	page 6-2-(25)
SGRSAVEM	Saves scene group data to a Memory Card.	page 6-2-(25)
SYSLOAD	Loads system data from an external device.	page 6-2-(26)
SYSLOADM	Loads system data from a Memory Card.	page 6-2-(26)
SYSSAVE	Saves system data to an external device.	page 6-2-(26)
SYSSAVEM	Saves system data to a Memory Card.	page 6-2-(27)

Format (Normal)

The commands are listed in alphabetical order. Input the commands in ASCII code. Either upper-case or lower-case characters can be input.

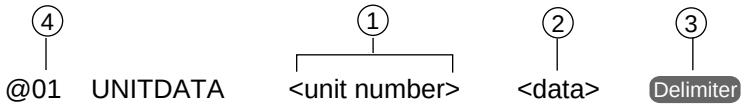
Example 1

Format for 1:1 Connection for RS-232C, RS-422, or Ethernet



Example 2

Format for Multi-drop Connections (1:N Connections) for RS-232C, RS-422



1. Set numerical values for the items in <> brackets.
2. Input a space between each parameter. (A space is not needed before the delimiter.)
3. Input the delimiter at the end of the command.
4. When multi-drop connections are being used, set the Controller's unit number (@01 to @31) at the beginning of the command. The response will be returned with the unit number at the beginning.
   To broadcast a command to all of the connected Controllers, input @XX instead of a unit number. The Controllers will not return responses to a broadcast command.

6-2-2-1 CLRMEAS: Clear Measure

Function

Clears the measurement values for the current scene.

Input

CLRMEAS Delimiter

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

6-2-2-2 DATASAVE

Function

Saves the current scene group data and system data. (Data for scene group 0 is saved to flash memory, data for scene groups 1 to 31 is saved to the Memory Card, and the system data is saved to the Memory Card.)

Input

DATASAVE Delimiter

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

Precaution Do not turn OFF the Controller's power supply until a response has been received.

6-2-2-3 DATE

Function 1

Reads the current date and time.

Input

DATE Delimiter

Output

Command executed correctly:
Month Day Hour Minute Year. Second Delimiter
OK Delimiter

Command not executed correctly:
ER Delimiter

Example

This example returns the time and date at 12:30:00 on August, 30 2000.

Input DATE Delimiter

Output 083012302000.00 Delimiter
OK Delimiter

Function 2

Sets the date and time.

Input

DATE <Month Day Hour Minute Year (first 2 digits) Year (last 2 digits). Seconds> Delimiter

Input item	Range	Remarks
Month	01 to 12	---
Day	01 to 31	---
Hour	00 to 23	---
Minute	00 to 59	---
Year (first 2 digits)	19 or 20	All four digits can be omitted or just the first two digits can be omitted.
Year (last 2 digits)	00 to 99	
Second	00 to 59	These two digits can be omitted.

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

Example

This example sets the time and date to 12:30:00 on August, 30 2000.

Input DATE 083012302000.00 Delimiter

Output OK Delimiter

CHECK Either all four digits of the year can be omitted or just the first two digits can be omitted. The last two digits cannot be omitted without omitting the first two as well.

6-2-2-4 DISPCOND: Display Condition

Function 1

Reads the current image display conditions.

Input

DISPCOND Delimiter

Output

Command executed correctly: Condition code Delimiter
OK Delimiter
Command not executed correctly: ER Delimiter

Condition code	Meaning
0	Through
1	Freeze (before scroll)
2	Freeze (after scroll)
3	Last NG (before scroll)
4	Last NG (after scroll)

Example

This example shows the output response when the display image is in “through.”

Input DISPCOND Delimiter

Output 0 Delimiter
OK Delimiter

Function 2

Changes the image display condition to the specified condition.

Input

DISPCOND <Condition code> Delimiter

The condition codes are the same as shown for *Function 1* above.

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

Example

This example shows how to change the display image to the “Last NG (before scroll)”.

Input DISPCOND 3 Delimiter

Output OK Delimiter

6-2-2-5 DISPIMG: Display Image

Function 1

Reads the memory number containing the image that is currently being displayed.

Input

DISPIMG Delimiter

Output

Command executed correctly: Memory number Delimiter
OK Delimiter
Command not executed correctly: ER Delimiter

CHECK A value of -1 will be output when “Through,” “Freeze,” or “Last NG” is being displayed.

Example

In this example, the image in memory number 12 is being displayed.

Input DISPIMG Delimiter

Output 12 Delimiter
OK Delimiter

Function 2

Changes the display image.

Input

DISPIMG <Memory number> Delimiter

- Set the memory number between -1 and 35.
- When -1 is specified, the display condition set with DISPCOND or in the Display settings window (for example, “Through,” “Freeze,” or “Last NG”) will be used.

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

Example

This example shows how to display the image in memory number 8.

Input DISPIMG 8 Delimiter

Output OK Delimiter

6-2-2-6 EXIT

Function

Ends the TELNET connection for Ethernet communications and disconnects the line.

Input

EXIT Delimiter

Output

Command executed correctly: None (Exits normally)
Command not executed correctly: ER Delimiter

CHECK This function can be used only when using an Ethernet connection.

6-2-2-7 IMGLOAD: Image Load

Function

Loads image data from an external device.

Input

IMGLOAD <Memory number> Delimiter

The memory number (0 to 35) specifies the destination for the image data being loaded from the external device.

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

CHECK The data transfer is performed with XMODEM (-CRC or SUM) or ZMODEM protocol. (The XMODEM (-1K) protocol is not supported.)
The Controller sends the character string “READY” to the external device when the Controller has completed preparations.

Example

This example loads image data from the external device to memory 2.

Input IMGLOAD 2 Delimiter

Output OK Delimiter

6-2-2-8 IMGLOADM: Image Load Memory Card

Function

Loads image data from a Memory Card.

Input

IMGLOADM <Memory number> <Filename> Delimiter

- The memory number (0 to 35) specifies the destination for the image data being loaded from the Memory Card.
- Specify the drive (C0 or C1) at the beginning of the file name.
- Specify the absolute path from the root directory.
- Add the filename extension.BMP to the filename.

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

Example

This example loads the file “LABEL1.BMP” in the Memory Card 0 directory DIR01 to memory 2.

Input IMGLOADM 2 /C0/DIR01/LABEL1.BMP Delimiter

Output OK Delimiter

6-2-2-9 IMGSAVE: Image Save

Function

Saves image data to an external device.

Input

For XMODEM transfers: IMGSAVE <Memory number> Delimiter
For ZMODEM transfers: IMGSAVE <Memory number> <Filename> Delimiter

The memory number (0 to 35) specifies the memory location containing the image data to be saved to the external device.

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

CHECK The XMODEM (-1K) protocol is not supported.

Example

This example saves the image data contained in memory 2 to the external device.

Input IMGSAVE 2 Delimiter

Output OK Delimiter

6-2-2-10 IMGSAVEM: Image Save Memory Card

Function

Saves image data to a Memory Card.

Input

IMGSAVEM <Memory number> <Filename> Delimiter

- The memory number (0 to 35) specifies the memory location containing the image data to be saved to the Memory Card.
- Specify the drive (C0 or C1) at the beginning of the file name.
- Specify the absolute path from the root directory.
- Add the filename extension .BMP to the filename.

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

Example

This example saves the image data contained in memory 2 as the file “LABEL1.BMP” in Memory Card 0 directory DIR01.

Input IMGSAVEM 2 /C0/DIR01/LABEL1.BMP Delimiter

Output OK Delimiter

6-2-2-11 MEASOUT: Measure Out

Function 1

Confirms the mode of the Controller: Monitor (results not output) or RUN (results output).

Input

MEASOUT Delimiter

Output

Command executed correctly: Mode number Delimiter
OK Delimiter
Command not executed correctly: ER Delimiter

- Mode numbers are as follows:

Mode number	Mode
0	Monitor (results not output)
1	RUN (results output)

Example

This example indicates that the Controller is in Run Mode.

Input MEASOUT Delimiter

Output 1 Delimiter
OK Delimiter

Function 2

Changes the mode of the Controller: Monitor (results not output) or RUN (results output).

Input

MEASOUT <Mode number> Delimiter

- Refer to *Function 1* for mode numbers.

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

Example

This example changes the Controller to Run Mode.

Input MEASOUT 1 Delimiter

Output OK Delimiter

6-2-2-12 MEASURE (M)

Function 1

Executes one measurement.

Input

MEASURE Delimiter

Output

Command executed correctly: Measurement result Delimiter
OK Delimiter
Command not executed correctly: ER Delimiter

CHECK Set *Normal data* to the unit to output measurement results. Only the command response will be output if *Normal data* is not set.

SeeAlso Refer to *6-2-3 Output Format (Normal)*.

Function 2

Executes one measurement on the image being displayed.

Input

MEASURE /I Delimiter

Output

Command executed correctly:	Measurement result Delimiter OK Delimiter
Command not executed correctly:	ER Delimiter

CHECK Set *Normal data* to the unit to output measurement results. Only the command response will be output if *Normal data* is not set.

SeeAlso Refer to *6-2-3 Output Format (Normal)*.

Function 3

Starts continuous measurement.

Input

MEASURE /C Delimiter

Output

Command executed correctly:	OK Delimiter (One time) Measurement result Delimiter (Continuous measurement)
Command not executed correctly:	ER Delimiter

CHECK Set *Normal data* to the unit to output measurement results. Only the command response will be output if *Normal data* is not set.

SeeAlso Refer to *6-2-3 Output Format (Normal)*.

Function 4

Stops continuous measurement.

Input

MEASURE /E Delimiter

Output

Command executed correctly:	OK Delimiter
Command not executed correctly:	ER Delimiter

6-2-2-13 MENUKEY

Function

Switches the serial interface input to Menu Operation mode.

Input

MENUKEY Delimiter

Output

None

CHECK The Controller will revert to Normal mode if the **Ctrl** + **Q** Key combination ($11) is input while the Controller is in Menu Operation mode.

6-2-2-14 MODELSET

Function

Registers the models again for all regions for the specified unit number. (When the through display is being used, the models will be registered based on the last image that was measured.)

Input

MODELSET <unit number> Delimiter

Specify the desired unit (0 to 9999).

CHECK Model re-registration is enabled only if model position compensation, circle position compensation, fine matching, pattern inspection, rotation positioning or ECM search unit numbers are specified. Other unit numbers will be ignored if they are specified.

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

Example 1

This example re-registers the unit 2 (pattern inspection) model.

Input MODELSET 2 Delimiter

Output OK Delimiter

CHECK If a unit number other than a model position compensation, circle position compensation, fine matching, pattern inspection, rotation positioning, or ECM search unit number is specified, the command will be ignored and only OK will be output.

Example 2

In this example, unit 1, where binary defect inspection is set, is specified.

Input MODELSET 1 Delimiter

Output OK Delimiter

CHECK Model re-registration is executed for the currently displayed Camera image. Switch to the Camera image for which the model is to be re-registered before executing this command. Use the Up and Down Keys on the Console to switch Camera images. Key codes corresponding to the Up and Down Keys can also be input from a personal computer if the MENUKEY command is executed.

6-2-2-15 PASSWORD

Function

Reads the password.

CHECK If the password has been forgotten, the set password can be obtained using this command.

Input

PASSWORD Delimiter

Output

Command executed correctly: Password data Delimiter
OK Delimiter
Command not executed correctly: ER Delimiter

Example

In this example, the password is set to AAAAAAA.

Input PASSWORD Delimiter

Output AAAAAAA Delimiter
OK Delimiter

6-2-2-16 RESET

Function

Resets the Controller.

Input

RESET Delimiter

Output

None

6-2-2-17 SCENE

Function 1

Reads the scene number of the scene being used.

Input

SCENE Delimiter

Output

Command executed correctly: Scene number Delimiter
OK Delimiter
Command not executed correctly: ER Delimiter

Example

In this example, scene 0 is being used.

Input SCENE Delimiter

Output 0 Delimiter
OK Delimiter

Function 2

Switches the scene number.

Input

SCENE <scene number> Delimiter

Specify a scene number between 0 and 31.

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

Example

In this example, the scene is switched to scene 2.

Input SCENE 2 Delimiter

Output OK Delimiter

6-2-2-18 SCNLOAD: Scene Load

Function

Loads scene data from an external device.

Input

SCNLOAD <scene number> Delimiter

Specify a scene number between 0 and 31.

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

CHECK The data transfer is performed with XMODEM (-CRC or SUM) or ZMODEM protocol. (The XMODEM (-1K) protocol is not supported.)
The Controller sends the character string “READY” to the external device when the Controller has completed preparations. Wait for the “READY” string to be received at the external device before starting the data transfer.

Example

This example loads scene data from the external device to scene 2.

Input SCNLOAD 2 Delimiter
Output OK Delimiter

6-2-2-19 SCNLOADM: Scene Load Memory Card

Function

Loads scene data from a Memory Card.

Input

SCNLOADM <scene number> <file name> Delimiter

- Specify a scene number between 0 and 31.
- Specify the drive (C0 or C1) at the beginning of the file name.
- Specify the absolute path from the root directory.
- Add the filename extension .SCN to the filename.

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

Example

This example loads the file “LABEL.SCN” to scene 2 from Memory Card 0 directory DIR01.

Input SCNLOADM 2 /C0/DIR01/LABEL.SCN Delimiter
Output OK Delimiter

6-2-2-20 SCNSAVE: Scene Save

Function

Saves scene data to an external device.

Input

For XMODEM transfer: SCNSAVE <scene number> Delimiter
For ZMODEM transfer: SCNSAVE <scene number> <filename> Delimiter

Specify a scene number between 0 and 31.

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

CHECK The XMODEM (-1K) protocol is not supported.

Example

This example saves the scene 2 scene data to the external device.

Input SCNSAVE 2 Delimiter

Output OK Delimiter

6-2-2-21 SCNSAVEM: Scene Save Memory Card

Function

Saves scene data to a Memory Card.

Input

SCNSAVEM <scene number> <file name> Delimiter

- Specify a scene number between 0 and 31.
- Specify the drive (C0 or C1) at the beginning of the file name.
- Specify the absolute path from the root directory.
- Add the filename extension .SCN to the filename.

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

Example

This example saves the scene 2 scene data as file “LABEL.SCN” in Memory Card 0 directory DIR01.

Input SCNSAVEM 2 /C0/DIR01/LABEL.SCN Delimiter

Output OK Delimiter

6-2-2-22 SCNGROUP: Scene Group

Function 1

Reads the scene group number being used.

Input

SCNGROUP Delimiter

Output

Command executed correctly: Scene group number Delimiter
OK Delimiter
Command not executed correctly: ER Delimiter

Example

In this example, scene group 0 is being used.

Input SCNGROUP Delimiter

Output 0 Delimiter
OK Delimiter

Function 2

Switches the scene group number.

Input

SCNGROUP <scene group number> Delimiter

Specify a scene group number between 0 and 31.

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

Example

This example switches to scene group 2.

Input SCNGROUP 2 Delimiter

Output OK Delimiter

6-2-2-23 SGRLOAD: Scene Group Load

Function

Loads scene group data from an external device.

Input

SGRLOAD <scene group number> Delimiter

Specify a scene group number between 0 and 31.

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

CHECK The data transfer is performed with XMODEM (-CRC or SUM) or ZMODEM protocol. (The XMODEM (-1K) protocol is not supported.)
The Controller sends the character string “READY” to the external device when the Controller has completed preparations. Wait for the “READY” string to be received at the external device before starting the data transfer.

Example

This example loads the scene group data from the external device to scene group 2.

Input SGRLOAD 2 Delimiter

Output OK Delimiter

6-2-2-24 SGRLOADM: Scene Group Load Memory Card

Function

Loads scene group data from a Memory Card.

Input

SGRLOADM <scene group number> <file name> Delimiter

- Specify a scene group number between 0 and 31.
- Specify the drive (C0 or C1) at the beginning of the file name.
- Specify the absolute path from the root directory.
- Add the filename extension .SGR to the filename.

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

Example

This example loads the file “LABEL.SGR” to scene group 2 from Memory Card 0 directory DIR01.

Input SGRLOADM 2 /C0/DIR01/LABEL.SGR Delimiter

Output OK Delimiter

6-2-2-25 SGRSAVE: Scene Group Save

Function

Saves scene group data to an external device.

Input

For XMODEM transfer: SGRSAVE <scene group number> Delimiter
For ZMODEM transfer: SGRSAVE <scene group number> <filename> Delimiter

Specify a scene group number between 0 and 31.

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

CHECK The XMODEM (-1K) protocol is not supported.

Example

This example saves the scene group data of scene group 2 to the external device.

Input SGRSAVE 2 Delimiter

Output OK Delimiter

6-2-2-26 SGRSAVEM: Scene Group Save Memory Card

Function

Saves scene group data to a Memory Card.

Input

SGRSAVEM <scene group number> <file name> Delimiter

- Specify a scene group number between 0 and 31.
- Specify the drive (C0 or C1) at the beginning of the file name.
- Specify the absolute path from the root directory.
- Add the filename extension .SGR to the filename.

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

Example

This example saves the scene group data of scene group 2 as file “LABEL.SGR” in Memory Card 0 directory DIR01.

Input SGRSAVEM 2 /C0/DIR01/LABEL.SGR Delimiter

Output OK Delimiter

6-2-2-27 SYSLOAD: System Load

Function

Loads system data from an external device.

Input

SYSLOAD Delimiter

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

CHECK The data transfer is performed with XMODEM (-CRC or SUM) or ZMODEM protocol. (The XMODEM (-1K) protocol is not supported.)
The Controller sends the character string “READY” to the external device when the Controller has completed preparations. Wait for the “READY” string to be received at the external device before starting the data transfer.

Example

This example loads the system data from the external device.

Input SYSLOAD Delimiter

Output OK Delimiter

6-2-2-28 SYSLOADM: System Load Memory Card

Function

Loads system data from a Memory Card.

Input

SYSLOADM <file name> Delimiter

- Specify the drive (C0 or C1) at the beginning of the file name.
- Add the filename extension .SYD to the filename.
- Specify the absolute path from the root directory.

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

Example

This example loads the file “SYSDAT1.SYD” from Memory Card 0 directory DIR01.

Input SYSLOADM /C0/DIR01/SYSDAT1.SYD Delimiter

Output OK Delimiter

6-2-2-29 SYSSAVE: System Save

Function

Saves system data to an external device.

Input

For XMODEM transfer: SYSSAVE Delimiter
For ZMODEM transfer: SYSSAVE <filename> Delimiter

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

CHECK The XMODEM (-1K) protocol is not supported.

Example

This example saves the system data to the external device.

Input SYSSAVE Delimiter

Output OK Delimiter

6-2-2-30 SYSSAVEM: System Save Memory Card

Function

Saves system data to a Memory Card.

Input

SYSSAVEM <file name> Delimiter

- Specify the drive (C0 or C1) at the beginning of the file name.
- Specify the absolute path from the root directory.
- Add the filename extension .SYD to the filename.

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

Example

This example saves the system data as the file “SYSDAT1.SYD” in Memory Card 0 directory DIR01.

Input SYSSAVEM /C0/DIR01/SYSDAT1.SYD Delimiter

Output OK Delimiter

6-2-2-31 UNITDATA

Function 1

Reads settings parameters and measurement values for the unit set to the current scene.

Input

UNITDATA <unit number> <data> Delimiter

- Specify a unit number between 0 and 9,999.
- The data will depend on the processing item for the specified unit.

SeeAlso Refer to the tables later in this section for a list of data.

Output

Command executed correctly: Value Delimiter
OK Delimiter
Command not executed correctly: ER Delimiter

Example

This example reads the judgement results for pattern inspection.

Input UNITDATA 5 0 Delimiter

Output 0 Delimiter
OK Delimiter

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Input Image

Camera Images (Measurement Data)

Data		Details
Measure-ment data	0	Judgement result 0: OK -2: Not measured

Camera Images (Settings Data)

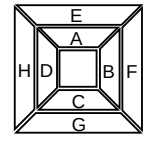
Data		Details
Settings data	16	Input Camera number (0 to 3)
	17	Filtering (Image 0) 0: OFF 1: Weak smoothing 2: Strong smoothing 3: Dilate 4: Erosion 5: Median 6: Enhance edges 7: Vertical edges 8: Horizontal edges 9: Extract edges
	18	Filtering (Image 1) 0 to 9: Same as filtering (Image 0)
	19	Filter 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 → BGS levels 1: BGS levels → Filtering
	26	Filtering order (Image 1) 0: Filtering → BGS levels 1: BGS levels → Filtering
	32	Camera 0 shutter speed 0: 1/120 1: 1/200 2: 1/500 3: 1/1,000 4: 1/2,000 5: 1/4,000 6: 1/6,000 7: 1/8,000 8: 1/12,000 9: 1/16,000 10: 1/20,000 11: 1/30,000 12: 1/60,000 13: 1/100,000 14: 1/160,000 15: 1/200,000
	33	Camera 1 shutter speed 0 to 15: Same as for Camera 0
	34	Camera 2 shutter speed 0 to 15: Same as for Camera 0
	35	Camera 3 shutter speed 0 to 15: Same as for Camera 0
	36 to 43	Camera 0 light level data (0 to 7) (See note.)
	52 to 59	Camera 1 light level data (0 to 7) (See note.)
	68 to 75	Camera 2 light level data (0 to 7) (See note.)
Settings data	84 to 91	Camera 3 light level data (0 to 7) (See note.)
	100	Frame/Field 0: Frame 1: Field

Note The following table shows the light levels for Intelligent Lighting.

Data				Camera light level adjustment section	Light level number
Camera 0	**Camera 1**	**Camera 2**	**Camera 3**		
36	52	68	84	A	0
37	53	69	85	B	1
38	54	70	86	C	2
39	55	71	87	D	3
40	56	72	88	E	4
41	57	73	89	F	5
42	58	74	90	G	6
43	59	75	91	H	7

F150-LTC20
F160-LTC20

F150-LTC50
F160-LTC50



Switch Camera (Measurement Data)

Data		Details
Measure-ment data	0	Judgement result 0: OK -2: Not measured.

Switch Camera (Settings Data)

Data		Details
Settings data	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 0)
	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 → BGS levels 1: BGS levels → Filtering
	26	Filtering order (Image 1) 0: Filtering → BGS levels 1: BGS levels → Filtering

Change Filtering (Measurement Data)

Data		Details
Measure-ment data	0	Judgement result 0: OK -2: Not measured.

Change Filtering (Settings Data)

Data		Details
Settings data	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 0)
	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 → BGS levels 1: BGS levels → Filtering
	26	Filtering order (Image 1) 0: Filtering → BGS levels 1: BGS levels → Filtering

Filtering Again (Measurement Data)

Data		Details
Measure-ment data	0	Judgement result 0: OK -2: Not measured.

Filtering Again (Settings Data)

Data		Details
Settings data	16	Image transfer mode 0: Image 1 → Image 0 1: Image 0 → Image 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 (Image 0) (0 to 255)
	22	BGS levels upper limit (Image 0) (0 to 255)
	25	Filtering order 0: Filtering first and then background cut 1: Background cut first and then filtering

Position Displacement Compensation

Binary Position Compensation (Measurement Data)

Data		Details	
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK	
	1	Scroll X	
	2	Scroll Y	
	3	Scroll θ	
	4	Measurement X	
	5	Measurement Y	
	6	Measurement angle	
	7	Region 0	Judgement result
	8		Gravity X
	9		Gravity Y
	10		Axis angle
	11		Area
	12		Reversed area
	13		Reference position X
	14		Reference position Y
	15		Reference angle
	16		Reference area
	17	Region 1	Judgement result
	18		Gravity X
	19		Gravity Y
	20		Axis angle
	21		Area
	22		Reversed area
	23		Reference position X
	24		Reference position Y
	25		Reference angle
	26		Reference area

Binary Position Compensation (Settings Data)

Data		Details
	30	Measurement image 0: Image 0 1: Image 1
	31	Displacement direction (0 to 18) (See note 1.)

Data		Details	
The following settings data is for gravity and area and gravity and axis measurement.			
Settings data	32	Region 0	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 (0.000 to 9,999,999.999)
	40		Area lower limit (0.000 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 measurement.			
	43	Region 0	Fill profile 0: OFF 1: ON
The following settings data is for gravity and axis measurement.			
	44	Region 0	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.			
Settings data	46	Region 0	Region upper left X (0 to 511) (See note 2.)
	47		Region upper left Y (0 to 483) (See note 2.)
	48		Region lower right X (0 to 511) (See note 2.)
	49		Region lower right Y (0 to483) (See note 2.)
	50		Reference position X (0 to 511)
	51		Reference position Y (0 to 483)
The following settings data is for gravity and area and gravity and axis measurement.			
Settings data	52	Region 1	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 (0.000 to 9,999,999.999)
	60		Area lower limit (0.000 to 9,999,999.999)
	61		Skipping X (1 to 15)
	62		Skipping Y (1 to 15)
The following settings data is for gravity and area measurement.			
	63	Region 1	Fill profile 0: OFF 1: ON

Data		Details	
The following settings data is for gravity and axis.			
	64	Region 1	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.			
Settings data	66	Region 1	Region upper left X (0 to 511) (See note 2.)
	67		Region upper left Y (0 to 483) (See note 2.)
	68		Region lower right X (0 to 511) (See note 2.)
	69		Region lower right Y (0 to483) (See note 2.)
	70		Reference position X (0 to 511)
	71		Reference position Y (0 to 483)

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

No.	Displacement X	Displacement 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 any previously drawn figures will be deleted.

EC Position Compensation (Measurement Data)

Data		Details	
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK	
	1	Scroll X	
	2	Scroll Y	
	3	Scroll θ	
	4	Measurement X	
	5	Measurement Y	
	6	Measurement angle	
	7	Region 0	Judgement result
	8		Measurement position X
	9		Measurement position Y
	10		Measurement angle
	11		Reference position X
	12		Reference position Y
	13		Reference angle
	14		Radius
	15		Circular value
	16		Line length 1
	17		Line length 2
	18		Upper left apex X
	19		Upper left apex Y
	20		Lower left apex X
	21		Lower left apex Y
	22		Upper right apex X
	23		Upper right apex Y
	24		Lower right apex X
	25		Lower right apex Y
	26	Region 1	Judgement result
	27		Measurement position X
	to		.... (Same as for region 0)
	43		Lower right apex X
	44		Lower right apex Y

EC Position Compensation (Settings Data)

Data		Details	
Settings data	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 note.)	
	55	Region 0	Search region upper left X (0 to 511)
	56		Search region upper left Y (0 to 483)
	57		Search region lower right X (0 to 511)
	58		Search region lower right Y (0 to 483)
The following settings data is for circle measurement.			
Settings data	59	Region 0	Circle color 0: Black 1: White 2: Both
	60		Skipping 0: OFF 1: ON
	61		Circular value (0 to 100)
	62		Center X (0 to 511)
	63		Center Y (0 to 483)
	64		Circumference radius (3 to 512)
	65		Circumference width (1 to 64)
	66		Radius judgement upper limit (1 to 9,999.999)
	67		Radius judgement lower limit (1 to 9,999.999)

Data		Details	
The following settings are for line conditions (common to cross points, boxes, and multiple cross points).			
Settings data	68	Region 0	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 multiple cross point measurement.			
Settings data	78	Region 0	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 999)
	84		Length 1 lower limit (0 to 200)
	85		Length 1 upper limit (0 to 200)
	86		Length 2 (1 to 999)
	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

Data		Details	
The following settings data is for box measurement.			
Settings data	90	Region 0	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 (1 to 512)
	94		Short side (1 to 484)
	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 multiple cross point measurement.			
	104	Region 0	Sorting method 0: X ascending order 1: X descending order 2: Y ascending order 3: Y descending order
The following settings data is for all measurements.			
Settings data	105	Region 1	Search region upper left X (0 to 511)
	106		Search region upper left Y (0 to 483)
	107		Search region lower right X (0 to 511)
	108		Search region lower right Y (0 to 483)
	to		... (Same as for region 0)
	153		Line parallelism (1 to 99)
	154		Sorting method 0: X ascending order 1: X descending order 2: Y ascending order 3: Y descending order

Note The displacement direction settings are shown in the following table.

No.	Displacement X	Displacement 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

No.	Displacement X	Displacement Y	Displacement θ
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

Edge Position Displacement (Measurement Data)

Data		Details	
Measurement data	0	Judgement result -2: Not measured. -1: NG 0: OK	
	1	Scroll X	
	2	Scroll Y	
	3	Scroll θ	
	4	Measurement X	
	5	Measurement Y	
	6	Measurement angle	
	7	Region 0	Judgement result
	8		Edge position X
	9		Edge position Y
	10		Reference position X
	11		Reference position Y
	12	Region 1	Judgement result
	13		Edge position X
	14		Edge position Y
	15		Reference position X
	16		Reference position Y

Edge Position Compensation (Settings Data)

Data		Details	
Settings data	20	Measurement image 0: Image 0 1: Image 1	
	21	Displacement direction (0 to 16) (See note.)	
	22	Region 0	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)
	29		Noise level (0 to 255)
	30		Noise width (0 to 255)
	31		Region upper left X (0 to 511)
	32		Region upper left Y (0 to 483)
	33		Region lower right X (0 to 511)
	34		Region lower right Y (0 to 483)
	35		Reference position X (0 to 511)
	36		Reference position Y (0 to 483)
	37	Region 1	Edge detection method 0: ↑ 1: ↓ 2: → 3: ←
	38		Edge color 0: Light → dark 1: 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 511)
	47		Region upper left Y (0 to 483)
	48		Region lower right X (0 to 511)
	49		Region lower right Y (0 to 483)
	50		Reference position X (0 to 511)
	51		Reference position Y (0 to 483)

Note The displacement direction settings are shown in the following table.

No.	Displacement X	Displacement 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	Midpoint	Midpoint	Relative angle

Model Position Compensation (Measurement Data)

Data		Details	
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK	
	1	Scroll X	
	2	Scroll Y	
	3	Scroll θ	
	4	Measurement X	
	5	Measurement Y	
	6	Measurement angle	
	7	Region 0	Judgement result
	8		Correlation
	9		Position X
	10		Position Y
	11		Angle
	12	Region 1	Judgement result
	13		Correlation
	14		Position X
	15		Position Y
	16		Angle

Model Position Compensation (Settings Data)

Data		Details	
Settings data	32	Displacement direction (0 to 18) (See note.)	
	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 angles	
	34	Skipping angle 0: 1° 1: 2° 3: 5° 4: 6° 5: 10° 6: 15° 7: 20° 8: 30°	
	35	Verification 0: ON 1: OFF	
	36	Candidate level (0 to 99)	
	37	Region 0	Model position upper left X (0 to 511)
	38		Model position upper left Y (0 to 483)
	39		Model position lower right X (0 to 511)
	40		Model position lower 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 (-9,999.999 to 9,999.999)
	47		X lower limit (-9,999.999 to 9,999.999)
	48		Y upper limit (-9,999.999 to 9,999.999)
	49		Y lower limit (-9,999.999 to 9,999.999)
	50		Angle judgement upper limit (-360.00 to 360.00)
	51		Angle judgement lower limit (-360.00 to 360.00)
	52	Region 1	Model position upper left X (0 to 511)
	53		Model position upper left Y (0 to 483)
	54		Model position lower right X (0 to 511)
	55		Model position lower 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 (-9,999.999 to 9,999.999)
	62		X lower limit (-9,999.999 to 9,999.999)
	63		Y upper limit (-9,999.999 to 9,999.999)
	64		Y lower limit (-9,999.999 to 9,999.999)
	65		Angle judgement upper limit (-360.00 to 360.00)
	66		Angle judgement lower limit (-360.00 to 360.00)

Note The displacement direction settings are shown in the following table.

No.	Displacement X	Displacement 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

Circle Position Compensation Data (Measurement Data)

Data		Details	
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK	
	1	Scroll X	
	2	Scroll Y	
	3	Scroll θ	
	4	Measurement X	
	5	Measurement Y	
	6	Measurement angle	
	7	Model 0	Judgement result
	8		Correlation
	9		Position X
	10		Position Y
	11	Model 1	Judgement result
	12		Correlation
	13		Position X
	14		Position Y
	15	Model 2	Judgement result
	16		Correlation
	17		Position X
	18		Position Y
	19	Model 3	Judgement result
	20		Correlation
	21		Position X
	22		Position Y
	23	Model 4	Judgement result
	24		Correlation
	25		Position X
	26		Position Y

Circle Position Compensation Data (Settings Data)

Data		Details	
Settings data	33	Verification 0: ON 1: OFF	
	34	Candidate level (0 to 99)	
	35	Model correlation judgement value (0 to 100)	
	36	Center X coordinate (0 to 511)	
	37	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)	
	41	Model 0	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	Model 1	Search region upper left X (0 to 511)
	46		Search region upper left Y (0 to 483)
	47		Search region lower right X (0 to 511)
	48		Search region lower right Y (0 to 483)
	49	Model 2	Search region upper left X (0 to 511)
	50		Search region upper left Y (0 to 483)
	51		Search region lower right X (0 to 511)
	52		Search region lower right Y (0 to 483)
	53	Model 3	Search region upper left X (0 to 511)
	53		Search region upper left Y (0 to 483)
	55		Search region lower right X (0 to 511)
	56		Search region lower right Y (0 to 483)
The following settings data is for 1 Model measurement.			
Settings data	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 angles	
	58	Skipping angle 0: 1° 1: 2° 3: 5° 4: 6° 5: 10° 6: 15° 7: 20° 8: 30°	
	59	Model 4	Model position upper left X (14 to 497)
	60		Model position upper left Y (16 to 467)
	61		Model position lower right X (14 to 497)
	62		Model position lower right Y (16 to 467)
	63		Search position upper left X (0 to 511)
	64		Search position upper left Y (0 to 483)
	65		Search position lower right X (0 to 511)
	66		Search position lower right Y (0 to 483)

Data		Details
The following settings data is for defect (circle) and defect (arc) measurement.		
Settings data	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 circular angle measurement.		
Settings data	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)

Scroll (Measurement Data)

Data		
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK
	1	Scroll X
	2	Scroll Y
	3	Scroll θ
	4	Measurement X
	5	Measurement Y
	6	Measurement angle
	7	Reference X
	8	Reference Y
	9	Reference angle

Scroll (Measurement Data)

Data		Details	
Settings data	32	Scroll X	Judgement upper limit (−1,024 to 1,024)
	33		Judgement lower limit (−1,024 to 1,024)
	34	Scroll Y	Judgement upper limit (−1,024 to 1,024)
	35		Judgement lower limit (−1,024 to 1,024)
	36	Scroll θ	Judgement upper limit (−180.00 to 180.00)
	37		Judgement lower limit (−180.00 to 180.00)

Measurement

Binary Defect (Measurement Data)

Data		Details	
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK	
	1	Region 0	Judgement result
	2		Region X 1 (See note.)
	3		Region Y 1 (See note.)
	4		Region X 2 (See note.)
	5		Region Y 2 (See note.)
	6		Gravity X
	7		Gravity Y
	8		Axis angle
	9		Area
	10		Reversed area
	11		Reference position X
	12		Reference position Y
	13		Reference angle
	14		Reference area
	15	Region 1	Judgement result
	to		... (Same as for region 0)
	99	Region 7	Judgement result
	to		... (Same as for region 0)
	111		Reference angle
	112		Reference area

Note 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.

Binary Defect (Settings Data)

Data		Details
Settings data	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

Data		Details	
The following settings data is for gravity and area, gravity and axis and area (var. box) measurement.			
Settings data	125	Region 0	Binary level upper limit (0 to 255)
	126		Binary level lower limit (0 to 255)
	127		Reverse binary level 0: Not reversed 1: Reversed
	128		Binary tracking 0: OFF 1: ON
	129		X upper limit (-9,999.999 to 9,999.999)
	130		X lower limit (-9,999.999 to 9,999.999)
	131		Y upper limit (-9,999.999 to 9,999.999)
	132		Y lower limit (-9,999.999 to 9,999.999)
	133		Area upper limit (0.000 to 9,999,999,999)
	134		Area lower limit (0.000 to 9,999,999,999)
	135		Skipping X (1 to 15)
	136		Skipping Y (1 to 15)
The following settings data is for gravity and area and area (var. box) measurement.			
	137	Region 0	Fill profile 0: OFF 1: ON
The following settings data is for gravity and axis measurement.			
	138	Region 0	Axis angle upper limit (-180.000 to 180.000)
	139		Axis angle lower limit (-180.000 to 180.000)

Data			Details
The following settings data is for area (var. box) measurement.			
Settings data	140	Region 0	Edge detection direction (left edge) 0: ↑ 1: ↓ 2: → 3: ←
	141		Edge color (left edge) 0: Light → dark 1: Dark → light
	142		Edge level (left edge) (0 to 100)
	143		Noise level (left edge) (0 to 255)
	144		Noise width (left edge) (0 to 255)
	145		Offset width (left edge) (-511 to 511)
	146		Edge detection direction (upper edge) 0: ↑ 1: ↓ 2: → 3: ←
	147		Edge color (upper edge) 0: Light → dark 1: Dark → light
	148		Edge level (upper edge) (0 to 100)
	149		Noise level (upper edge) (0 to 255)
	150		Noise width (upper edge) (0 to 255)
	151		Offset width (upper edge) (-511 to 511)
	152		Edge detection direction (right edge) 0: ↑ 1: ↓ 2: → 3: ←
	153		Edge color (right edge) 0: Light → dark 1: Dark → light
	154		Edge level (right edge) (0 to 100)
	155		Noise level (right edge) (0 to 255)
	156		Noise width (right edge) (0 to 255)
	157		Offset width (right edge) (-511 to 511)
	158		Edge detection direction (lower edge) 0: ↑ 1: ↓ 2: → 3: ←
	159		Edge color (lower edge) 0: Light → dark 1: Dark → light
	160		Edge level (lower edge) (0 to 100)
	161		Noise level (lower edge) (0 to 255)
	162		Noise width (lower edge) (0 to 255)
	163		Offset width (lower edge) (-511 to 511)

Data		Details	
The following settings data is for processing item region and reference position measurement.			
	164	Region 0	Region upper left X (0 to 511) (See note.)
	165		Region upper left Y (0 to 483) (See note.)
	166		Region lower right X (0 to 511) (See note.)
	167		Region lower right Y (0 to483) (See note.)
	168		Region upper left X (left edge) (0 to 511)
	169		Region upper left Y (left edge) (0 to 483)
	170		Region lower right X (left edge) (0 to 511)
	171		Region lower right Y (left edge) (0 to483)
	172		Region upper left X (upper edge) (0 to 511)
	173		Region upper left Y (upper edge) (0 to 483)
	174		Region lower right X (upper edge) (0 to 511)
	175		Region lower right Y (upper edge) (0 to483)
	176		Region upper left X (right edge) (0 to 511)
	177		Region upper left Y (right edge) (0 to 483)
	178		Region lower right X (right edge) (0 to 511)
	179		Region lower right Y (right edge) (0 to483)
	180		Region upper left X (lower edge) (0 to 511)
	181		Region upper left Y (lower edge) (0 to 483)
	182		Region lower right X (lower edge) (0 to 511)
	183		Region lower right Y (lower edge) (0 to483)
	184		Reference position X (0 to 511)
	185		Reference position Y (0 to 483)
	186	Region 1	Binary level upper limit (0 to 255)
	to		... (Same as for region 0)
	552	Region 7	Binary level upper limit (0 to 255)
	to		... (Same as for region 0)
	611		Reference position X (0 to 511)
	612		Reference position Y (0 to 483)

Note If these settings are changed, one rectangular region will be set and any previously drawn figures will be deleted. This is true for regions 1 to 7 as well.

CHECK Only the allocations for region 0 are listed here. Refer to the allocations for region 0 to calculate the numbers for regions 1 to 7.

Classification (Measurement Data)

Data		Details
Measurement data	0	Judgement result -2: Not measured. -1: NG 0: OK
	1	Measurement position X
	2	Measurement position Y
	3	Correlation
	4	Index number

Classification (Settings Data)

Data		Details
Settings data	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 upper limit (-9,999.999 to 9,999.999)
	24	X lower limit (-9,999.999 to 9,999.999)
	25	Y upper limit (-9,999.999 to 9,999.999)
	26	Y lower limit (-9,999.999 to 9,999.999)
	27	Correlation upper limit (0 to 100)
	28	Correlation 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

Density Defect (Measurement Data)

Data		Details	
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK	
	1	Region 0	Judgement result
	2		Region X 1 (See note.)
	3		Region Y 1 (See note.)
	4		Region X 2 (See note.)
	5		Region Y 2 (See note.)
	6		Large defect
	7		Small defect
	8		Max. density
	9		Min. density
	10		Deviation
	11		Large defect position X
	12		Large defect position Y
	13		Small defect position X
	14		Small defect position Y
	15		Deviation position X
	16		Deviation position Y
	17		Large defect reference position X
	18		Large defect reference position Y
	19		Small defect reference position X
	20		Small defect reference position Y
	21		Deviation reference position X
	22		Deviation reference position Y
	23	Region 1	Judgement result
	to		... (Same as for region 0)
	155	Region 7	Judgement result
	to		... (Same as for region 0)
	176		Deviation reference position Y

Note The upper left and lower right coordinates of the calculated measurement region will be output whenever Defect (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.

Density Defect (Settings Data)

Data		Details
Settings data	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

Data		Details	
The following setting data is for Defect and area (var. box).			
Settings data	182	Region 0	Large defect flag 0: OFF 1: ON
	183		Small defect flag 0: OFF 1: ON
	184		Small defect color 0: White 1: Black 2: Both
	185		Density flag 0: OFF 1: ON
	186		Large defect judgement (0 to 255)
	187		Small defect judgement (0 to 255)
	188		Density upper limit (0 to 255)
	189		Density lower limit (0 to 255)
	190		Element size (4 to 80)
	191		Comparing pitch (1 to 6)
The following settings data is for area (var. box) measurement.			
Settings data	192	Region 0	Measurement direction 0: X line 1: Y line 2: Box
	193		Edge detection direction (left edge) 0: ↑ 1: ↓ 2: → 3: ←
	194		Edge color (left edge) 0: Light → dark 1: Dark → light
	195		Edge level (left edge) (0 to 100)
	196		Noise level (left edge) (0 to 255)
	197		Noise width (left edge) (0 to 255)
	198		Offset width (left edge) (-511 to 511)
	199		Edge detection direction (upper edge) 0: ↑ 1: ↓ 2: → 3: ←
	200		Edge color (upper edge) 0: Light → dark 1: Dark → light
	201		Edge level (upper edge) (0 to 100)
	202		Noise level (upper edge) (0 to 255)
	203		Noise width (upper edge) (0 to 255)
	204		Offset width (upper edge) (-511 to 511)

Data		Details	
Settings data	205	Region 0	Edge detection direction (right edge) 0: ↑ 1: ↓ 2: → 3: ←
	206		Edge color (right edge) 0: Light → dark 1: Dark → light
	207		Edge level (right edge) (0 to 100)
	208		Noise level (right edge) (0 to 255)
	209		Noise width (right edge) (0 to 255)
	210		Offset width (right edge) (-511 to 511)
	211		Edge detection direction (lower edge) 0: ↑ 1: ↓ 2: → 3: ←
	212		Edge color (lower edge) 0: Light → dark 1: Dark → light
	213		Edge level (lower edge) (0 to 100)
	214		Noise level (lower edge) (0 to 255)
	215		Noise width (lower edge) (0 to 255)
	216		Offset width (lower edge) (-511 to 511)
The following settings data is for defect (deviation) measurement.			
	217	Region 0	Defect judgement (0 to 127)
The following data is for the defect (line) inspection region.			
Settings data	218	Region 0	Start X (0 to 511)
	219		Start Y (0 to 483)
	220		End X (0 to 511)
	221		End Y (0 to 483)
	222		Width (1 to 64)
The following data is for the defect (circumference) inspection region.			
Settings data	223		Center X (0 to 511)
	224		Center Y (0 to 483)
	225		Radius (1 to 512)
	226		Width (1 to 64)
The following data is for the defect (arc) inspection region.			
Settings data	227		Center X (0 to 511)
	228		Center Y (0 to 483)
	229		Radius (1 to 512)
	230		Width (1 to 64)
	231		Start angle (-180.000 to 180.000)
	232		End angle (-180.000 to 180.000)

Data		Details	
The following data is for the defect (region) inspection region.			
Settings data	233	Region 0	Region upper left X (0 to 511) (See note.)
	234		Region upper left Y (0 to 483) (See note.)
	235		Region lower right X (0 to 511) (See note.)
	236		Region lower right Y (0 to 483) (See note.)
The following data is for the defect (variable box) inspection region.			
Settings data	237	Region 0	Region upper left X (left edge) (0 to 511)
	238		Region upper left Y (left edge) (0 to 483)
	239		Region lower right X (left edge) (0 to 511)
	240		Region lower right Y (left edge) (0 to 483)
	241		Region upper left X (upper edge) (0 to 511)
	242		Region upper left Y (upper edge) (0 to 483)
	243		Region lower right X (upper edge) (0 to 511)
	244		Region lower right Y (upper edge) (0 to 483)
	245		Region upper left X (right edge) (0 to 511)
	246		Region upper left Y (right edge) (0 to 483)
	247		Region lower right X (right edge) (0 to 511)
	248		Region lower right Y (right edge) (0 to 483)
	249		Region upper left X (lower edge) (0 to 511)
	250		Region upper left Y (lower edge) (0 to 483)
	251		Region lower right X (lower edge) (0 to 511)
	252		Region lower right Y (lower edge) (0 to 483)
The following data is for the defect (deviation/box) inspection region.			
	253	Region 0	Region upper left X (0 to 511)
	254		Region upper left Y (0 to 483)
	255		Region lower right X (0 to 511)
	256		Region lower right Y (0 to 483)
The following data is for the defect (deviation/circumference) inspection region.			
	257	Region 0	Center X (0 to 511)
	258		Center Y (0 to 483)
	259		Radius (10 to 242)
The following data is the inspection region parameters for processing items other than defect (deviation).			
	260	Region 0	Large defect reference position X (0 to 511)
	261		Large defect reference position Y (0 to 483)
	262		Small defect reference position X (0 to 511)
	263		Small defect reference position Y (0 to 483)

Data		Details	
The following data is the inspection region parameters for defect (deviation).			
	264	Region 0	Deviation reference position X (0 to 511)
	265		Deviation reference position Y (0 to 483)
	266	Region 1	Large defect flag 0: OFF 1: ON
	to		... (Same as for region 0)
	770	Region 7	Large defect flag 0: OFF 1: ON
	to		... (Same as for region 0)
	852		Deviation reference position X (0 to 511)
	853		Deviation reference position Y (0 to 483)

Note If these settings are changed, one rectangular region will be set and any previously drawn figures will be deleted. This is true for regions 1 to 7 as well.

CHECK Only the allocations for region 0 are listed here. Refer to the allocations for region 0 to calculate the numbers for regions 1 to 7.

EC Defect (Measurement Data)

Data		Details	
Measurement data	0	Judgement result -2: Not measured. -1: NG 0: OK	
	1	Region 0	Judgement
	2		Defect width (See note.)
	3		Defect length (See note.)
	4		Gravity X
	5		Gravity Y
	6		Area
	7		Number of labels
	8	Region 1	Judgement
	to		... (Same as for region 0)
	50	Region 7	Judgement
	51		Defect width (See note.)
	52		Defect length (See note.)
	53		Gravity X
	54		Gravity Y
	55		Area
	56		Number of labels

Note These values are output in pixels regardless of the calibration setting. This is true for regions 1 to 7 as well.

EC Defect (Settings Data)

Data		Details	
Settings data	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)	
	65	Removal region 0	Region upper left X (0 to 511) (See note.)
	66		Region upper left Y (0 to 483) (See note.)
	67		Region lower right X (0 to 511) (See note.)
	68		Region lower right Y (0 to483) (See note.)
The following settings data is for circle removal.			
Settings data	69	Removal region 0	Circle color 0: Black 1: White 2: Both
	70		Latitude of angle (0 to 99)
	71		Circle search 0: OFF 1: ON
	72		Circle center X coordinate (0 to 511)
	73		Circle center Y coordinate (0 to 483)
	74		Circumference radius (3 to 512)
	75		Circumference width (1 to 64)
The following settings data is for line removal.			
	76	Removal region 0	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.			
	77	Removal region 0	Range of angle (0 to 359)
	78		Limits of angle (0 to 45)
The following settings data is common to all measurements.			
	79	Removal region 1	Region upper left X (0 to 511)
	to		... (Same as for removal region 0)
The following settings data is common to all measurements			
Settings data	163	Removal region 7	Region upper left X (0 to 511)
	to		... (Same as for removal region 0)
	175		Range of angle (0 to 359)
	176		Limits of angle (0 to 45)
The following settings data is common to all measurements			

Data		Details	
Settings data	177	Inspection region 0	Region upper left X (0 to 511) (See note.)
	178		Region upper left Y (0 to 483) (See note.)
	179		Region lower right X (0 to 511) (See note.)
	180		Region lower right Y (0 to 483) (See note.)
The following settings data is for defect measurement.			
Settings data	181	Inspection region 0	Extracting level 0: Level 1 1: Level 2 2: Level 3 3: Level 4 4: Level 5
	182		Defect color 0: Black 1: White
	183		Defect width upper limit (0 to 100)
	184		Defect width lower limit (0 to 100)
	185		Defect length upper limit (0 to 999)
	186		Defect length lower limit (0 to 999)
The following settings data is for gravity and area and labeling measurement.			
Settings data	187	Inspection region 0	X upper limit (-9,999.999 to 9,999.999)
	188		X lower limit (-9,999.999 to 9,999.999)
	189		Y upper limit (-9,999.999 to 9,999.999)
	190		Y lower limit (-9,999.999 to 9,999.999)
	191		Area upper limit (0.000 to 9,999,999.999)
	192		Area lower limit (0.000 to 9,999,999.999)
	193		Binary level upper limit (0 to 255)
	194		Binary level lower limit (0 to 255)
	195		Reverse binary level 0: Not reversed 1: Reversed
	196		Defect display 0: Simple 1: Detail
The following settings are for labeling measurement.			
Settings data	197	Inspection region 0	No. of labels upper limit (0 to 2,500)
	198		No. of labels lower limit (0 to 2,500)
	199		Noise area upper limit (0 to 9,999,999.999)
	200		Noise area lower limit (0 to 9,999,999.999)
	201		Fill Holes Mode 0: OFF 1: ON
	202		Sort 0: Area descending 1: Area ascending 2: X gravity descending 3: X gravity ascending 4: Y gravity descending 5: Y gravity ascending
	203		Outside trimming 0: OFF 1: ON
	204		No. of labels (0 to 2,499)

Data		Details	
The following settings data is for gravity and area.			
Settings data	205	Inspection region 0	Skipping X (1 to 15)
	206		Skipping Y (1 to 15)
	207		Fill profile 0: OFF 1: ON
	208	Inspection region 1	Region upper left X (0 to 511)
	to		... (Same as for inspection region 0)
The following settings data is for gravity and area.			
Settings data	394	Inspection region 7	Region upper left X (0 to 511)
	to		... (Same as for inspection region 0)
	424		Fill profile 0: OFF 1: ON

Note If these settings are changed, one rectangular region will be set and any previously drawn figures will be deleted. This is true for regions 1 to 7 as well.

CHECK Only the allocations for region 0 are listed here. Refer to the allocations for region 0 to calculate the numbers for regions 1 to 7.

EC Positioning (Measurement Data)

Data		Details		
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK		
	1	Region 0	Judgement result	
	2		Measurement X	
	3		Measurement Y	
	4		Measurement angle	
	5		Reference position X	
	6		Reference position Y	
	7		Reference angle	
	8		Radius	
	9		Circular value	
	10		Line length 1	
	11		Line length 2	
	12		Upper left apex X	
	13		Upper left apex Y	
	14		Lower left apex X	
	15		Lower left apex Y	
	16		Upper right apex X	
	17		Upper right apex Y	
	18		Lower right apex X	
	19		Lower right apex Y	
	20		No. of cross points	(See note.)
	21		Cross point position 1 X	
	22		Cross point position 1 Y	
	23		Cross point position 2 X	
	24		Cross point position 2 Y	
	25		Cross point position 3 X	
	26		Cross point position 3 Y	
	27		Cross point position 4 X	
	28		Cross point position 4 Y	
	29		Cross point position 5 X	
	30		Cross point position 5 Y	
	31		Cross point position 6 X	
	32		Cross point position 6 Y	
	33		Cross point position 7 X	
	34		Cross point position 7 Y	

Data		Details		
Measure-ment data	35	Region 0	Cross point position 8 X	
	36		Cross point position 8 Y	
	37		Cross point position 9 X	
	38		Cross point position 9 Y	
	39		Cross point position A X	
	40		Cross point position A Y	
	41		Cross point position B X	
	42		Cross point position B Y	
	43		Cross point position C X	
	44		Cross point position C Y	
	45		Cross point position D X	
	46		Cross point position D Y	
	47		Cross point position E X	
	48		Cross point position E Y	(See note.)
	49		Cross point position F X	
	50		Cross point position F Y	
	51		Cross point position G X	
	52		Cross point position G Y	
	53		Cross point position H X	
	53		Cross point position H Y	
	55		Cross point position I X	
	56		Cross point position I Y	
	57		Cross point position J X	
	58		Cross point position J Y	
	59		Cross point position K X	
	60		Cross point position K Y	
	61	Region 1	Judgement result	
	to		... (Same as for region 0)	
	421	Region 7	Judgement result	
	to		... (Same as for region 0)	
	480		Cross point position K Y	

Note These values will be output in pixels regardless of the setting for calibration. This is true for regions 1 to 7 as well.

CHECK Only the allocations for region 0 are listed here. Refer to the allocations for region 0 to calculate the numbers for regions 1 to 7.

EC Positioning (Settings Data)

Data		Details	
	500	Measurement image 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)	
	505	Region 0	Search region upper left X (0 to 511)
	506		Search region upper left Y (0 to 483)
	507		Search region lower right X (0 to 511)
	508		Search region lower right Y (0 to483)
	509		Reference position X (0 to 511)
	510		Reference position Y (0 to 483)
	511		Reference angle (0 to 359)
The following settings data is for circle measurement.			
Settings data	512	Region 0	Circle color 0: Black 1: White 2: Both
	513		Skipping 0: OFF 1: ON
	514		Circular value (0 to 100)
	515		Center X (0 to 511)
	516		Center Y (0 to 483)
	517		Circumference radius (3 to 512)
	518		Circumference width (1 to 64)
	519		Radius judgement upper limit (1 to 9,999.999)
	520		Radius judgement lower limit (1 to 9,999.999)

Data		Details	
The following settings are for line conditions (common to cross points, boxes, and multiple cross points).			
Settings data	521	Region 0	Extracting level 0: Level 1 1: Level 2 2: Level 3 3: Level 4 4: Level 5
	522		Line angle specification 0: OFF 1: ON
	523		Line angle 0 specification 0: OFF 1: ON
	524		Line angle 0 (0 to 359)
	525		Line angle 1 specification 0: OFF 1: ON
	526		Line angle 1 (0 to 359)
	527		Line angle 2 specification 0: OFF 1: ON
	528		Line angle 2 (0 to 359)
	529		Line angle 3 specification 0: OFF 1: ON
	530		Line angle 3 (0 to 359)
The following settings data is for cross point and multiple cross point measurements.			
Settings data	531	Region 0	Target color 0: Black 1: White
	532		Angle specification 0: OFF 1: ON
	533		Range of angle (0 to 359)
	534		Limits of angle (0 to 99)
	535		Length specification 0: OFF 1: ON
	536		Length 1 (1 to 999)
	537		Length 1 lower limit (0 to 200)
	538		Length 1 upper limit (0 to 200)
	539		Length 2 (1 to 999)
	540		Length 2 lower limit (0 to 200)
	541		Length 2 upper limit (0 to 200)
	542		Defined side of θ 0: Midline of corner 1: Side 1 2: Side 2

Data		Details	
The following settings data is for box measurements.			
Settings data	543	Region 0	Box color 0: Black 1: White
	544		Result coordinate 0: Center 1: Upper left 2: Lower left 3: Upper right 4: Lower right
	545		Defined side of θ 0: All 1: Upper 2: Lower 3: Left 4: Right
	546		Long side (1 to 512)
	547		Short side (1 to 484)
	548		Long side lower limit (1 to 200)
	549		Long side upper limit (1 to 200)
	550		Short side lower limit (1 to 200)
	551		Short side upper limit (1 to 200)
	552		Long side distance lower limit (1 to 200)
	553		Long side distance upper limit (1 to 200)
	554		Short side distance lower limit (1 to 200)
	555		Short side distance upper limit (1 to 200)
	556		Line parallelism (1 to 99)
The following settings data is for multiple cross point measurements.			
Settings data	557	Region 0	Sorting method 0: X ascending order 1: X descending order 2: Y ascending order 3: Y descending order
	558	Region 1	Search region upper left X (0 to 511)
	to		... (Same as for region 0)
	876	Region 7	Search region upper left (0 to 511)
	to		... (Same as for region 0)
	928		Sorting method 0: X ascending order 1: X descending order 2: Y ascending order 3: Y descending order

CHECK Only the allocations for region 0 are listed here. Refer to the allocations for region 0 to calculate the numbers for regions 1 to 7.

Edge Position (Measurement Data)

Data		Details	
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK	
	1	Region 0	Judgement result
	2		Edge position X
	3		Edge position Y
	4		Reference position X
	5		Reference position Y
	6	Region 1	Judgement result
	to		... (Same as for region 0)
	36	Region 7	Judgement result
	37		Edge position X
	38		Edge position Y
	39		Reference position X
	40		Reference position Y

Edge Position (Settings Data)

Data		Details	
Settings data	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	
	52	Region 0	Edge detection direction 0: ↑ 1: ↓ 2: → 3: ←
	53		Edge color 0: Light → dark 1: Dark → light
	54		X upper limit (-9,999.999 to 9,999.999)
	55		X lower limit (-9,999.999 to 9,999.999)
	56		Y upper limit (-9,999.999 to 9,999.999)
	57		Y lower limit (-9,999.999 to 9,999.999)
	58		Edge level (0 to 100)
	59		Noise level (0 to 255)
	60		Noise width (0 to 255)
	61		Region upper left X (0 to 511)
	62		Region upper left Y (0 to 483)
	63		Region lower right X (0 to 511)
	64		Region lower right Y (0 to 483)
	65		Reference position X (0 to 511)
	66		Reference position Y (0 to 483)
	67	Region 1	Edge detection method 0: ↑ 1: ↓ 2: → 3: ←
	to		... (Same as for region 0)
	157	Region 7	Edge detection method 0: ↑ 1: ↓ 2: → 3: ←
	to		... (Same as for region 0)
	171		Reference position Y (0 to 483)

CHECK Only the allocations for region 0 are listed here. Refer to the allocations for region 0 to calculate the numbers for regions 1 to 7.

Fine Matching (Measurement Data)

Data		Details
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK
	1	Quantity
	2	Area
	3	Gravity X
	4	Gravity Y

Fine Matching (Settings Data)

Data		Details
Settings data	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)
	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 5)
	41	Difference (0 to 255) (See note 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 511) (See note 2.)
	46	Model registration area upper left Y (0 to 483) (See note 2.)
	47	Model registration area lower right X (0 to 511) (See note 2.)
	48	Model registration area lower right Y (0 to 483) (See note 2.)
	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 note 1.)
	58	Difference (black) (0 to 255) (See note 1.)

Note 1. The settings for differences in data 41, 57, and 58 are as following when setting and reading the values.

Data	Setting	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 these settings are changed, one rectangular region will be set and any previously drawn figures will be deleted.

EC Circle Count (Measurement Data)

Data		Details	
Measurement data	0	Judgement result -2: Not measured. -1: NG 0: OK	
	1	Quantity	
	2	Circle 0	Center X
	3		Center Y
	4		Radius
	5		Circular value
	6	Circle 1	Center X
	7		Center Y
	8		Radius
	9		Circular value
	to		... (Same as for circle 0)
	254	Circle 63	Center X
	255		Center Y
	256		Radius
	257		Circular value

CHECK Only the allocations for circle 0 and circle 63 are listed here. Refer to the allocations for circle 0 to calculate the numbers for circles 1 to 62.

EC Circle Count (Settings Data)

Data		Details
Settings data	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	Inspected region upper left X (0 to 511) (See note.)
	276	Inspected region upper left Y (0 to 483) (See note.)
	277	Inspected region lower right X (0 to 511) (See note.)
	278	Inspected region lower right Y (0 to 483) (See note.)
	279	Circle color 0: Black 1: White 2: Both
	280	Circle center X coordinate (0 to 511)
	281	Circle center Y coordinate (0 to 483)
	282	Circumference radius (3 to 512)
	283	Circumference width (1 to 64)
	284	Quantity upper limit (0 to 64)
	285	Quantity lower limit (0 to 64)
	286	Skipping 0: OFF 1: ON
	287	Circular value (0 to 100)
	288	Radius upper limit (1 to 9,999.999)
	289	Radius lower limit (1 to 9,999.999)

Note If these settings are changed, one rectangular region will be set and any previously drawn figures will be deleted.

Pattern Inspection (Measurement Data)

Data		Details	
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK	
	1	Region 0	Judgement result
	2		Correlation
	3		Position X
	4		Position Y
	5		Reference position X
	6		Reference position Y
	7	Region 1	Judgement result
	to		... (Same as for region 0)
	379	Region 63	Judgement result
	380		Correlation
	381		Position X
	382		Position Y
	383		Reference position X
	384		Reference position Y

Pattern Inspection (Settings Data)

Data		Details	
Settings data	512	Accuracy 0: Normal 1: Precise	
	513	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	
	516	Region 0	Model position upper left X (0 to 511) (See note.)
	517		Model position upper left Y (0 to 483) (See note.)
	518		Model position lower right X (0 to 511) (See note.)
	519		Model position lower right Y (0 to 483) (See note.)
	520		Model reference position X (0 to 511)
	521		Model reference position Y (0 to 483)
	522		Search region upper left X (0 to 511)
	523		Search region upper left Y (0 to 483)
	524		Search region lower right X (0 to 511)
	525		Search region lower right Y (0 to 483)
	526		Correlation upper limit (0 to 100)
	527		Correlation lower limit (0 to 100)
	528		Position X upper limit (-9,999.999 to 9,999.999)
	529		Position X lower limit (-9,999.999 to 9,999.999)
	530		Position Y upper limit (-9,999.999 to 9,999.999)
	531		Position Y lower limit (-9,999.999 to 9,999.999)
	532	Region 1	Model position upper left X (0 to 511) (See note.)
	to		... (Same as for region 0)
	1524	Region 63	Model position upper left X (0 to 511) (See note.)
	to		... (Same as for region 0)
	1539		Position Y lower limit (-9,999.999 to 9,999.999)

Note If these settings are changed, one rectangular region will be set and any previously drawn figures will be deleted. This is true for regions 1 to 63 as well.

CHECK Only the allocations for region 0 are listed here. Refer to the allocations for region 0 to calculate the numbers for regions 1 to 63.

QUEST Character Verification (Measurement Data)

Data		Details		
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK		
	1	Region 0	Judgement	
	2		Row 1 character 1	String similarity
	3			Candidate 1 code
	4			Candidate 1 similarity
	5			Candidate 2 code
	6			Candidate 2 similarity
	to		... (Row 1 characters 2 to 19 same as for row 1 character 1.)	
	97		Row 1 character 20	String similarity
	98			Candidate 1 code
	99			Candidate 1 similarity
	100			Candidate 2 code
	101			Candidate 2 similarity
	102		Row 2 character 1	String similarity
	103			Candidate 1 code
	104			Candidate 1 similarity
	105			Candidate 2 code
	106			Candidate 2 similarity
	to		... (Row 2 characters 2 to 19 same as for row 2 character 1.)	
	197		Row 2 character 20	String similarity
	198			Candidate 1 code
	199			Candidate 1 similarity
	200			Candidate 2 code
	201			Candidate 2 similarity
	202	Region 1	Judgement	
	to		... (Same as for region 0)	
	800	Region 3	Row 2 character 20	String similarity
	801			Candidate 1 code
	802			Candidate 1 similarity
	803			Candidate 2 code
	804			Candidate 2 similarity

QUEST Character Verification (Settings Data)

Data		Details
Settings data	897	Measurement image 0: Image 0 1: Image 1
	898	Character color 0: Black 1: White

Data		Details
Settings data	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

Data		Details
Settings data	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
	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) (0to 99.9)

Data		Details	
Settings data	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	Measurement result output 0: OFF 1: ON	
	936	Common judgement	Similarity level (0 to 100)
	937		Differential level (0 to 100)
	938	Individual judgement conditions	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)
	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)

Data		Details		
Settings data	971	Individual judgement conditions	X (-1 to 100)	
	972		Y (-1 to 100)	
	973		Z (-1 to 100)	
	974		: (-1 to 100)	
	975		/ (-1 to 100)	
	976	Region 0	Mode 0: Fixed region 1: Auto extraction	
	977		Type of 1st line 0: Not specifying 1: Specifying	
	978		Type of 2nd line 0: Not specifying 1: Specifying	
	979		1st line string (See note.)	
	980		2nd line string (See note.)	
	981		Auto	Upper left X coordinate (0 to 511)
	982			Upper left Y coordinate (0 to 483)
	983			Lower right X coordinate (0 to 511)
	984			Lower right Y coordinate (0 to 483)
	985		Fixed 1st character	Upper left X coordinate (0 to 511)
	986			Upper left Y coordinate (0 to 483)
	987			Lower right X coordinate (0 to 511)
	988			Lower right Y coordinate (0 to 483)
	989		Fixed 2nd character	Upper left X coordinate (0 to 511)
	990			Upper left Y coordinate (0 to 483)
	991			Lower right X coordinate (0 to 511)
	992			Lower right Y coordinate (0 to 483)
	to		... (Fixed characters 3 to 19 same as for fixed 1st character).	
	1061		Fixed 20th character	Upper left X coordinate (0 to 511)
	1062			Upper left Y coordinate (0 to 483)
	1063			Lower right X coordinate (0 to 511)
	1064			Lower right Y coordinate (0 to 483)

Data		Details		
Settings data	1065	Region 1	Mode 0: Fixed region 1: Auto extraction	
	to		... (Same as for region 0)	
	1154	Region 2	Mode 0: Fixed region 1: Auto extraction	
	to		... (Same as for region 0)	
	1243	Region 3	Mode 0: Fixed region 1: Auto extraction	
	to		... (Same as for region 0)	
	1331		Fixed 20th character	Lower right Y coordinate (0 to 483)
	1332	Ring characters (0: 0, 1: O)		

CHECK Only the allocations for region 0 are listed here. Refer to the allocations for region 0 and calculate the numbers for regions 1 to 3.

Rotation Positioning (Measurement Data)

Data		Details	
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK	
	1	Region 0	Judgement result
	2		Correlation
	3		Position X
	4		Position Y
	5		Angle
	6		Reference position X
	7		Reference position Y
	8	Region 1	Judgement result
	to		... (Same as for region 0)
	50	Region 7	Judgement result
	51		Correlation
	52		Position X
	53		Position Y
	54		Angle
	55		Reference position X
	56		Reference position Y

Rotation Positioning (Settings Data)

Data		Details	
Settings data	72	Rotation range 0: None 1: ± 2° 2: ± 5° 3: ± 8° 4: ± 10° 5: ± 15° 6: ±30° 7: ±45° 8: ±60° 9: ±90° 10: All angles	
	73	Skipping angle 0: 1° 1: 2° 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	
	78	Region 0	Model position upper left X (0 to 511) (See note.)
	79		Model position upper left Y (0 to 483) (See note.)
	80		Model position lower right X (0 to 511) (See note.)
	81		Model position lower right Y (0 to 483) (See note.)
	82		Model reference position X (0 to 511)
	83		Model reference position Y (0 to 483)
	84		Search region upper left X (0 to 511)
	85		Search region upper left Y (0 to 483)
	86		Search region lower right X (0 to 511)
	87		Search region lower right Y (0 to 483)
	88		Correlation upper limit (0 to 100)
	89		Correlation lower limit (0 to 100)
	90		Position X upper limit (-9,999.999 to 9,999.999)
	91		Position X lower limit (-9,999.999 to 9,999.999)
	92		Position Y upper limit (-9,999.999 to 9,999.999)
	93		Position Y lower limit (-9,999.999 to 9,999.999)
	94		Angle upper limit (-360.000 to 360.000)
	95		Angle lower limit (-360.000 to 360.000)
	96	Region 1	Model position upper left X (0 to 511) (See note.)
	to		... (Same as for region 0)
	204	Region 7	Model position upper left X (0 to 511) (See note.)
	to		... (Same as for region 0)
	221		Angle lower limit (-360.000 to 360.000)

Note If these settings are changed, one rectangular region will be set and any previously drawn figures will be deleted. This is true for regions 1 to 7 as well.

CHECK Only the allocations for region 0 are listed here. Refer to the allocations for region 0 to calculate the numbers for regions 1 to 7.

ECM Search (Measurement Data)

Data		Details
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK
	1	EC correlation
	2	Search position X
	3	Search position Y
	4	Reference position X
	5	Reference position Y

ECM Search (Settings Data)

Data		Details
Settings data	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	Edge extraction 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 X 1 (0 to 511) (See note.)
	24	Model region Y 1 (0 to 483) (See note.)
	25	Model region X 2 (0 to 511) (See note.)
	26	Model region Y 2 (0 to 483) (See note.)
	27	Reference X (0 to 511)
	28	Reference Y (0 to 483)
	29	Search region X 1 (0 to 511)
	30	Search region Y 1 (0 to 483)
	31	Search region X 2 (0 to 511)
	32	Search region Y 2 (0 to 483)
	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 (0 to 9)
	42	Search skipping (0 to 9)
	43	Matching edges display 0: OFF 1: ON

Note Mask figures cannot be registered.

Lot Number OCV1 (Measurement Data)

Data		Details	
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK	
	1	Digit 1	Judgement
	2		Candidate 1 code
	3		Candidate 1 similarity
	4		Candidate 2 code
	5		Candidate 2 similarity
	6	Digit 2	Judgement
	7		Candidate 1 code
	8		Candidate 1 similarity
	9		Candidate 2 code
	10		Candidate 2 similarity
	11	Digit 3	Judgement
	12		Candidate 1 code
	13		Candidate 1 similarity
	14		Candidate 2 code
	15		Candidate 2 similarity
	16	Digit 4	Judgement
	17		Candidate 1 code
	18		Candidate 1 similarity
	19		Candidate 2 code
	20		Candidate 2 similarity

Lot Number OCV1 (Settings Data)

Data		Details
Settings data	32	Measurement image 0: Image 0 1: Image 1
	33	Character color 0: Black 1: White

Data		Details
Settings data	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	Forced extraction 0: OFF 1: ON
	43	No. of dilations (0 to 9)
	44	Extraction direction 0: From left 1: From right

Data		Details
Settings data	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
	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)

Data		Details	
Settings data	80	Auto	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)
	84	Fixed 1st digit	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)
	88	Fixed 2nd digit	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)
	92	Fixed 3rd digit	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)
	96	Fixed 4th digit	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)

Labeling (Measurement Data)

Data		
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK
	1	Number of labels
	2	Measured X
	3	Measured Y
	4	Area
	5	Reference X
	6	Reference Y
	7	Reference area
	8	Displacement X
	9	Displacement Y
	10	Difference area

Labeling (Settings Data)

Data		Details	
Settings data	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 511) (See note.)
	34		Upper left Y (0 to 483) (See note.)
	35		Lower right X (0 to 511) (See note.)
	36		Lower right Y (0 to 483) (See note.)
	37	Binary level	Upper limit (0 to 255)
	38		Lower limit (0 to 255)
	39		Reverse binary level 0: Not reversed 1: Reversed
	40	Area	Upper limit (0.000 to 9,999,999.999)
	41		Lower limit (0.000 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 2,499)	
	46	Number of labels	Upper limit (0 to 2,500)
	47		Lower limit (0 to 2,500)
	48	Area	Upper limit (0.000 to 9,999,999.999)
	49		Lower limit (0.000 to 9,999,999.999)
	50	Gravity X	Upper limit (-9,999.999 to 9,999.999)
	51		Lower limit (-9,999.999 to 9,999.999)
	52	Gravity Y	Upper limit (-9,999.999 to 9,999.999)
	53		Lower limit (-9,999.999 to 9,999.999)

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

Label Data (Measurement Data)

Data		Details
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK
	1	Label No.
	2	Gravity X
	3	Gravity Y
	4	Area A

Label Data (Settings Data)

Data		Details	
Settings data	32	Label unit (-1: None, 0 to 9,999)	
	33	Label number (0 to 2,499)	
	34	Region number (0 to 7)	
	35	Gravity X	Upper limit (-9,999.999 to 9,999.999)
	36		Lower limit (-9,999.999 to 9,999.999)
	37	Gravity Y	Upper limit (-9,999.999 to 9,999.999)
	38		Lower limit (-9,999.999 to 9,999.999)
	39	Area	Upper limit (0.000 to 9,999,999.999)
	40		Lower limit (0.000 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	

Edge Pitch (Measurement Data)

Data		
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK
	1	Number of edges
	2	Average pitch
	3	Maximum pitch
	4	Minimum pitch
	5	Average width
	6	Maximum width
	7	Minimum width

Edge Pitch (Settings Data)

Data		Details
Settings data	31	Measurement image 0: Image 0 1: Image 1
	32	Coordinate mode 0: Calibration OFF 1: Calibration OFF
	33	Number of edges upper limit (0 to 255)
	34	Number of edges lower limit (0 to 255)
	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 511)
	40	Region upper left Y (0 to 483)
	41	Region lower right X (0 to 511)
	42	Region lower right Y (0 to483)
	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

Density Data (Measurement Data)

Data		
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK
	1	Density average
	2	Density deviation
	3	Reference average
	4	Reference deviation
	5	Difference average
	6	Difference deviation

Density Data (Settings Data)

Data		Details
Settings data	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 511) (See note.)
	37	Region upper left Y (0 to 483) (See note.)
	38	Region lower right X (0 to 511) (See note.)
	39	Region lower right Y (0 to483) (See note.)

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

Measurement Support

Calculation (Measurement Data)

Data		Details
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK
	1	Calculation result 0
	2	Calculation result 1
	3	Calculation result 2
	4	Calculation result 3
	5	Calculation result 4
	6	Calculation result 5
	7	Calculation result 6
	8	Calculation result 7
	9	Judgement result 0 -1: NG 0: OK
	10	Judgement result 1 -1: NG 0: OK
	11	Judgement result 2 -1: NG 0: OK
	12	Judgement result 3 -1: NG 0: OK
	13	Judgement result 4 -1: NG 0: OK
	14	Judgement result 5 -1: NG 0: OK
	15	Judgement result 6 -1: NG 0: OK
	16	Judgement result 7 -1: NG 0: OK

Calculation (Settings Data)

Data		Details
Settings data	17	Judgement lower limit 0 (-9,999,999.999 to 9,999,999.999)
	18	Judgement upper limit 0 (-9,999,999.999 to 9,999,999.999)
	19	Judgement lower limit 1 (-9,999,999.999 to 9,999,999.999)
	20	Judgement upper limit 1 (-9,999,999.999 to 9,999,999.999)
	21	Judgement lower limit 2 (-9,999,999.999 to 9,999,999.999)
	22	Judgement upper limit 2 (-9,999,999.999 to 9,999,999.999)
	23	Judgement lower limit 3 (-9,999,999.999 to 9,999,999.999)
	24	Judgement upper limit 3 (-9,999,999.999 to 9,999,999.999)
	25	Judgement lower limit 4 (-9,999,999.999 to 9,999,999.999)
	26	Judgement upper limit 4 (-9,999,999.999 to 9,999,999.999)
	27	Judgement lower limit 5 (-9,999,999.999 to 9,999,999.999)
	28	Judgement upper limit 5 (-9,999,999.999 to 9,999,999.999)
	29	Judgement lower limit 6 (-9,999,999.999 to 9,999,999.999)
	30	Judgement upper limit 6 (-9,999,999.999 to 9,999,999.999)
	31	Judgement lower limit 7 (-9,999,999.999 to 9,999,999.999)
	32	Judgement upper limit 7 (-9,999,999.999 to 9,999,999.999)
	41	Reflect to overall judgement 0: ON 1: OFF

Trend Monitor (Measurement Data)

Data		Details
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK
	1	Measurement value
	2	Warning -1: Warning 0: No warning
	3	Maximum
	4	Minimum
	5	Average
	6	Deviation
	7	Measure count
	8	NG count
	9	Warning count

Trend Monitor (Settings Data)

Data		Details
Settings data	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

Branching Control

Branching (Measurement Data)

Data		Details
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK
	1	Expression A
	2	Expression B
	3	Evaluation result
	4	Destination

Conditional Branching (Settings Data)

Data		Details
Settings data	6	Destination unit number for true -1: End processing 0 to 32767: Unit number
	7	Destination unit number for false -1: End processing 0 to 32767: Unit number
	10	Condition 0: A = B 1: A ≤ B 2: A < B 3: A ≥ B 4: A > B

DI Branching (Measurement Data)

Data		Details
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK
	1	DI input value
	2	Destination

DI Branching (Settings Data)

Data		Details
Settings data	4	Destination (DI = 0) -1: End processing 0 to 32767: Unit number
	5	Destination (DI = 1) -1: End processing 0 to 32767: Unit number
	to	... (DI = 2 to DI = 30 are the same as for DI = 0)
	35	Destination (DI = 31) -1: End processing 0 to 32767: Unit number

CHECK Destination settings can be made for 0 to 31. Select the data number to match the DI number.

Results Output

Memory Card Data (Measurement Data)

Data		Details
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK
	1	Calculation result 0
	2	Calculation result 1
	to	..
	8	Calculation result 7

Memory Card Data (Settings Data)

Data		Details
Settings data	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: Slot 0 1: Slot 1

DO Data (Measurement Data)

Data		Details
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK
	1	Calculation result 0
	2	Calculation result 1
	to	..
	8	Calculation result 7

DO Data (Settings Data)

Data		Details
Settings data	17	Output format 0: Binary 1: BCD

DO Judgement (Measurement Data)

Data		Details
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK
	1	Calculation result 0
	2	Calculation result 1
	to	..
	32	Calculation result 31
	33	Judgement result 0 -1: NG 0: OK
	34	Judgement result 1 -1: NG 0: OK
	to	...
	64	Judgement result 31 -1: NG 0: OK

DO Judgement (Settings Data)

Data		Details
Settings data	65	Judgement lower limit 0 (-9,999,999.999 to 9,999,999.999)
	66	Judgement upper limit 0 (-9,999,999.999 to 9,999,999.999)
	67	Judgement lower limit 1 (-9,999,999.999 to 9,999,999.999)
	68	Judgement upper limit 1 (-9,999,999.999 to 9,999,999.999)
	to	... (Judgement lower limit 2 to judgement lower limit 30 is the same).
	127	Judgement lower limit 31 (-9,999,999.999 to 9,999,999.999)
	128	Judgement upper limit 31 (-9,999,999.999 to 9,999,999.999)
	161	Reflect to overall judgement 0: ON 1: OFF

Host Link Data (Measurement Data)

Data		Details
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK
	1	Calculation result 0
	2	Calculation result 1
	to	..
	8	Calculation result 7

Normal Data (Measurement Data)

Data		Details
Measure-ment data	0	Judgement result -2: Not measured. -1: NG 0: OK
	1	Calculation result 0
	2	Calculation result 1
	to	..
	8	Calculation result 7

Normal Data (Settings Data)

Data		Details
Settings data	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: Delimiter
	22	Record separator 0: None 1: Comma 2: Tab 3: Space 4: Delimiter
	23	0 suppress 0: OFF 1: ON

Results Display

Display string (Settings Data)

Data		Details
Settings data	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

Display Measure (Measurement Data)

Data		Details
Measure-ment data	0	Measurement value

Display Measure (Settings Data)

Data		Details
Settings data	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)

Display Judge (Measurement Data)

Data		Details
Measure-ment data	0	Display judgement -1: NG 0: OK
	1	Measurement

Display Judge (Settings Data)

Data		Details
Settings data	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 upper limit (-9,999,999.999 to 9,999,999.999)
	38	Judgement lower limit (-9,999,999.999 to 9,999,999.999)

Display Item (Settings Data)

Data		Details
Settings data	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)

Display Time (Settings Data)

Data		Details
Settings data	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

Display Figure (Settings data)

Data		Details
Settings data	32	Display color (figure color 0 to 6)
	33	Line type (for lines only) 0: Solid line 1: Dash line

Display Line (Measurement Data)

Data		Details
Measure-ment data	0	1st point X measurement value
	1	1st point Y measurement value
	2	2nd point X measurement value
	3	2nd point Y measurement value

Display Line (Settings Data)

Data		Details
Settings data	32	Display color 0: OK color 1: NG color
	33	Display properties 0: Solid line 1: Dash line

Display Box (Measurement Data)

Data		Details
Measure-ment data	0	1st point X measurement value
	1	1st point Y measurement value
	2	2nd point X measurement value
	3	2nd point Y measurement value

Display Box (Settings Data)

Data		Details
Settings data	32	Display color 0: OK color 1: NG color
	33	Display properties 0: Solid line 1: Dash line

Display Circle (Measurement Data)

Data		Details
Measure-ment data	0	Center X measurement value
	1	Center Y measurement value
	2	Radius measurement value

Display Circle (Settings Data)

Data		Details
Settings data	32	Display color 0: OK color 1: NG color
	33	Display properties 0: Solid line 1: Dash line

Display Cursor (Measurement Data)

Data		Details
Measure-ment data	0	X coordinate measurement value
	1	Y coordinate measurement value

Display Cursor (Settings Data)

Data		Details
Settings data	32	Display color 0: OK color 1: NG color

Function 2

Sets the parameters for the unit set to the current scene.

Input

UNITDATA <unit No.> <data> <parameter>Delimiter

- Specify a unit number between 0 and 9,999.
- The data will depend on the processing item for the specified unit.

SeeAlso Refer to *List of Data on page 6-2-(28)*.

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

Example

In this example, the model position upper left X coordinate for region 0 for pattern inspection is set to 100.

Input UNITDATA 5 516 100 Delimiter

Output OK Delimiter

6-2-2-32 UNITDAT2

Function 1

Reads the character string for QUEST character verification.

Input

UNITDAT2 <unit No.> <data> Delimiter

- Specify a unit number between 0 and 9,999.
- For information on data, refer to *List of Data on page 6-2-(28)*.

Output

Command executed correctly: Value
OK Delimiter
Command not executed correctly: ER Delimiter

Example

This example shows how to read the inspection character string for QUEST character verification.

Input UNITDAT2 7 979 Delimiter

Output AAA Delimiter
OK Delimiter

Function 2

Sets character string for QUEST character verification.

Input

UNITDAT2 <unit No.> <data> <character string> Delimiter

- Specify a unit number between 0 and 9,999.
- For information on data, refer to *List of Data on page 6-2-(28)*.

Output

Command executed correctly: OK Delimiter
Command not executed correctly: ER Delimiter

Example

This example shows how to set the character string “ABC” for QUEST character verification.

Input UNITDAT2 7 979 ABC Delimiter

Output OK Delimiter

6-2-2-33 VERGET: Version Get

Function

Reads the system's version information.

Input

VERGET Delimiter

Output

Command executed correctly:	Version information Delimiter OK Delimiter
Command not executed correctly:	ER Delimiter

Example

System version information is read.
In this example, the Application Software is the F250-UM(E), the software version is 2.00, and the creation date is 12/1/2001 at 12 noon.

Input VERGET Delimiter

Output F250-UM Ver2.00 2001/12/01 12:00 Delimiter
OK Delimiter

6-2-3 Output Format (Normal)

When *Normal data* is set to a unit, the measurement results are output by output number in ascending order. Measurement results are output using normal communications when the communications mode is set to menu operation.

Outputting ASCII Data

■ **Output Format**

<Data 0 measurement>, <Data 1 measurement>, - - -
<Data 7 measurement> Delimiter

CHECK Settings such as the data format, number of digits, and data delimiter can be changed as necessary. The following table shows the default settings.

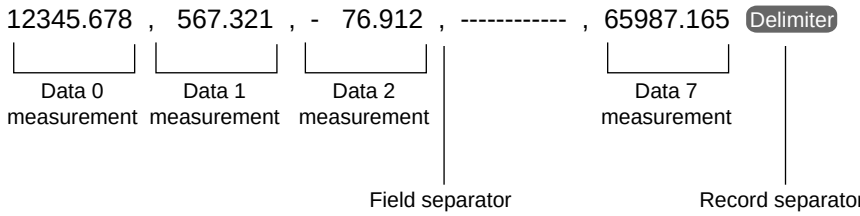
SeeAlso Refer to the *2-42 Normal Data*.

■ **Condition Settings**

Item	Setting
Output format	ASCII
Digits of integer	8 digits
Digits of decimal	3 digits
Minus	-
Field separator	Comma
Record separator	Delimiter
0 Suppress	OFF (Spaces are inserted in empty digits.)

Example

This example shows an example data output.



CHECK The field separator is required in order for the output to continue to the next data field.

- **Digital Output Range**
  -9,999,999.999 ≤ measurement ≤ 9,999,999.999
  The minimum value of “-9,999,999.999” will be output for measurements less than -9,999,999.999.
  The maximum value of “9,999,999.999” will be output for measurements greater than 9,999,999.999.
- **JG (Judgement) Outputs**
  The following values are output when JG (Judgement) has been set:
  OK: 0
  NG: -1

CHECK After measurements have been made in Run Mode, the data up through the last measurement will be output even if the mode is changed to another mode. The data output will not be interrupted midway.

Outputting Binary Data

The measurement data is multiplied by 1,000 and then output consecutively using four bytes for each data element. Negative numbers are output as 2's complements.

SeeAlso Refer to *2's complements* in *7-4 Terminology*.

■ Data Format

<Data 0 ×1,000> <Data 1 ×1,000> ••• <Data 7 ×1,000>

4 bytes 4 bytes 4 bytes

■ Condition Settings

Item	Setting
Output format	Binary
Digits of integer	Setting these conditions is not required. They are for ASCII output only.
Digits of decimal	
Minus	
Field separator	
Record separator	
0 Suppress	

Example

This example shows an example data output when data 0 is 256.324 and data 1 is -1.000.

$00	$03	$E9	$44	$FF	$FF	$FC	$18

Data 0: 256324 (256.324 × 1,000)

Data 1: -1000 (-1.000 × 1,000)

CHECK Unlike ASCII, no field or record separators are output to separate the data for binary output

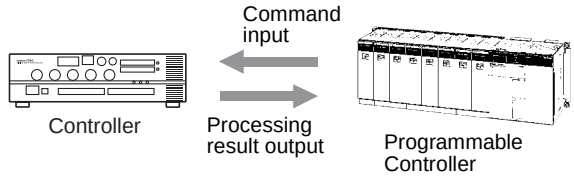
SeeAlso Refer to *2-42 Normal Data*.

- **Digital Output Range**
  -2,147,483.648 ≤ measurement ≤ 2,147,483.647
  The minimum value of "-2,147,483.648" will be output for measurements less than -2,147,483.648.
  The maximum value of "2,147,483.647" will be output for measurements greater than 2,147,483.647.
- **JG (Judgement) Outputs**
  The following values are output when JG (Judgement) has been set:
  OK: 0
  NG: -1000 (-1 × 1,000)

CHECK After measurements have been made in Run Mode, the data up through the last measurement will be output even if the mode is changed to another mode. The data output will not be interrupted midway.

6-3 Host Link Serial Interface

This section explains the required communications specifications settings and I/O format when using the Controller's serial interface (RS-232C/RS-422) to communicate with an external device, such as a Programmable Controller (PLC).



Note Ethernet connections cannot be used.

6-3-1 Setting Communications Specifications

If the communications mode is set to **Host link**, the Controller can communicate with a host device such as a Programmable Controller (PLC) through its serial interface using the host link protocol.

CHECK Only a 1:1 connection can be made with host link; the Controller's host link does not support 1:N connections.

CHECK Set the output data using the Host Link data output processing item.

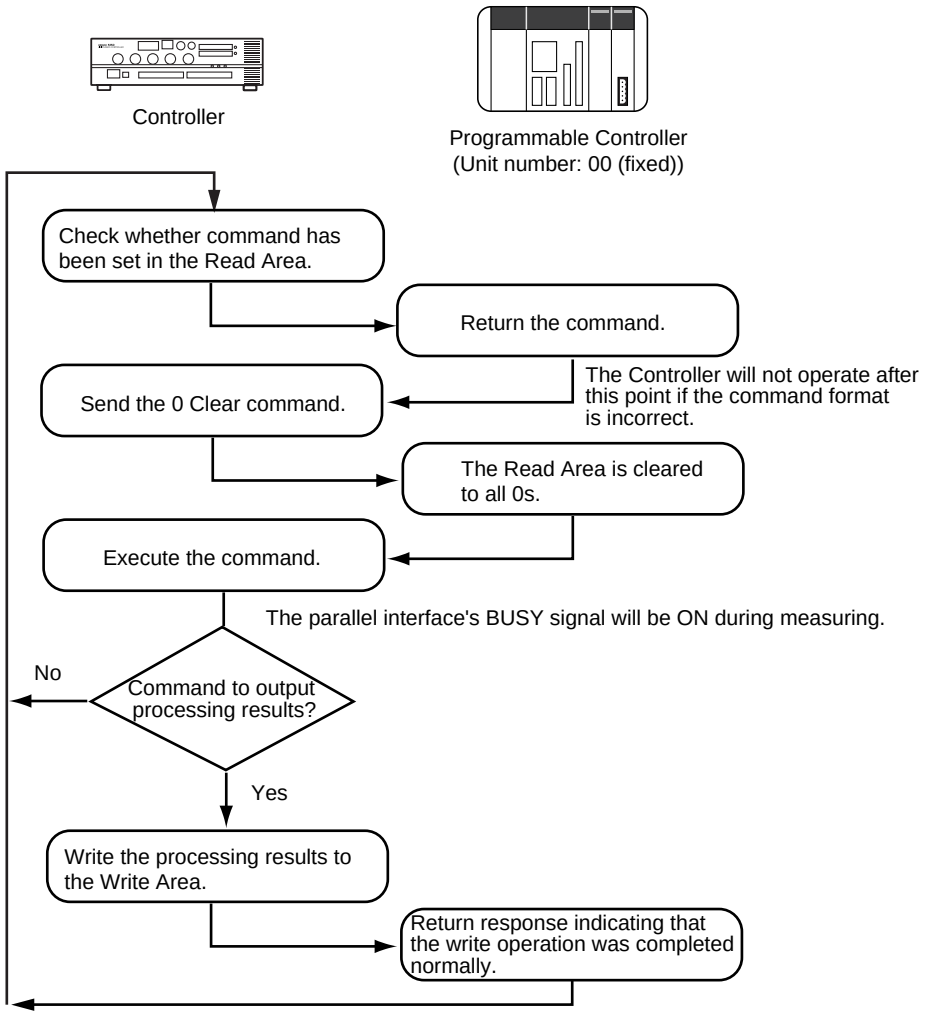
- Setting Mode
  Command inputs are not received.
- Monitor Mode
  Command inputs are received, but the measurement results are not output to external devices.
  When a command is input to read a set value, the appropriate value will be output.
- Run Mode
  Command inputs are received and measurement results are output.

CHECK After measurements have been made in Run Mode, the data up through the last measurement will be output even if the mode is changed to another mode. The data output will not be interrupted midway.

Operational Flowcharts

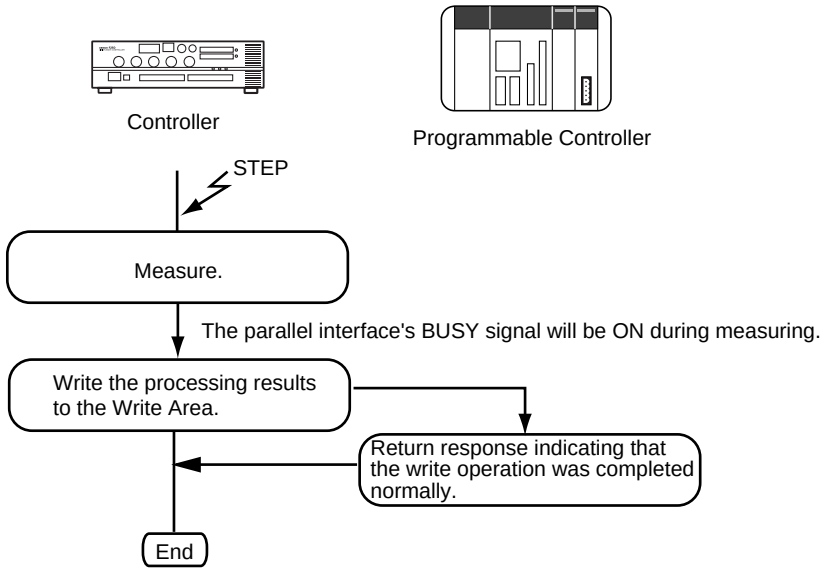
Serial Interface with I/O

Set the commands in the read bits of the Programmable Controller. The Controller will read the commands directly from the read bits.



Note If a response is not received within 5 seconds, a timeout error will occur in the Controller because the Programmable Controller may be disconnected or malfunctioning. An error message will be displayed on the Controller's screen and the parallel interface's ERR signal will be turned ON.

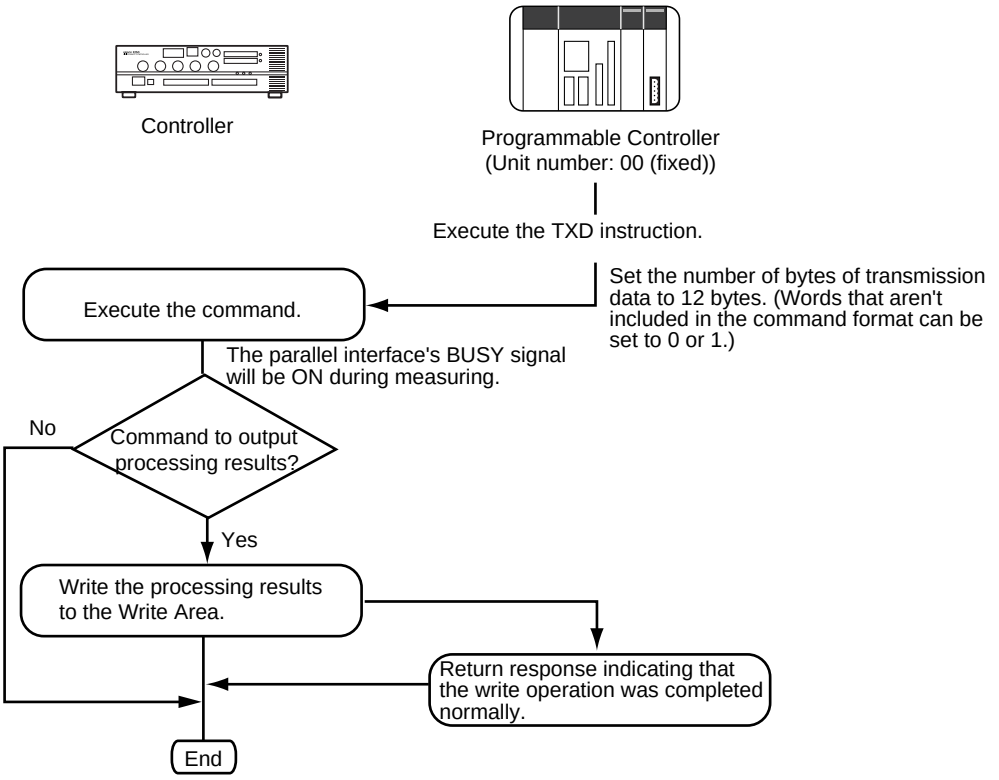
Inputting the Measurement Trigger from the STEP Signal



Note If a response is not received within 5 seconds, a timeout error will occur in the Controller because the Programmable Controller may be disconnected or malfunctioning. An error message will be displayed on the Controller's screen and the parallel interface's ERR signal will be turned ON.

Using the TXD Instruction

With this method, the command is not set in the Read Area, it is actively transmitted from the Programmable Controller to the Controller. Set the ***Read area*** to ***None*** in the **Communications (Host link)** window.



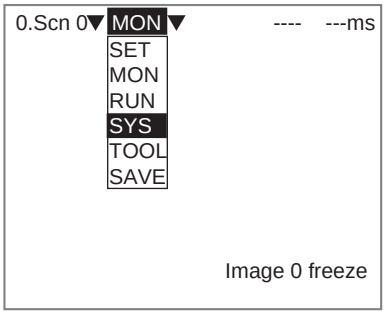
Note If a response is not received within 5 seconds, a timeout error will occur in the Controller because the Programmable Controller may be disconnected or malfunctioning. An error message will be displayed on the Controller's screen and the parallel interface's ERR signal will be turned ON.

Controller Settings

Communications Speed and Communications Mode

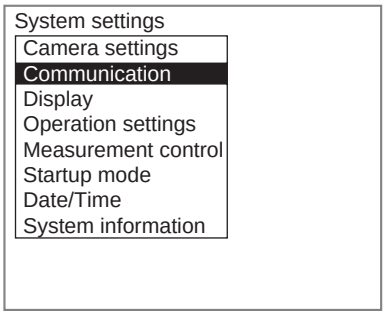
Use the following procedure to set communications specifications such as the baud rate and data length. Set the same communications specifications in the Controller and the external device.

1. Move the cursor to ***MON*** or ***RUN*** and press the **ENT** Key.

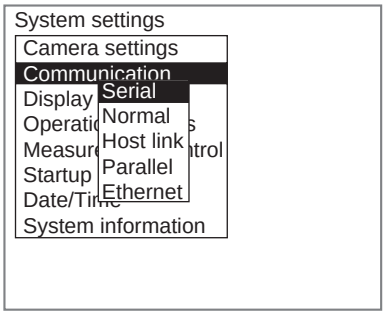


2. Select ***SYS***.

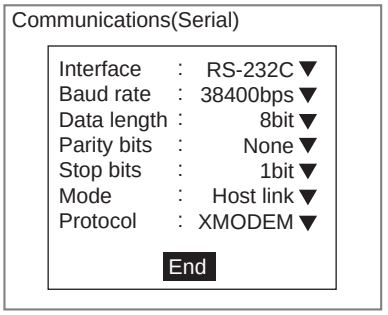
The *System settings* menu will be displayed.



3. Select ***Communications***.
   The communications menu will be displayed.



4. Select ***Serial***.
   The *Communications (Serial)* window will be displayed.



5. Set each parameter to the desired setting.

6. Select ***End***.

   The displayed settings will be registered and the *System settings* menu (from step 3) will be displayed.

The following table shows the possible communications settings. The asterisk (*) indicates the default setting.

Item	Possible settings	
Interface	Select ***RS-232C***. (from RS-232C* or RS-422)	
Baud rate (See note 1.)	2,400, 4,800, 9,600, 19,200, 38,400*, 57,600, 115,200 (bps)	Set the same settings that are set in the Programmable Controller.
Data length	7 or 8* (bits)	
Parity bits	None*, Odd, or Even	
Stop bits	1* or 2 (bits)	
Mode	Select ***Host link***.	
Transfer protocol (See note 2.)	XMODEM*, ZMODEM	

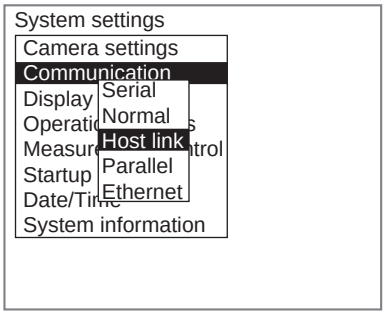
Note

1. RS-232C standards are not defined for speeds over 20 kbps. Depending on the cable length, communications may be unreliable at speeds of 38,400 bps and higher when ***RS-232C*** is selected. If there are problems with communications, reduce the baud rate to 19,200 bps.
2. XMODEM (-1K) is not supported.

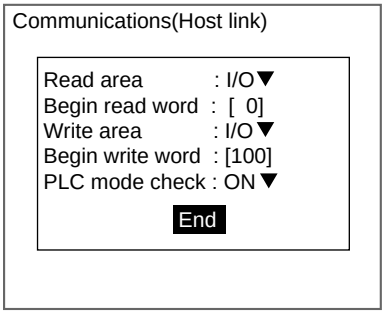
Settings Related to the Programmable Controller

Specify the location of the Read Area where the Controller reads commands and the location of the Write Area where the Controller outputs the execution results.

1. Select ***Host link*** communications



The *Communications (Host link)* window will be displayed.



2. Set the locations of the Read and Write Areas.
3. Select ***End***.

The new settings will be registered and the screen in step (1.) will return.

The following table explains the settings in the *Communications (Host link)* window. The asterisk (*) indicates the default setting.

Item		Possible settings
Read area		Select the data area where the Read Area is located. The Controller checks the Read Area for commands. Select the IR (I/O) area*, HR area, LR area, DM area, or None. (If “None” is selected, the Controller won't read commands but will receive commands transmitted with the TXD instruction.)
Begin read word		Specify the Read Area's starting word address. (The setting range is 0 to 9995 and the default setting is 0.)
Write area		Select the data area where the Write Area is located. The Controller outputs execution results to the Write Area. Select the IR (I/O) area*, HR area, LR area, DM area, or None. (If “None” is selected, the Controller won't write execution results.)
Begin write word		Specify the Write Area's starting word address. (The setting range is 0 to 9996 and the default setting is 100.)
Programmable Controller mode check	ON*	The Programmable Controller's operating mode is checked when the Controller enters Monitor Mode or Run Mode. Measurements won't start unless the Programmable Controller is in MONITOR mode. (An error message will be displayed at the Controller.)
	OFF	When the Controller enters Monitor Mode or Run Mode, a mode change command is sent to the Programmable Controller to switch it to MONITOR mode.

6-3-2 Input Format (Host Link)

The following commands can be input from the host computer to the Controller. Specify the command to be executed in the Programmable Controller's Read Area.

Commands that Control Controller Operations

Use the following commands to execute operations in the Controller, such as executing measurements and switching scenes.

Command code	Function	Page
0010	Executes one measurement.	page 6-3-(9)
0011	Starts continuous measurement.	page 6-3-(10)
0012	Stops continuous measurement.	page 6-3-(10)
0020	Switches the scene number to the specified scene number.	page 6-3-(10)
0021	Increments (+1) the scene number being used.	page 6-3-(10)
0022	Decrements (-1) the scene number being used.	page 6-3-(10)
0030	Switches the scene group number to the specified scene group number.	page 6-3-(11)
0031	Increments (+1) the scene group number being used.	page 6-3-(11)
0032	Decrements (-1) the scene group number being used.	page 6-3-(11)
0040	Registers the model again.	page 6-3-(12)
0066	Saves the current scene group data and system data that is being used.	page 6-3-(12)
0092	Resets the Controller.	page 6-3-(12)

Commands that Read Current Controller Settings

The Controller settings data can be obtained.

Command code	Function	Page
0023	Reads the scene number currently being used.	page 6-3-(11)
0033	Reads the scene group number currently being used.	page 6-3-(11)
1070	Reads the specified unit data.	page 6-3-(13)

Commands that Change Controller Current Settings

Controller settings can be changed and operation controlled from the host while accessing the current settings.

Measurement region data and expression conditions can be set.

Command code	Function	Page
1060	Sets the specified unit data.	page 6-3-(12)

Format (Host Link)

The commands are listed in order based on their command code. Input the commands in BCD format and set the commands in the Read Area. Bits that aren't used (listed as ---) are ignored, so these bits can be set to either 0 or 1.

0010: One-time Measurement

Executes one measurement.

Read Area word	Bits				Contents
	15 to 12	11 to 8	7 to 4	3 to 0	
+0	0000	0000	0001	0000	Command code

Output: The measurement results are output.

CHECK Set *Host link data output* to the unit to output measurement results. Refer to *2-41 Host Link Data.*

0011: Start Continuous Measurement

Starts continuous measurement.

Read Area word	Bits				Contents
	15 to 12	11 to 8	7 to 4	3 to 0	
+0	0000	0000	0001	0001	Command code

Output: The measurement results are output.

CHECK Set *Host link data output* to the unit to output measurement results. Refer to *2-41 Host Link Data.*

0012: Stop Continuous Measurement

Stops continuous measurement.

Read Area word	Bits				Contents
	15 to 12	11 to 8	7 to 4	3 to 0	
+0	0000	0000	0001	0010	Command code

0020: Switch Scene (Specific Scene Number)

Switches the scene number to the specified scene number.

Read Area word	Bits				Contents
	15 to 12	11 to 8	7 to 4	3 to 0	
+0	0000	0000	0010	0000	Command code
+1	----	----	10s digit	1s digit	Scene number (00 to 31)

0021: Switch Scene (Increment Scene Number by 1)

Increments the scene number currently being used. If the current scene number is 31, the scene number will rollover to 0.

Read Area word	Bits				Contents
	15 to 12	11 to 8	7 to 4	3 to 0	
+0	0000	0000	0010	0001	Command code

0022: Switch Scene (Decrement Scene Number by 1)

Decrements the scene number currently being used. If the current scene number is 0, the scene number will rollover to 31.

Read Area word	Bits				Contents
	15 to 12	11 to 8	7 to 4	3 to 0	
+0	0000	0000	0010	0010	Command code

0023: Read Scene Number

Reads the scene number currently being used.

Read Area word	Bits				Contents
	15 to 12	11 to 8	7 to 4	3 to 0	
+0	0000	0000	0010	0011	Command code

Write Area word	Bits				Contents
	15 to 12	11 to 8	7 to 4	3 to 0	
+0	Write flags	0000	0000	0000	Write flag
+1	0000	0000	10^1 digit	10^0 digit	Scene number (00 to 31)

CHECK Write Flags: Each time that data is output, the write flags are switched between “0000" and “1111". The status of these bits can be monitored to see when data has been written.

0030: Switch Scene Group (Specific Scene Group Number)

Switches the scene group number to the specified scene group number.

Read Area word	Bits				Contents
	15 to 12	11 to 8	7 to 4	3 to 0	
+0	0000	0000	0011	0000	Command code
+1	----	----	10^1 digit	10^0 digit	Scene group number (00 to 31)

0031: Switch Scene Group (Increment Scene Group Number by 1)

Increments the scene group number currently being used. If the current scene group number is 31, the number will rollover to scene group 0.

Read Area word	Bits				Contents
	15 to 12	11 to 8	7 to 4	3 to 0	
+0	0000	0000	0011	0001	Command code

0032: Switch Scene Group (Decrement Scene Group Number by 1)

Decrements the scene group number currently being used. If the current scene group number is 0, the number will rollover to scene group 31.

Read Area word	Bits				Contents
	15 to 12	11 to 8	7 to 4	3 to 0	
+0	0000	0000	0011	0010	Command code

0033: Read Scene Group Number

Reads the scene group number currently being used.

Read Area word	Bits				Contents
	15 to 12	11 to 8	7 to 4	3 to 0	
+0	0000	0000	0011	0011	Command code

Write Area word	Bits				Contents
	15 to 12	11 to 8	7 to 4	3 to 0	
+0	Write flags	0000	0000	0000	Write flag
+1	0000	0000	10^1 digit	10^0 digit	Scene group number (00 to 31)

CHECK Write Flags: Each time that data is output, the write flags are switched between “0000" and “1111". The status of these bits can be monitored to see when data has been written.

0040: Re-register Model

Registers the models again for all regions for the specified unit number. (When the through display is being used, the models will be registered based on the last image that was measured.)

Re-registers all region models for the relevant unit.

CHECK Model re-registration is valid only if model position compensation, circle position compensation, fine matching, pattern inspection, rotation positioning, or ECM search unit numbers have been specified. Any other specified unit numbers will be ignored.

Read Area word	Bits				Contents
	15 to 12	11 to 8	7 to 4	3 to 0	
+0	0000	0000	0100	0000	Command code
+1	10^3 digit	10^2digit	10^1 digit	10^0 digit	Unit number (0 to 9999)

CHECK The model is re-registered for the current Camera image. If the *Camera image* or *Switch cameras* image processing items are set to 2 or more units, use the Up and Down Keys to switch between each input image. This is only possible when the image size is set to *All*.

0066: Data Save

Saves the current scene group data and system data that is being used. System data is saved to scene group 0 data, if scene group 0 is the current scene group, system data is saved to flash memory. The scene group data is saved to the Memory Card if the current scene group number is between 1 and 31.

Read Area word	Bits				Contents
	15 to 12	11 to 8	7 to 4	3 to 0	
+0	0000	0000	0110	0110	Command code

0092: Reset

Resets the Controller.

Read Area word	Bits				Contents
	15 to 12	11 to 8	7 to 4	3 to 0	
+0	0000	0000	1001	0010	Command code

1060: Set Unit Data

Sets the specified unit’s parameters.

The data codes are the same as the ones used for the UNITDATA command.

SeeAlso Refer to *6-2 Normal Serial Interface* for details.

Read Area word	Bits				Contents
	15 to 12	11 to 8	7 to 4	3 to 0	
+0	0001	0000	0110	0000	Command code
+1	10^3 digit	10^2 digit	10^1 digit	10^0 digit	Unit number (00 to 9999)
+2	10^3 digit	10^2 digit	10^1 digit	10^0 digit	Data code (0 to 9999)
+3	10^3 digit	10^2 digit	10^1 digit	10^0 digit	New setting
+4	Sign	10^6 digit	10^5 digit	10^4 digit	
+5	0000	10^{-1} digit	10^{-2} digit	10^{-3} digit	

CHECK Sign: Positive (0000) or negative (1111)

1070: Read Unit Data

Reads the parameters and measurement values for the specified unit

The data codes are the same as the ones used for the UNITDATA command.

SeeAlso Refer to *6-2 Normal Serial Interface* for details.

Read Area word	Bits				Contents
	15 to 12	11 to 8	7 to 4	3 to 0	
+0	0001	0000	0111	0000	Command code
+1	10^3 digit	10^2 digit	10^1 digit	10^0 digit	Unit number (00 to 9999)
+2	10^3 digit	10^2 digit	10^1 digit	10^0 digit	Data code (0 to 9999)

Write Area word	Bits				Contents
	15 to 12	11 to 8	7 to 4	3 to 0	
+0	Write flags	0000	0000	0000	Write flag
+1	10^3 digit	10^2 digit	10^1 digit	10^0 digit	Reading data
+2	Sign	10^6 digit	10^5 digit	10^4 digit	
+3	0000	10^{-1} digit	10^{-2} digit	10^{-3} digit	

CHECK Write Flags: Each time that data is output, the write flags are switched between “0000" and “1111". The status of these bits can be monitored to see when data has been written.
Sign: Positive (0000) or negative (1111)

6-3-3 Output Format (Host Link)

When *Host link data output* is set for a unit, the measurement results are output in order from the smallest output number.

The measurement results are output in BCD code to the Write Area in the Programmable Controller.

Each time that data is output, the write flags are switched between "0000" and "1111". The status of these bits can be monitored to see when data has been written.
After the first measurement, the write flags are cleared to "0000" so store "1111" in this digit as the initial value before starting measurements.

Write Area word	Bits				Contents
	15 to 12	11 to 8	7 to 4	3 to 0	
+0	Write flags	0000	0000	0000	Write flags
+1	10^3 digit	10^2 digit	10^1 digit	10^0 digit	Measurement result
+2	Sign	10^6 digit	10^5 digit	10^4 digit	
+3	0000	10^{-1} digit	10^{-2} digit	10^{-3} digit	

0000: Positive
1111: Negative

Output Data

- **Digital Output Range**
  -9,999,999.999 ≤ measurement ≥ 9,999,999.999
  The minimum value of "-9,999,999.999" will be output for measurements less than -9,999,999.999.
  The maximum value of "9,999,999.999" will be output for measurements greater than 9,999,999.999.
- **JG (Judgement) Outputs**
  The following values are output when JG (Judgement) has been set:
  OK: 0
  NG: -1

CHECK After measurements have been made in Run Mode, the data up through the last measurement will be output even if the mode is changed to another mode. The data output will not be interrupted midway.

Example 1

This example shows the data output when the data 0 measurement is 143.250, data 1 is not set, and the data 2 measurement is -6,943.298.

Data	Write Area word	Bits				Contents
		15 to 12	11 to 8	7 to 4	3 to 0	
Data 0	+0	0000	0000	0000	0000	Write flags (0000)
	+1	0000	0001	0100	0011	Four lowest integer digits
	+2	0000	0000	0000	0000	Sign and two highest integer digits
	+3	0000	0010	0101	0000	Decimal point

Data	Write Area word	Bits				Contents
		15 to 12	11 to 8	7 to 4	3 to 0	
Data 2	+4	0000	0000	0000	0000	Write flags (0000)
	+5	0110	1001	0100	0011	Four lowest integer digits
	+6	1111	0000	0000	0000	Sign and two highest integer digits
	+7	0000	0010	1001	1000	Decimal point

CHECK Output numbers that have not been set, such as data 1 in the example above, are omitted from the data output.

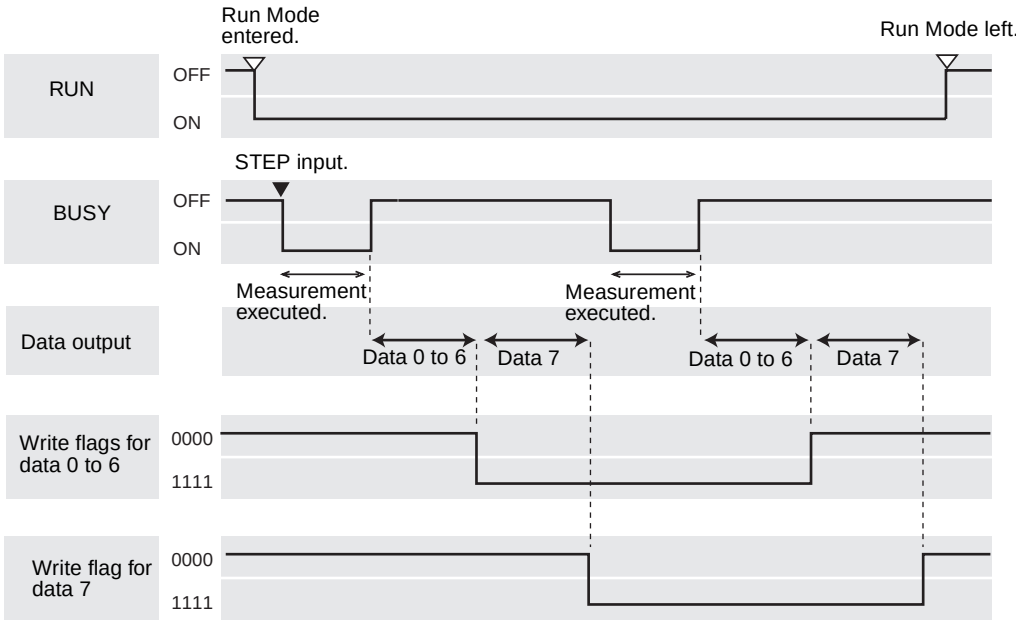
Example 2

The results for up to 7 data elements can be output at one time. If 8 or more output numbers have been set, the data will be output in groups of 7 elements max.

In this example, output numbers 0 through 7 have been set. The results for data 0 to data 6 are output the first time and the results for data 7 are output the second time.

Data	Write Area word	Bits				Contents
		15 to 12	11 to 8	7 to 4	3 to 0	
First batch:	+0	0000	0000	0000	0000	Write flags (0000)
Data 0 to data 6	+1	0000	0001	0100	0011	Measurement result
	+2	0000	0000	0000	0000	
	+3	0000	0010	0101	0000	
	: :	: :	: :	: :	: :	: :
	+(4×n)+0	0000	0000	0000	0000	Write flags (0000)
	+(4×n)+1	0110	1001	0100	0011	Measurement result
	+(4×n)+2	1111	0000	0000	0000	
	+(4×n)+3	0000	0010	1001	1000	
	: :	: :	: :	: :	: :	: :
Second batch: Data 7	+28	1111	0000	0000	0000	Write flags (1111)
	+29	0000	0001	0110	0011	Measurement result
	+30	0000	0000	0000	0000	
	+31	0000	0010	0101	0000	

The data and write flags are output at the timing shown in the following time chart. The write flags are updated when the corresponding data is output.



6-3-4 Sample Ladder Program

This sample program is compatible with OMRON C200H, C200HS, and CQM1 Programmable Controllers. The Controller inputs a measurement command from the Programmable Controller's Read Area and outputs the judgement results to the Programmable Controller's Write Area.

Programmable Controller Settings

The following communications conditions are set for the Programmable Controller's host link port. This port may be in the Programmable Controller's CPU Unit or a Host Link Unit. Refer to the Programmable Controller's Operation Manual for details on setting the host link communications parameters.

Item	Setting
Communications mode	SYSWAY (Host Link)
Connection (1:1 or 1:N)	1:N connection
Node number	00
Baud rate	Same as the settings in the Controller.
Data length	
Parity bits	
Stop bits	

Controller Settings

The communications conditions and expression settings are as follows.

Communications Settings

Item	Setting
Baud rate	Same as the settings in the Programmable Controller
Data length	
Parity bits	
Stop bits	
Read area	DM
Begin read word	0100
Write area	DM
Begin write word	0106

Host Link Data Output Settings

0. Camera input

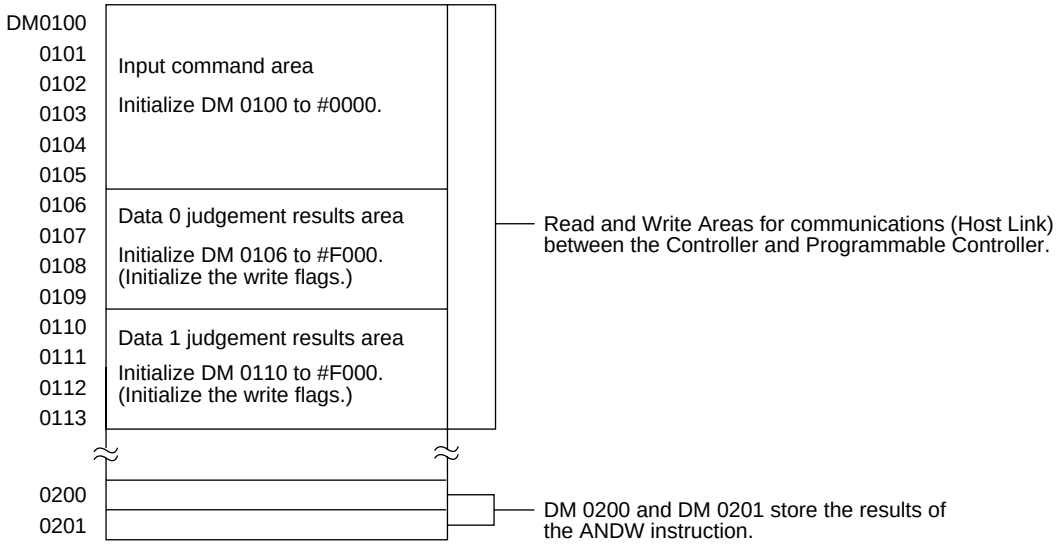
1. Pattern

2. Host link data

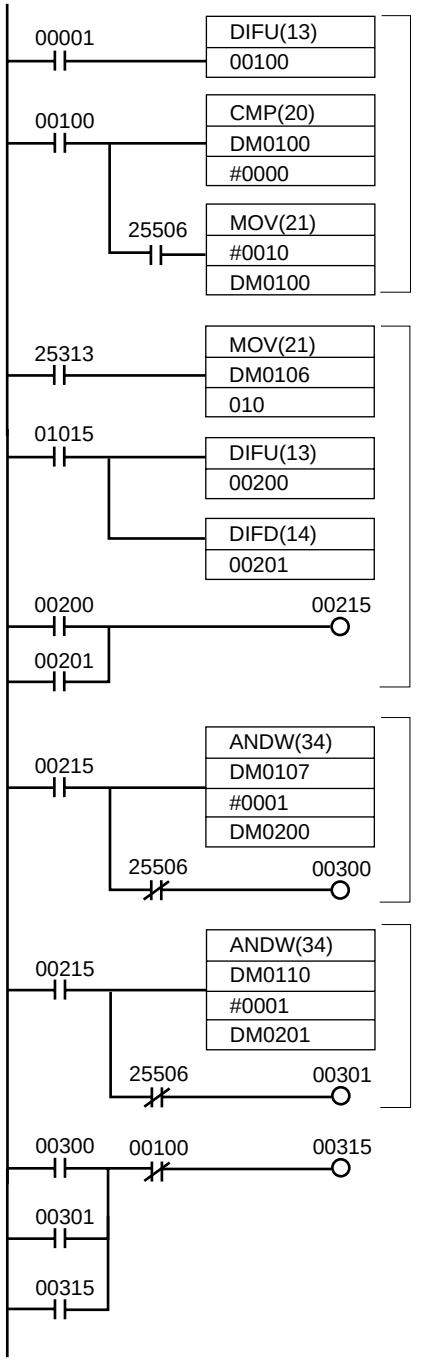
When the above processing items have been set for units, set the following expressions for data 0 and data 1 in *Host link data output*.

Data 0: U1.R00JG
Data 1: U1.R01JG

DM Area Allocation in the Programmable Controller

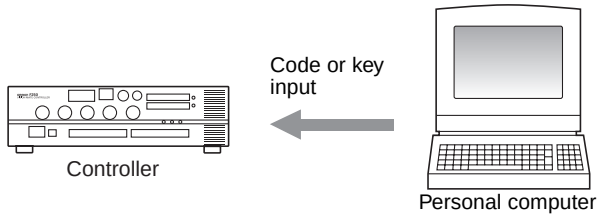


Ladder Program



6-4 Serial Interface Menu Operations

This section shows how to navigate through the Controller's menus from a personal computer via a serial interface (RS-232C/RS-422, or Ethernet connection) by inputting codes or keys that correspond to Console keys.



Note The RS-232C/RS-422 connection and Ethernet connections cannot be used at the same time. Connect only one of these types of connections.

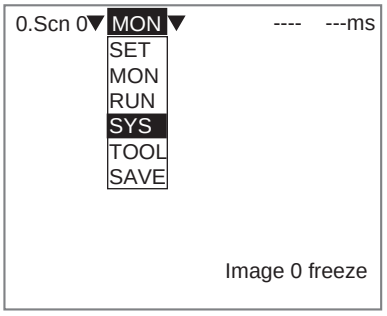
6-4-1 Setting Communications Specifications

Set the same communications specifications in the Controller and the external device. If the *Normal data* processing item has been set for a unit, the measurement results will be output in normal (no-protocol) format even if Menu Operation has been selected for the mode. Xon/Xoff flow control cannot be used because the codes for the **Ctrl** + **S** and **Ctrl** + **Q** key inputs are the same as those for Xon/Xoff.

CHECK Only a 1:1 connection can be made with menu operations; the Controller's menu operations do not support 1:N connections.

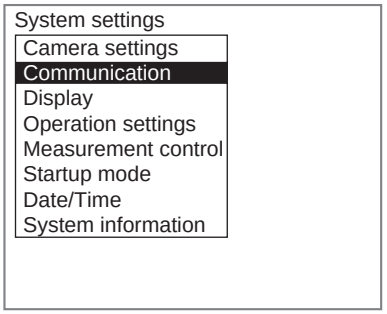
RS-232C or RS-422 Connections

1. Move the cursor to ***MON*** or ***RUN*** and press the **ENT** Key.



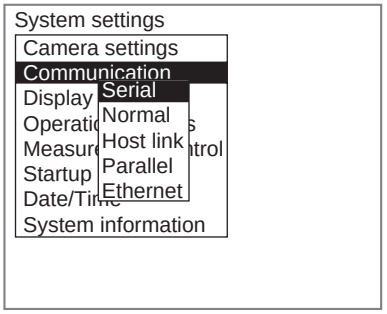
2. Select ***SYS***.

   The *System settings* menu will be displayed.



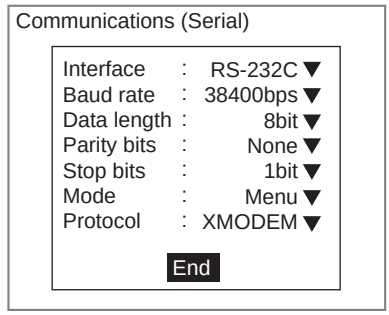
3. Select ***Communications***.

   The communications menu will be displayed.



4. Select ***Serial***.

The *Communications (Serial)* window will be displayed.



5. Set each parameter to the desired setting.
6. Select ***End***.

   The displayed settings will be registered and the System settings menu (from step 4) will be displayed.

   The following table shows the possible communications settings. The asterisk (*) indicates the default setting.

Item	Possible settings	
Interface	Select ***RS-232C***. (from RS-232C* or RS-422)	
Baud rate (See note 1.)	2,400, 4,800, 9,600, 19,200, 38,400*, 57,600, 115,200 (bps)	Set the same settings that are set in the personal computer.
Data length	7 or 8* (bits)	
Parity bits	None*, Odd, or Even	
Stop bits	1* or 2 (bits)	
Mode	Select ***Menu***.	
Transfer protocol (See note 2.)	XMODEM*, ZMODEM	Set the same settings that are set in the personal computer.

Note

1. RS-232C standards are not defined for speeds over 20 kbps. Depending on the cable length, communications may be unreliable at speeds of 38,400 bps and higher when ***RS-232C*** is selected. If there are problems with communications, reduce the baud rate to 19,200 bps.
2. XMODEM (-1K) is not supported.

Ethernet Connections

The operations are the same as for the RS-232C/RS-422 connections.

SeeAlso Refer to *6-3-1 Setting Communications Specifications*.

The following table shows the possible communications settings. The asterisk (*) indicates the default setting.

Item	Possible settings	
Interface	Cannot be used with Ethernet connections. Any settings will be ignored.	
Baud rate		
Data length		
Parity bits		
Stop bits		
Mode	Select ***Menu***.	
Transfer protocol (See note.)	XMODEM*, ZMODEM	Set the same settings that are set in the personal computer.

Note XMODEM (-1K) is not supported.

CHECK To exit an Ethernet connection, set *Mode* to *Normal* and use the normal command to enter EXIT.

SeeAlso Refer to *6-2 Normal Serial Interface*.

Key Input and Console Key Correspondence

Console Key	Input from RS-232C	
	Key	Code
ESC Key	CTRL + [	($1B)
TRIG Key	CTRL + A	($01)
ENT Key	CTRL + M	($0D)
SHIFT + ESC Keys	CTRL + I, TAB	($09)
SHIFT + TRIG Keys	CTRL + T	($14)
SHIFT + ENT Keys	CTRL + R	($12)
Left Key	CTRL + S	($13)
Up Key	CTRL + E	($05)
Right Key	CTRL + D	($04)
Down Key	CTRL + X	($18)
SHIFT + Left Keys	CTRL + F	($06)
SHIFT + Up Keys	CTRL + W	($17)
SHIFT + Right Keys	CTRL + H	($08)
SHIFT + Down Keys	CTRL + Z	($1A)
F1 Key	CTRL + C	($03)
F2 Key	CTRL + V	($16)
F3 Key	CTRL + B	($02)
F4 Key	CTRL + N	($0E)
F5 Key	CTRL + J	($0A)
F6 Key	CTRL + K	($0B)
F7 Key	CTRL + L	($0C)
F8 Key	CTRL + O	($0F)
F9 Key	CTRL + P	($10)
--- (See note.)	CTRL + Q	($11)

Note Changes the serial interface input to normal (no-protocol) mode. This input is valid only in Monitor Mode and Run Mode.

6-4-2 Inputting Characters from the Computer

The computer can be used to input filenames and comments that will be displayed on-screen. Characters can be input only when the software keyboard is being displayed on the Controller's screen.

Enclose the input characters within double quotation marks.
Example: "LABEL"

CHECK Characters can be input in normal (no-protocol) mode.

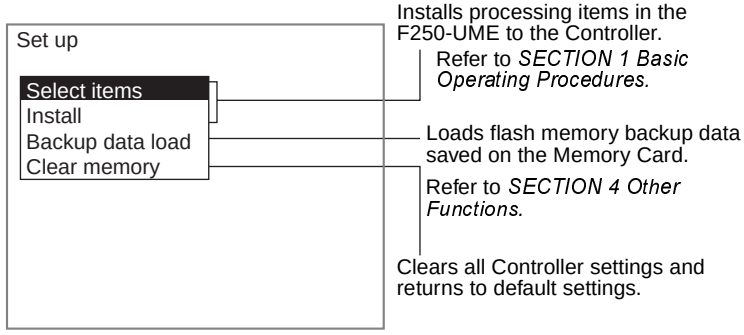
CHECK The following characters cannot be used: ¥ / : . , ; * ? " < > | &

SECTION 7
Appendices

7-1 Set Up Menu . . . . . 7-(2)
7-2 Troubleshooting . . . . . 7-(4)
7-3 FAQ . . . . . 7-(9)
7-4 Terminology . . . . . 7-(12)
7-5 Character Codes . . . . . 7-(15)
7-6 Menu Hierarchy . . . . . 7-(16)

7-1 Set Up Menu

This section gives a general description of the Setup menu in the F250-UME. For detailed information, refer to the pages in this manual where a detailed description of each item can be found.

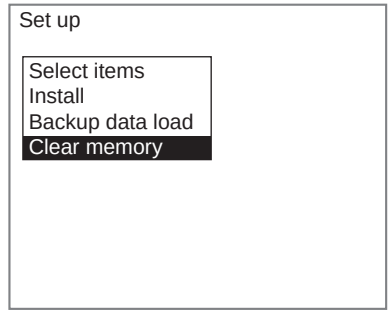


CHECK Refer to *SECTION 1 Basic Operating Procedures* for information on starting the Setup Menu.

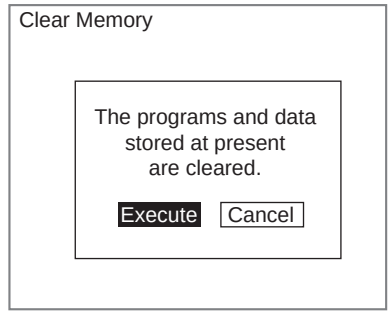
Clearing Memory

The *Clear Memory* processing item clears all Controller settings and returns to the default settings. Any installed processing items will also be cleared.

1. Start the Setup Menu and select ***Clear Memory***.



A confirmation message will be displayed.



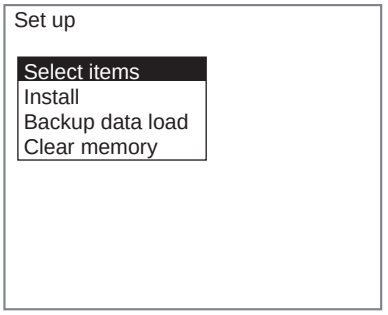
2. Select ***Execute***.

Precaution Do not turn OFF the power or input a RESET signal while a message is being displayed in any save or load operation. Data in memory will be destroyed, and the Controller may not operate correctly the next time it is started.

All settings will be cleared and the screen in (1.) will return.

Checking Setup Menu Version

1. Press the **SHIFT+ESC** Keys at the basic Setup Menu Screen.



The Setup Menu version information will be displayed.

2. Press the **ENT** Key.
   The screen in (1.) will return.

7-2 Troubleshooting

This section lists the errors that may be displayed on the screen, along with their probable causes and remedies.

When the error messages marked with an asterisk are displayed, the ERR signal will come ON at the parallel interface.

Error message	Causes and remedies
APPLICATION ERROR	Flash memory backup data saved on a higher-level model was loaded. Restart the setup menu and either load backup data suitable for the Controller that is being used or reinstall the software.
BATTERY LOW	The battery volume (for date and time data backup) is low. The battery must be replaced. Contact your OMRON representative.
HMLIB ERROR	The Controller has a fault. Contact your OMRON representative.
Draw at least one OR figure.	Draw diagrams in OR mode. Reason: NOT mode is used to delete part of a drawn diagram. Refer to *1-5-4 Drawing a Region.*
PLC is not in MONITOR Mode.	Change the mode of the Programmable Controller to MONITOR Mode.
SYSTEM ERROR	The Controller has a failure. Contact your OMRON representative.
Set address is not available.	Check the Controller address and enter the correct address. Refer to *6-2 Normal Serial Interface*.
Installation failed.	Mount the F250-UME correctly in Memory Card slot 0 and re-execute installation. Refer to *1-3 Installing the Application Software*.
Intelligent Lighting is not selected.	Check the settings under *SYS/Camera settings*. Refer to *5-2 Camera Settings*.
This camera cannot use with Intelligent Lighting.	Check the settings under *SYS/Camera settings*. Reason: Cameras other than F160-S1 and F150-S1A cannot use Intelligent Lighting. Refer to *5-2 Camera Settings*.
Illegal syntax in expression.	Check the following for the expression: - There are the same number of right and left parentheses. - There is not more than one operator in a row without a variable in between them. - There is not more than one function in a row without a variable in between them. - There is not more than one region number in a row. - There is not more than one constant in a row. - There are not too many, or too few arguments for a function.
Detailed settings of camera is incorrect.	Correct the settings. Refer to *Setup Manual*.
Camera connection is incorrect.*	Check the following: - Are the Camera Cables connected to the Controller? - Is the Camera Cable disconnected from the Camera? - Is the setting correct under *Camera image/Camera settings* or *Switch camera/Camera settings*? Refer to *2-1 Inputting Camera Images* and *2-2 Switching Cameras* - Check the settings under *SYS/Camera settings* then restart the Controller. Refer to *5-2 Camera Settings*.
Cannot register Defect (Deviation) when image 1 is selected.	If density defect is set, select Image 0 under *Measurement image*. Refer to*2-14 Density Defects*.

Error message	Causes and remedies
Calibration failed.	Perform sampling in at least 2 places. Reason: Sampling or specifying points has only been performed once. Refer to *2-1 Inputting Camera Images*.
	Perform sampling in 3 places, including X and Y directions or specify a point. Reason: 3 places are specified in a solid line in one direction, X or Y. Refer to *2-1 Inputting Camera Images*
Limits of warning exceed limits of judgement.	Re-set the upper and lower limits for the warning so that they fall within the judgement upper and lower limits. Refer to *2-34 Trend Monitor*.
Set measurement in advance.	Select the measurement to be displayed on the Trend Monitor. Refer to *2-34 Trend Monitor*.
Cannot access this file.	Check the following points and re-select a file. - Is the file read-only? - Is Japanese used in the file name? - Does the Memory Card have sufficient space to save the file?
Search coordinates are not appropriate.	For ECM searches, set the search coordinates within the screen dimensions.
	For other processing items, set the search coordinates to within the circumscribing rectangle of the model.
Cannot operate line brightness during last NG display.	Check the *Image status* setting under *SYS/Conditions/Display setting*. Reason: Either *Last NG (before scroll)* or *Last NG (after scroll)* is selected under *Image status*. Refer to *5-3-2 Measurement Screen Settings*.
Cannot capture display during last NG display.	Check the *Image status* setting under *SYS/Conditions/Display setting*. Reason: Either *Last NG (before scroll)* or *Last NG (after scroll)* is selected under *Image status*. Refer to*5-3-2 Measurement Screen Settings*.
Scn Group file cannot be written in.	Change the file attributes so that it is write enabled.
Failure of DIC deployment.	Delete the unused models or processing items that are set to other units. Reason: There is insufficient disk space so the selected dictionary cannot be opened.
Cannot operate line brightness during reduction image display.	Check the *Image size* setting under *SYS/Conditions/Display setting*. Reason: *Reduced* has been selected under *Image size*. Refer to *Image Size* under *5-3-2 Measurement Screen Settings*.
Cannot change shutter speed of this camera.	Check the *Camera* settings under *SYS/Camera settings*. Reason: Only F160-S1 and F160-S1A Camera shutter speeds can be adjusted from the menu. Refer to *5-3-2 Measurement Screen Settings*.
Host Link error. Change to normal mode.*	After checking for the following items, either change the communications mode under *SYS/Communications/Serial* to Host Link mode (See note.), or restart the Controller: - The cable is connected properly. - The communications specifications for the Programmable Controller and the Controller are the same. - The Programmable Controller is ON. Note: The communications mode will automatically return to normal mode when this error occurs. Refer to the *Setup Manual* and to *6-3 Host Link Serial Interface*.

Error message	Causes and remedies
Process item cannot be registered.	There is insufficient work memory. Delete scenes and units that are not required. Refer to *Deleting Units on page 1-(22)*.
	The following processing items cannot be registered before the first *Camera image* unit. - *Switch camera* - *Change filtering* - *Filtering again*.
Direction settings are not appropriate.	- Select midpoint for X and Y when relative angle selected for θ. - Select the same region number for X and Y when region 0 or region 1 selected for θ. Reason: Position cannot be compensated with the current combination.
Cannot select this direction.	Combine upper, lower, left, and right edge search directions that will surround the area to be measured. Reason: The selected directions do not surround the region to be searched. Refer to *2-12 Detecting Binary Defects* and *2-14 Density Defects*
Background must not be same color as Normal.	Change one of the colors. Refer to *5-3-4 Changing Character or Figure Colors.*
Communications error (Data transmission). Communications error. (Normal)* Communications error. (Host Link)*	Turn OFF the power to the Controller and check for the following items before restarting the Controller. - The cable is connected properly. - The communications specifications for the external device and the Controller are the same. - The external device is operating properly. Reason: Data transfer has been interrupted due to a communications error in communications between the Controller and an external device. If the same error message appears after restart, it may mean that the Controller is faulty. Contact your OMRON representative. Refer to the *Setup Manual, and to 6-2 Normal Serial Interface*, *6-3 Host Link Serial Interface*, and *6-4 Serial Interface Menu Operations*.
Timeout error (Data transmission). Timeout error. (Normal)* Timeout error. (Host Link)*	Turn OFF the power to the Controller and check for the following items before restarting the Controller. - The cable is connected properly. - The communications specifications for the external device and the Controller are the same. - The external device is operating properly. Reason: Data transfer has been interrupted due to a timeout in communications between the Controller and an external device. If the same error message appears after restart, it may mean that the Controller is faulty. Contact your OMRON representative. Refer to the *Setup Manual, and to 6-2 Normal Serial Interface*, *6-3 Host Link Serial Interface*, and *6-4 Serial Interface Menu Operations*.
Incorrect data format received.	Select the correct transfer file and re-execute the data transfer. Reason: The wrong file has been selected.
	Reinstall the processing item. Reason: The scene data or scene group data that was to be loaded includes processing item(s) that are not currently installed to the Controller. Refer to *1-3 Installing the Application Software*.
Data are too large. Cannot save by serial communication.	Save the data to a Memory Card or delete surplus data and then save. Reason: Data 2MB and over cannot be saved via serial communications. Refer to *4-2 Backing Up Data*.

Error message	Causes and remedies
Failed to load data.	Mount the Memory Card properly and re-execute.
Cannot delete directory having files.	Delete the files in the directory to be deleted or move the files to another directory. Reason: Only empty directories can be deleted. Refer to *4-6-5 Deleting Files and Directories*.
Directory name is not specified.	Specify the directory name and press the ENT Key.
Directory name contains unusable character.	Check the directory name. The following characters cannot be used: ¥ / , : ; * ? ″ < > ! & . SPC (*space*)
Same directory name has already existed.	Specify a directory name that is not being used.
Same file name has already existed.	Specify a file name that is not being used in the directory.
Calculated magnification highers. Correct magnification range: 0.001 to 9.999.	Check for the following items, set the magnification again, and re-execute calibration: - Widen the point or sampling width. - Shorten the length of the actual coordinates. Reason: The Camera magnification is not between 0.00100 and 9.99999. Refer to *2-1 Inputting Camera Images*
Calculated magnification lowers. Correct magnification range: 0.001 to 9.999.	
Password is incorrect.	Enter the correct password. Refer to *5-4-4 Setting Passwords* and *6-2 Normal Serial Interface*.
No Backup Data in memory card.	Mount the Memory Card on which the backup data was saved to Memory Card slot 1 (C1). Refer to*Loading Data on page 4-(22)*.
The backup data is not correct.	This backup data is damaged and cannot be loaded.
Date/time settings error.	Set the correct date and time. Reason: A date not in the calendar or an invalid time has been input. Refer to *5-8 Setting the Calendar Date and Time (Date/Time).*
File name is not specified.	Specify the file name and then press the ENT Key.
File name contains unusable characters.	Check the directory name. The following characters cannot be used: ¥ / , : ; * ? ″ < > ! & . SPC (*space*)
Fan error.*	Turn OFF the Controller power supply and check that nothing is obstructing the fan operation. If the error message continues to be displayed when the Controller is restarted, the Controller itself may be malfunctioning. Contact your OMRON representative.
Cannot select image 1 when Defect (Deviation) is registered.	To use Image 1 for measurement, delete the region to which density deviation is set. Refer to*2-14 Density Defects*.
Contents of memory card is incorrect. Cannot execute *Select items* and *Install*.	Turn OFF the Controller power supply, re-install the F250-UME, and restart the Controller. If the error remains even after the Controller is started again, the F250-UME may be malfunctioning. Contact your OMRON representative.
Memory card access error.	Check for the following items: - The recommended Memory Card has not been inserted. - Use another Memory Card. - The Memory Card has not been formatted. Refer to the Setup *Manual*.
Memory card is not inserted.	Insert the recommended Memory Card. Refer to the Setup *Manual*.
Insufficient free space of memory card	- Delete unnecessary files to create free space. - Replace the Memory Card with a bigger capacity card. Refer to *4-6 Memory Card Operations*.

Error message	Causes and remedies
Insufficient flash memory.	- Make the region to be registered smaller. - Delete unnecessary scenes and detection items.
Insufficient model memory.	- Reduce the size of the registered model. - Delete unnecessary models.
Insufficient work memory.	- Reduce the size of the registered model. - Delete unnecessary models. - Reduce the size of regions to be registered. - Delete unnecessary scenes and units. Refer to *Deleting Units on page 1-(22)* and *4-1-3 Initializing Measurement Conditions: Clearing Scenes*.
String must be set within 20 characters.	Set the character string to within 20 characters. The “m” and “v” that precede production dates and expiration dates will not be counted in the number of characters. E.g., mYY = 2 characters.
Model is not appropriate.	For classification, pattern inspections, and rotation positioning: - Register an image with high contrast as the model. - Increase the model size (15 × 9 pixels min.).
	For density defect inspections: - Reduce the element size or increase the inspection region.
	For fine matching: - Set the model registration range to within 6,6 to 505,477.
	For model position compensation: - Register an image with high contrast as the model.
	For circle position compensation: - Register an image with high contrast as the model. - The rotation direction reference position will be registered, so use an image with a defect and register a model.
	For ECM searches: - Adjust the edge extraction level so that the edges of the section to be registered as the model will be extracted. - Adjust the edge extraction level so that fine edges appear thicker. Reason: No edge-extracted image exists in the region.
Model is too large.	Reduce the size of the region to be registered as the model.
Model is not registered.	Specify the region to be registered as the model.
Label unit isn’t set up.	Set a label unit. Reason: The label unit is set to No.
Portion of region is off screen.	Draw the region so that it fits on the screen.
Loaded file error.*	Specify the correct file and reload. Reason: - A formatting error may have occurred during data or program file load. - Data 2MG or greater cannot be loaded using serial communications. Load the data using the Memory Card. Refer to *4-2 Backing Up Data*.

7-3 FAQ

Controller Operation

Question	Answer
When units are added to or deleted from a flowchart, what happens to expressions in processing items (calculations, branching, etc.) referencing other unit data?	Unit numbers are automatically incremented or decremented in expressions or for branching. If a unit that is being reference is deleted, however, an error will occur and "#ERR" will be displayed.
What data is saved to flash memory or the Memory Card when the save operation is executed?	System data and scene data for scene group 0 will be saved to flash memory. Scene data for scene groups 1 to 31 will be overwritten on the Memory Card.
Why can scene group data sometimes not be saved even though there is sufficient space on the Memory Card?	When saving scene groups, work memory in the Controller is required in addition to Memory Card space. If there is not sufficient work memory, scene groups containing a lot of data cannot be saved. Try deleting unnecessary data and saving again.
Does processing time depend on the type of images being displayed on the monitor?	Processing time varies with the type of images displayed on the monitor. When a "through" image is used, measurement starts only after completing the previous image input, making processing slower than with "freeze" images. Processing time is also different depending on when scrolling is performed (before or after). Refer to page 5-(7) in *SECTION 5 System Settings*.
Why is a memory image not display even when the Shift+Up/Down Keys are pressed when *Last NG*□ is displayed on the screen?	Memory images cannot be displayed when the image status is set to *Last NG*□. Change the image status to display through or freeze images to display memory images. Refer to page 5-(7) in *SECTION 5 System Settings*.
Can characters displayed on the screen be deleted?	Yes. The information displayed on the screen can be set under the system settings. Refer to *5-3 Screen Display and Monitor*.
Can bitmap files that are not 512 × 484 pixels be loaded?	No. Only the following images can be loaded to the Controller. 512 × 484-pixel images Gray-scale images 256-gradation images

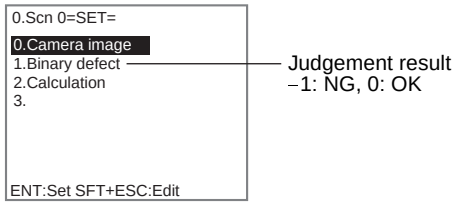
Image Input

Question	Answer
Why are the Camera coordinates output to the external device when calibration is set?	Check whether or not *Coordinate mode/Calibration* is to ON for each unit. If set to OFF, the Camera coordinate values will be output.
What happens to the display when 5 or more *Camera image* or *Switch camera* processing items are set?	If the image status is set to *Through (□□) (Before scroll)*, the first 4 images at image input are displayed. If the image status is set to *Through (□□) (After scroll)*, the first 3 images and the last image are displayed. Refer to *Image Status on page 5-(7)*.
Can the image be viewed after filtering when *Change filtering* or *Filtering again* have been executed?	If the image status is set to (□□) *(After scroll)*, the image can be viewed after filtering when *Change filtering* or *Filtering again* have been executed. Refer to *Image Status on page 5-(7)*.

General Measurements

Question	Answer
QUEST Character Verification Can the characters that are read (A to Z, 0 to 9, :, /, _ (space)) be output directly as text strings to an external divide?	Turn ON the *Output results* under the *Measurement conditions.* The text strings will be output through the serial port. Refer to *2-21 QUEST Character Verification*.
EC Positioning Can an edge-extracted image be captured?	No. Edge-extracted images are produced by processing camera buffer images, so they cannot be captured. Only images input through the Camera Image processing item can be captured.

Measurement Support

Question	Answer
How do I set a formula with more than 64 characters in an expression?	Set up an additional expression and an expression that will reference the additional expression. Refer to *2-29 Calculation.*
Is there any way to count NG images?	Yes, by using the Calculation processing item. Use the following procedure. Example: Counted NG images for Binary Defect 1. Set a Calculation unit after the Binary Defect unit.  2. Set the following expression for calculation 0 in the Calculation unit: U2.D00-U1.JG Refer to *2-29 Calculation*. ***CHECK*** To output the count to an external device, change the Calculation processing item to a DO Data or a Normal Data processing item (depending on where the data is to be output.) Refer to *2-39 DO Data* or *2-42 Normal Data*.

Results Display

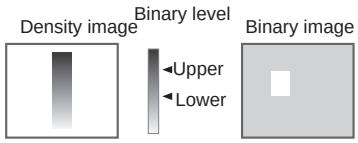
Question	Answer
Can figures display with the Display Figure processing item be changed through serial communications?	No, they cannot be changed through serial communications and must be changed from the Console. Refer to *6-2 Normal Serial Interface*.

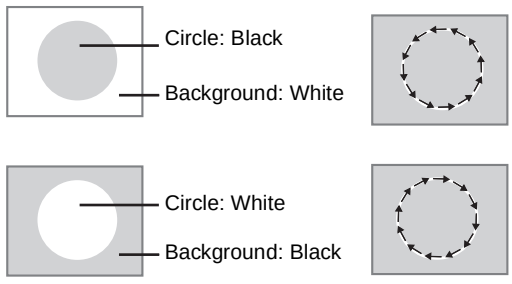
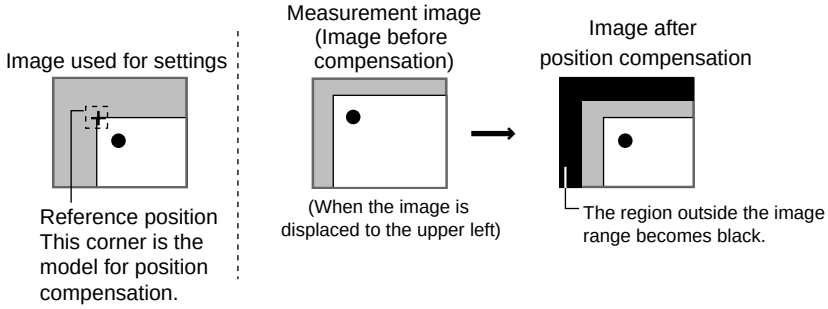
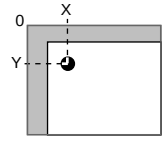
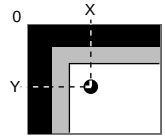
I/O

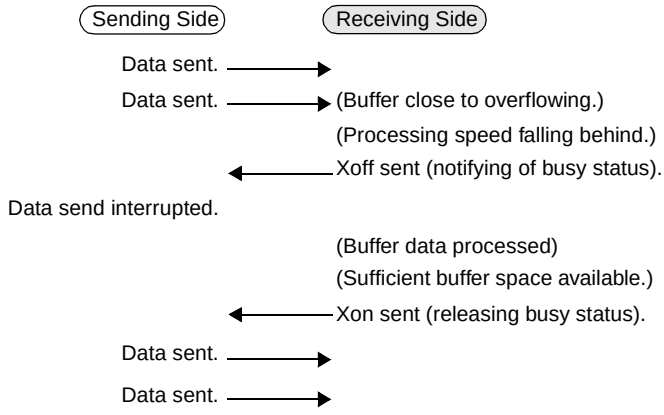
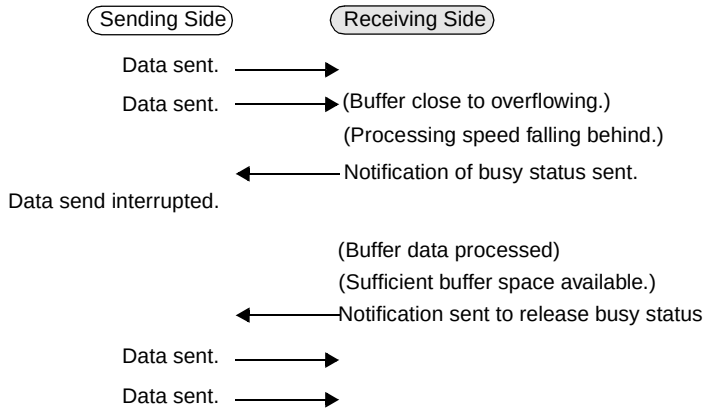
Question	Answer
Will the RUN signal be output during scene switching?	- The RUN signal will remain ON during scene switching in Run Mode. - The RUN signal will remain OFF during scene switching in Monitor Mode.
Will the RUN signal turn OFF when the ERROR signal turns ON with Camera or other errors in Run Mode?	The RUN signal will remain ON even if the ERROR signal turns ON.
Why does the ERR signal turn ON when no error message has been displayed?	The ERR signal turns ON when STEP is input while the BUSY signal is ON. Select whether or not the ERR signal will turn ON under *SYS/Measurement control.* Refer to *STEP in Measure on page 5-(32)*.
	The ERR signal turns ON when a command input via parallel interface has not been received correctly. For example, the switch scene group command was input but there is no Memory Card mounted in Memory Card slot 1 so the current scene group data was unable to be saved. The ERR signal turns ON.
In what format is data output for “normal” output?	The output format can be changed under the condition settings for normal data output. It can be set to either ASCII or binary. Refer to *2-42 Normal Data*.
A command to switch the scene group was executed through the parallel interface when a Memory Card was not inserted, preventing returning to the previous scene group. How can this be fixed?	Using a Memory Card Place the Memory Card into slot 1 and execute the command to switch the scene group again. Without a Memory Card Perform the following. In this example, scene group 0 is returned to. 1. Turn OFF the *Save at switch Scn Group* setting under the *Operation settings* within the *System settings.* 2. Execute a command to switch to scene group 0 through the parallel interface.

7-4 Terminology

HELP This section explains terms listed beside the HELP icons. Terms explained in the main body of the manual are not listed here.

Term	Explanation
Binary	Binary refers to the separation of the density images with 256 gradations read by the Camera into black pixels and white pixels. Upper and lower threshold values (binary levels) are set and the parts of the density image that fall within that gradatiion range are converted to white pixels and the rest are converted to black pixels. The Controller uses the white pixels to measure the object. 
2's complement	A common method used to express negative numbers in binary format. The 2's complement method expresses a negative number by inverting all of the bits of the positive value and then adding 1. Example: The 2's complement of −1 is expressed as follows: The value −1 can be derived from 0 − 1. Subtract −1 from 0 assuming there is a 1 in this place. 00000000 (= 0) −) 00000001 (= 1) 11111111 (=-1) ⇐ The 2's complement of −1 (in 8 digits) There is an easy way to calculate a 2's complement without doing the above calculation, that is, you invert all of the bits of the positive value and then add 1. 00000001 (= 1) ↓ Invert all bits. 11111110 ↓ Add 1. 11111111 (=-1) The MSB can be used to determine if a number is positive or negative. If the MSB is 0, the number is positive (or zero). If the MSB is 1, the number is negative. Numbers expressed in the 2's complement method are convenient in that they can be used in calculations without further conversion. Example for −1 + 10 = 9: 11111111 (= -1) +) 00001010 (= 10) 00001001 (= 9)

<table>
<tr><th>Term</th><th colspan="2">Explanation</th></tr>
<tr><td>Edge Code (EC)</td><td colspan="2">An edge code indicates the direction of an edge. The directions are indicated by arrows in the following diagram.
Changes in brightness are detected as the edge and the direction of the change in brightness is found. The direction of the arrows is determined by whether the measurement image and the background are black or white.
Original image Edge code image
 
The edge codes can still be used for low contrast images if image light difference and change direction (edge code) processing items are used.</td></tr>
<tr><td>Calibration</td><td colspan="2">Calibration is the conversion of measurement results from pixels to physical units, such as μm, mm, cm, or m. Set the relationship between the physical coordinates and the camera coordinates to convert the measurement results from pixels to physical units. To output calibrated measurement results to an external device, set Coordinate mode/Calibration to ON for each unit.</td></tr>
<tr><td>Output coordinates</td><td colspan="2">Select the type of coordinates to be output to external devices.
  </td></tr>
<tr><td></td><td>Before scroll</td><td>Outputs the coordinates before position compensation.
The screen display will be the display set under SYS/Conditions/Display settings.
  </td></tr>
<tr><td></td><td>After scroll</td><td>Outputs the coordinates after position compensation.
The screen display will be the display set under SYS/Conditions/Display settings.
.
  </td></tr>
<tr><td>Center of gravity</td><td colspan="2">The center of gravity is calculated by regarding the white pixels as a sheet of thick paper of uniform thickness. The center of gravity is the point at which the sheet of paper would balance when placed on a sharp point. For example, the center of gravity for a circular object would be the center of the circle. The center of gravity of a rectangular object would be the intersection of lines drawn from diagonally opposite corners.</td></tr>
</table>

Term	Explanation
Software flow control, Xon/Xoff control	A flow control method. Flow is controlled using Xon and Xoff signals. 
Correlation	The extent of conformity with the model is expressed as a correlation value. A correlation value between 0 and 100 is displayed. The higher the correlation value, the more similar the input image is to the model.
Density image	Density images are the gray images of 256 gradations read by the Camera.
Flow control	Flow control is used to adjust the rate of data transfer. The receiving side notifies the sending side when it cannot keep up with the processing speed, causing the sending side to interrupt the transmission, and then the receiving side notifies the sending side when it wants the transmission to be restarted.  Flow control methods include both hardware and software methods. The Controller uses software flow control.
Model	The model is the image pattern used for detection.

7-5 Character Codes

When *QUEST OCV* is used to recognize 1st and 2nd candidate characters, the recognized characters are output to external devices as decimal character codes. When no pattern is detected, an underscore (_) is output.

Method for Calculating Decimal Outputs

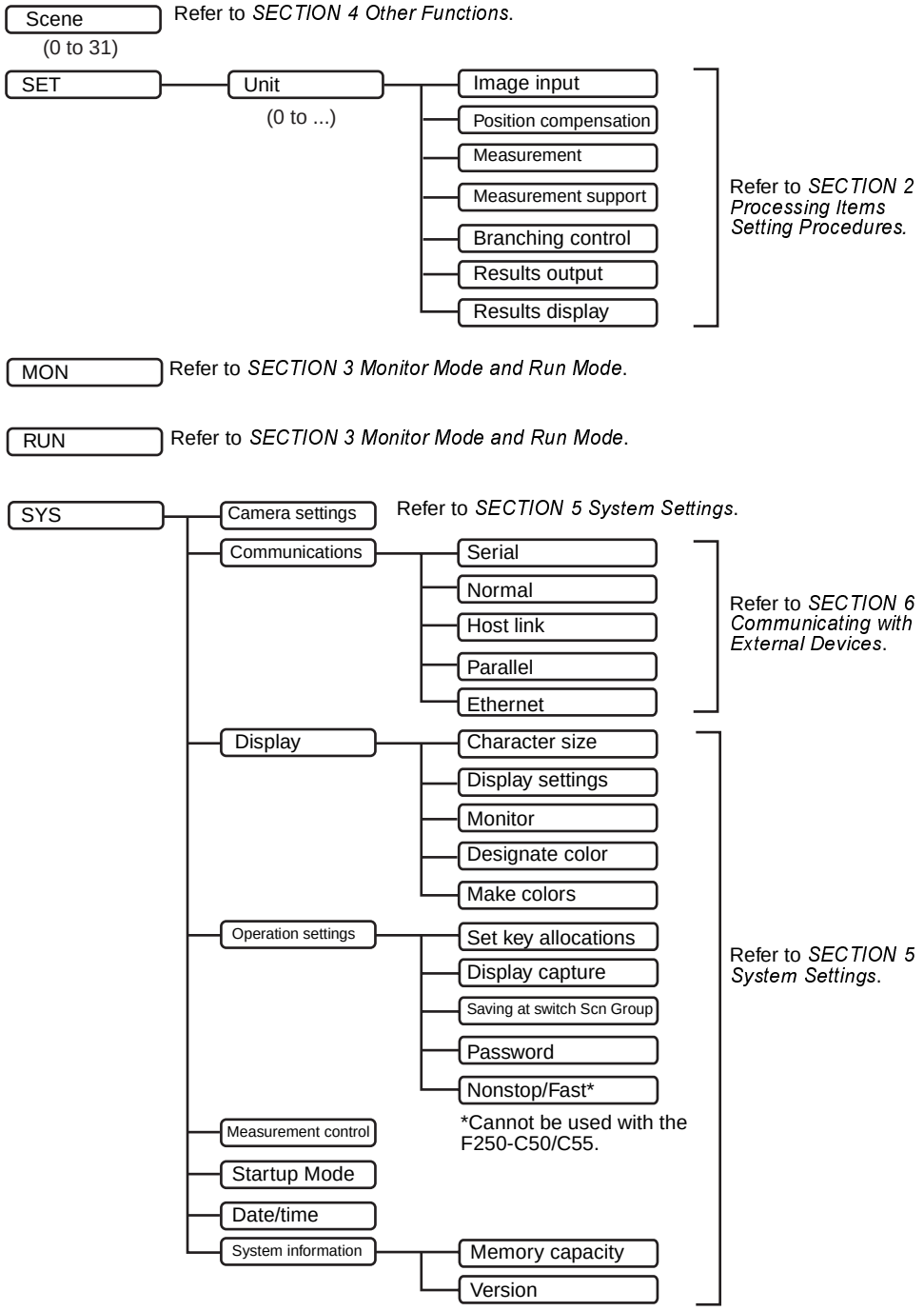
(Numeric value of the leftmost digit of the recognized character) x 16 + (Numeric value of the rightmost digit) = output value

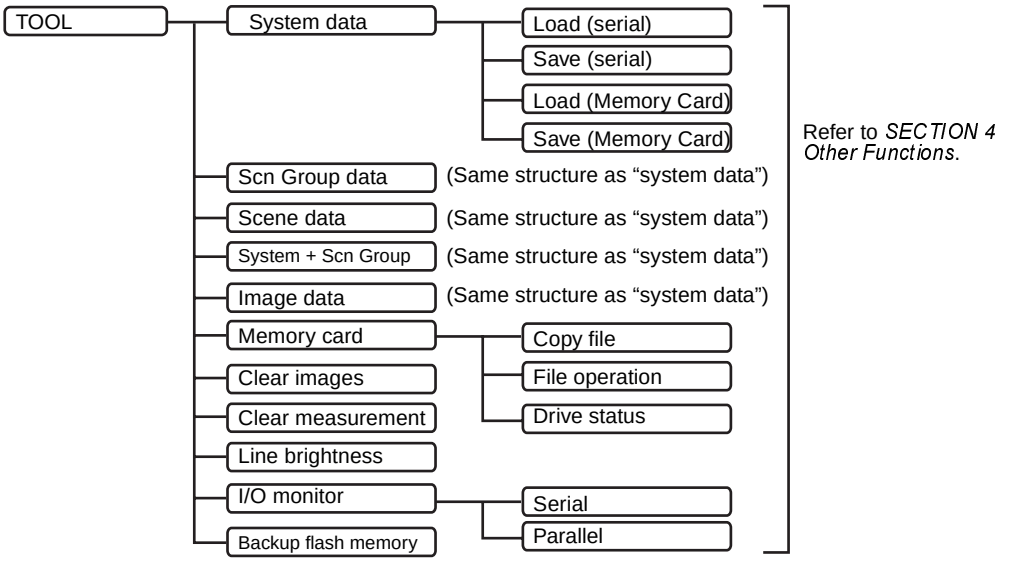
Example: When the recognized character is “2”, the output will be “50.”
When the recognized character is “C”, the output will be “67.”

Leftmost digit

Rightmost digit	0	1	2	3	4	5	6	7
0		DE		0	@	P	`	p
1	SH	D1	!	1	A	Q	a	q
2	SX	D2	”	2	B	R	b	r
3	EX	D3	#	3	C	S	c	s
4	ET	D4	$	4	D	T	d	t
5	EQ	NK	%	5	E	U	e	u
6	AK	SN	&	6	F	V	f	v
7	BL	EB	’	7	G	W	g	w
8	BS	CN	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y
A	LF	SB	*	:	J	Z	j	z
B	HM	EC	+	;	K	[	k	{
C	CL	→	,	<	L	\	l	¦
D	CR	←	-	=	M	]	m	}
E	SO	↑	.	>	N	^	n	~
F	SI	↓	/	?	O	_	o	

7-6 Menu Hierarchy

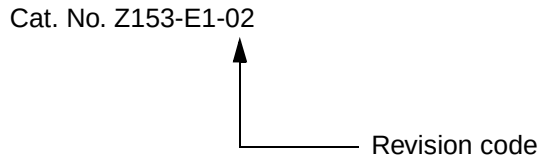




SAVE Refer to *SECTION 4 Other Functions*.

Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.



The following table outlines the changes made to the manual during each revision. Page numbers refer to the previous version.

Revision code	Date	Revised content
01	August 2001	Original production
02	December 2001	“F250” was globally changed to either “Controller” or “Application Software” to more clearly distinguish between hardware and software. “Trim” was changed to “extract” in relation to QUEST Character Verifications and Lot Number OCU 1. **Pages 1-2, 2-507, 2-511, 2-518, 6-26, 6-32, 6-43, 6-63, and 6-102:** Information was added on new processing items and commands. **Pages 1-3 and 1-63:** “Exit” was changed to “turn power OFF.” **Pages 1-46, 1-47, 2-20, 2-30, 2-37, 2-45, 2-70, 2-75, 2-80, 2-81, 2-83, 2-84, 2-86 to 2-88, 2-90, 2-93, 2-94, 2-96, 2-229, 2-230, 2-257, 2-265, 2-271, 2-305, 2-310, 2-316, 2-317, 2-319, 2-320, 2-322 to 2-325, 2-328, 2-329, 2-330, 2-331, 2-357, 2-460, 2-492, 2-506, 2-559, 4-21, 5-39, 6-8, 6-19, 6-115, 6-130, 7-4, and 7-7 to 7-11:** General information or revisions were added. **Pages 1-48, 2-33, 2-270, 2-428, 2-429, 2-541 to 2-543, 2-546, 2-556, 2-562, 2-587, 2-573, 2-597, 2-601, 2-606, 2-609, 2-613, 2-618, 4-22, 5-7, 5-17 to 5-20, 5-22, 5-23, 5-36, 6-75, 6-90, 6-110, 6-130, and 7-13:** Corrections were made. **Pages 2-228 and 2-243:** Graphics were removed. **Pages 5-25 to 5-29 and 6-35:** Pages and information were removed.