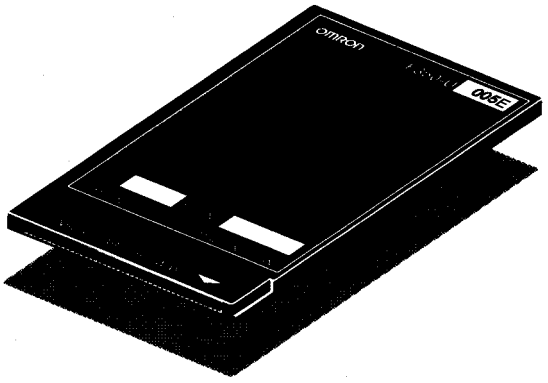
F350-U005E
IC Package Inspection Software 1

Operation Manual

Produced March 1997



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.

Important Indicates information of importance that, if not heeded, could result in damage to the product, malfunction, or incorrect operation.

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.

Symbols

The following symbols appear at the bottom of each page in *Section 4 Functions and their Operation* and indicate the measurement items that apply to a particular menu operation.

Lead	Indicates information for using lead inspection.
Pattern	Indicates information for using pattern inspection.
Surface A	Indicates information for using surface defect inspection A.
Surface B	Indicates information for using surface defect inspection B.
Surface C	Indicates information for using surface defect inspection C.
Position Compensation	Indicates information for using position compensation.

Menu Item Notation

Menu items are sometimes abbreviated on the menu bar due to space limitations. In this manual, the non-abbreviated form of the menu items are used and, if an abbreviation is displayed on the menu bar, the characters that are actually displayed are underlined. If no characters are underlined, then the menu item is not abbreviated on the display.

For example, “O.Position compensation” appears on the menu display as “O.Posi cmp” and is given in this manual as “O.Position compensation”

TABLE OF CONTENTS

TABLE OF CONTENTS

About this Manual:

This manual describes the operation of the F350-U005E IC Package Inspection Software 1 and includes the sections described below. The F350-U005E IC Package Inspection Software 1 is a software package used with the F350 Visual Inspection System.

Please read this manual carefully and be sure you understand the information provided before attempting to operate the F350-U005E IC Package Inspection Software 1.

Section 1 provides a general introduction to the F350 IC Package Inspection Software 1.

Section 2 describes the system configuration, starting and stopping the software, and basic menu operations.

Section 3 describes the six measurment items in the F350 IC Package Inspection Software 1. This section explains the functions and operations in order, using typical measurements as examples.

Section 4 provides detailed explanations of the functions and their usage.

Section 5 provides a list of error messages, and the causes and remedies for them.

The **Appendices** provide a menu hierarchy diagram for the software and methods for calculating scene data sizes.

⚠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
Introduction

This section provides a general introduction to the F350 IC Package Inspection Software 1.

1-1 Before Using this Manual

Copyright

The copyright of this software (the stored and written contents of the system memory card and operation manual) belongs to OMRON Corporation.

Copying and Modifications

This software may not be copied in whole or in part, except for the purposes of storage or for changes or modifications for the customer's own use.

This software may be changed or modified only for the customer's own use. OMRON, however, accepts no responsibility for problems or damages arising from customer changes or modifications to the software.

Handling the System Memory Card

Do not leave the system memory card in dusty or wet locations as this may cause connection errors. To prevent destruction of system program data or deformation of the card, avoid high temperatures, high humidity, and direct sunlight. Also, do not bend, scratch or apply shock to the card.

1-2 Applicable Manuals

The manuals used with the F350 Visual Inspection System are shown in the following table. Manuals are listed according to the steps involved in setting up and operating a system.

The following three manuals are used with the F350 Visual Inspection System. The first and last manual are used with all systems. The second manual depends on the applications software that is being used.

- F350 Setup Menu Operation Manual: Included with the F350-C12E/C41E IMP Unit.
- F350 Application Software Operation Manual: Included with the Application Software (F350-U□□□E).
- F350 OVL Reference Manual: Included with F350-L12E OVL Unit.

Procedure		Manual	
		Application Program	**OVL program**
System design	Consider the lighting, I/O devices, and so on, and determine the system configuration. Design the system carefully, taking into account variations in conditions and the objects that are to be inspected/read.	F350-series Data Sheet	
Assembly/Installation	Install the F350 Visual Inspection System by assembling the hardware and wiring the power supply and peripheral devices.	F350 Setup Menu Operation Manual	
Software settings	Start up the software and make the settings for the F350 Visual Inspection System and the settings for starting the software, communicating with I/O devices, and so on.	Make the settings using the Setup Menu, which is standard with F350-C12E/C41E IMP Unit. (Refer to the F350 Setup Menu Operation Manual.)	Mount the F350-L12E OVL Unit and program using OVL, a specialized BASIC programming language. (Refer to the F350 OVL Reference Manual.)
Inspection/Reading condition settings	Start up the software and make the inspection/reading settings. Set the criteria for determining the inspection/read area and the acceptability of the inspected products.	Make the settings using the F350-U□□□E Application Program. Do actual testing according to the conditions that have been set. (Refer to the relevant F350 operation manual.)	Mount the F350-L12E OVL Unit and program using OVL, a specialized BASIC programming language. Do actual testing according to the conditions that have been set. (Refer to the F350 OVL Reference Manual.)
Testing/Inspection/ Reading	Do actual testing for the conditions that have been set. If adjustments are required, change the settings.		
Maintenance	Carry out periodic inspections. This is essential in order to maintain the F350 Visual Inspection System in optimum operating conditions.	F350 Setup Menu Operation Manual	

1-3 Features

The F350 IC Package Inspection Software 1 enables the inspection of IC leads, surface characters, and packages. There are several measurement items available in the IC package inspection programs, making it possible to inspect several measurement items, such as lead inspection and pattern inspection, simultaneously.

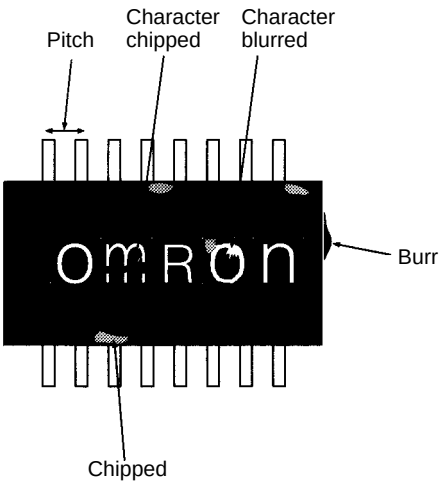
Lead Inspection Inspects IC pin pitches, widths, and lengths.

Pattern Inspection Detects missing and blurred patterns.

Surface Defect Inspection A Detects chips, burrs, scratches, and dirt on IC packages using unique algorithms.

Surface Defect Inspection B Detects scratches and dirt on IC packages quickly.

Surface Defect Inspection C Detects faults in shapes from binary images.



SECTION 2
Preparation for Operation

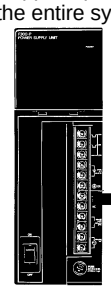
This section describes the system configuration, starting and quitting the Application Program, and basic menu operation.

2-1 System Configuration

The numbers of cameras and the types of I/O devices that can be used depends on the application software. Check that the system is correctly configured for the application software.

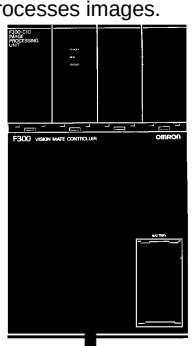
Basic System Configuration (Must be used.)

F300-P2,
★ F300-P2E
Power Supply Unit
Supplies power to the entire system.

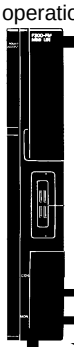


(Important: The F200-P Power Supply Unit cannot be mounted because its capacity is too small.)

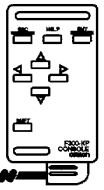
★ F350-C12E,
F350-C41E IMP Unit
Processes images.



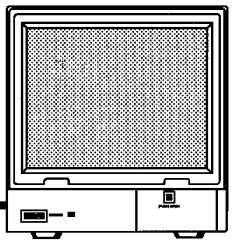
★ F300-FM2 MMI Unit
Provides Memory Card functions and menu operations via a Video Monitor and Console.



★ F300-KP Console

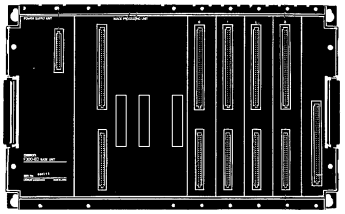


F300-M09 Video Monitor (100 VAC)



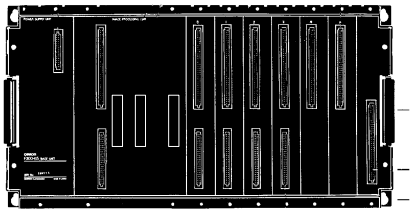
★ F309-VM Monitor Cable

★ F300-B32 (3 slots)

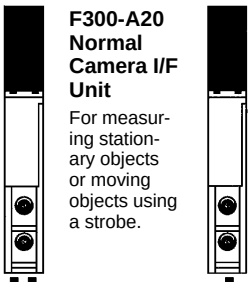


or

★ F300-B52 (5 slots)

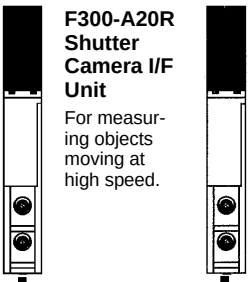


Camera I/F Units (use four maximum)



F300-A20 Normal Camera I/F Unit
For measuring stationary objects or moving objects using a strobe.

★ F300-A22S Normal Simultaneously Camera I/F Unit
For measuring stationary objects or moving objects using a strobe, and for measuring two places simultaneously using two cameras.



F300-A20R Shutter Camera I/F Unit
For measuring objects moving at high speed.

★ F300-A22RS Shutter Simultaneously Camera I/F Unit
For measuring objects moving at high speed, and for measuring two places simultaneously using two cameras.

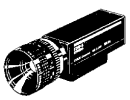
F300-A23RS Frame Shutter Camera I/F Unit
This I/F Unit is used exclusively with the F300-S4R.
For measuring objects moving at high speed, and for measuring two places simultaneously using two cameras.

★ F309-VSR2 Camera Cable

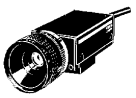
★ F309-VSR2 Camera Cable

★ F309-VSR2 Camera Cable

F200-S Camera



*** F300-S Camera**



★ F300-S2R Shutter Camera

F300-S3DR Shutter Camera

F300-S4R Frame Shutter Camera

· Lens

· Light

Cameras (use eight maximum) Only one F200-S Camera can be used.

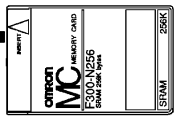
Important
1. An incorrect image may be read if different types of cameras and I/F Units are used together. Do not mix different types of cameras and I/F Units.
2. Strobes cannot be used when an F200-S Camera is used for inspection.

Some of the products listed may not be available overseas. Please contact your nearest OMRON sales office by referring to the addresses provided at the back of this manual.

Note A star (★) before a model number indicates conformance to the EC Directives. Use only these Units when constructing a system that must conform to EC Directives.
Refer to Appendix A in the Setup Manual for a complete list of the Units that conform to EC Directives.

F350-U005E IC Package Inspection Software 1
IC package inspection programs

Peripheral Devices



★ **F300-N256/N512/N2M Memory Card**
Use to store scene data. In addition, a Memory Card is required to back up scene data when using multiple scenes with an F350-C12E IMP Unit.

I/F Units (Use one that matches the peripheral devices connected.)

★ **F300-E2 RS-232C I/F Unit**
Used to input instructions through the RS-232C interfaces provided on this Unit. All input operations must be performed from the measurement screen.

★ **F300-D2 Terminal Block Unit**
Used to input instructions and output measurement results through the terminal block provided on this Unit. All input and output operations must be performed from the measurement screen.

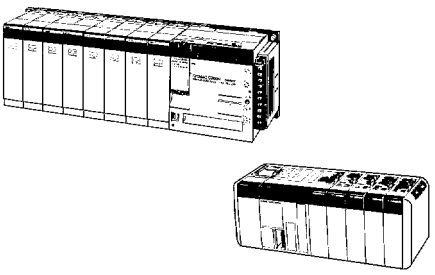
★ **F300-DC2 Parallel I/O Unit**
Used to input instructions and output measurement results through the parallel I/O interface provided on this Unit. All input and output operations must be performed from the measurement screen.

F300-FS Strobe I/F Unit
Use to take images while using a strobe light.

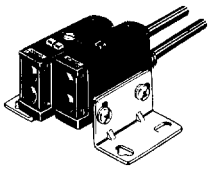
Note
Either one or two Strobe I/F Units can be mounted. All connected strobe lights flash while the application software is being operated. For details regarding strobe flash timing, refer to *4-2-1 Selecting the Image Display Method*.

★ **F300-G Dummy Unit**
Use to insert into empty slots to protect and connectors and maintain external strength and appearance.

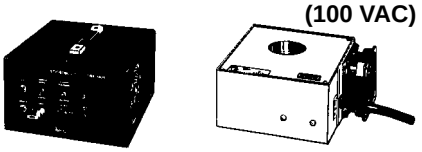
C200H or CQM1 Programmable Controller



Synchronization Sensor



3Z4S-LT DSX-240 Strobe Device (100 VAC)



F309-VFS Strobe Cable

2-2 Starting and Quitting

2-2-1 Starting

The application program contains six different measurement items: Position compensation, Lead inspection, Pattern inspection, Surface defect inspection A, Surface defect inspection B, Surface defect inspection C. The application and inspection procedures differ depending on the measurement item being used. Install the ones necessary for your application.

Once the application program has been started, you will need to set the order in which to execute measurement items and the conditions for executing each.

Measurement item	Description
Position compensation	The position of the measured object can be compensated so that the measurement location does not fall outside of the inspection area.
Lead inspection	Inspects the pitches, widths, and lengths of the pins on a side of the IC after the side is selected according to object being inspected (connector, SOP, or QFP).
Pattern inspection	Inspects for defects in patterns, such as chips, scratches, and blurring. Patterns other than characters such as symbols, designs, or character strings, can be registered as models to inspect presence/absence or defects. The degree of movement from a reference position can also be determined.
Surface defect inspection A	Inspects for defects such as burrs and chips on the edges of products, and for surface defects and dirt. The inspection region can be set to match the shape of the products. Detects defects by searching for density changes within the inspection region. For high-speed detection of defects and dirt use ”Surface defect inspection B.”
Surface defect inspection B	Inspects for surface defects and dirt. The inspection region can be set to match the area for inspection. Detects defects by searching for gray-scale deviations within the inspection region.
Surface defect inspection C	Detects shape defects or presence/absence defects in formed goods. Converts the image to binary and finds the center of gravity of the white pixels.

Not all measurement items can be installed at the same time.

The following table shows the possible combinations of measurement items that can be installed. It is possible to install only the required measurement items. For example, in the fifth group below (Lead inspection, Surface defect inspection A, and Surface defect inspection B) only the Lead inspection and Surface defect inspection A measurement items need be installed if Surface defect inspection B is not required.

IMP Unit	Position compensation	Lead inspection	Pattern inspection	Surface defect inspection A	Surface defect inspection B	Surface defect inspection C
F350-C12E	O	O				
	O		O			
	O			O	O	O
		O	O			
		O		O	O	
		O		O		O
		O			O	O
			O	O	O	O
F350-C41E	A maximum of five measurement items in any combination can be installed.					

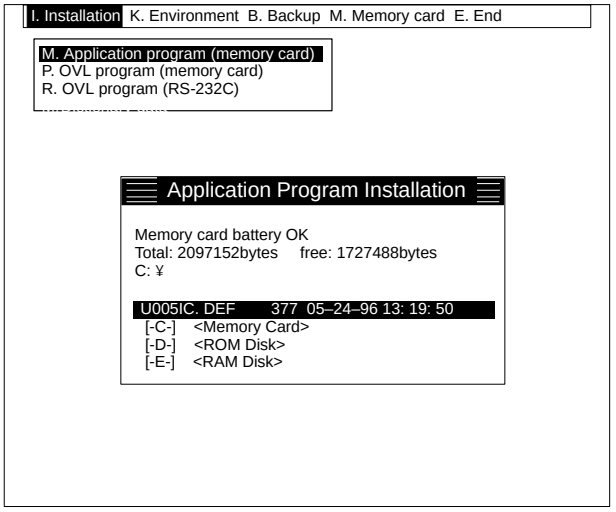
The Setup Menu is used to install and run an Application Program. Operate the Setup Menu by referring to *3-1 Starting the Setup Menu* in the *F350 Setup Menu Operation Manual*.

When an Application Program is installed, any previously installed software and data are deleted from memory. In addition, when an F350-C41E IMP Unit is used, all of the data saved to the RAM disk is deleted. Save this data in advance, if it is required. Refer to *5.3 B.Backup* in the *F350 Setup Menu Operation Manual*.

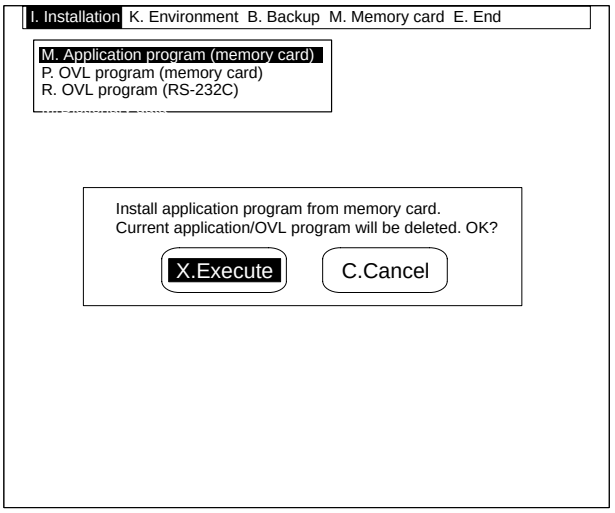
Procedure

1, 2, 3...

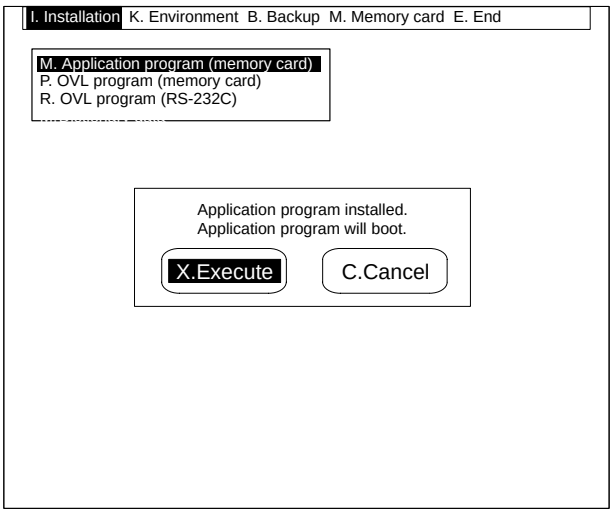
1. Select “I.Installation.”
2. Select “M.Application program (memory card).” The Application Program directory will be displayed.



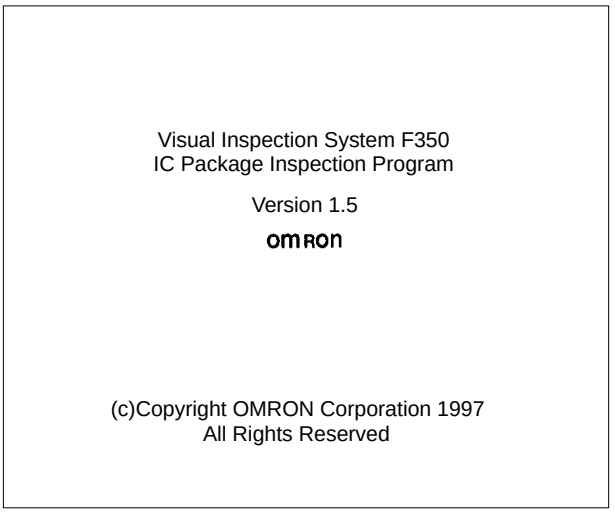
3. Select the filename. A confirmation message will be displayed.



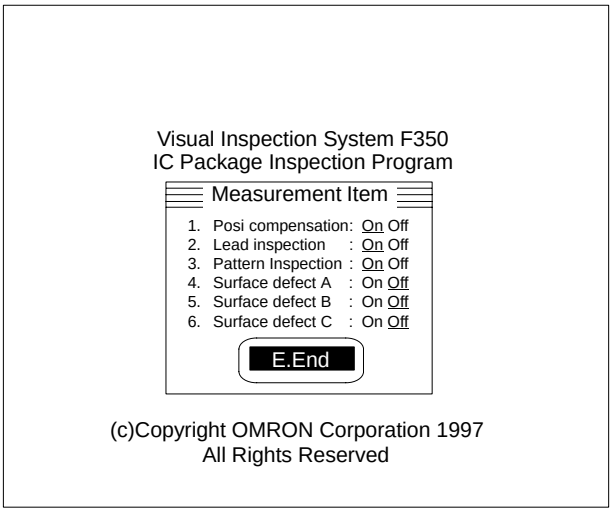
4. Select “X.Execute.” The Application Program will be installed. A confirmation message will be displayed when installation is complete.



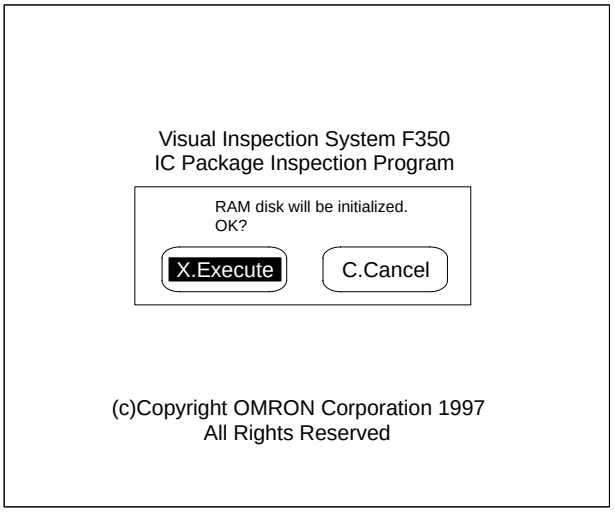
5. Select “X.Execute.” The Application Program will be started.
   The Initial Screen is shown below.



Set the measurement items to be installed to ON and select “E.End.”



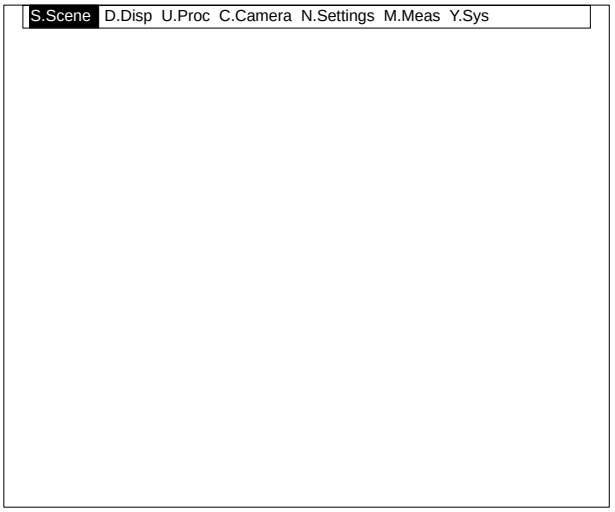
If the F350-C41E is being used, a message will be displayed to confirm whether the RAM disk is to be initialized. Select “X.Execute.”



6. The Application Program Basic Screen and the image from the connected camera 0 will be displayed.

   Adjust the image focus.

   If multiple cameras are connected, select the image from the camera to be adjusted. Refer to *4-4-1 Select the Camera Number: C.Camera*.



Important Do not turn off the power during installation. If power is turned off during these operations, memory contents will be destroyed and the F350 will malfunction when it is turned on again.

Once installed, the Application Program will run each time the power is turned on. Select “K.Environment” and “M.Initial Mode” in the Setup Menu to change the program which runs initially. Refer to *5-2-1 Designating Startup Operations: M.Initial mode* in the *F350 Setup Menu Operation Manual*.

2-2-2 Quitting

Important Do not turn off the power during the following operations. If power is turned off during these operations, memory contents will be destroyed and the F350 will malfunction when it is turned on again.

- While data is being saved, loaded, or copied.
- While the orange memory card access indicator on the MMI Unit is lit.
- While the model is being registered.

Procedure

1, 2, 3... 1. Turn off the F350 power.

2. Turn off the Video Monitor power.

Data settings are stored when the F350 is turned off.

Note 1) The Setup Menu and OVL system cannot be started from the Application Program. Quit the Application Program before starting the Setup Menu or OVL system.

2) To run the Setup Menu, turn on the power while holding down the Enter Key. Refer to *3-1 Starting the Setup Menu* in the *F350 Setup Menu Operation Manual*.

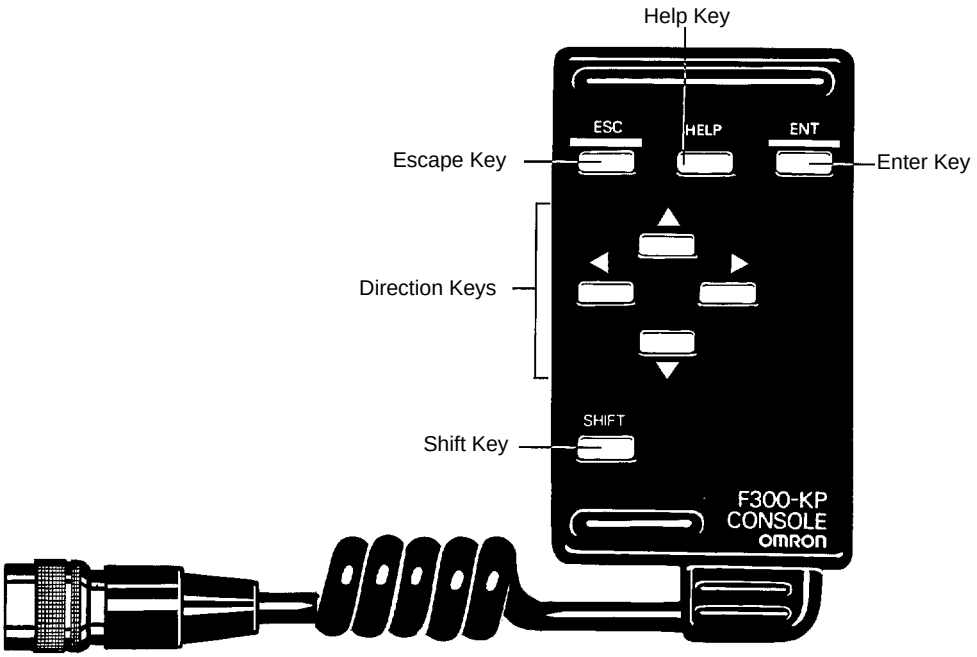
3) To start the OVL system, run the Setup Menu, change the "K.Environment/ M.Initial Mode" to "OVL prompt," and restart the F350. Refer to *2-2-1 Starting Up* in the *F350 OVL Reference Manual*.

2-3 Basic Menu Operation

The Application Program is operated from the Console.

2-3-1 About the Console

The names of the various Console parts and their functions are described below. Only the basic key functions are described here. Some of them are assigned special functions in some of the menus. Special key functions are described on the comment line of the screen.

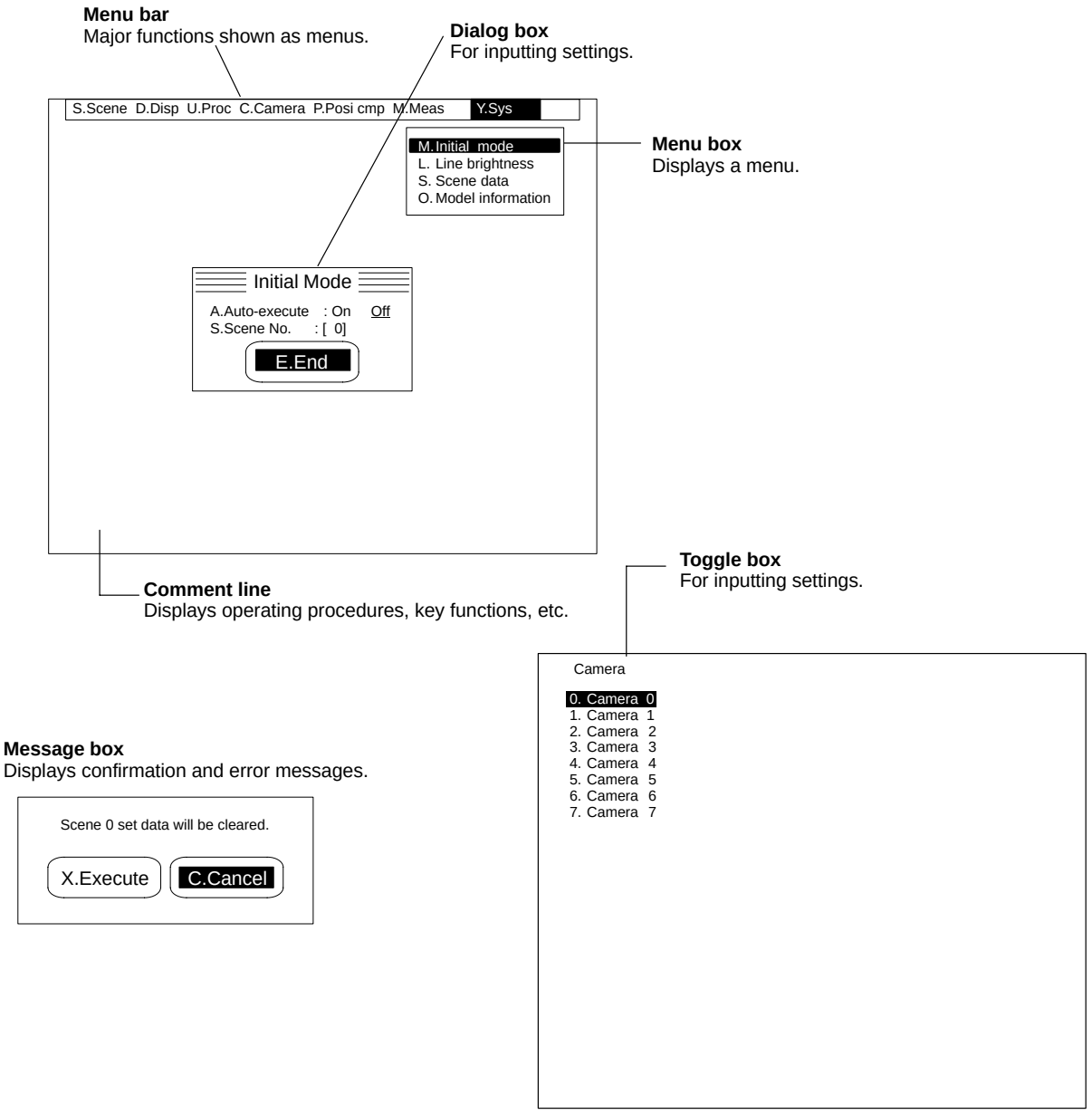


F300-KP Console

Marking	Name	Function
ESC	Escape Key	Interrupts processing and displays the previous menu level.
HELP	Help Key	Assigned a different function for each menu.
ENT	Enter Key	Executes the function at the cursor position. If a menu is displayed, the next menu level at the cursor position will be displayed. Sets input data when settings are being made.
▲ ▼	Direction Keys	Move the cursor up and down. In numerical input mode, the Direction Keys increase or decrease a number by 1.
▶ ◀		Move the cursor left and right.
SHIFT	Shift Key	Has no effect when pressed alone but changes the function of other keys pressed simultaneously. The menus assign functions to combinations of the Shift Key with other keys.
Example: SHIFT+ESC		Displays the extended menu, if any exists.

2-3-2 Key to the Screens

The menus and their functions are described below.



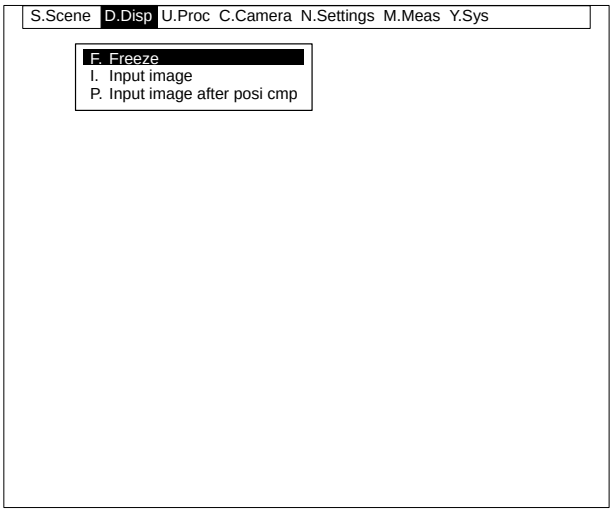
2-3-3 Selecting a Menu

The Application Program is hierarchical and it is necessary to select related menus to set data. Select the appropriate menu for operations such as setting data or executing measurements. Refer to the menu hierarchical diagram in *Appendix A* to determine the overall menu hierarchy.

Procedure

1, 2, 3... 1. Move the cursor to the required menu item and press the Enter Key. The next level in the menu hierarchy will be displayed. Repeat the procedure to move down another level.

2. Press the Escape Key. The previous level in the menu hierarchy will be displayed. Press the Escape Key again to move up another level.



2-3-4 Inputting Settings

Dialog boxes and toggle boxes are both used on data setting screens. Dialog boxes allow multiple data settings to be made simultaneously when “E.End” is selected. Toggle boxes, however, allow one setting to be selected from several possibilities.

All settings are set to default values at the factory. Change the settings as required.

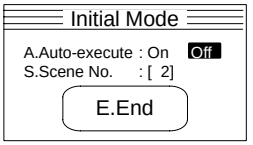
Settings in Dialog Boxes

The current settings are underlined when a dialog box is displayed.

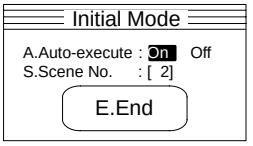
Procedure

1, 2, 3...

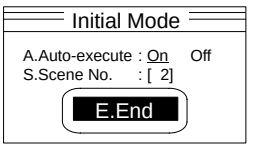
1. Press the Up/Down Keys to move the cursor to the setting to be changed. The cursor will move to the current setting.



2. Press the Right/Left Keys to move the cursor to the required data setting.



3. Move the cursor to “E.End” and press the Enter Key. The selected setting will be input into the system.



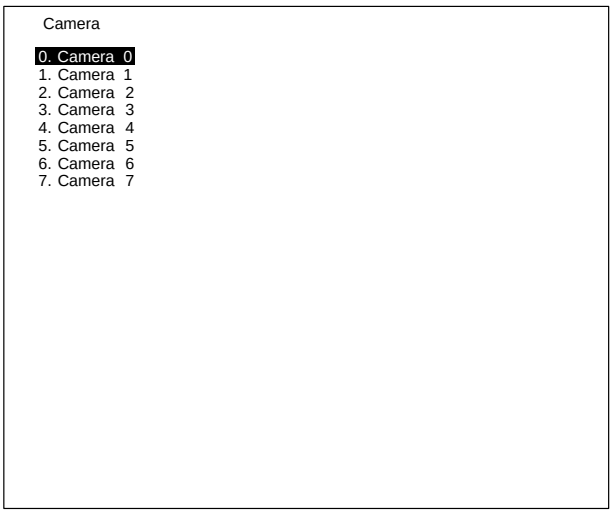
Settings in Toggle Boxes

The cursor will be at the current data setting when a toggle box is displayed.

Procedure

1, 2, 3...

1. Move the cursor to the required new data setting and press the Enter Key. The selected setting will be input into the system.



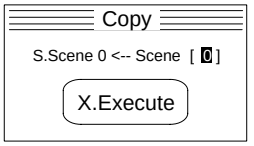
2-3-5 Inputting Numbers

The method for inputting numbers to set scene numbers and evaluation criteria is described below. All settings are set to default values at the factory. Change the settings as required.

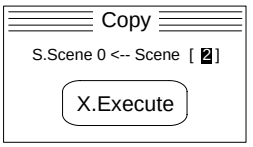
Procedure

1, 2, 3...

1. Move the cursor to the item for which a number is to be input and press the Enter Key. The number input mode will be entered.



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

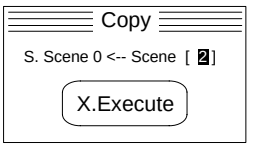


3. Press the Up/Down Keys to increase or decrease the number.

   Entering a Minus Sign (–)
   Move the cursor to the extreme left position and press the Up/Down Keys to display the minus sign.

   Repeat steps 2 and 3 above to input multiple values.

4. Press the Enter Key. The value will be input into the system.

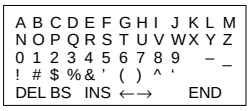


A convenient method exists for fine adjustment of a number. Move the cursor to the number to be changed and press the Direction Keys shown in the following table.

Key	Action
▶	Increases the least-significant digit by one.
◀	Decreases the least-significant digit by one.

2-3-6 Inputting Characters

The method for inputting characters for file names or scene comments is described below. Characters can be input by selecting them from the following character table.



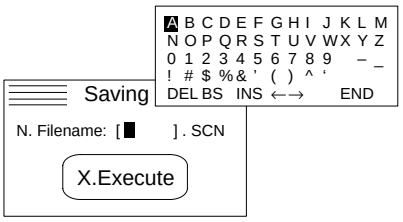
The displays other than characters have the functions described below.

Display	Action
DEL	Deletes the character at the cursor position.
BS	Deletes the character immediately to the left of the cursor position.
INS	Toggles between insert and overwrite modes. The initial setting is overwrite.
←	Moves the cursor to the left.
→	Moves the cursor to the right.
END	Ends the character input operation.

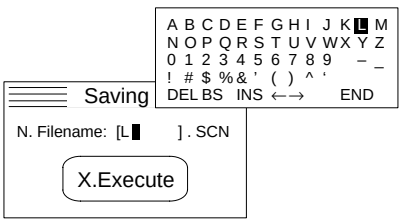
Procedure

1, 2, 3...

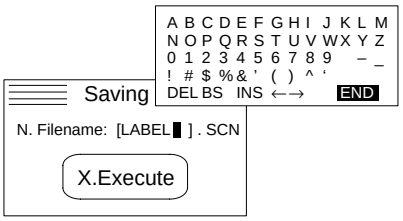
1. Move the cursor to the item for which a character is to be input and press the Enter Key. The character input mode will be entered, and the characters that can be input will be displayed on the screen.



2. Move the cursor to the character that is to be input.



3. Press the Enter Key to input the character. Repeat steps 2 and 3 above to input multiple characters.



4. When all the characters have been input, move the cursor to “End” and press the Enter Key. The character input mode will be quit, and the input characters will be set.

Clearing All Characters

To clear all characters, press the Shift and Enter Keys while in the character input mode.

Inserting Characters

“INS” can be used to toggle between the insert and overwrite modes. An underline will be displayed while in the insert mode, and the cursor will be displayed while in the overwrite mode.

SECTION 3
Using the Menus

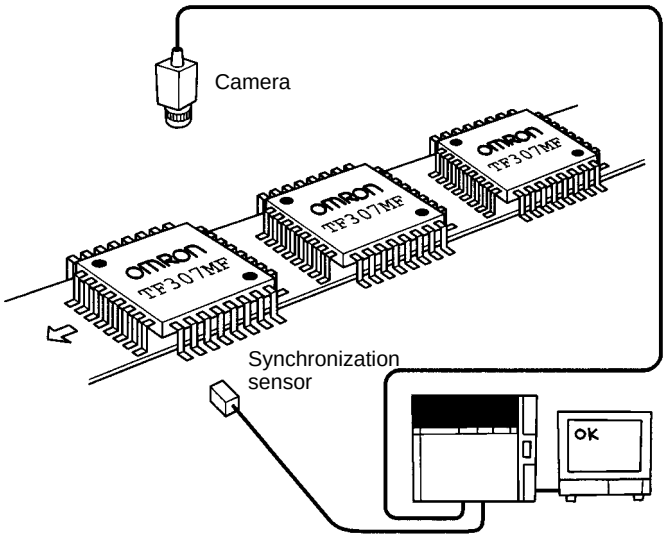
This section describes the six measurement items in the F350 IC Package Inspection program. Select the measurement items that are suitable for the objects being inspected. This section explains the functions and operations in order, using typical measurements as examples.

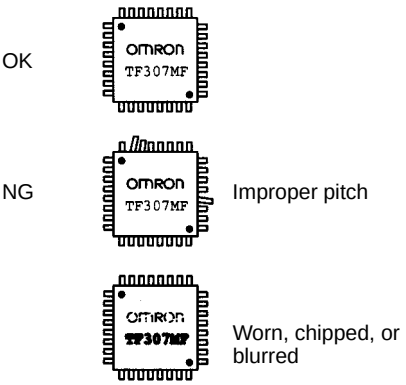
3-1 IC Package Inspection

Use the software to inspect the pin pitches of IC packages or detect the chipped or blurred character patterns on IC packages. When the IC packages reach the measurement position, a STEP signal is input from a synchronization sensor. The position compensation function is set to allow measurement when the position of the IC packages is not consistent, i.e., deviates from the measurement position.

The F350 carries out measurements in sync with the STEP signal.

When an IC package comes into position, as in the following example, a STEP signal will be input from the synchronization sensor. The F350 operates in sync with the STEP signal. Inspection results are output to the Terminal Block so that improper IC packages are ejected in the next stage.

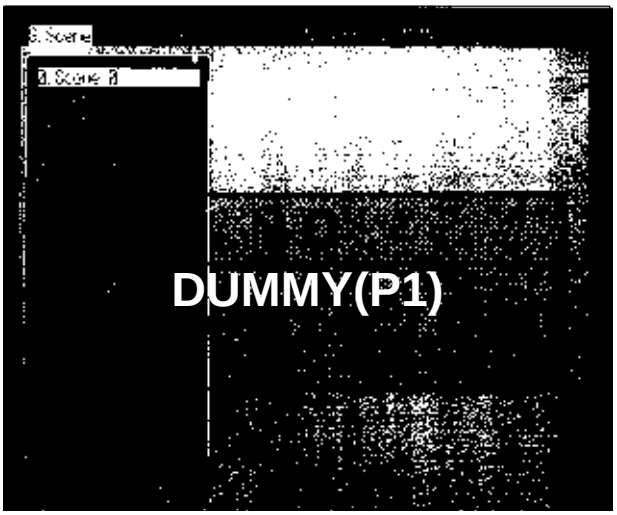




Procedure

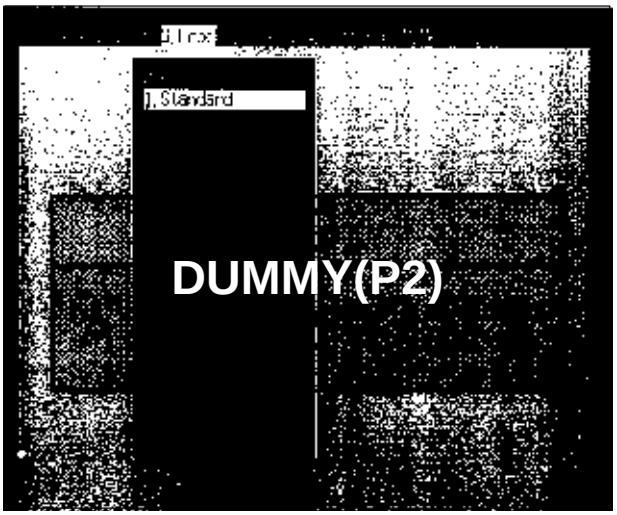
Selecting the Scene Number

1, 2, 3... 1. Select scene 0. Subsequent data settings will apply to scene 0. Refer to *4-1-1 Selecting Scene Number*.



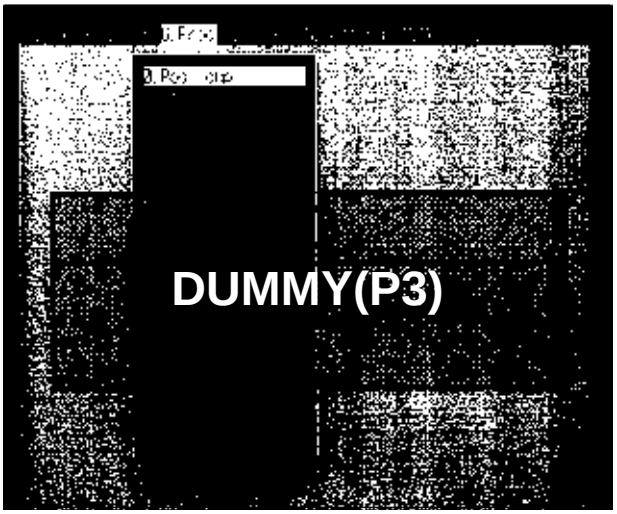
Setting Processes

2. Set position compensation for process number 0.
3. Set lead inspection for process number 1.
4. Set pattern inspection for process number 2.
   Refer to *4-3-1 Setting Measurement Items*.

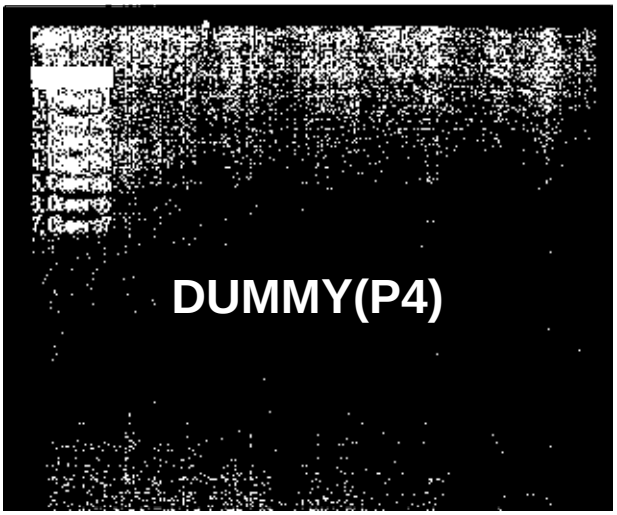


Setting Position Compensation

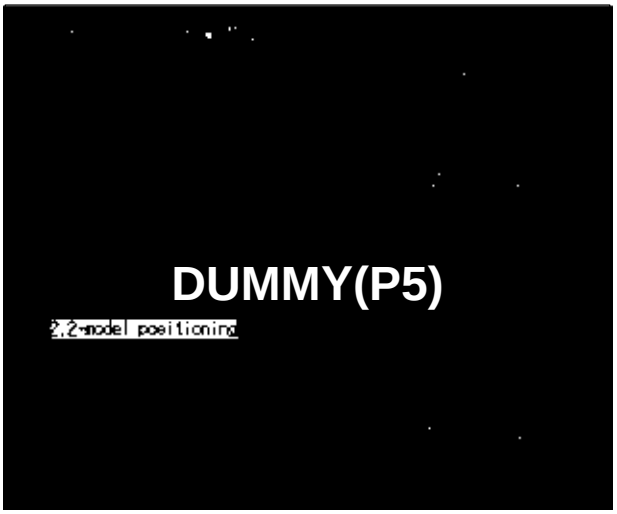
5. Select “0.Position compensation” under “U.Process.”
   “P.Position compensation” will be displayed on the menu bar. Refer to *4-3-2 Switching Processes*.



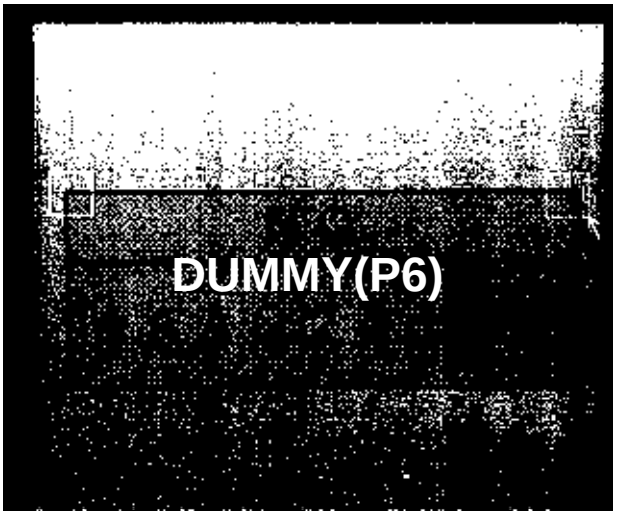
6. Select camera 0. Refer to *4-4-1 Selecting the Camera Number*.



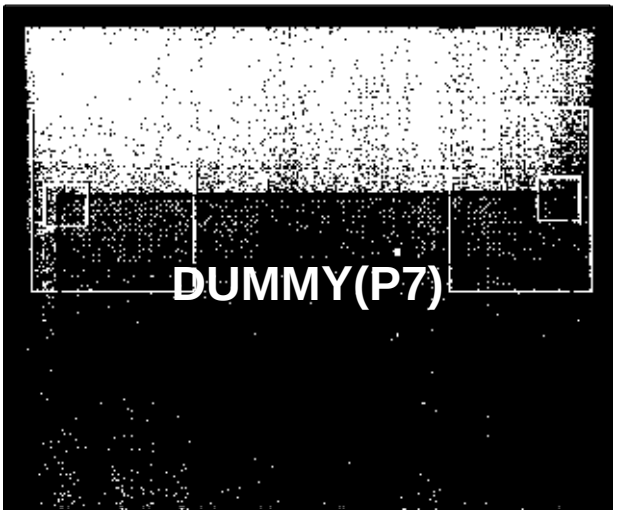
7. Select the position compensation method. In this case, select 2-model positioning. Refer to *4-23-1 Selecting the Position Compensation Mode*.



8. Register the position compensation model. Refer to *4-23-1 Selecting the Position Compensation Mode*.

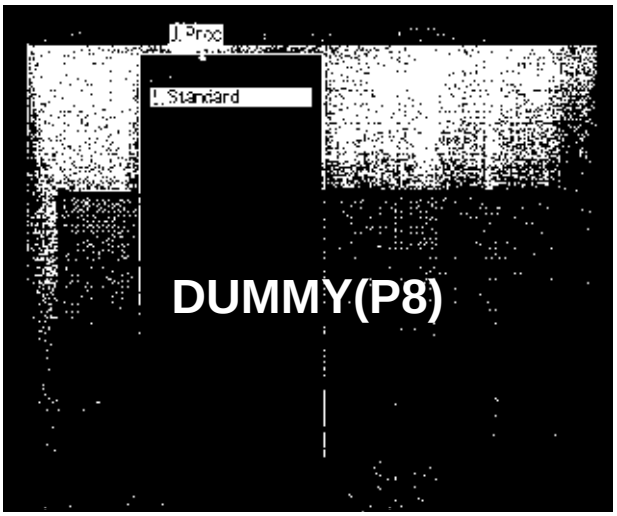


9. Draw the position compensation region. Refer to *4-23-3 Setting the Position Compensation Region*.

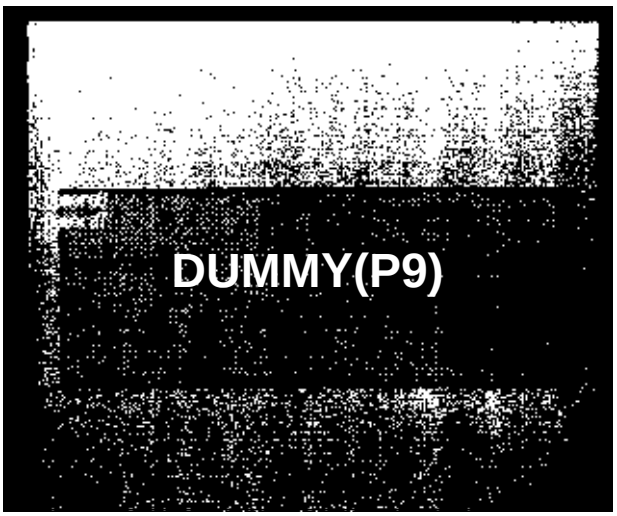


Setting Lead Inspections

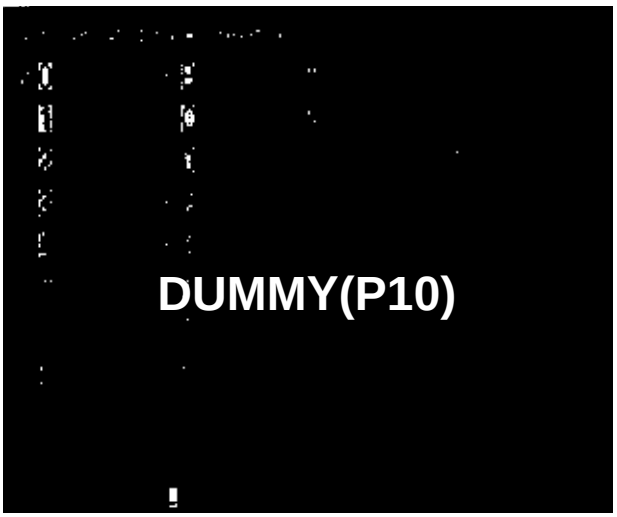
10. Select “1.Lead inspection” under “U.Process.” “L.Lead” will be displayed. Refer to *4-3-2 Switching Processes*.



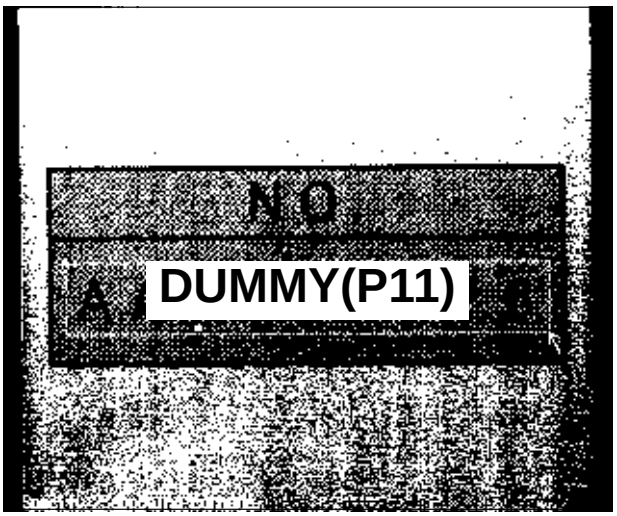
11. Select camera 0. Refer to *4-4-1 Selecting the Camera Number*.



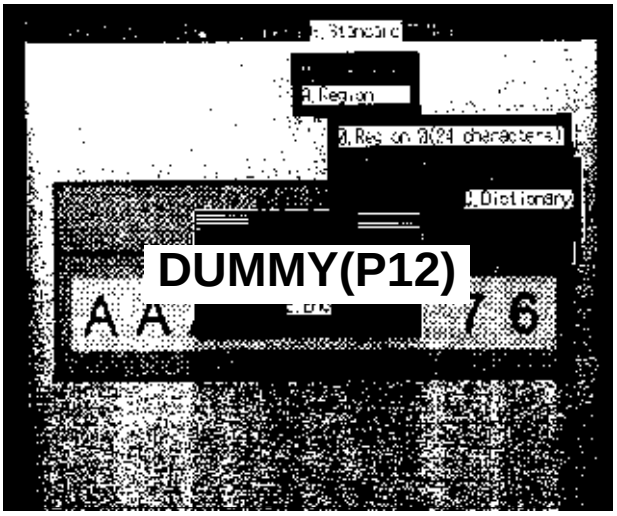
12. Set the calibration data. Refer to *4-4-4 Setting Calibration Data*.



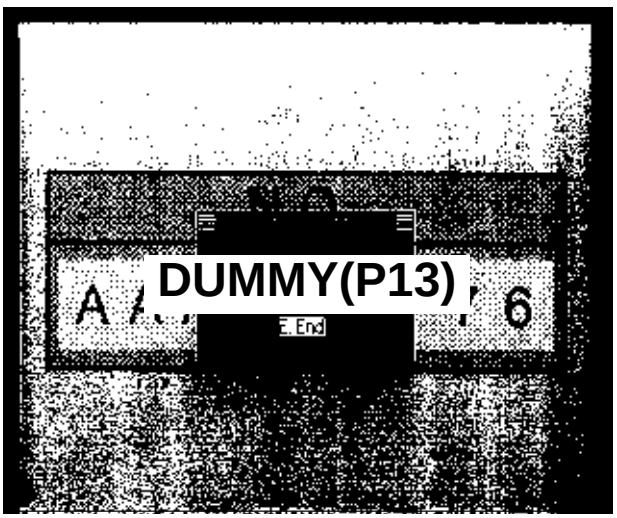
13. Set the conditions of the IC being inspected. Refer to *4-5 L.Lead/I.Lead Condition*.



14. Set the measurement conditions. Refer to *4-6 L.Lead/C.Measure Condition*.

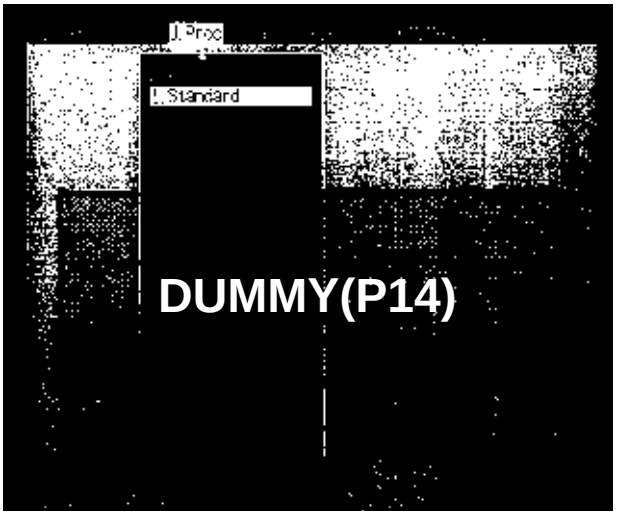


15. Register the model. Refer to *4-7 L.Lead/H.Manual Registration*.

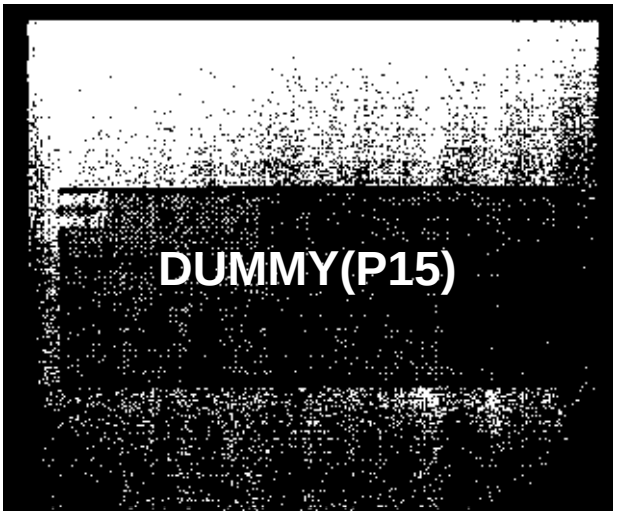


Setting Pattern Inspections

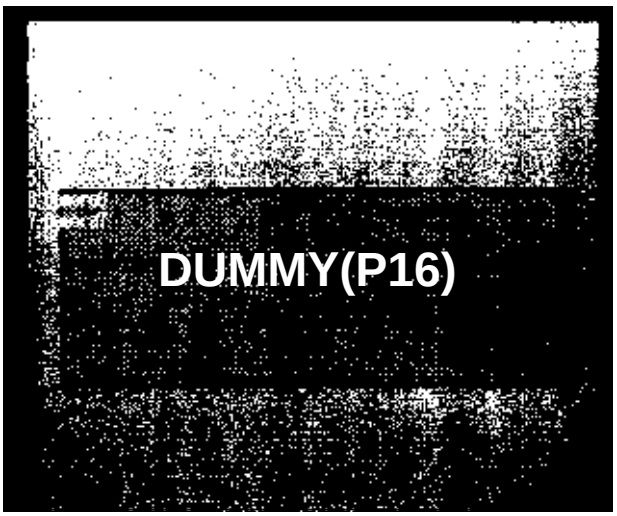
16. Select “2.Pattern” under “U.Process.” “P.Pattern” will be displayed on the menu bar. Refer to *4-3-2 Switching Processes*.



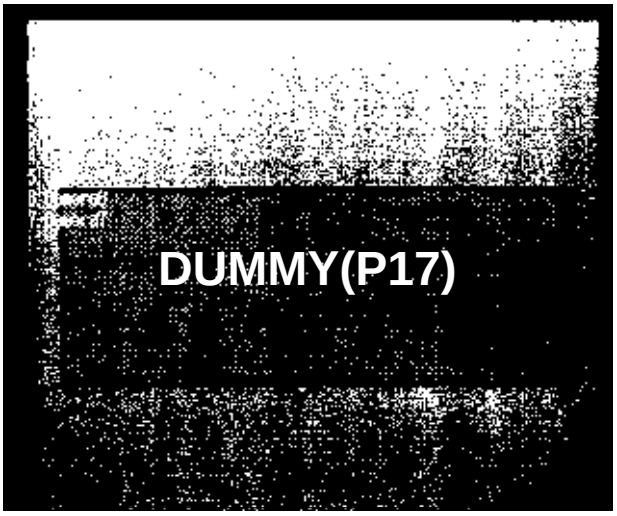
17. Select camera 0. Refer to *4-4-1 Selecting the Camera Number.*



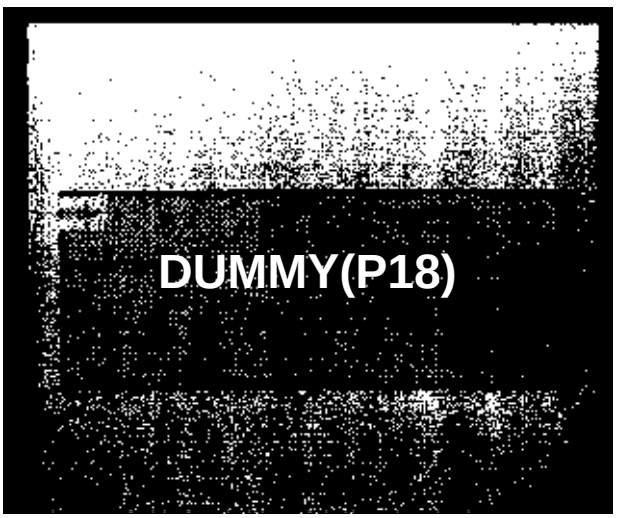
18. Set the region to be registered as the model. Refer to *4-10-1 Registering Individual Models*.



19. Set the region to search for the model. Refer to *4-10-1 Registering Individual Models*.

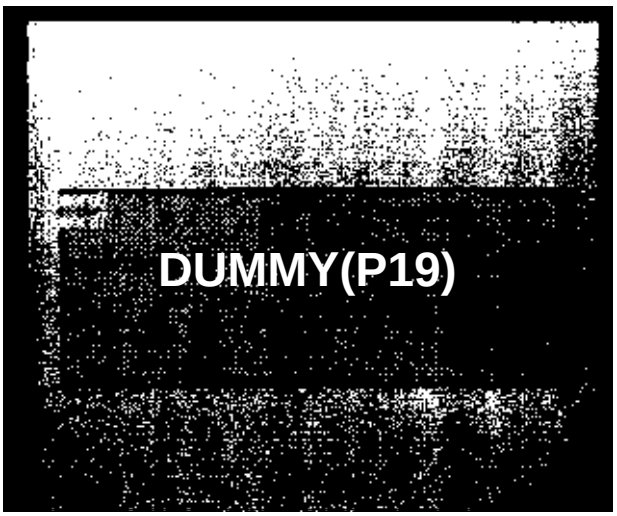


20. Set the judgement criteria. Refer to *4-10-1 Registering Individual Models*.



Measurement

21. Execute the measurement using the measurement command. Inspection results are output to the video monitor and Parallel I/O Unit. Refer to *4-25-1 Entering Measurement Screens*.



SECTION 4
Functions and their Operation

This section provides detailed explanation of the functions and their operations.

■ Setting Conditions

■ Lead Inspection

■ Pattern Inspection

■ Surface Defect Inspection A

■ Surface Defect Inspection B

■ Surface Defect Inspection C

■ Position Compensation

■ Measurements

■ System

■ Setting Conditions

4-1 S.Scene

The IC Package Inspection Software 1 allows up to 16 measurement conditions called scenes to be set and stored. The data that is stored is called scene data and is identified by scene numbers.

Measurement conditions that have been set can be stored as scene data for each scene number. Refer to *4-26-3 Saving and Loading Scene Data*.

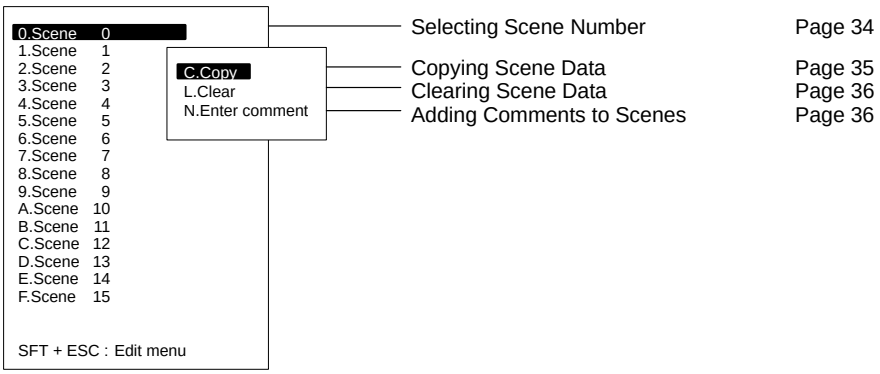
Use Memory Cards with enough available space for the data that is set. Standard sizes for scene data are provided in *Appendix B*.

Note Methods for backing up scene data will differ according to the IMP Unit that is used. When an **F350-C12E IMP Unit** is used, a Memory Card is required in order to use multiple scenes. Scene data other than Scene #0 is backed up on the Memory Card. If no Memory Card is inserted, scenes cannot be switched, copied, or cleared.

- Use separate Memory Cards for backing up the other scene data and for saving and loading dictionary data.
- The same Memory Cards cannot be used with other application programs.
- Do not open the MMI Unit's Memory Card cover from the time "S.Scene" is selected until you return to the menu bar.

When an **F350-C41E IMP Unit** is used, a Memory Card is not required in order to switch, copy, and clear scenes.

The "S.Scene" menu allows switching of the scene number and editing scene data.



4-1-1 Selecting the Scene Number: S.Scene

"S.Scene" selects the scene number to display. The measurement conditions can be set for the specified scene number and the measurement performed according to the measurement conditions that have been set.

Initial Scene Number

The scene number displayed at start up is the same as the scene number displayed when the application program was previously shut down.

The factory default setting is Scene #0 and this scene number is displayed when the unit is first started.

If "A.Automatic execution" is turned on using "Y.System/M.Initial mode," the measurement screen will be displayed for the set scene number.

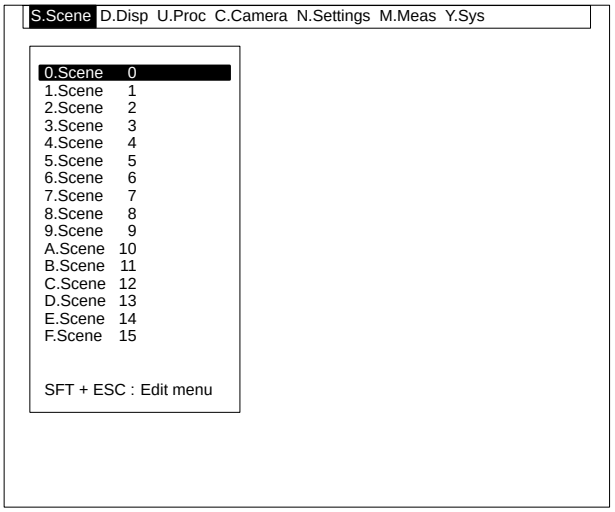
Refer to *4-26-1 Automatic Measurement*.

Displaying Scene Comments

If a comment is input for a scene, the comment is displayed instead of the scene number.

Refer to *4-1-4 Adding Comments to Scenes*.

Procedure Select the scene number. The selected scene will be displayed.



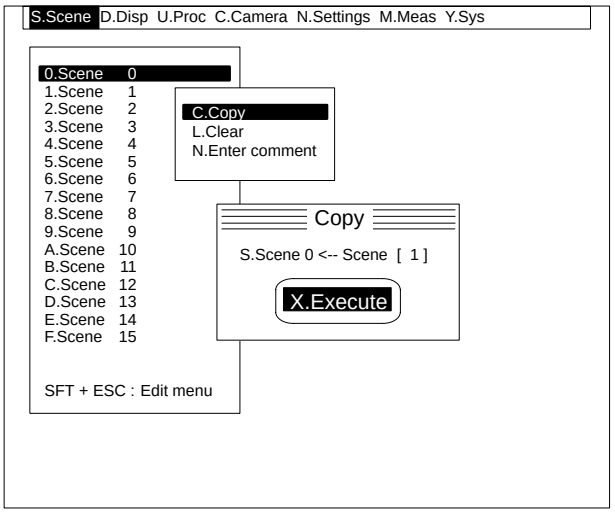
4-1-2 Copying Scene Data: C.Copy

"C.Copy" writes the scene data of the selected scene number to a different scene number. "C.Copy" provides a convenient method of re-using existing data when scenes have many conditions in common.

Procedure

1, 2, 3...

1. Move the cursor to the copy destination scene number and press the Shift and Escape Keys.
2. Select "C.Copy."
3. Input the copy source scene number.



4. Select "X.Execute." The scene data will be copied from the copy source scene number to the copy destination scene number.

Important Copying scene data can take a long time if many measurement models are registered or if the model regions are large. Do not, however, turn off the power during a copy operation as this may destroy the data. If this occurs, clear the set data and restart the system.

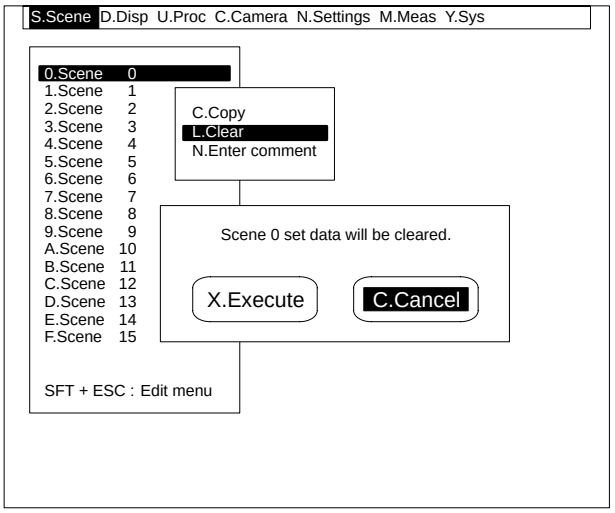
4-1-3 Clearing Scene Data: L.Clear

"L:Clear" sets the scene data for the selected scene number to the initial default data. Clearing existing data with this instruction is recommended before setting new scene data.

Procedure

1, 2, 3...

1. Move the cursor to the scene number to be cleared and press the Shift and Escape Keys.
2. Select "L.Clear." A confirmation message will be displayed.



3. Check to see that the selected scene number is highlighted and then select "X.Execute." All scene data for the selected scene number will revert to the initial default data.

4-1-4 Adding Comments to Scenes: N.Enter Comment

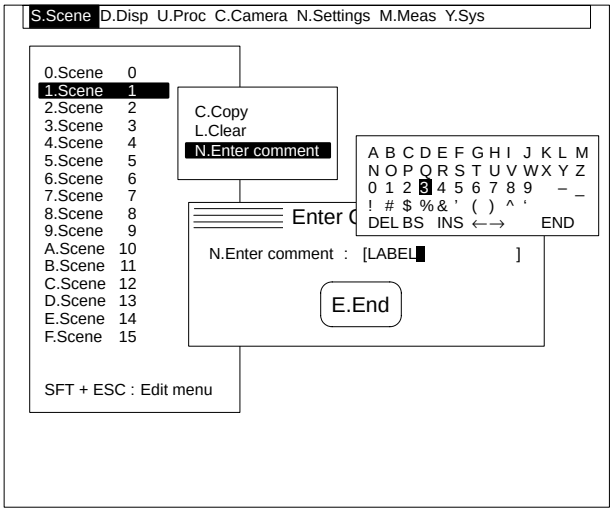
"N.Enter comment" can be used to add comments to scenes. Comments, such as the item being measured, can be used as a scene title.

The comment can be up to ten characters long.

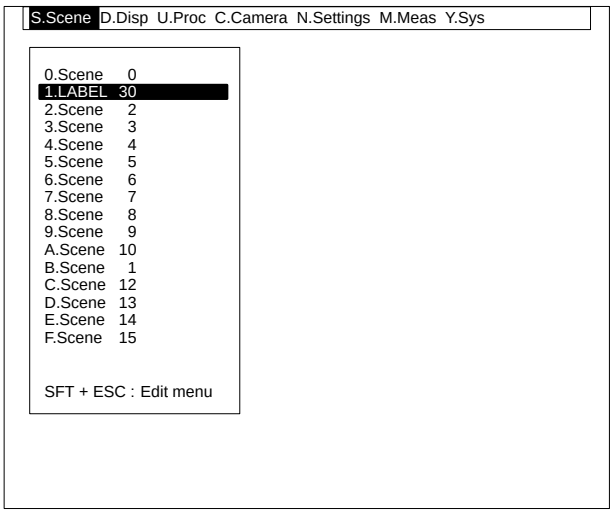
Procedure

1, 2, 3...

1. Move the cursor to the scene number for which a comment is to be entered and press the Shift and Escape Keys.
2. Select "N.Enter comment."
3. Enter the comment.



4. Select “E.End.” The comment will be displayed instead of the scene number.



4-2 D.Display

“D.Display” can be used to set the method for displaying images on the Video Monitor. Select a display method that is useful for setting scene data and monitoring measurement status.

F.Freeze	Selecting the Image Display Method	Page 37
I.Input image	Inputting Images	Page 38
P.Input image after posi cmp	Inputting Images After Position Compensation	Page 39

4-2-1 Selecting the Image Display Method: F.Freeze

There are two methods for displaying images: static (freeze) and dynamic (unfreeze). When unfreeze is selected, images from the camera are displayed as is. Select unfreeze when focusing the camera and adjusting images.

When freeze is selected, images are displayed as static images. Select freeze for displaying as static images the measured images of objects moving at high speed, or for setting data while observing a static image.

There are two methods for displaying static images. One way is to freeze the camera image just as it is, and the other way is to freeze the image after position compensation. For more information, refer to *4-2-2 Inputting Images* and *4-2-3 Inputting Images After Position Compensation*.

Using Strobes

When unfreeze is selected, strobes flash continuously. When freeze is selected, strobes flash simultaneously with the inputting of images.

Timing of Inputting Images

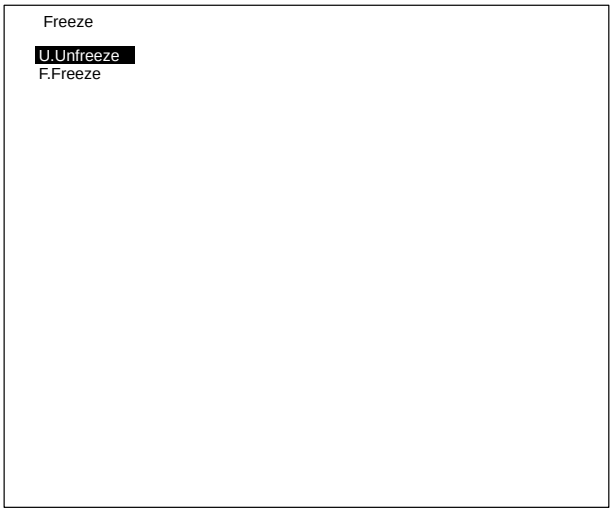
Static (freeze) images are updated when the following functions are executed:

- Start-up
- The scene number is switched using“S.Scene.”
- The image is input using “D.Display/I.Input image.”
- The image is input using “D.Display/P.Input image after position compensation.”
- The camera number is switched using “C.Camera.”
- A measurement is executed using “M.Measure/O.Measure monitor.”
- A measurement is executed using “M.Measure/O.Measure.”

Procedure

1, 2, 3...

1. Select “F.Freeze.”
2. Select the display method. If “F.Freeze” is selected, the image at the time “F.Freeze” was selected will be displayed.



4-2-2 Inputting Images: I.Input Image

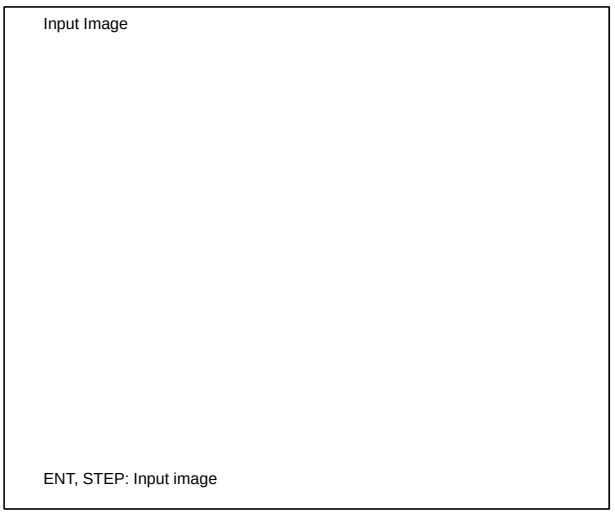
“I.Input image” displays camera images as static just as they are (i.e., without position compensation). The timing for inputting images can be specified by pressing the Enter Key or using the STEP signal. Images are input simultaneously with the pressing of the Enter Key or inputting of the STEP signal, and the static (freeze) image is displayed. The display method is automatically set to “F.Freeze.”

For information on displaying images after position compensation, refer to *4-2-3 Inputting Images After Position Compensation*.

Procedure

1, 2, 3...

1. Select “I.Input image.” The dynamic (unfreeze) image will be displayed.
2. Press the Enter Key or turn ON the STEP signal. The static (freeze) image will be displayed.



4-2-3 Inputting Images After Position Compensation: P.Input Image After Position Compensation

"P.Input image after position compensation" displays as static (freeze) images the image after position compensation in either of the following circumstances:

1. When position compensation is set for the same camera number up to the process number that is currently displayed.
2. When position compensation is set for the process number that is currently displayed.

The timing for inputting images can be specified by pressing the Enter Key or using the STEP signal. Set the position compensation function in advance. For details, refer to *4-23 P.Position Compensation*.

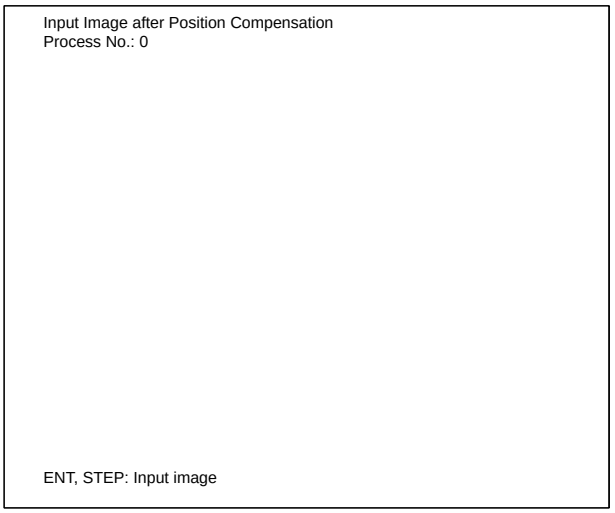
Images are input simultaneously with the pressing of the Enter Key or the inputting of a STEP signal, and the static (freeze) images are displayed. The display method is automatically set to"F.Freeze."

If the measurement object's position and inclination are not fixed, first display the static (freeze) image after position compensation and then set the measurement conditions.

Procedure

1, 2, 3...

1. Select "I.Input image." The dynamic (unfreeze) image and the process number for which position compensation is to be executed will be displayed.
2. Press the Enter Key or turn ON the STEP signal. The static (freeze) image will be displayed.



4-3 U.Process

The Application Program contains three measurement items, which are used in combination to perform actual inspections. "U.Process" is used to set up measurement items as processes for execution by performing the following:

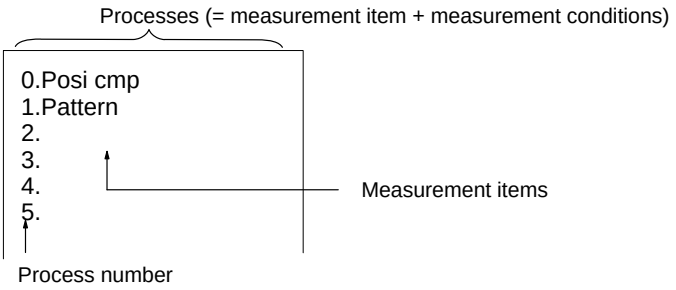
- Set the order in which measurement items are to be executed by assigning them to process numbers.
- Switch the measurement item displayed on the menu bar.

You must switch to the process for the desired measurement item before measurement conditions can be set for the measurement item.

For details on the measurement items that can be set, refer to *2-2 Starting and Quitting an Application Program*.

4-3-1 Setting Measurement Items: U.Process

"U.Process" is used to set the order in which to execute measurement items by allocating the desired measurement items to process numbers 0 to F. When a measurement instruction is input, the measurement items assigned to process numbers 0 to F are executed in order beginning with the lowest process number. Any process number for which no measurement item is set will be skipped.

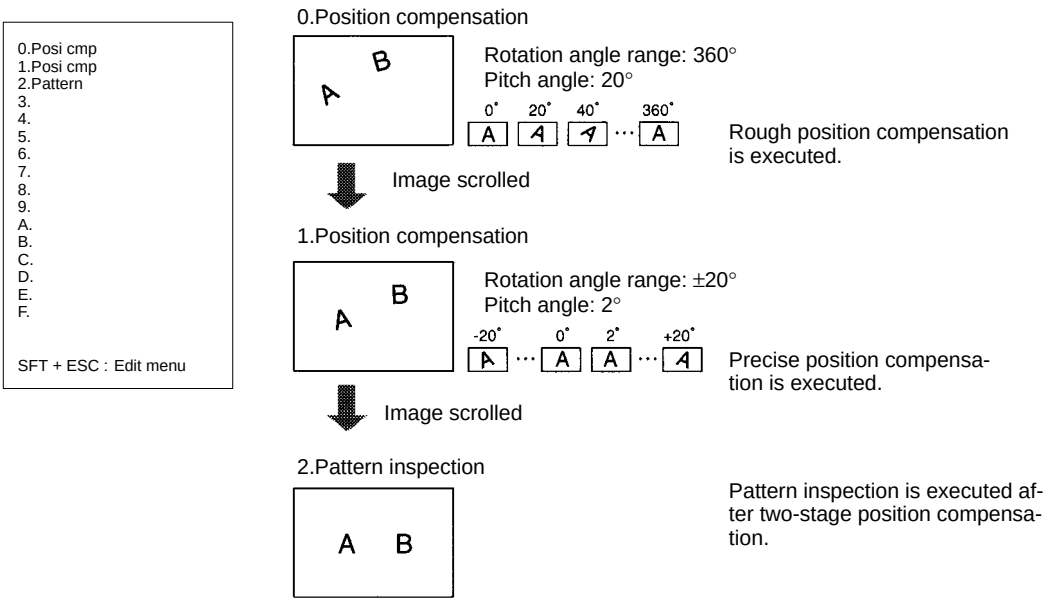


In the above example, pattern inspection is executed after position compensation.

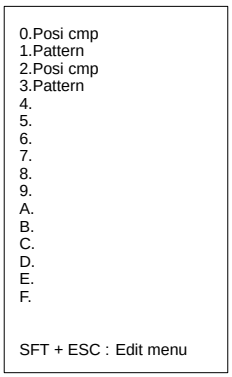
Up to 16 processes can be set per screen.

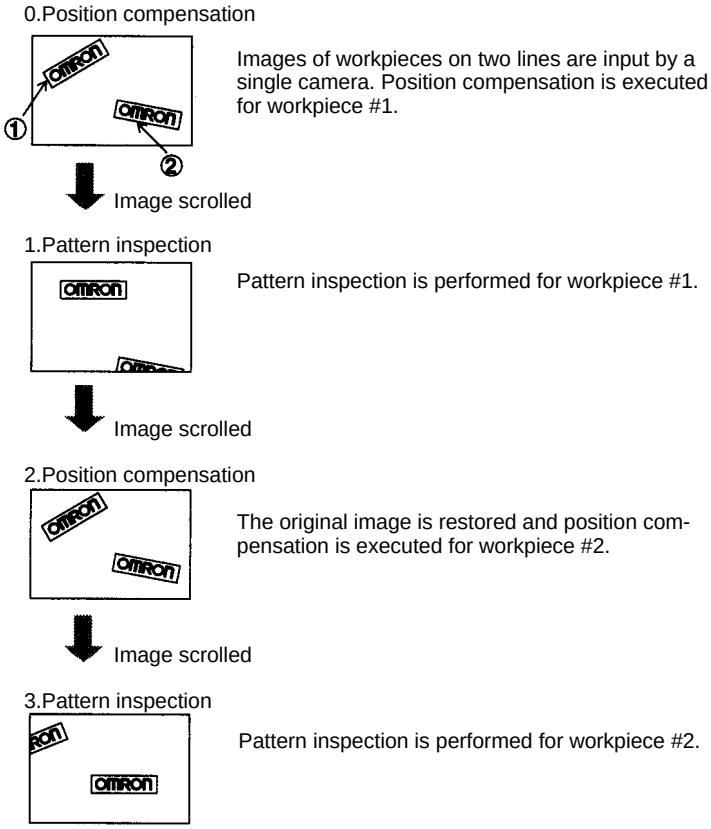
Example:

Two stages of position compensation can be executed for a single camera. When it is necessary to inspect a large range of rotation, two-stage position compensation can be used to reduce the number of registered rotation models, enabling faster position compensation. Refer to the example in the following illustration.



When images of multiple workpieces are input by a single camera, position compensation can be executed for the respective workpieces. Refer to the example in the following illustration.





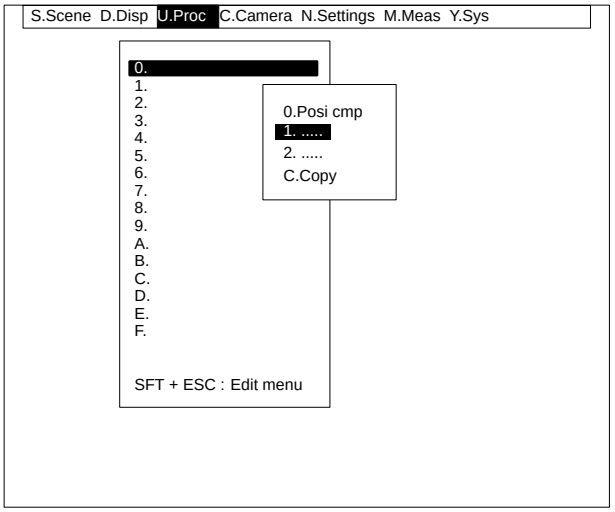
Procedure

1, 2, 3...

1. Move the cursor to the process number for which the measurement item is to be set, and press the Shift+Escape Keys. The measurement items will be displayed.

   If a process number for which a measurement item is already set is selected, a message will be displayed to confirm that the previously setting should be cleared. To set a different measurement item for that number, execute the “clear” operation.

2. Select the measurement item to be used for measurement.



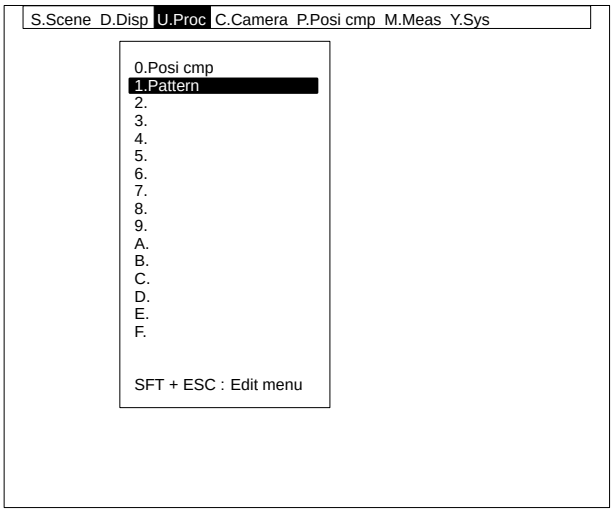
The measurement time per scene can be shortened by consecutively setting processes with the same camera number, filtering, and background suppression level. The measurement time also varies with the order of measurement items if the measurement items include surface defect inspection B. The measurement time can be shortened by setting surface defect inspection B as the last process number. Refer to *4-25-1 Entering Measurement Screens*.

4-3-2 Switching Processes: U.Process

"U.Process" is used to select the process to be displayed on the menu bar. The measurement conditions and other settings can then be set for the measurement item that is displayed.

Procedure

Select the process number to be switched. The measurement item for the selected process will be displayed on the menu bar.



4-3-3 Copying Measurement Item Settings: C.Copy

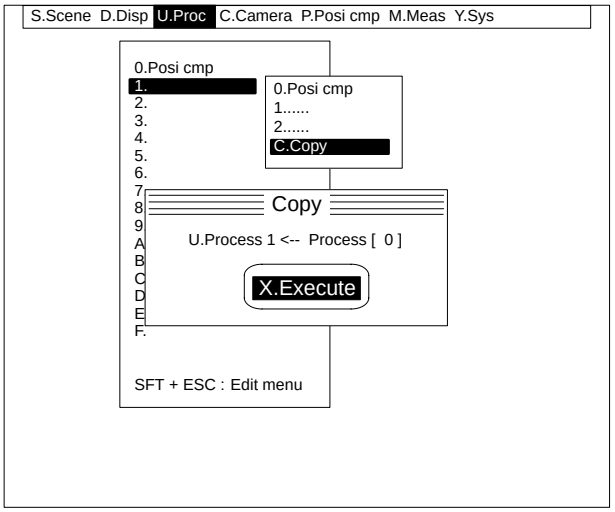
"C.Copy" copies the setting of a specified process number to another process number. In cases where there are a lot of conditions in common between processes, it is convenient to copy process data that has already been created.

Procedure

1, 2, 3...

1. Move the cursor to the process number of the copy destination and press the Shift+Escape Keys.
2. Select "C.Copy."
3. Enter the process number of the copy source.

4. Select “X.Execute.” The data will be copied from the copy source to the copy destination.



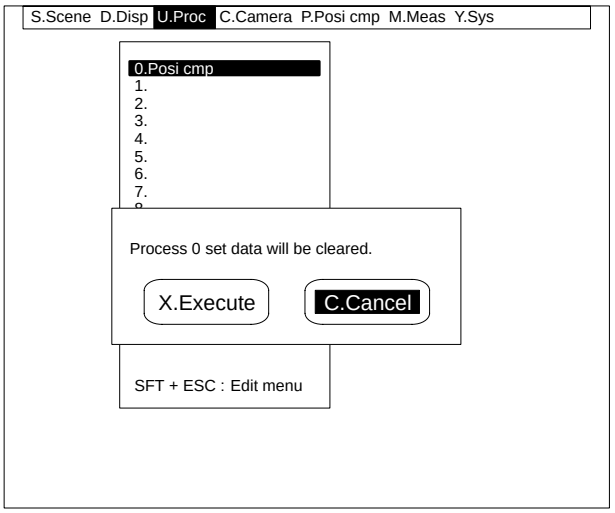
4-3-4 Clearing Measurement Item Settings: U.Process

“U.Process” is also used to clear all setting for the specified process number. In order to set a different measurement item for a particular process number, it is first necessary to clear any measurement item that may already be set for that number.

Procedure

1, 2, 3...

1. Move the cursor to the process number to be cleared, and press the Shift+Escape Keys. A confirmation message will be displayed.
2. Check the process number again, and then select “X.Execute.” All of the data that has been set for that number will be cleared.



4-4 C.Camera

"C.Camera" can be used to select the camera number and set data related to the displayed image of the measured object.

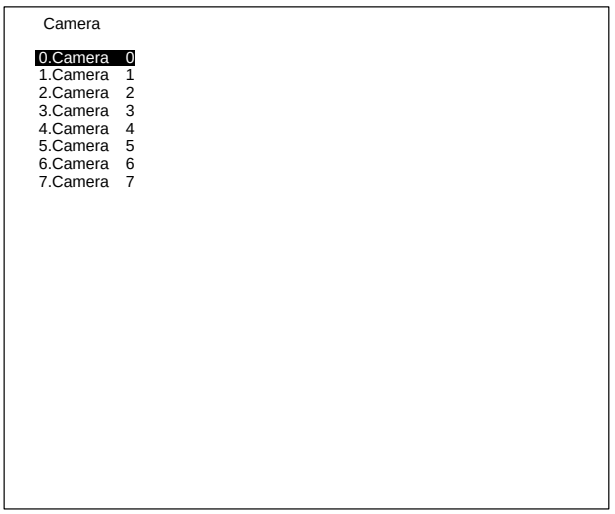
4-4-1 Selecting the Camera Number: C.Camera

"C.Camera" is used to select the camera number for the currently displayed process. A camera number can be selected for each process number.

Procedure

1, 2, 3...

1. Select "C.Camera."
2. Select the camera number. The image from the selected camera number will be displayed.



4-4-2 Selecting Filtering: F.Filtering

"F.Filtering" is used to process the camera image into an image more suitable for measurement. Select a filtering function that matches the environment and required measurement.

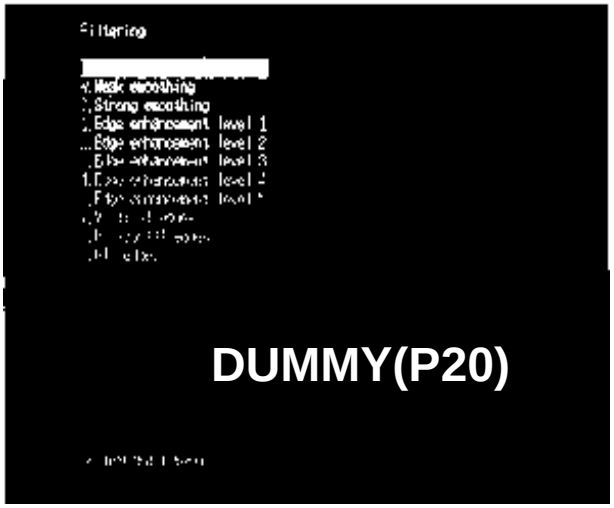
If filtering is specified for a particular camera number, the filtered image is always displayed for that camera number.

If more than one camera is used, filtering can be set individually for each camera.

Important Correct measurement is not possible if the filtering and background suppression levels used during measurement are different from those used that were used when the model was registered. When setting the filtering and background suppression levels for the measurement object, set the filter and background suppression levels for each camera number before registering models. Do not change the filtering after registering the models.

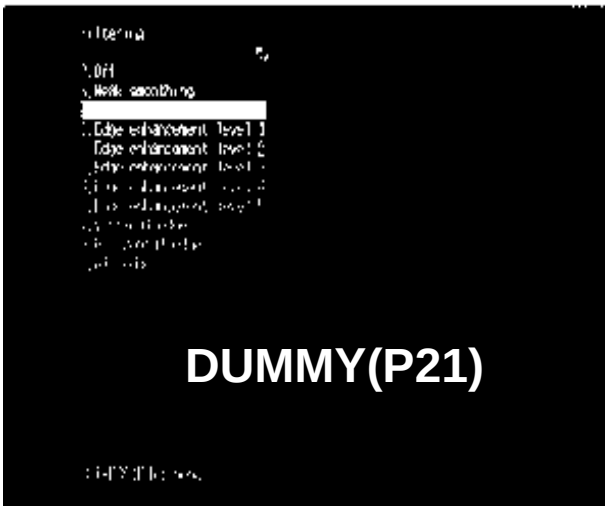
OFF

No filtering. The raw image is displayed.



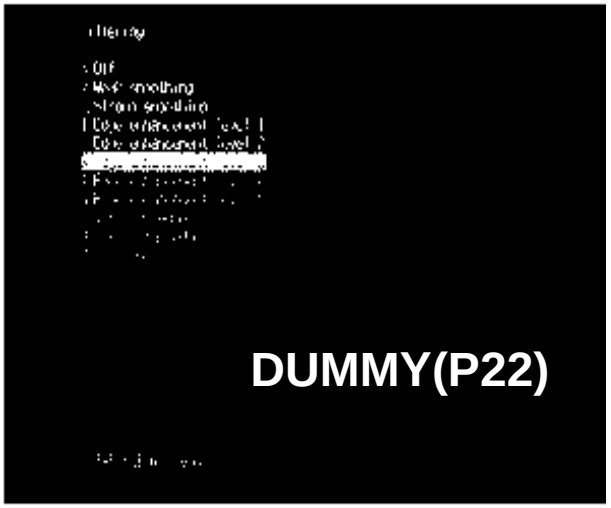
Smoothing

Displays a smoothed image with noise suppressed. Smoothing allows suppression of the effects of uneven lighting due to scratches, patterns, or roughness of the surface. Select either weak or strong smoothing.



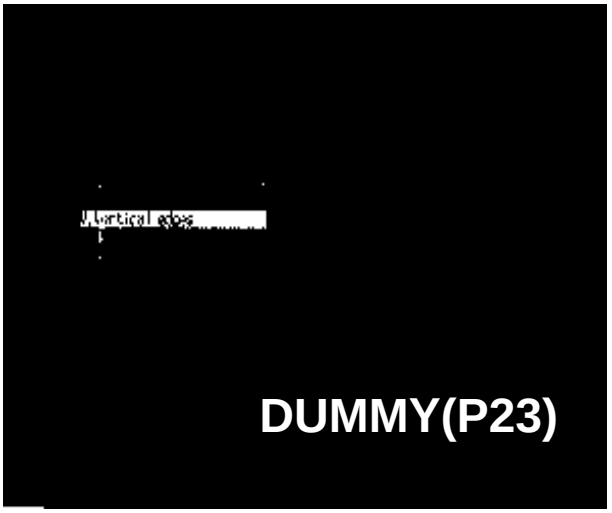
Edge Enhancement

Displays an image with enhanced edges between bright and dark regions. Select the degree of edge enhancement from 1 to 5. Edge enhancement 5 is stronger than edge enhancement 1.



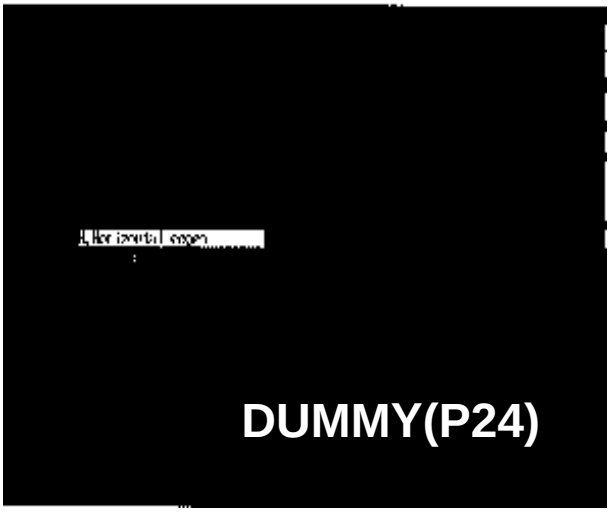
Vertical Edges

Displays an image of only the vertical edges between bright and dark regions.

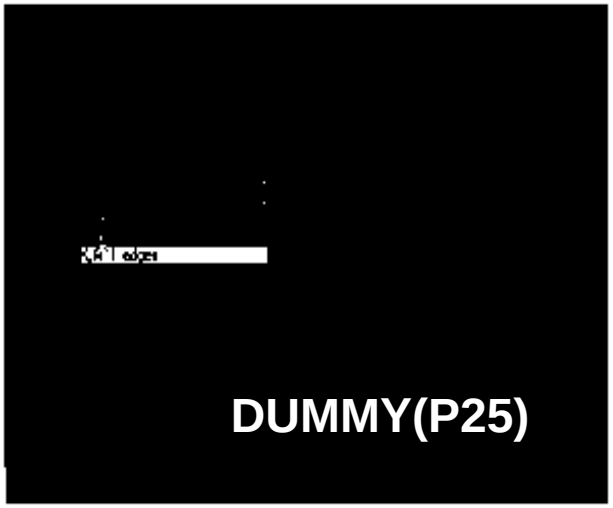


Horizontal Edges

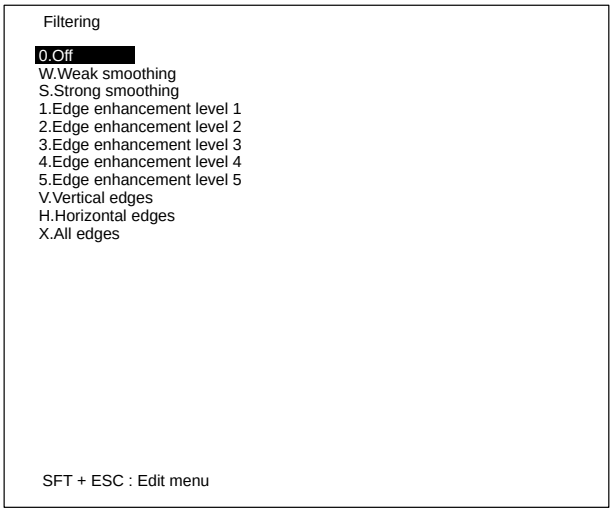
Displays an image of only the horizontal edges between bright and dark regions.



All Edges Displays an image of all edges between bright and dark regions.



Procedure Select “F.Filtering.” The image will be displayed using the filtering at the cursor position. Set the filtering for the displayed camera number.



Copying Filter Settings

The filter settings for a specified process number can be copied to the process number that is currently displayed.

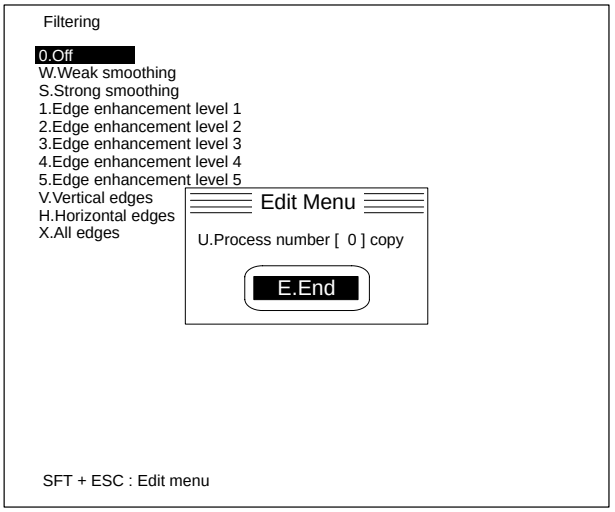
Note The measurement time per scene can be shortened if processes with the same camera number, filtering, and background suppression level are set consecutively. The measurement time also varies with the order of measurement items if the measurement items include surface defect inspection B. The measurement time can be shortened by setting surface defect inspection B as the last process number. Refer to *4-25-1 Entering Measurement Screens*.

Procedure

1, 2, 3...

1. Select “F.Filtering.”
2. Press the Shift+Escape Keys. The Edit menu will be displayed.
3. Enter the copy source process number.

4. Select “E.End.” The copy source filter settings will be copied.



4-4-3 Setting Background Suppression Levels: B.BGS Level

“B.BGS level” changes images with densities below the lower limit to 0, and densities above the upper limit to 255. Images with densities between the lower and upper limits are graded from 0 to 255.

Noise can be eliminated by converting the background of the object being read to specific densities.

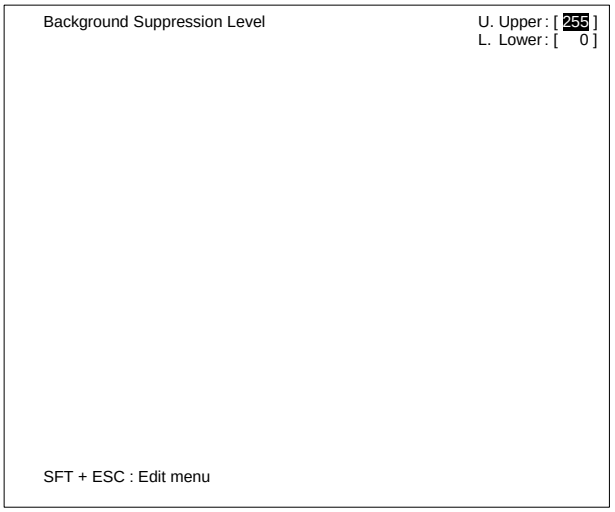
Important Correct measurement is not possible if different background suppression levels are used during measurement than those used when the model data was registered. Do not change the background suppression level after registering the models.

Key input	Action
▲/▼	Select the upper and lower limits.
◀ / ▶	Change the numbers.

Procedure

1, 2, 3...

1. Select “B.BGS level.”
2. Set the upper and lower limits.
3. Press the Enter Key. The upper and lower limits will be set.



Copying the Background Suppression Level

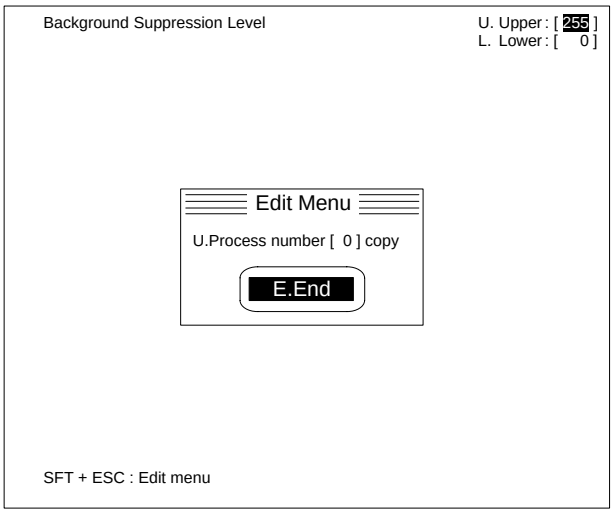
The background suppression level for a specified process number can be copied to the process number that is currently displayed.

Note The measurement time per scene can be shortened if processes with the same camera number, filtering, and background suppression level are set consecutively. The measurement time also varies with the order of measurement items if the measurement items include surface defect inspection B. The measurement time can be shortened by setting surface defect inspection B as the last process number. Refer to *4-25-1 Entering Measurement Screens*.

Procedure

1, 2, 3...

1. Select “B.BGS level.”
2. Press the Shift+Escape Keys. The Edit menu will be displayed.
3. Enter the copy source process number.
4. Select “E.End.” The copy source background suppression level setting will be copied.



4-4-4 Setting Calibration Data: A.Calibration

“A.Calibration” converts inspection results (pixel measurements) into physical units such as mm. Set the calibration data for making this conversion. Refer to the following table for the default values of calibration data.

Parameter	Default value
Field of view	512 (W) x 484 (H)
Magnification	1 (1 mm/pixel)
Coordinate system	Left-handed system
Origin of physical coordinates (0, 0)	Screen coordinates (0, 0)
Camera angle	0°

Different calibration data can be set for each camera according to the field of view. Select a camera number before setting calibration data. Refer to *4-4-1 Selecting the Camera Number*.

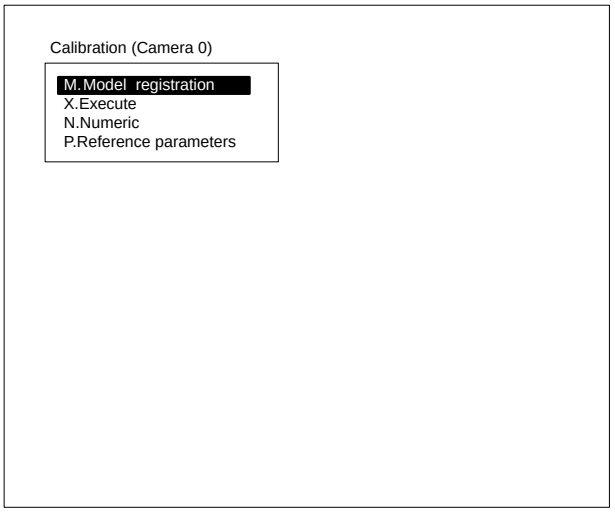
Registering Calibration Models

Set a rectangular region containing a mark (an image with a feature) as the calibration model. The physical coordinates of the mark must be known. The rectangular region is called a “model frame.” Move the mark to two or more positions and input the physical coordinates of the positions to set the calibration data. The position where the physical coordinates are input is called the “reference point.” Calibration models need not be registered if calibration data is set with the “A.Calibration/N.Numeric input” menu.

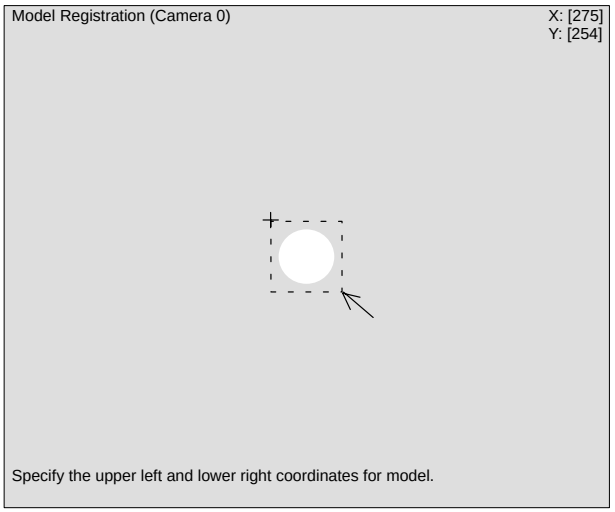
Procedure

1, 2, 3...

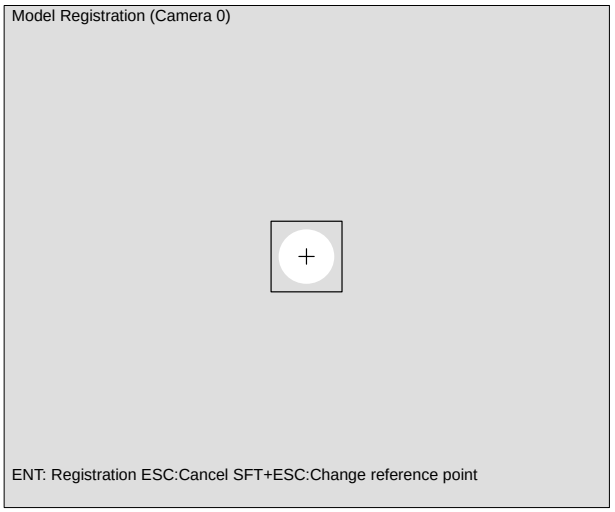
1. Select “A.Calibration.”
2. Select “M.Model registration.” A dotted box and an arrow cursor will be displayed.



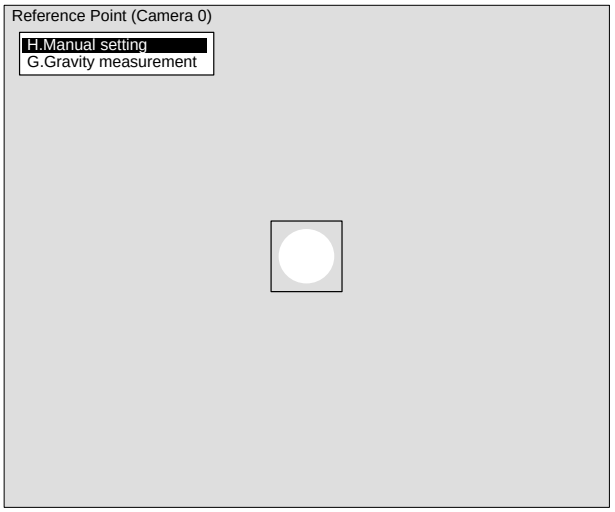
3. Specify the top-left corner coordinates of the model frame.
4. Specify the bottom-right corner coordinates of the model frame.



5. Specify the reference point. Press the Enter Key to locate the reference point in the center of the model frame. The image in the model frame will be registered as the calibration model. To change the reference point, go to step 6.

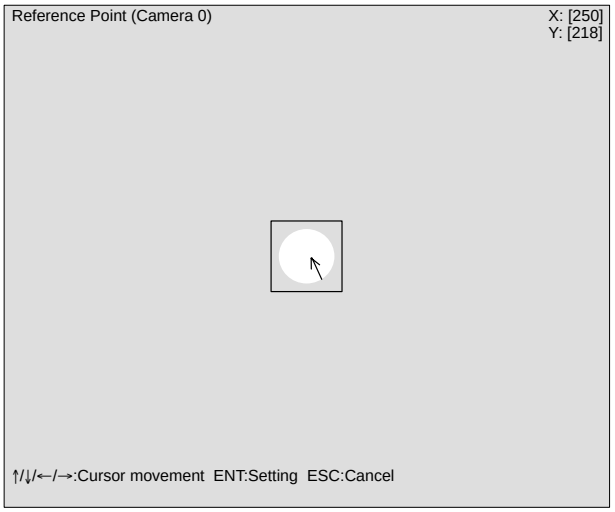


6. Press the Shift+Escape Keys. To specify a point in the model frame as a reference point, perform steps 7 to 9. To specify the center of gravity of the mark as a reference point, go to step 10.
7. Select “H.Manual setting.”

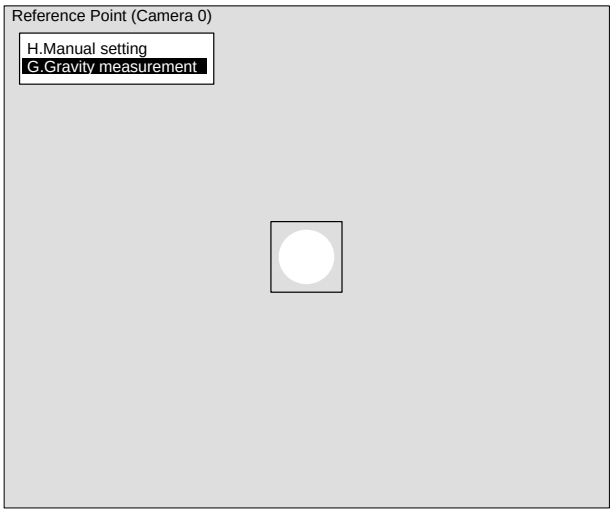


8. Move the cursor to specify the point.

9. Press the Enter Key. The image in the model frame will be registered as the calibration model and the specified point will be used as the reference point.

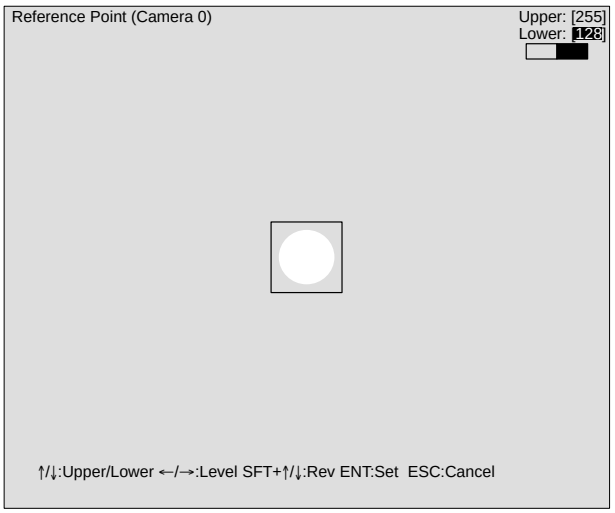


10. Select “G.Gravity measurement.”

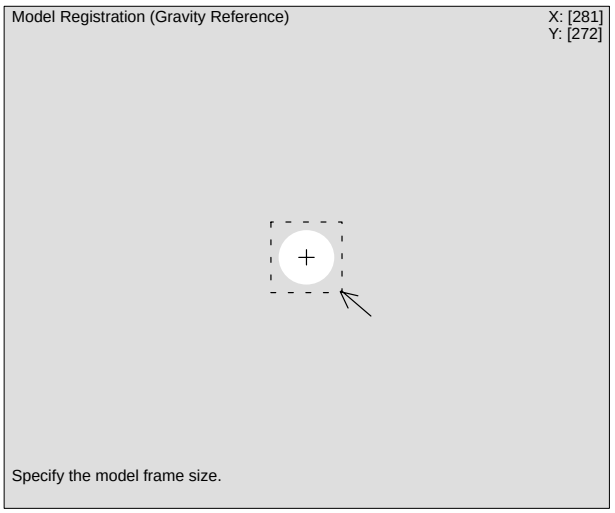


11. Set the binary level to make the mark white.

12. Press the Enter Key. The center of gravity will be measured, and the model frame will be moved so that the center of gravity is in the center of the model frame.



13. Specify the size of the model frame on the basis of the center of gravity.
14. Press the Enter Key. The image in the model frame will be registered as the calibration model and the center of gravity of the mark will be used as the reference point.



Setting Calibration Data

The following three methods can be used for setting calibration data. The latest calibration data overwrites the previous calibration data.

Sampling

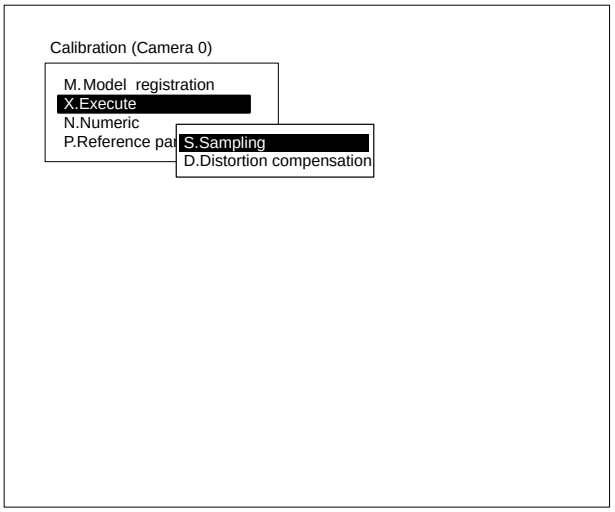
Search within a search region for an image that has the same pattern as the pattern of the calibration model, and display a cursor in the reference point of the image so that the physical coordinates of the reference point can be input. Move the mark for sampling in two or more positions.

Procedure

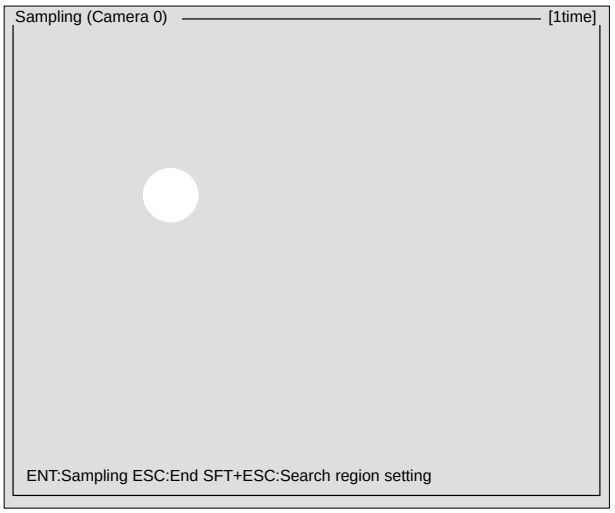
1, 2, 3...

1. Select “A.Calibration.”
2. Select “X.Execute.”

3. Select “S.Sampling.”

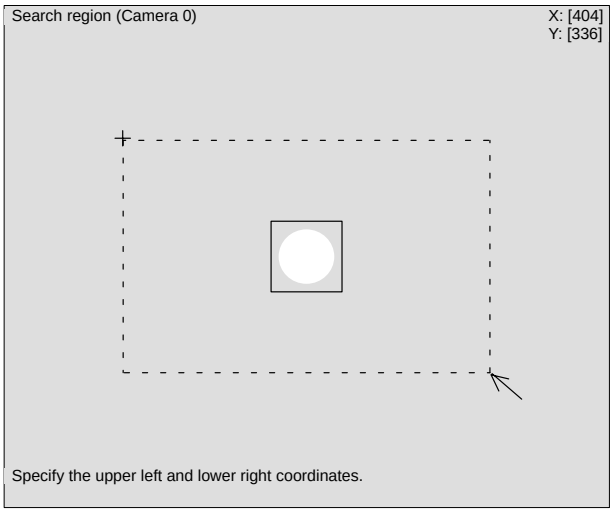


4. Move the workpiece so that the mark will be displayed in the search region. Follow the procedures in steps 5 and 6 to change the search region. If there is nothing to be changed, go to step 7.



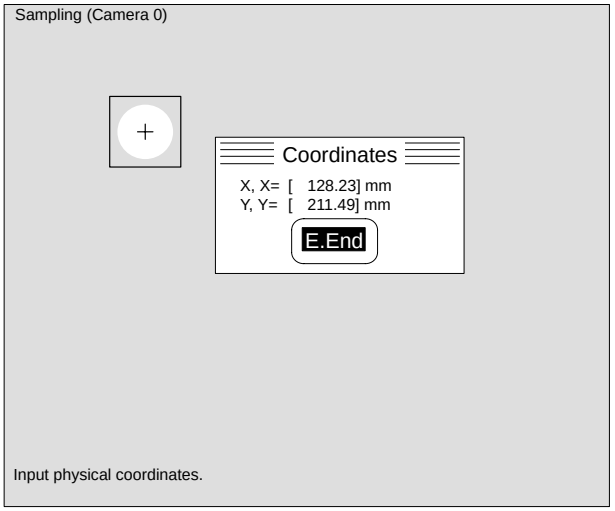
5. Press the Shift+Escape Keys.

6. Specify the coordinates at the top-left and bottom-right corners of the search region.



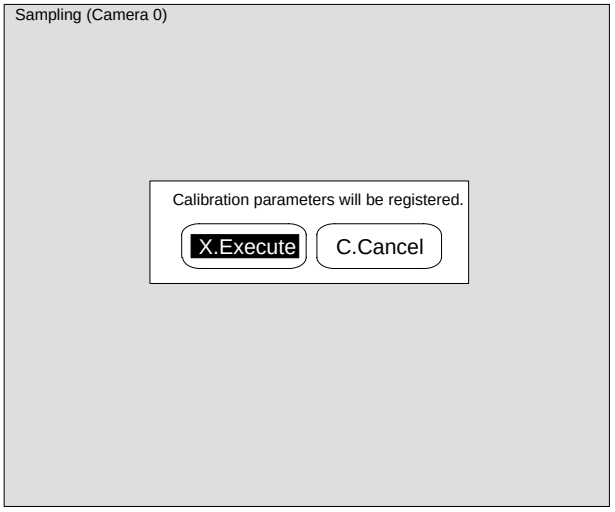
7. Press the Enter Key. Sampling will be executed, a cursor will be displayed in the reference point of the image, and the coordinates menu will be displayed.
8. Set the physical coordinates of the reference point and select “E.End.” To execute sampling in two or more positions, repeat steps 4 to 8.

   Sampling is possible in a maximum of 15 positions with a calibration model. The larger the number of sampling operations is, the more precise calibration data will be.



9. Press the Escape Key. A confirmation message is displayed. The confirmation message is displayed automatically when sampling has been executed in 15 positions.

10. Select “X.Execute.”



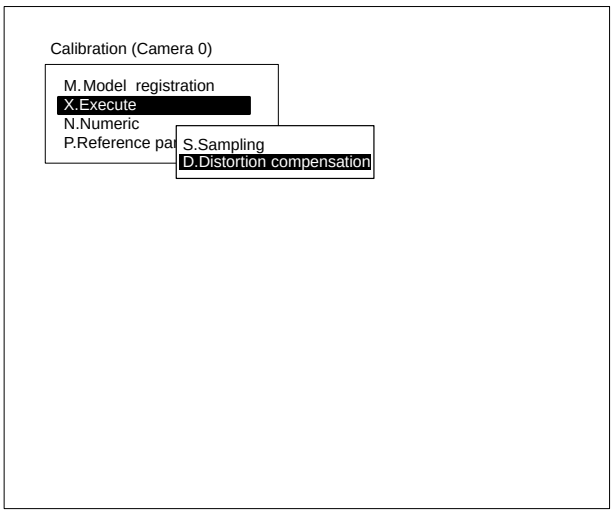
Distortion Compensation

Optical distortion, which is caused by irregularities in the lens, can be corrected with “D.Distortion compensation”. Select “D.Distortion compensation” to obtain more accurate calibration data.

Procedure

1, 2, 3...

1. Select “A.Calibration.”
2. Select “X.Execute.”
3. Select “D.Distortion compensation.” A rectangular region will be displayed at the top-left of the screen.

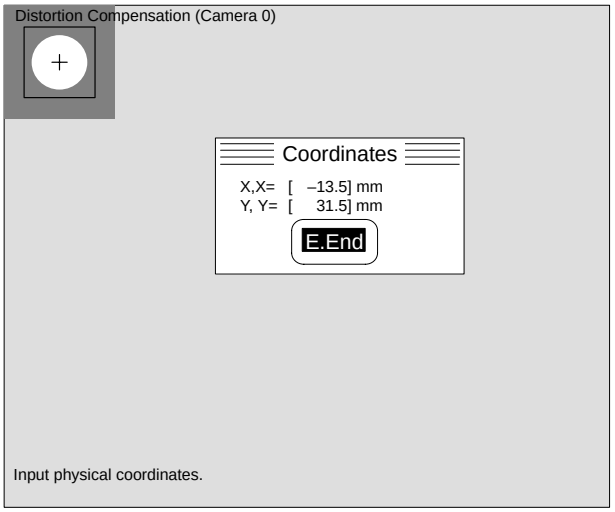


4. Move the workpiece so that the mark is displayed inside this rectangular region.

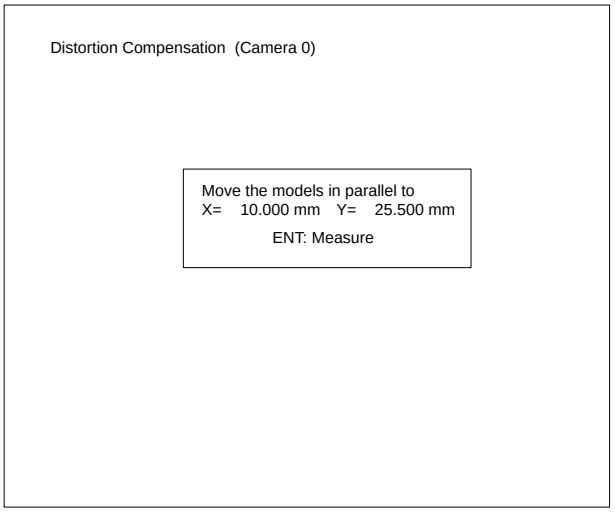
Important Move the workpiece horizontally and vertically only. Incorrect calibration data will result if the workpiece is rotated.

5. Press the Enter Key. A cursor will be displayed in the reference point of the mark, and the coordinates menu will also be displayed.
6. Set the physical coordinates of the reference point and select “E.End.” Similar rectangular regions will be displayed at the top-right and bottom-left of

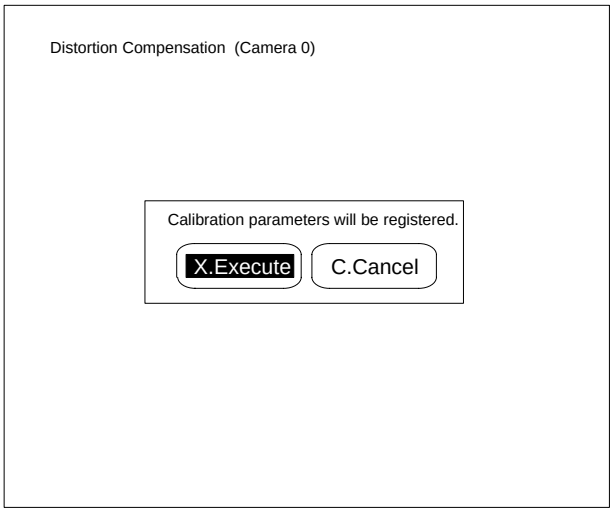
the screen. Repeat steps 4 to 6. A message will be displayed when the operation is complete.



7. Move the mark to the specified physical coordinate position.
8. Press the Enter Key. Repeat steps 7 and 8 as instructed in the messages that will be displayed. A confirmation message will be displayed when the input of all 25 positions is complete.



9. Select “X.Execute.”



Numeric

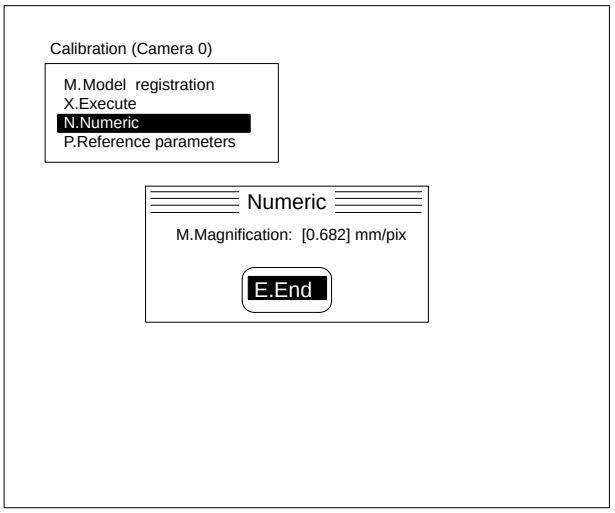
Input a value directly for the magnification. The magnification indicates the physical dimension per pixel. For example, if a length of 10 mm is displayed with 100 pixels on the screen, the magnification will be 0.1 (10 mm/100 pixels).

Parameters other than the magnification are set to default values. If calibration data has been set with sampling or distortion compensation, all the calibration data will be overwritten.

Procedure

1, 2, 3...

1. Select “A.Calibration.”
2. Select “N.Numeric.” The Numeric screen will be displayed.
3. Input the magnification within a range from 0.001 to 9.999.
4. Select “E.End.”



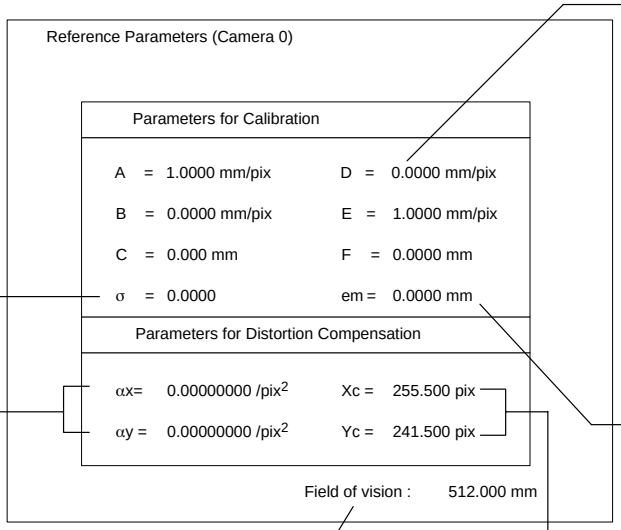
Checking the Calibration Data

Check the calibration data that has been set.

σ is the standard deviation of the errors. This standard deviation is calculated from the errors between the physical coordinates input when the calibration data was set and the coordinates converted using the conversion factors A to F.
The standard deviation is calculated using the following formula.

$$\sigma = \sqrt{\left[\sum_{i=1}^{N} \{(RXi - X'i)^2 + (RYi - Y'i)^2\}/N\right]}$$

Where,
Rxi, Ryi: the input physical coordinates (for i = 1 to N)
X'i, Y'i: the physical coordinates converted using the conversion factors (for i = 1 to N)
N: number of data points (no distortion compensation = 5, distortion compensation = 25)



A to F are the calculated conversion factors which are used to convert the camera coordinates to physical coordinates.
The converted coordinates are calculated using the following formula.

$$X' = A * X + B * Y + C$$
$$Y' = D * X + E * Y + F$$

Where,
X, Y: measured position in camera coordinate system (units: pixels)
X', Y': converted position in physical coordinate system (units: mm)

"em" is the maximum error.
The maximum error between the physical coordinates input when the calibration data was set and the coordinates converted using the conversion factors A to F.
The maximum error is calculated using the following formula.

$$em = MAX\left(\sqrt{(RXi - X'i)^2 + (RYi - Y'i)^2}\right)$$

Where,
MAX: function to output the maximum value achieved from 0 to N.
Rxi, Ryi: the input physical coordinates (for i = 1 to N)
X'i, Y'i: the physical coordinates converted using the conversion factors (for i = 1 to N)
N: number of data points (no distortion compensation = 5, distortion compensation = 25)

Xc: X coordinate of lens center
Yc: Y coordinate of lens center

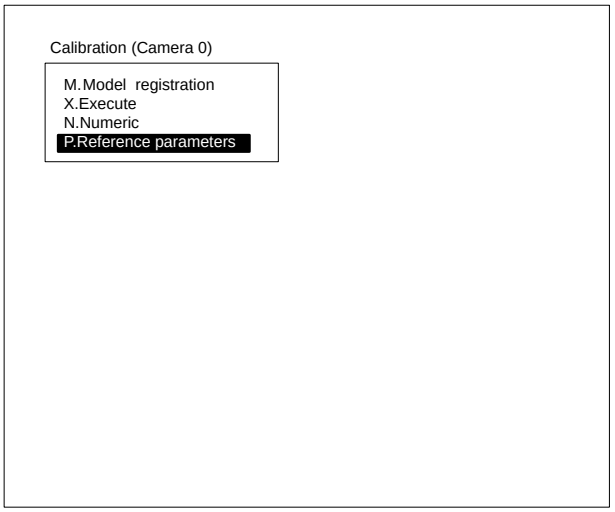
αX is the distortion coefficient in the X direction.
αY is the distortion coefficient in the Y direction.

The physical dimensions in the X direction of the field of view in millimeters (mm).

Procedure

1, 2, 3... 1. Select "A.Calibration."

2. Select “P.Reference parameters.” The parameter table of the calibration data for the currently displayed camera will be displayed.



■ Lead Inspection

Lead inspection appears on the menus as simply “L.Lead”.

“L.Lead inspection” inspects the pitch, width, and length of IC pins. It makes it possible to use a registered IC pin model to search for input images that have the same pattern as the IC pin model, and to judge whether the input images are OK or NG. The side of the IC package can be selected according to the object being inspected.

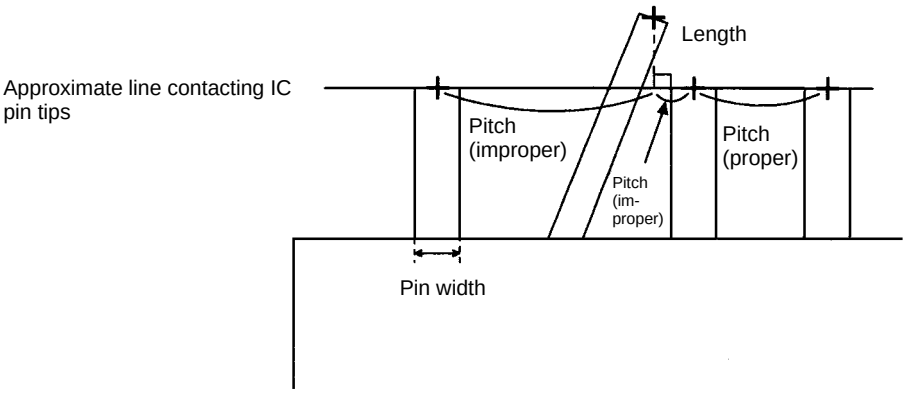
Lead inspection must be set for a process number before it can be used. Refer to *4-3 U.Process*.

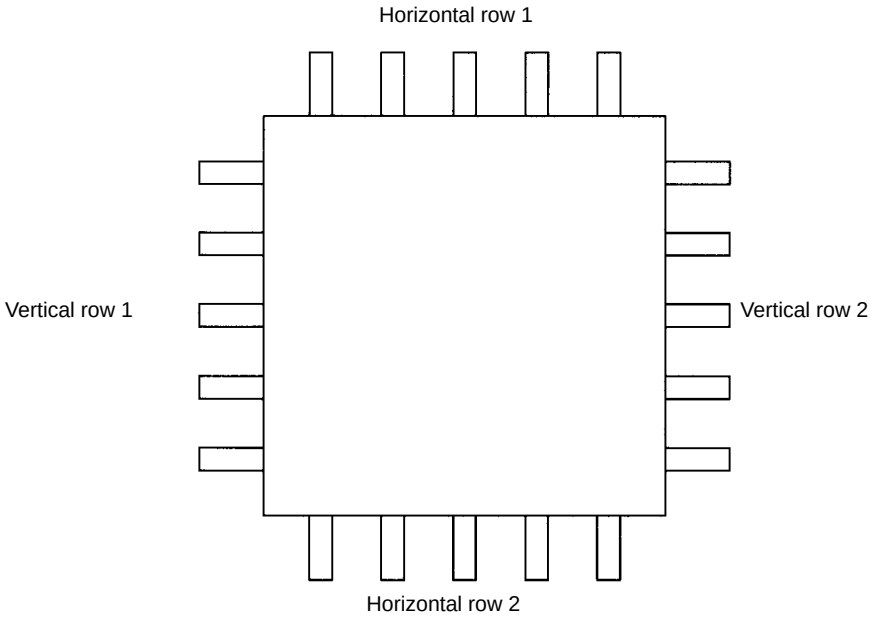
Select the camera number before setting the measurement conditions. Refer to *4-4-1 Selecting the Camera Number*.

4-5 L.Lead/I.Lead Condition

“I.Lead Condition” sets the IC pin pitch, width, and length for inspection together with inspection criteria.

Conditions	Details
P.Pin pitch	Used to set the IC pin pitch between 0.001 and 9.999 mm.
A.Pitch (±)	Used to set the IC pin pitch criteria (tolerance) between 0.001 and 9.999 mm.
W.Pin width	Used to set the IC pin width between 0.001 and 9.999 mm. This setting is necessary for automatic model registration and is not effective when models are registered manually.
B.Pin length (±)	Used to set the IC pin length criteria (tolerance) between 0.001 and 9.999 mm on the basis of the lengths of approximate lines contacting the coordinates of IC pin tips as models.
R.Correlation crit	Used to set the correlation criteria within between 0 and 100 so that areas which resemble the model are searched for in the input images. The correlation value of the area is compared with the criteria and judged OK or NG. • Pins whose correlation value is equal to or greater than the criteria will be judged OK. • Pins whose correlation value is less than the criteria will be judged NG. The criteria for the ideal sample will be 100.
1.Horizontal row 1 2.Horizontal row 2 3.Vertical row 1 4.Vertical row 2	Used to set the numbers of IC pins.

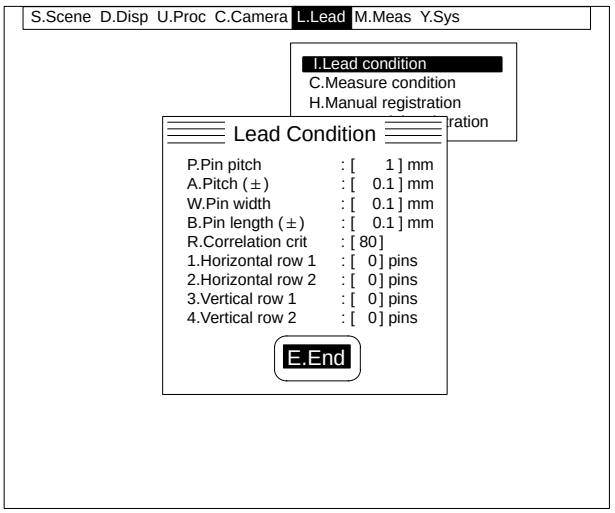




Procedure

1, 2, 3... 1. Set the conditions of IC. Set the data and criteria according to the type of IC to be inspected.

2. Select “E.End.”



4-6 L.Lead/C.Measure Condition

"C.Measure condition" sets measurement conditions according to the number of IC pins and the inspection precision. If the "P.Pitch" setting is changed, all models previously registered will be cleared.

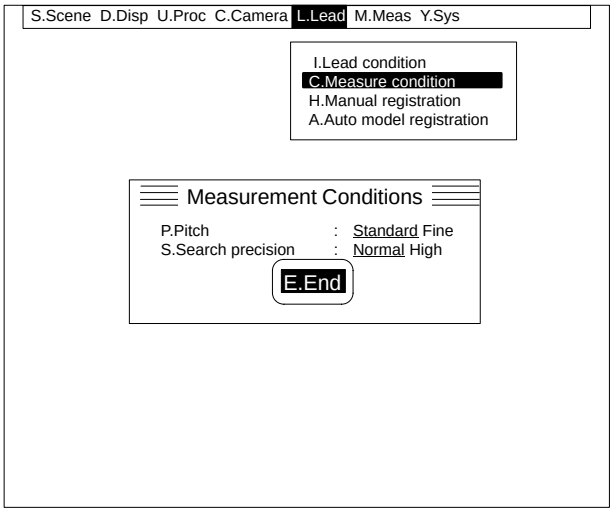
The required processing time can be checked. Refer to *4-9 M.Measure/O.Measure Monitor* and *4-25-1 Entering Measurement Screens*.

Conditions	Details
P.Pitch	Used to set the IC pin pitch for inspection. Set this item to fine if the IC to be inspected has more than 20 pins (the measurement time is longer).
S.Search precision	Used to select the precision for searching for models and obtaining the position of the model. This setting will not be effective when the IC pin pitch is set to fine. Normal: The position of the model is obtained in pixels. High: The position of the model is obtained in subpixels.

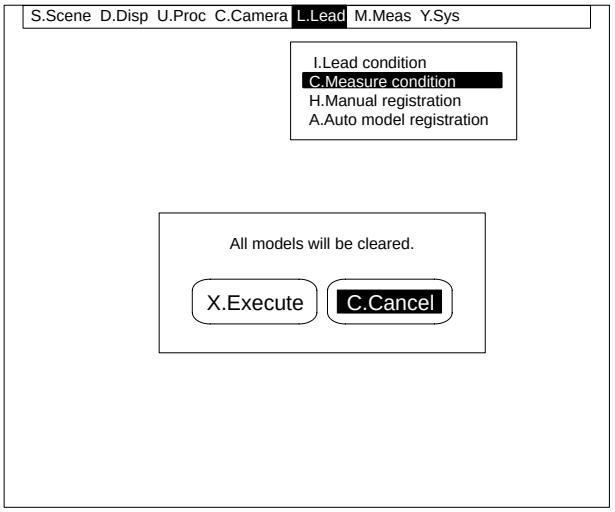
Procedure

1, 2, 3...

1. Set the measurement conditions. Set the measurement conditions according to the type of IC to be inspected.
2. Select "E.End." The measurement conditions will be set. If the P.Pitch setting is changed when models have been registered, a confirmation message will be displayed.



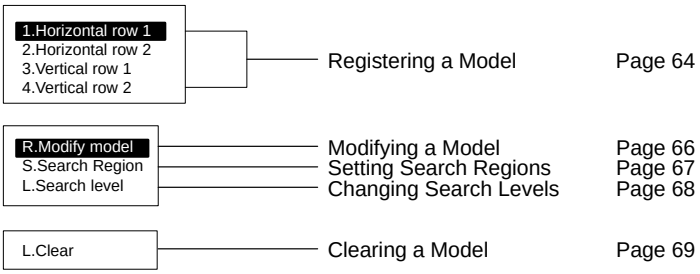
3. Select "X.Execute." The models will be cleared.



4-7 L.Lead/H.Manual Registration

"H.Manual registration" is used to register an IC pin pattern as a model. The model is used to search for input images that have patterns similar to the pattern of the model, to obtain IC pin pitches, lengths, and correlation values from the input images, and to judge whether the input image is OK or NG.

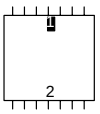
The required processing time can be checked. Refer to *4-9 M.Measure/O.Measure Monitor* and *4-25-1 Entering Measurement Screens*.



4-7-1 Registering a Model: H.Manual Registration

"H. Manual registration" registers a model. Registered models only are used in executing measurements. There are four rows for model registration. Of these rows only those for which models have been registered will be used for measurements. When the measurement command is input they will execute measurements.

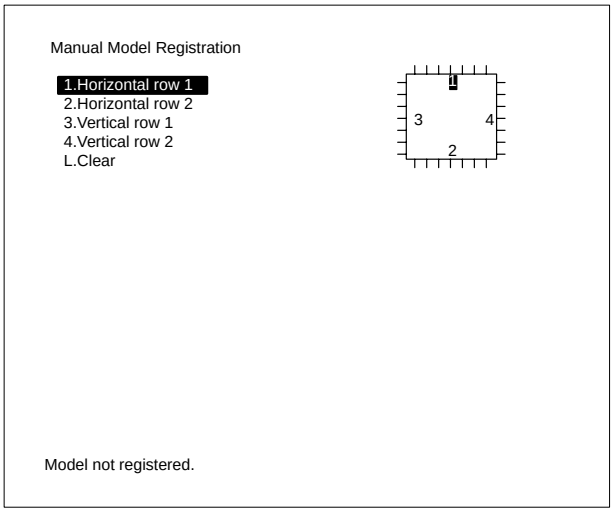
In the work piece in the following diagram, models have been registered for only Horizontal row 1 and Horizontal row 2.



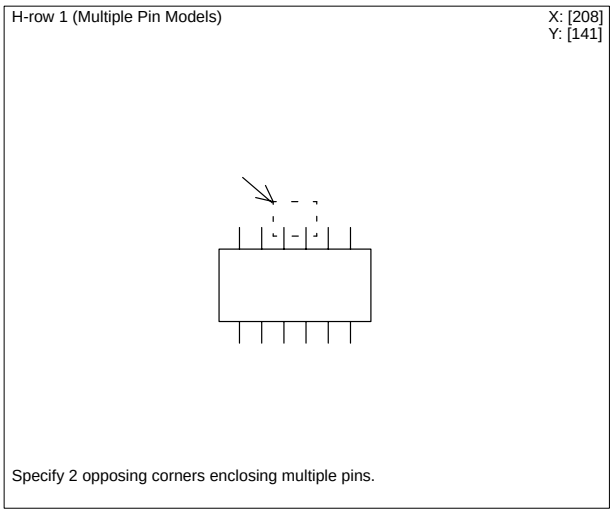
Important Correct measurement is not possible if different filtering and background suppression levels are used during measurement than those used when model was registered. Ensure that any required filtering and background suppression levels are set before registering the models. Refer to *4-4-2 Selecting Filtering* and *4-4-3 Setting Background Suppression Levels.*

Procedure

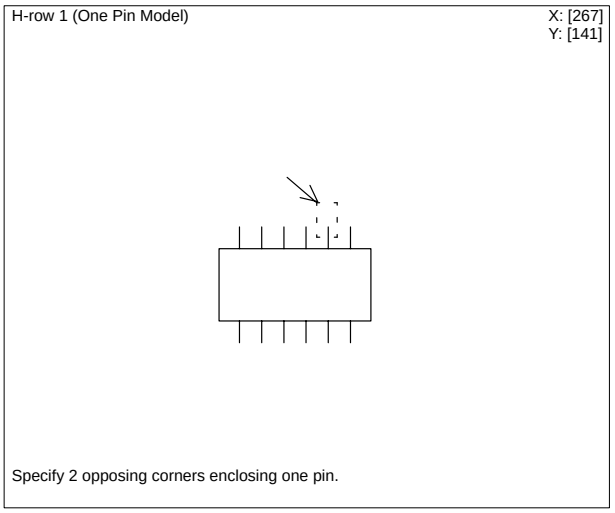
1, 2, 3... 1. Select the row. If P.Pitch has been set to fine with the "L.Lead/C.Measure condition" item, follow steps 2 and 3 to register multiple pin models. If "P.Pitch" has been set to standard, go to step 4.



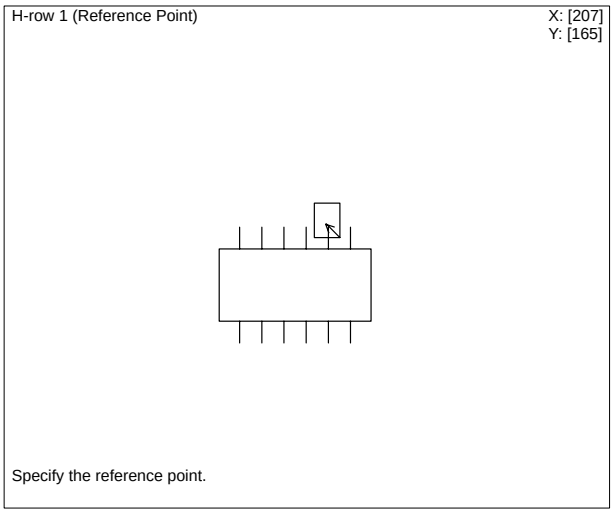
2. Specify the top-left corner coordinates of a frame that encloses the multiple IC pins.
3. Specify the bottom-right corner coordinates of the frame.



4. Specify the top-left corner coordinates of a frame that encloses a single IC pin.
5. Specify the bottom-right corner coordinates of the frame.



6. Specify the reference point. For measurement, specify the position to be detected.



Important Do not turn off the power during model registration. If power is turned off during model registration, memory contents will be destroyed and the F350 will malfunction when it is turned on again.

4-7-2 Modifying a Model: R.Modify Model

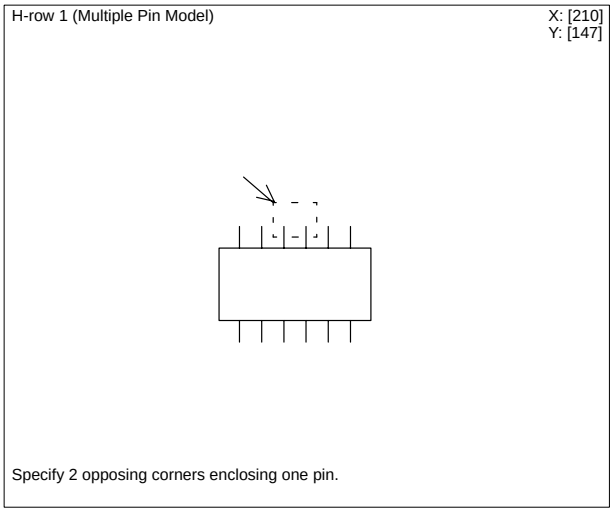
"R.Modify model" modifies models. Registered models and their search regions are displayed when the cursor is moved to row numbers.

Important Correct measurement is not possible if different filtering and background suppression levels are used during measurement than those used when model was registered. Ensure that any required filtering and background suppression levels are set before registering the models. Refer to *4-4-2 Selecting Filtering* and *4-4-3 Setting Background Suppression Levels.*

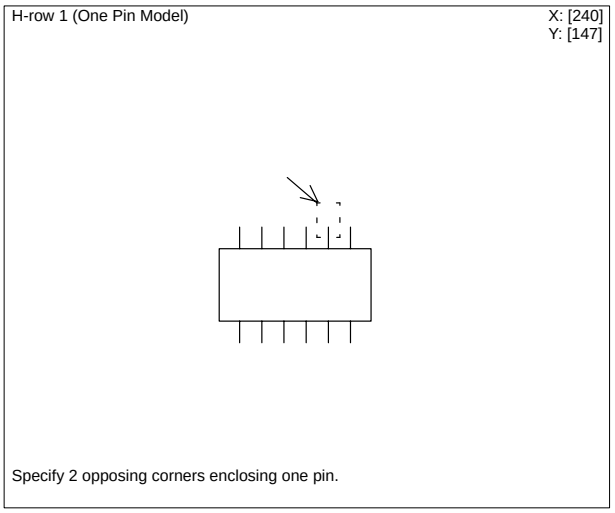
Procedure

1, 2, 3...

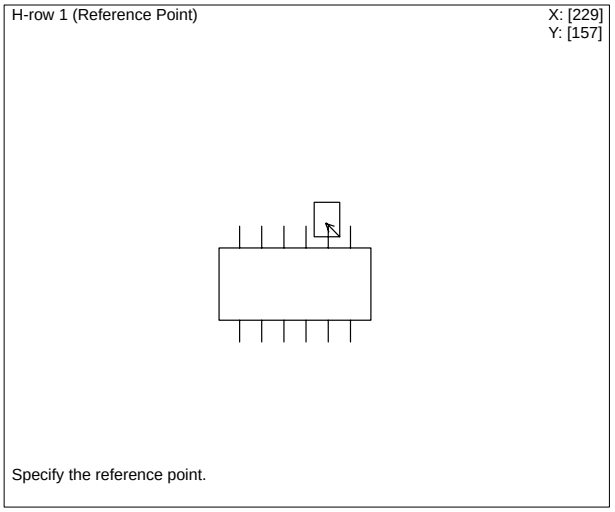
1. Select "R.Modify model." If P.Pitch has been set to fine with the "L.Lead/C.Measure" condition item, follow steps 2 and 3 to register multiple pin models. If "P.Pitch" has been set to standard, go to step 4.
2. Specify the top-left corner coordinates of a frame that encloses the multiple IC pins.
3. Specify the bottom-right corner coordinates of the frame.



4. Specify the top-left corner coordinates of a frame that encloses a single IC pin.
5. Specify the bottom-right corner coordinates of the frame.



6. Specify the reference point. For inspection, specify the position to be detected.



Important Do not turn off the power during model registration. If power is turned off during model registration, memory contents will be destroyed and the F350 will malfunction when it is turned on again.

4-7-3 Setting Search Regions: S.Search Region

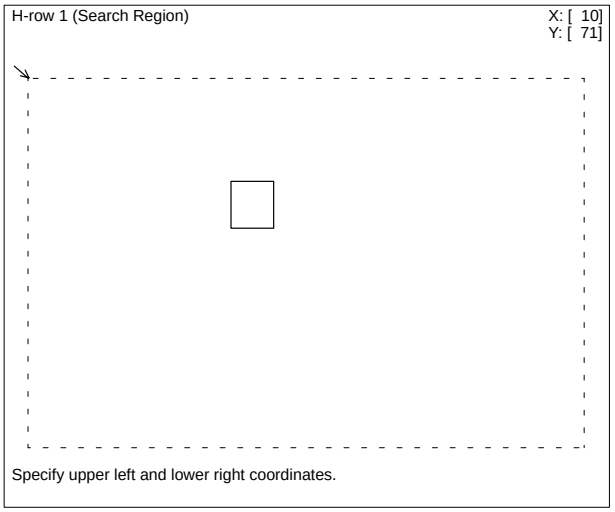
"S.Search Region" sets regions to search for models that have been registered.

Procedure

1, 2, 3...

1. Select "S.Search Region." The search region will be displayed by dotted lines, and the region registered as the model will be displayed by solid lines.
2. Specify the top-left corner coordinates of the search region.

3. Specify the bottom-right corner coordinates of the search region. The specified search region will be registered.



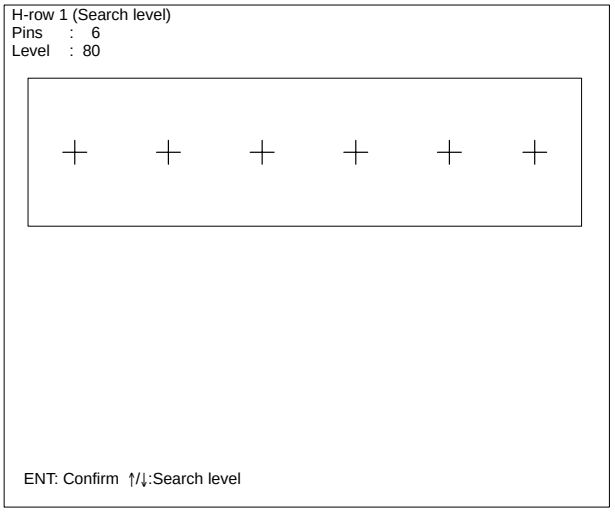
4-7-4 Changing Search Levels: L.Search Level

"L.Search level" sets the search level between 1 and 100 for searching for IC pins. The images that have correlation values equal to or greater than the search level are found as candidates. The search level of sampled IC pins will be 100 if the sampled IC pins perfectly coincides with the model. The default search level is 80. Lower the search level of IC pins if the IC pins are not searched stably. The search level can be changed only if the pin pitch has been set to normal with the "L.Lead/C.Measure condition" item.

Procedure

1, 2, 3...

1. Select "L.Search level." The pins in the search region will be inspected continuously.
2. Change the search level by pressing the Up/Down Keys to change the value.
3. Press the Enter Key. The search level will be set.



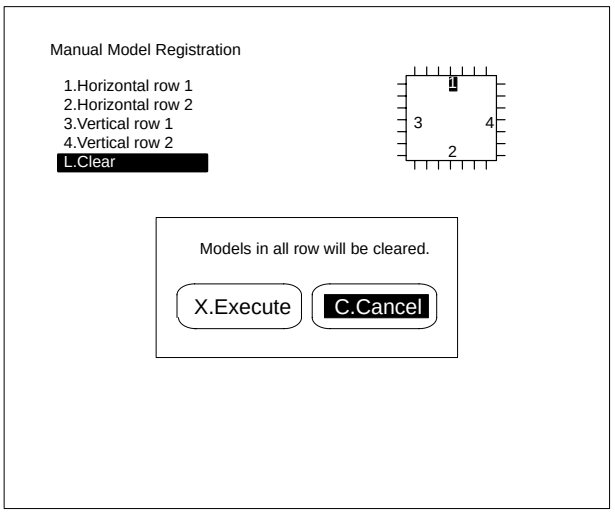
4-7-5 Clearing a Model: L.Clear

"L.Clear" clears the models in all rows and sets the search levels of the models to the default values.

Procedure

1, 2, 3...

1. Select "L.Clear." A confirmation message will be displayed.
2. Select "X.Execute."



4-8 L.Lead/A.Auto Model Registration

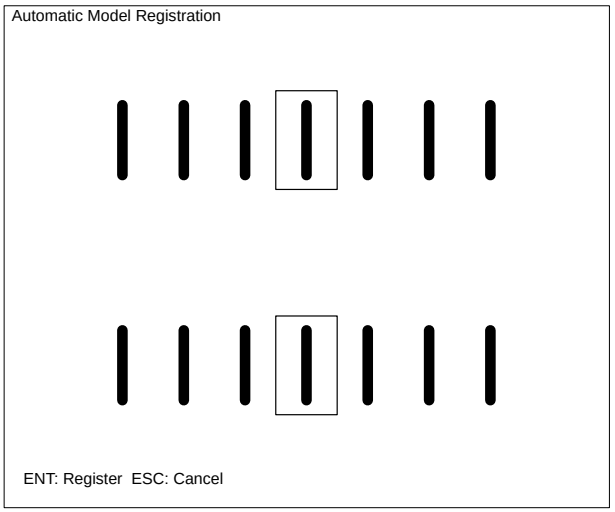
"A.Auto model registration" register IC pin patterns as models. Models are automatically registered according to the conditions set with the "L.Lead/I.Lead condition" item and the calibration data set with the "C.Camera/A.Calibration" item. A model is used to search for input images that have patterns similar to the pattern of the model, to obtain IC pin pitches, lengths, and correlation values from the input images, and to judge whether the input images are OK or NG. If models have already been registered by means of "H.Manual registration," those models will be cleared when automatic model registration is executed using the "A.Auto-registration" item. The search level value set in "H.Manual registration" however, will take priority. The search level will be set to 80 if no models have been registered.

Important Correct measurement is not possible if different filtering and background suppression levels are used during measurement than those used when model was registered. Ensure that any required filtering and background suppression levels are set before registering the models. Refer to *4-4-2 Selecting Filtering* and *4-4-3 Setting Background Suppression Levels.*

The required processing time can be checked. Refer to *4-9 M.Measure/O.Measure Monitor* and *4-25-1 Entering Measurement Screens*.

Procedure

1, 2, 3... 1. Press the Enter Key. The models will be registered.



Example
Horizontal row 1: 7 pins
Horizontal row 2: 7 pins

The type of models registered varies with the “P.Pitch” setting in the “L.Lead/C.Measure condition” item. Single and multi-pin models are registered when the pin pitch is set to fine. Only single-pin models are registered when the pin pitch is set to normal.

4-9 M.Measure/O.Measure Monitor

“M.Measure/O.Measure monitor” can be used to monitor measurement values and times before performing actual measurements.

O.Measure monitor
M.Measure
Checking Measurement Values and Measurement Times Page 70
Refer to *4-25 M.Measure/M.Measure* Page 203

4-9-1 Checking Measurement Values and Measurement Times: O.Measure Monitor

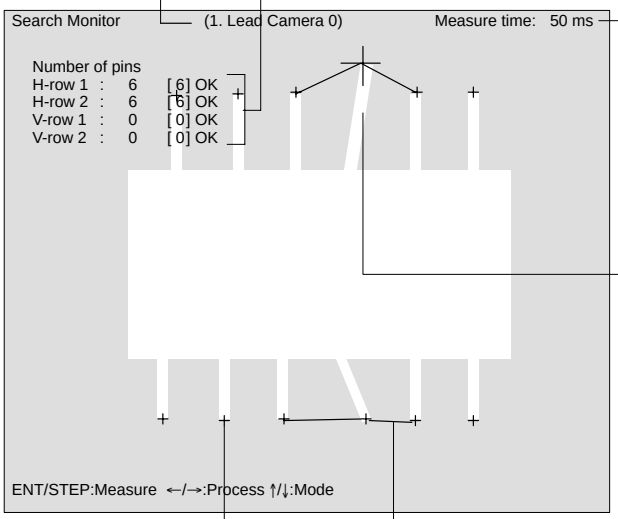
“O.Measure monitor” monitors measurement values based on the set data. Measured results are output to the Video Monitor only, even when a Parallel I/O Unit or Terminal Block Unit is mounted. The measurement time for each process is also displayed on the Video Monitor. When several processes are set, the measurement time for each can be monitored by switching between them.

Important

Instruction Input Timing
The next instruction must not be input while an instruction is being executed. Neither the instruction currently being executed nor the next instruction will be properly executed. When a Terminal Block Unit or Parallel I/O Unit is mounted, the BUSY signal will turn ON during instruction execution. Check to be sure that the BUSY signal is OFF before inputting the next instruction.

Search Monitor

The IC pins in all rows are searched for using registered models when the mode is switched to Search Monitor.



The current process number, the set measurement item name, and the camera number.

The number of IC pins in each row that has been searched and the number of IC pins set with the “L.Lead/I.Lead condition” item for each row. The judgement is in reverse video if the number of IC pins that has been searched is NG.

The measurement time for the current process.

When position compensation is set for the same camera number for the preceding process, the time displayed includes position compensation time.

When position compensation is set in succession, the time displayed includes the time for position compensation over several stages. This does not include the time for displaying the measured results on the Video Monitor.

In some cases, successive processes are processed in parallel. This means that the total of all separate process times will not necessarily equal the scene measurement time. Confirm the measurement time for each scene on the measurement screen.

4-25-1 Entering Measurement Screens

A large cursor is displayed if IC pin lengths or correlation values are NG.

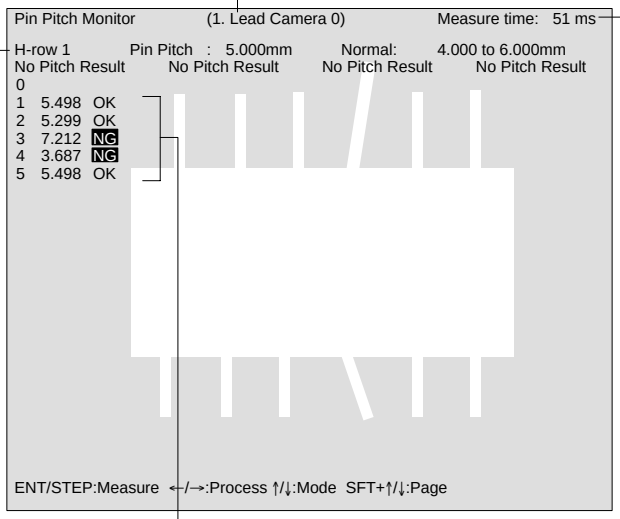
The cursors in IC pin positions are connected with a line if the IC pin pitch is NG.

A cursor is displayed in the position of each IC pin that has been searched.

IC Pin Pitch Monitor

Row number and the normal range of the pin pitch set with the “L.Lead/I.Lead condition” item.

The current number, process the set measurement item name, and the camera number.



The measurement time for the current process.

When position compensation is set for the same camera number for the preceding process, the time displayed includes position compensation time.

When position compensation is set in succession, the time displayed includes the time for position compensation over several stages. This does not include the time for displaying the measured results on the Video Monitor.

In some cases, successive processes are processed in parallel. This means that the total of all separate process times will not necessarily equal the scene measurement time. Confirm the measurement time for each scene on the measurement screen.

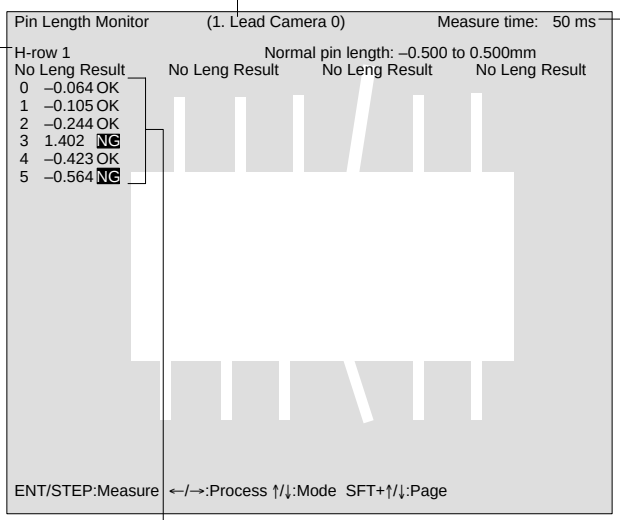
4-25-1 Entering Measurement Screens

Actual IC pin pitches that have been measured are displayed according to the calibration data if the IC pins have correlation values equal to or greater than the search level. The IC pin pitch is the distance between an IC pin and the adjacent one above.
Judgement results are in reverse video if IC pin pitches are not within the normal range.

IC Pin Length Monitor

Row number and the normal range of the pin length set with the “L.Lead/I.Lead condition” item.

The current process number, the set measurement item name, and the camera number.



The measurement time for the current process.

When position compensation is set for the same camera number for the preceding process, the time displayed includes position compensation time.

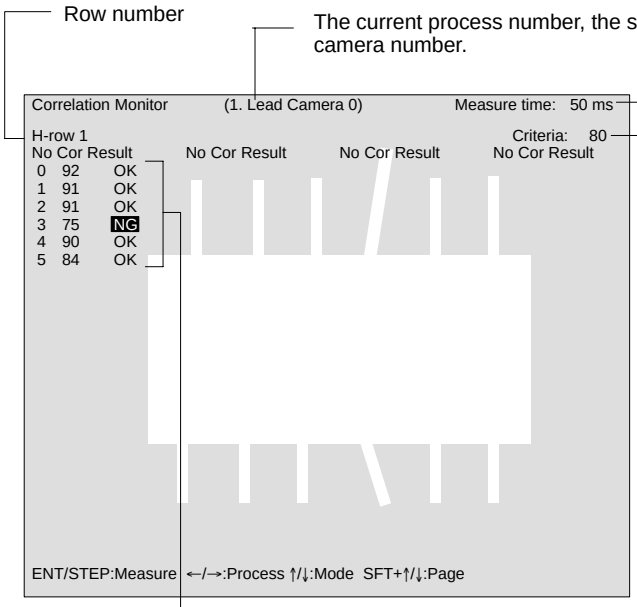
When position compensation is set in succession, the time displayed includes the time for position compensation over several stages. This does not include the time for displaying the measured results on the Video Monitor.

In some cases, successive processes are processed in parallel. This means that the total of all separate process times will not necessarily equal the scene measurement time. Confirm the measurement time for each scene on the measurement screen.

4-25-1 Entering Measurement Screens

Actual IC pin lengths that have been measured are displayed according to the calibration data if the IC pins have correlation values as large as or greater than the search level.
Judgement results are in reverse video if IC pin lengths are not within the normal range.

Correlation Value Monitor



The measurement time for the current process.

When position compensation is set for the same camera number for the preceding process, the time displayed includes position compensation time.

When position compensation is set in succession, the time displayed includes the time for position compensation over several stages. This does not include the time for displaying the measured results on the Video Monitor.

In some cases, successive processes are processed in parallel. This means that the total of all separate process times will not necessarily equal the scene measurement time. Confirm the measurement time for each scene on the measurement screen.

4-25-1 Entering Measurement Screens

Criteria set with the “L.Lead/I.Lead condition” item.

Correlation values with the model.
“NG” will be highlighted if the correlation value of the sampled image is less than the criteria.

Console

The following instructions can be input from the Console.

All Monitor Modes

Instruction	Key	Action
Measure	ENT	Executes a measurement. When position compensation is set for the same camera number for the preceding process, the measurement is executed after position compensation.
Switch process	◀ / ▶	Switches the process and executes the measurement item as set. Process which have no set data are skipped. When position compensation is set for the same camera number for the preceding process, the measurement is executed after the position compensation.
Switch mode	▲/▼	Switches the search, pin pitch, pin length, or correlation value monitor mode.
Quit measurement	ESC	Quits the measure monitor screen.

Pin Pitch, Pin Length, Correlation Value Monitor

Instruction	Key	Action
Switch page	SHIFT + ▲/▼	Switches rows to be displayed.

RS-232C

The following instructions can be input via the RS-232C. Attach a delimiter to the input code (ASCII). Ensure that it matches the communications specifications of the F350 and the external devices. Refer to *5-2-3 Setting the RS-232C Communications Specifications* in the *F350 Setup Menu Operation Manual*.

Important Set the instruction delimiter to CR, or CR + LF. Always use channel 0. Channel 1 on the RS-232C I/F Unit cannot be used.

All Monitor Modes

Measure

M m	Delimiter

Measurement is executed once. When position compensation is set for the same camera number for the preceding process, the measurement is executed after position compensation.

Quit measurement

Q q	Delimiter

Quits the measure monitor screen.

Parallel I/O

The following instruction can be input from a Parallel I/O Unit or Terminal Block Unit. Connect and wire the external devices. The leading edge (OFF to ON) of the STEP signal is indicated by ↓.

Refer to *2-4 Connecting Peripheral Devices* in the *Setup Menu Operation Manual*.

All Monitor Modes

Instruction	Input data STEP DI: 76543210	Action
Measure	↓	Executes a measurement one time in sync with the STEP signal's leading edge (OFF to ON). When position compensation is set for the same camera number for the preceding process, the measurement is executed after the position compensation.

■ Pattern Inspection

Pattern inspection appears on the menus as simply “P.Pattern.”

“P.Pattern” detects faults in patterns, such as missing or blurred character patterns. It makes it possible to use a model to search for input images that have patterns similar to the pattern of the model, to obtain correlation values from the input images and the model, and to judge whether the input images are OK or NG. A single character of a sampled character string can be automatically extracted for model registration.

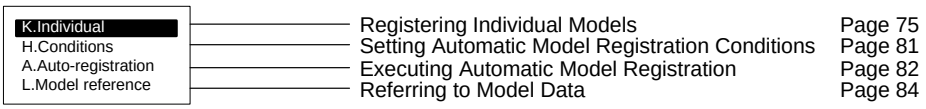
Pattern inspection must be set for a process number before it can be used. Refer to *4-3 U.Process*.

Select the camera number before registering the models. Refer to *4-4-1 Selecting the Camera Number*.

4-10 P.Pattern/M.Model

A model is used to search for input images that have patterns similar to the pattern of the model and obtain correlation values from the input images and the model. “M.Model” registers models and criteria.

The required processing time can be checked. Refer to *4-12 M.Measure/O.Measure Monitor* and *4-25-1 Entering Measurement Screens*.



4-10-1 Registering Individual Models: K.Individual

“K.Individual” registers single-character models in rectangular regions. When the cursor is moved to a model number, the image of the corresponding model that has been registered will be displayed in the displayed model frame. If the image of the model is not required, press the Shift and Escape Keys and set “S.Model reference” to OFF.

Registering New Models: K.Individual

Use the following procedure to register a new model.

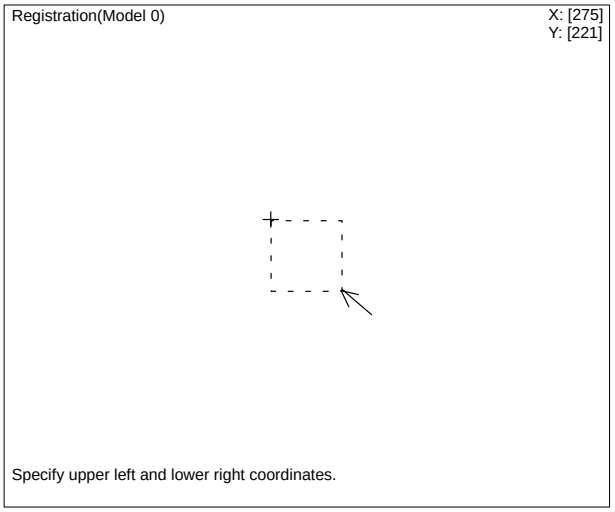
Important Correct measurement is not possible if different filtering and background suppression levels are used during measurement than those used when model was registered. Ensure that any required filtering and background suppression levels are set before registering the models. Refer to *4-4-2 Selecting Filtering* and *4-4-3 Setting Background Suppression Levels.*

Procedure

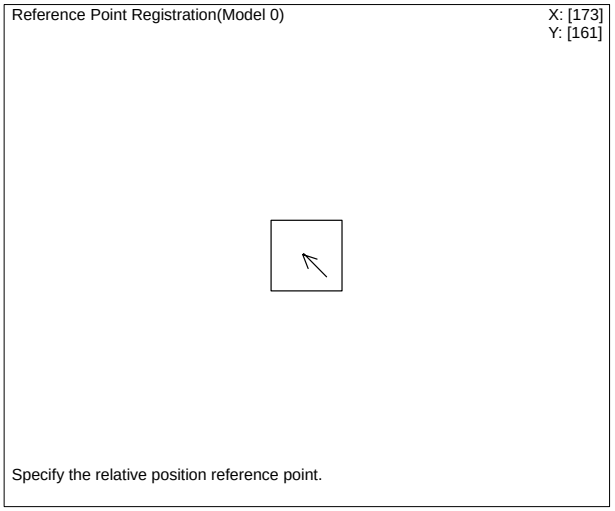
1, 2, 3...

1. Select the model number. A rectangle in dotted lines and an arrow cursor will be displayed.
2. Specify the top-left coordinates of the region to be registered.

3. Specify the bottom-right coordinates of the region to be registered.



4. Specify the reference point for relative position inspection. The image in the model frame will be registered as the model.



Important Do not turn off the power during model registration. If power is turned off during model registration, memory contents will be destroyed and the F350 will malfunction when it is turned on again.

Modifying Models: R.Modify

"R.Modify" modifies and re-registers single-character models that were previously registered. If the cursor is moved to a model number, the image that has been registered as the corresponding model will be inserted in the currently displayed model frame. If the model image is not required, press the Shift and Escape Keys and set "S.Model reference" to OFF.

Important Correct measurement is not possible if different filtering and background suppression levels are used during measurement than those used when model was registered. Ensure that any required filtering and background suppression levels are set before registering the models. Refer to *4-4-2 Selecting Filtering* and *4-4-3 Setting Background Suppression Levels.*

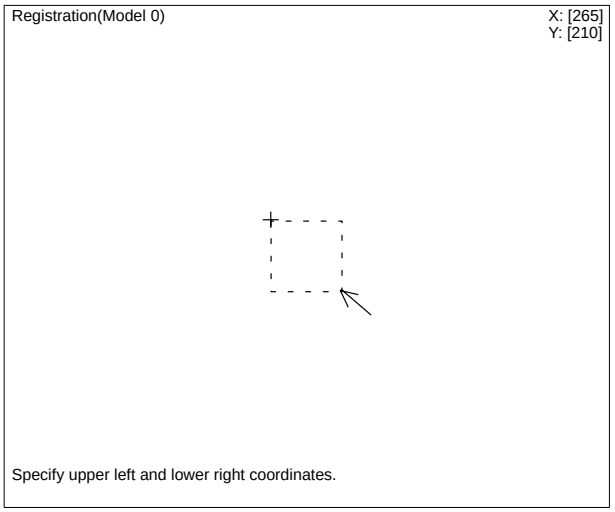
Models registered with the "A.Auto-registration" item can be modified individually. Models are registered from model 0 up to the maximum number of models

which can be set. It is possible to check images of the registered models and their model numbers. Refer to *4-10-4 Referring to Model Data*.

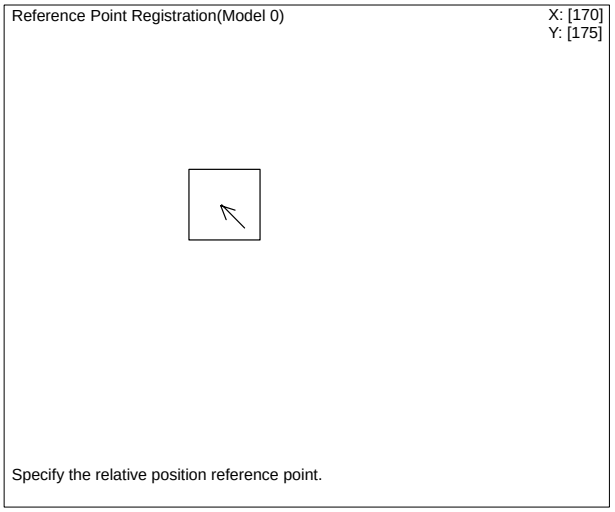
Procedure

1, 2, 3...

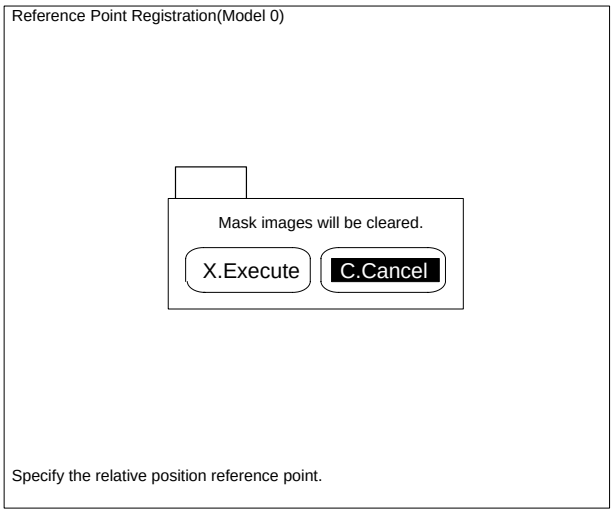
1. Select the model number.
2. Select “R.Modify.” A rectangle in dotted lines and an arrow cursor will be displayed in the registered region.
3. Set the top-left coordinates of the region to be registered.
4. Set the bottom-right coordinates of the region to be registered.



5. Specify the reference point for relative position inspection.



6. Clear the mask image. The image in the rectangle will be registered as the model.



Setting Mask Regions: M.Mask

"M.Mask" masks one section of rectangular regions that have been registered as models. This section can be excluded from the model and reset as a model. The size of the rectangular region, however, cannot be changed. the mask region is drawn using the following figures.

Figure	Drawing method
B.Box	Specify 2 opposing corners.
C.Circle	After specifying the center of the circle, specify any point on the circumference.
P.Polygon	Specify the adjacent corners in sequence. A maximum of 64 corners can be specified. Designate the last corner (to be connected to the first corner) and then press the Enter Key twice to create the polygon.

To draw the figures, select a drawing mode. There are two drawing modes. They are as follows:

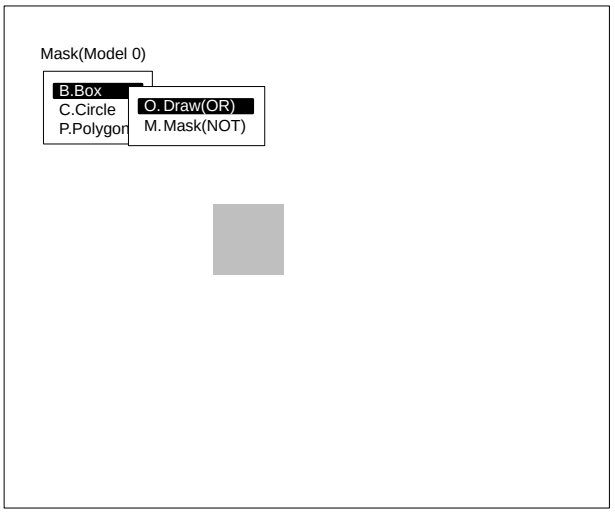
Drawing mode	Action
O.Draw(OR)	Used to draw regions to register as models. These regions are drawn in rectangular regions that had previously been registered as models.
M.Mask(NOT)	Used to mask and delete parts of models. The regions that are drawn are removed from the models.

Procedure

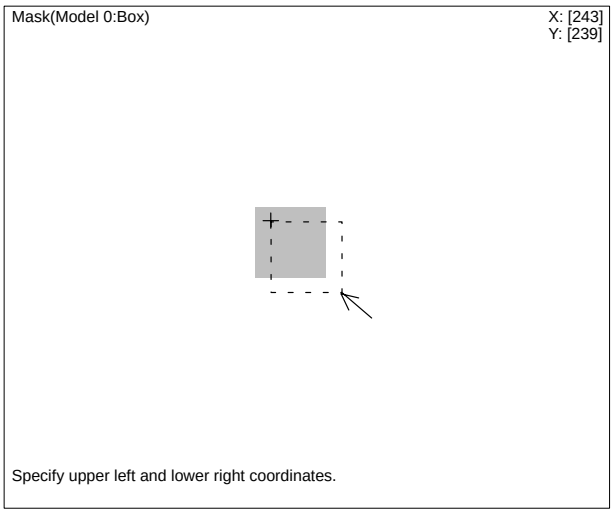
1, 2, 3...

1. Select the model number.
2. Select "M.Mask." The model will be displayed.
3. Select the figure to be drawn.

4. Select a drawing mode.



5. Specify the region to be masked. Move the arrow cursor to specify the coordinates.



Important Do not turn off the power while mask regions are being set or the memory contents will be destroyed and the F350 will malfunction when it is next turned on.

Setting Search Regions: S.Search Region

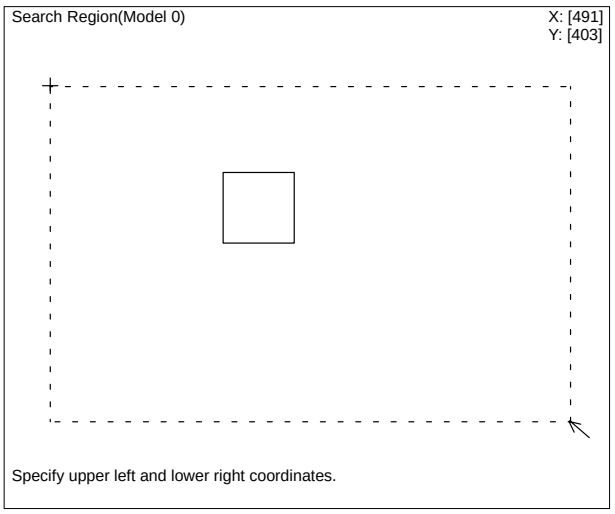
"S.Search region" sets a search region for each model individually. The search region should be large enough to search for samples even if they are not consistently positioned.

Procedure

1, 2, 3...

1. Select the model number.
2. Select "S.Search region." The search region will be displayed by dotted lines, and the region registered as the model will be displayed by solid lines.
3. Specify the top-left corner coordinates of the search region.

4. Specify the bottom-right corner coordinates of the search region. The specified search region will be registered.



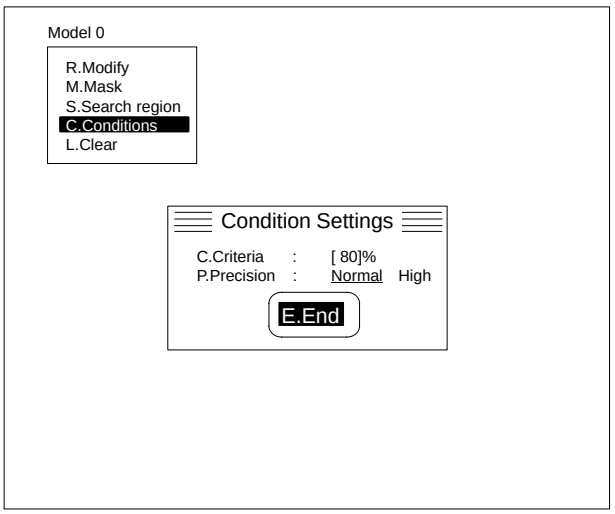
Setting Evaluation Conditions: C.Conditions

"C.Conditions" sets criteria within a range from 0 to 100 so that the correlation value between an image that has been searched for and a model will be judged OK if the correlation value is equal to or larger than the criteria and NG if the correlation value is less than the criteria. The criteria of sampled image will be 100 if the sampled image perfectly coincides with the model. The positions of models can be obtained in pixels if "P.Precision" is set to normal or subpixels if "P.Precision" is set to high.

Procedure

1, 2, 3...

1. Select the model number.
2. Select "C.Conditions."
3. Set the criteria.
4. Set the precision.
5. Select "E.End."



Clearing Model Data: L.Clear

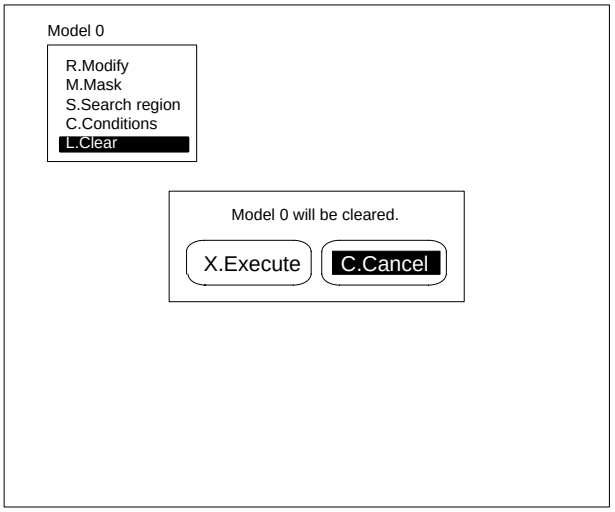
"L.Clear" clears the data for selected models and resets it to default values. Clear all models which are not to be used for measurement.

Procedure

1, 2, 3...

1. Select the model number.

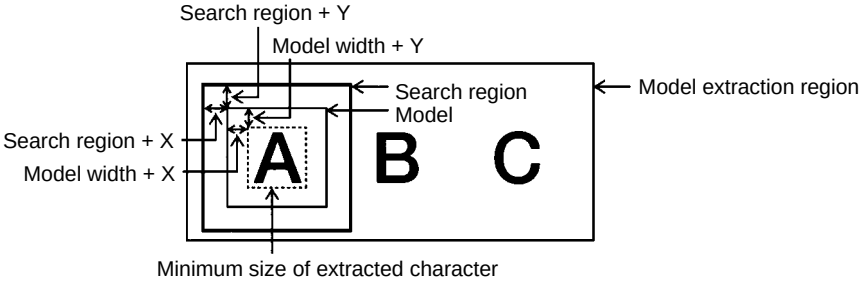
2. Select “L.Clear.” A confirmation message will be displayed.
3. Select “X.Execute” after rechecking the model number. All the set data for the specified mode number will be cleared.



4-10-2 Setting Automatic Model Registration Conditions: H.Conditions

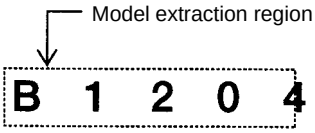
“H.Conditions” sets model registration conditions and draws extraction regions that enclose single characters to be registered as models.

Conditions	Details
H.Character order	Used to select the directions in which characters are extracted from the text string.
I.Min size X J.Min size Y	Used to set the minimum size of characters to be extracted between 1 and 256. If the actual size of an extracted character is less than 23 x 19, the size is set to 23 x 19 to register the character.
K.Model width + X L.Model width + Y	Used to register regions that enclose extracted characters and their margins as models between 0 and 256. Draw the extraction regions of characters considering the margins.
V.Search region + X W.Search region + Y	Used to register regions that enclose models with margins as search regions within a range from 0 to 256.
N.Devi threshold	Used to set density deviation thresholds between 0 and 100 to be used to extract characters. The default value of each density deviation threshold is 15. When the space between two adjacent characters to be extracted is too narrow and they cannot be extracted one at a time, decrease the density deviation value. When the characters become separated and extracted, increase the density deviation value.
C.Criteria	Used to set correlation criteria between 0 and 100 so that the correlation value between and image that has been searched for and a model will be judged OK if the correlation value is equal to or larger than the criteria and NG if the correlation value is less than the criteria. The criteria of a sampled images will be 100 if the sampled image perfectly coincides with the model.
P.Precision	Set to normal to obtain the positions of models in pixels. Set to high to obtain the positions of models in subpixels.
M.Max quantity	Used to set the maximum number of extracted characters.

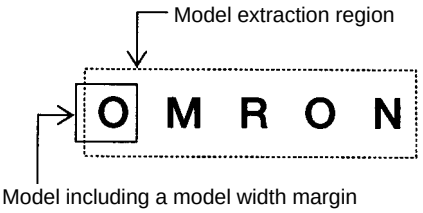


Characters cannot be extracted properly in the following cases:

- A character is partly out of the model extraction region.

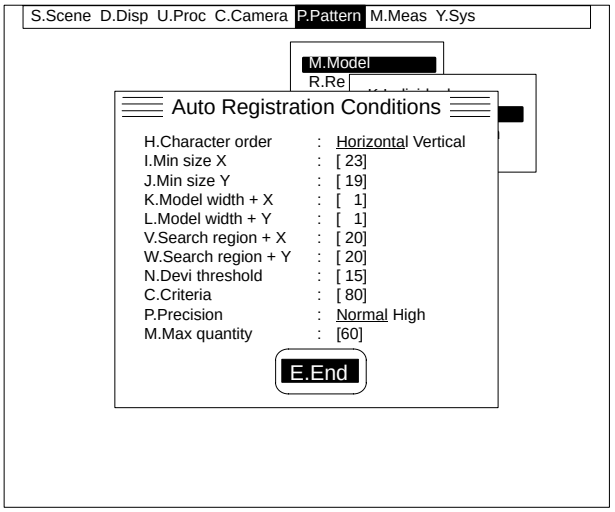


- A model including the margin is out of the model extraction region.



Procedure

1, 2, 3... 1. Select “H.Conditions.” Set the model registration conditions.
2. Select “E.End.”



4-10-3 Executing Automatic Model Registration: A.Auto-registration

“A.Auto-registration” draws model extraction regions that enclose characters to be registered as single-character models. Based on the “H.Auto registration conditions,” characters are extracted one at a time from the model extraction region and registered. Characters cannot be extracted if the space between the characters is too narrow. Either enlarge or reduce the image of the characters. White pixels are enlarged and black pixels are reduced in size when the image is enlarged. White pixels are reduced and black pixels are enlarged in size when the image is reduced. Each of the original images is, however, registered with a reference point in the center of a rectangular region as a model.

Important Correct measurement is not possible if different filtering and background suppression levels are used during measurement than those used when model was registered. Ensure that any required filtering and background suppression levels are set before registering the models. Refer to *4-4-2 Selecting Filtering* and *4-4-3 Setting Background Suppression Levels.*

Each extracted models are registered from model 0 up to the maximum number of models. Models previously registered are overwritten. If their model numbers

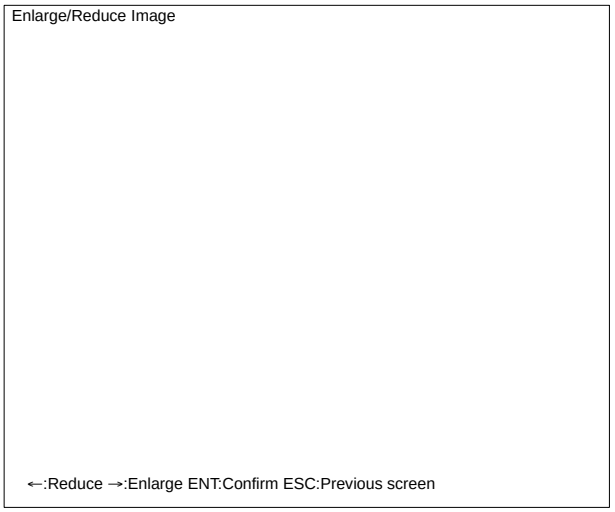
are set for relative position inspection, the relative position inspection settings will be cleared. Individual models can be registered with model numbers after the preset maximum number of registered models. It is possible to check images of the registered models and their model numbers. Refer to *4-10-4 Referring to Model Data*.

Models can be corrected individually. Refer to *4-10-1 Registering Individual Models*.

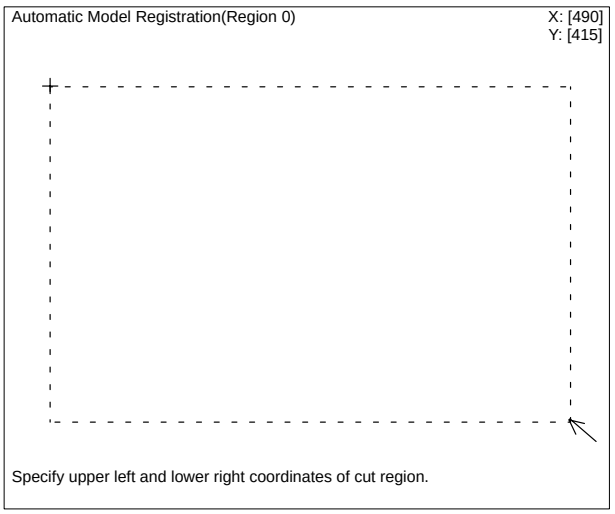
Procedure

1, 2, 3...

1. Select “A.Auto-registration.” The enlarge/reduce image screen will be displayed.
2. Enlarge or reduce the image.

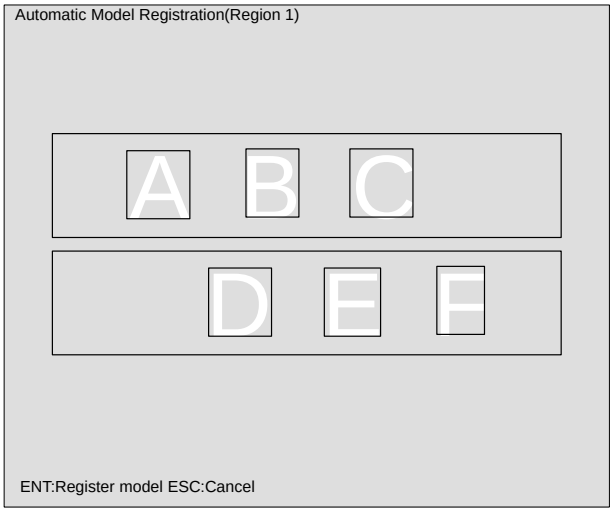


3. Specify the top-left corner coordinates of the region to extract the characters.
4. Specify the bottom-right corner coordinates of the region. The specified region will be set as a model extraction region. To draw two or more model extraction regions, repeat steps 3 to 4. Up to four model extraction regions can be drawn.



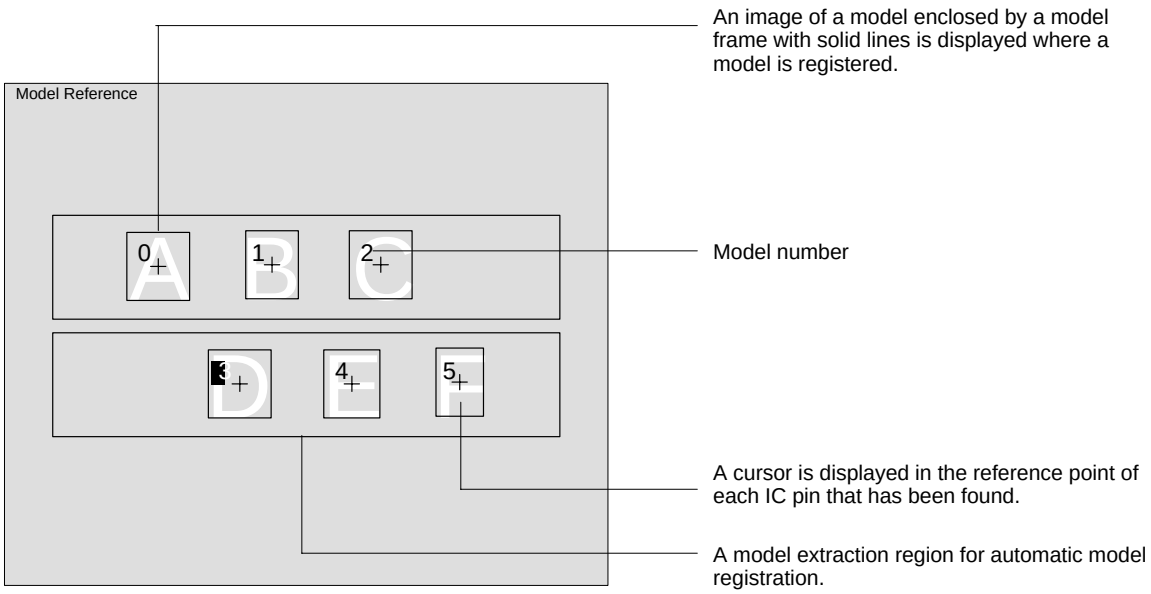
5. Execute automatic character extraction. Individual regions, each of which is used for single character extraction, will be displayed.

6. Press the Enter Key. Each model will be registered.



4-10-4 Referring to Model Data: L.Model Reference

"L.Model reference" allows all registered models to be displayed.

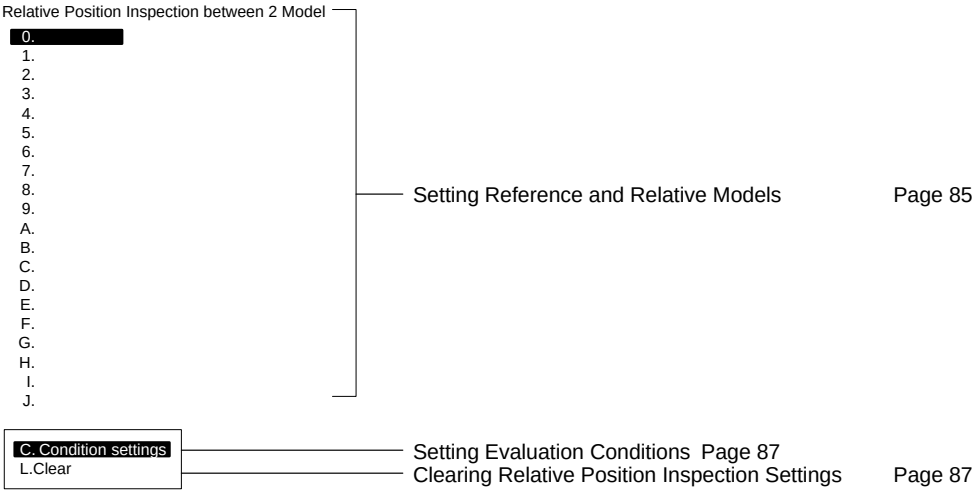


Procedure Select "L.Model reference." All registered models will be displayed.

4-11 P.Pattern/R.Relative Position

Relative position inspection checks the relative position of two models. This inspection is used to determine if the position of one model (the relative model) is correct relative to the origin position on a model which is always fixed in position (the reference model). "R.Relative position" sets the conditions for relative position inspection.

Measurement values are converted into actual dimensions and output according to the preset calibration data. Refer to *4-4-4 Setting Calibration Data*.



4-11-1 Setting Reference and Relative Models: R.Relative Position

Select reference and relative models. The position of the relative model can be determined based on the position of the reference model as the origin position. The reference point varies with the model registration method. Any point within the rectangular region registered as the model can be specified as the reference point if the model is registered individually. The center of gravity of a rectangular region as a model is the reference point if the model is registered automatically. Refer to *4-10 P.Pattern/M.Model*.

If the cursor is moved to a model number, the image of a corresponding model that has been registered will appear in the displayed model frame. If the image of the model is not required, press the Shift and Escape Keys and set “S.Model reference” to OFF.

Note

1. Only registered models can be selected. Refer to *4-10 P.Pattern/M.Model*.
2. A model cannot be set as a reference model for more than one relative position inspection, but it can be set as a relative model for multiple relative position inspections.

Example

No Good

Relative position inspection	Reference model	Relative model
0	Model 0	Model 1
1	Model 0	Model 2

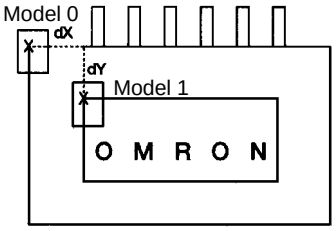
A single reference model is not available for more than one type of relative position inspection.

O.K.

Relative position inspection	Reference model	Relative model
0	Model 1	Model 0
1	Model 2	Model 0

A single relative model is available for more than one type of relative position inspection.

Example: Inspection of Label Location

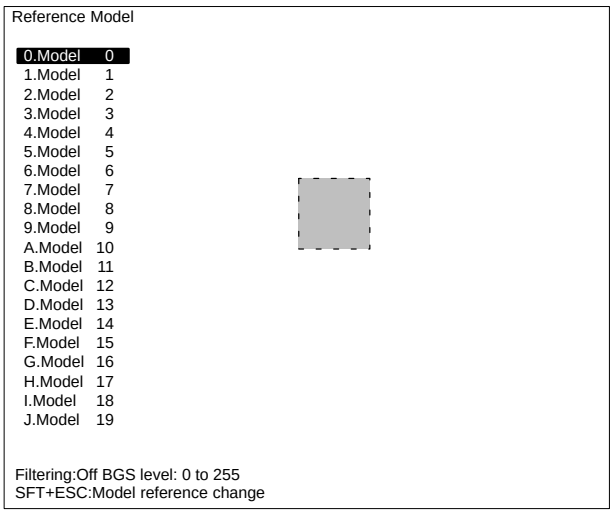


Reference model: Model 0
Relative model: Model 1

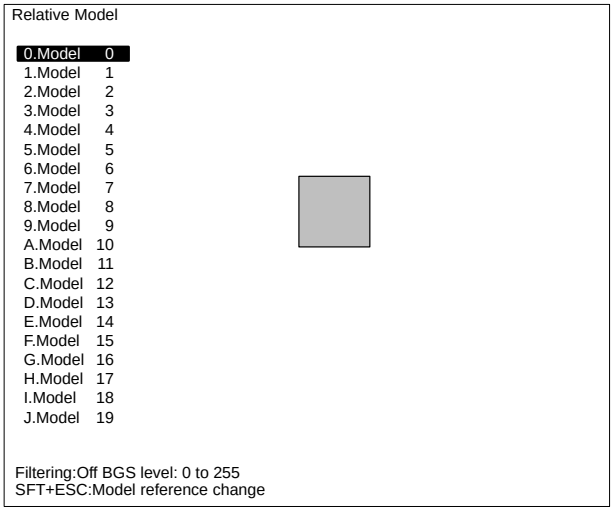
Procedure

1, 2, 3...

1. Select the relative position inspection number. A list of model numbers will be displayed.
2. Select the model number of the reference model. A list of model numbers will be displayed.



3. Select the model number of the relative model. The reference and relative models will be set.



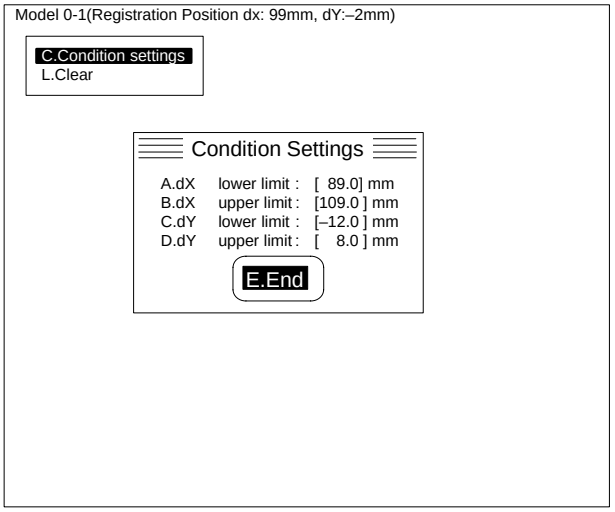
4-11-2 Setting Evaluation Conditions: C.Condition Settings

The position of a reference model is fixed, so it can be used as an origin to check whether the position of a relative model is OK or NG. “C.Condition settings” sets the upper and lower limits of the permissible position of a relative model. Measurement values are converted into physical dimensions and output according to the preset calibration data. Refer to *4-4-4 Setting Calibration Data*.

Procedure

1, 2, 3...

1. Select “C.Condition settings.”
2. Set the upper and lower limits so that they satisfy the following conditions:
   dx upper limit ≧ dx lower limit
   dy upper limit ≧ dy lower limit
   For dx and dy, refer to *4-11-1 Example: Inspection of Label Location*.
3. Select “E.End.”



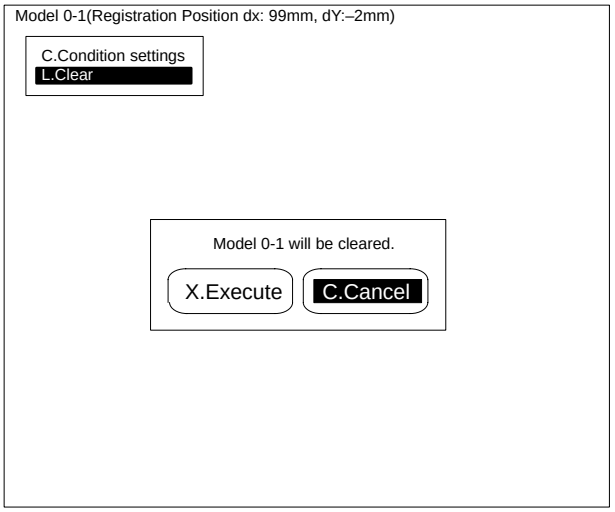
4-11-3 Clearing Relative Position Inspection Settings: L.Clear

“L.Clear” clears reference and relative models and restores the criteria to the default settings. Clear any relative position inspections not used for measurement.

Procedure

1, 2, 3...

1. Select “L.Clear.” A confirmation message will be displayed.
2. Recheck the model number, and select “X.Execute.” All the data for the relative position inspection will be cleared.



4-12 M.Measure/O.Measure Monitor

"M.Measure/O.Measure monitor" can be used to monitor measurement values and times before performing actual measurements.

O.Measure monitor
M.Measure
Checking Measurement Values and Measurement Times Page 88
Refer to *4-25 M.Measure/M.Measure* Page 203

4-12-1 Checking Measurement Values and Measurement Times: O.Measure Monitor

"O.Measure monitor" monitors measurement values based on the set data. Measured results are output to the Video Monitor only, even when a Parallel I/O Unit or Terminal Block Unit is mounted. The measurement time for each process is also displayed on the Video Monitor. When several processes are set, the measurement time for each can be monitored by switching between them.

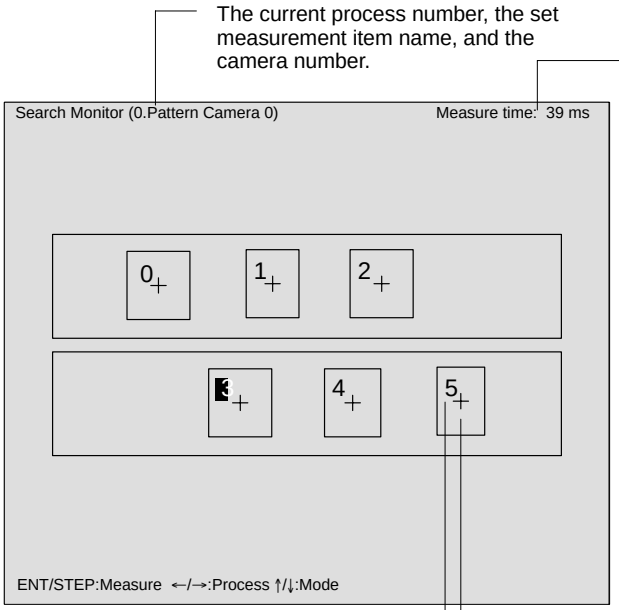
Important

Instruction Input Timing

The next instruction must not be input while an instruction is being executed. Neither the instruction currently being executed nor the next instruction will be properly executed. When a Terminal Block Unit or Parallel I/O Unit is mounted, the BUSY signal will turn ON during instruction execution. Check to be sure that the BUSY signal is OFF before inputting the next instruction.

Search Monitor

Registered models are search for in Search Monitor mode.



The current process number, the set measurement item name, and the camera number.

The measurement time for the current process.

When position compensation is set for the same camera number for the preceding process, the time displayed includes position compensation time.

When position compensation is set in succession, the time displayed includes the time for position compensation over several stages. This does not include the time for displaying the measured results on the Video Monitor.

In some cases, successive processes are processed in parallel. This means that the total of all separate process times will not necessarily equal the scene measurement time. Confirm the measurement time for each scene on the measurement screen.

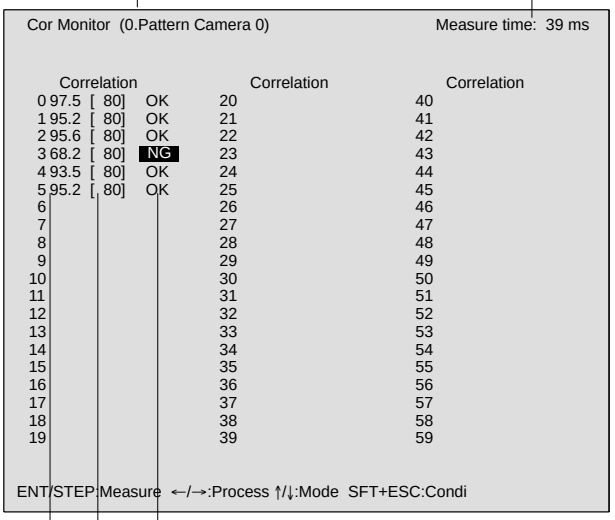
4-25-1 Entering Measurement Screens

Model number. This is in reverse video if the correlation value is NG.

A cursor is displayed in the reference point.

Correlation Value Monitor

The correlation value for each model is measured in Correlation Value Monitor mode.



The current process number, the set measurement item name, and the camera number

The measurement time for the current process.

When position compensation is set for the same camera number for the preceding process, the time displayed includes position compensation time.

When position compensation is set in succession, the time displayed includes the time for position compensation over several stages. This does not include the time for displaying the measured results on the video monitor.

In some cases, successive processes are processed in parallel. This means that the total of all separate process times will not necessarily equal the scene measurement time. Confirm the measurement time for each scene on the measurement screen.

☞ *4-25-1 Entering Measurement Screens*

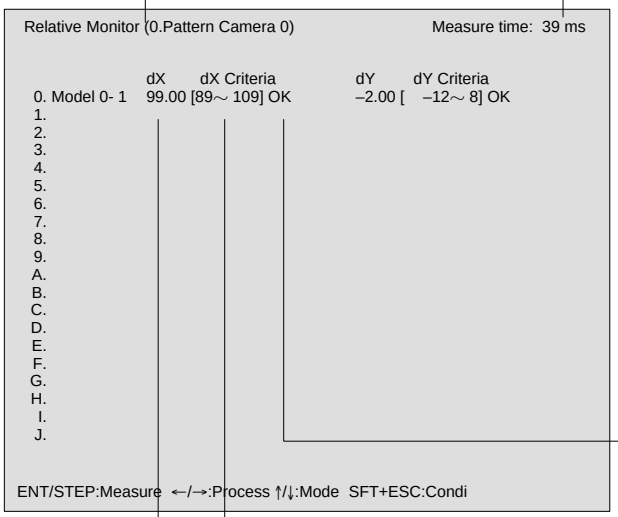
Measurement values less than the criteria are judged NG and the judgement results are in reverse video.

Criteria.

Correlation value.

Relative Position Monitor

The relative position of two models is measured in Relative Position Monitor mode



The current process number, the set measurement item name, and the camera number

The measurement time for the current process.

When position compensation is set for the same camera number for the preceding process, the time displayed includes position compensation time.

When position compensation is set in succession, the time displayed includes the time for position compensation over several stages. This does not include the time for displaying the measured results on the video monitor.

In some cases, successive processes are processed in parallel. This means that the total of all separate process times will not necessarily equal the scene measurement time. Confirm the measurement time for each scene on the measurement screen.

☞ *4-25-1 Entering Measurement Screens*

Measurement values not within the criteria are judged NG and in reverse video.

Criteria

Measured relative position. The values are converted into actual dimensions and output on the basis of calibration data.

Console

The following instructions can be input from the Console.

All Monitor Modes

Instruction	Key	Action
Measure	ENT	Executes a measurement. When position compensation is set for the same camera number for the preceding process, the measurement is executed after position compensation.
Switch process	◀ / ▶	Switches the process and executes the measurement item as set. Process which have no set data are skipped. When position compensation is set for the same camera number for the preceding process, the measurement is executed after the position compensation.
Switch mode	▲/▼	Switches the search, correlation value, or relative position monitor mode.
Quit measurement	ESC	Quits the measure monitor screen.

Correlation Value Monitor

Instruction	Key	Action
Change conditions	SHIFT + ESC	Makes it possible to change evaluation conditions in the following methods by referring to correlation values. • Changing the evaluation conditions of models individually. • Changing the evaluation conditions of all models for the displayed camera on the screen. Refer to *4-10-1 Registering Individual Models*.

Relative Position Monitor

Instruction	Key	Action
Change conditions	SHIFT + ESC	Makes it possible to change evaluation conditions by referring to measurement values. Refer to *4-11-2 Setting Evaluation Conditions*.

RS-232C

The following instructions can be input via the RS-232C. Attach a delimiter to the input code (ASCII). Ensure that it matches the communications specifications of the F350 and the external devices. Refer to *5-2-3 Setting the RS-232C Communications Specifications* in the *F350 Setup Menu Operation Manual*.

Note Set the instruction delimiter to CR, or CR + LF. Always use channel 0. Channel 1 on the RS-232C Unit cannot be used.

All Monitor Modes

Measure

M m	Delimiter

Measurement is executed once. When position compensation is set for the same camera number for the preceding process, the measurement is executed after position compensation.

Quit measurement

Q q	Delimiter

Quits the measure monitor screen.

Parallel I/O

The following instructions can be input from a Parallel I/O Unit or Terminal Block Unit. Connect and wire the external devices. The leading edge (OFF to ON) of the STEP signal is indicated by ↓.

Refer to *2-4 Connecting Peripheral Devices* in the *Setup Menu Operation Manual*.

All Monitor Modes

Instruction	Input data STEP DI: 76543210	Action
Measure	↓	Executes a measurement one time in sync with the STEP signal's leading edge (OFF to ON). When position compensation is set for the same camera number for the preceding process, the measurement is executed after the position compensation.

■ Surface Defect Inspection A

Surface defect inspection A appears on the menus simply as “K.Surface A”

“K.Surface A” detects chips, burrs, scratches, and dirt in inspection regions. It detects defects by searching for changes in density within the inspection region. Four modes are available for detecting these defects. Select the most suitable mode according to the type of inspection.

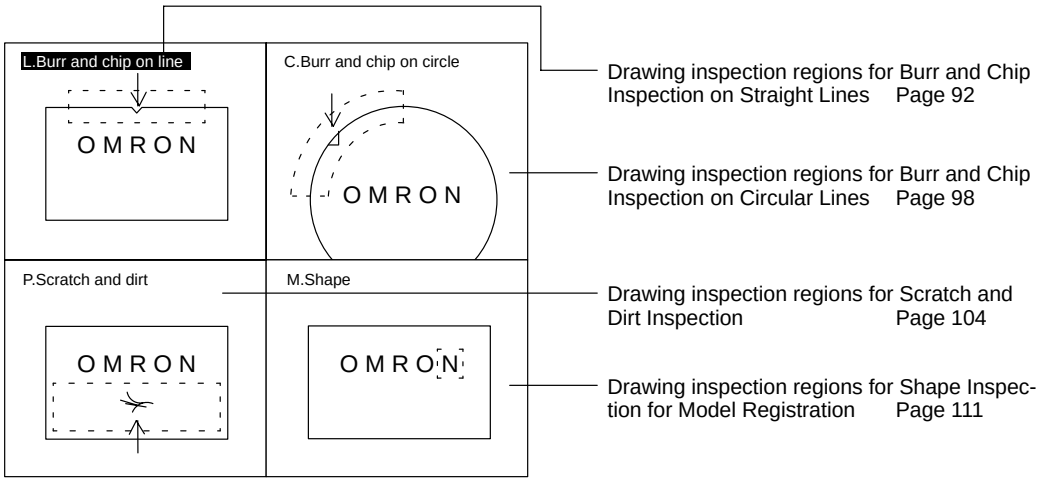
Surface defect inspection A must be set for a process number before it can be used. Refer to *4-3 U.Process*.

Select the camera number before setting the inspection region. Refer to *4-4-1 Selecting the Camera Number*.

4-13 K.Surface A/R.Registration

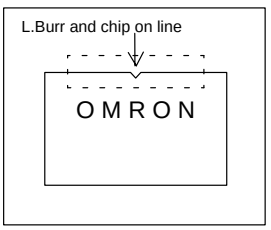
Four modes are available to detect chips, burrs, scratches, and dirt in inspection regions. Use “R.Registration” to select the most suitable mode according to the type of inspection before drawing the inspection region. Use the position compensation function if the position or angle of the inspection part is not stable. Refer to *4-23 P.Position Compensation*.

When using the position compensation function, display a still (freeze) image after position compensation and then draw the inspection region. Refer to *4-2-3 Inputting Images After Position Compensation*.

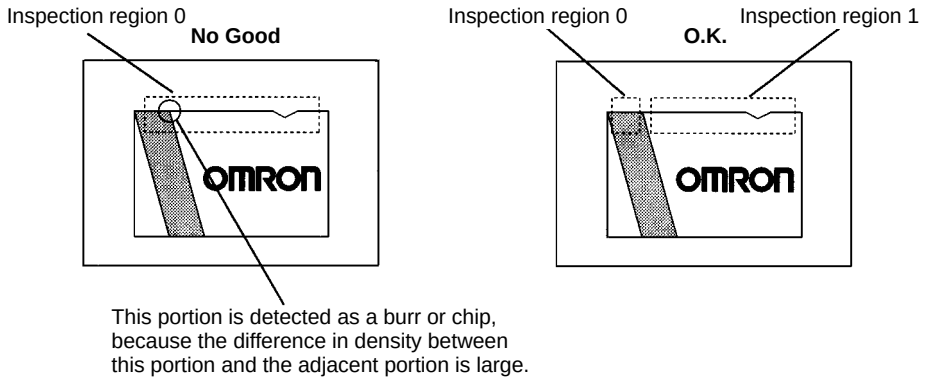


4-13-1 Drawing Inspection Regions for Burr and Chip Inspection on Straight Lines: L.Burr and Chip on Line

“L.Burr and Chip on Line” inspects for chips and burrs along the straight edge of a workpiece. Draw the inspection regions. Specify the start point, end point, and width of the region.



Important Do not draw the inspection region to include any mark or pattern, otherwise incorrect inspection will result because marks and patterns inside the inspection region cannot be differentiated from chips and burrs.

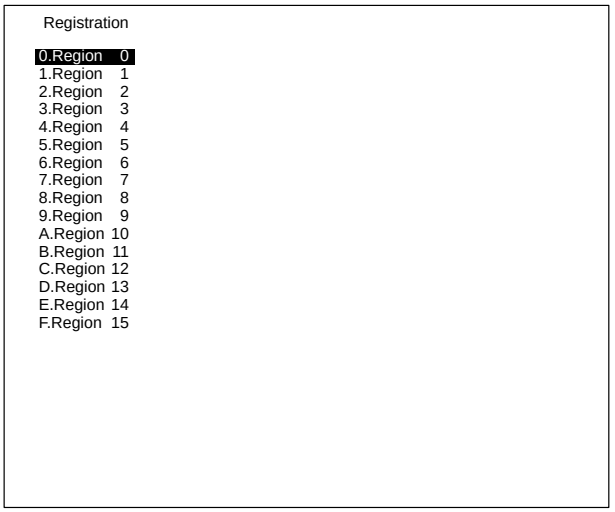


Drawing New Inspection Regions

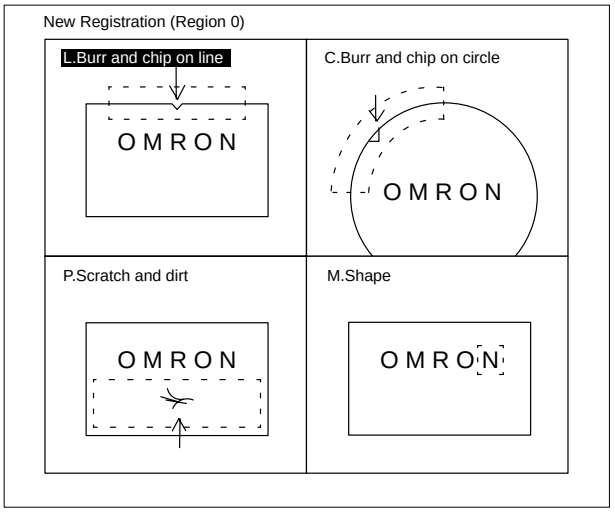
Use the following procedure to draw a new inspection region.

Procedure

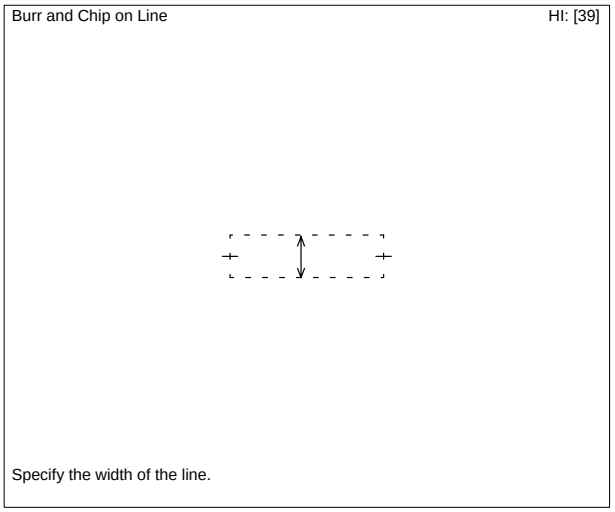
1, 2, 3... 1. Select the region number. A list of inspection mode will be displayed.



2. Select “L.Burr and chip on line.” An arrow cursor will be displayed in the center of the screen.



3. Draw a rectangular region. The region that is drawn will be registered will be registered as the inspection region.

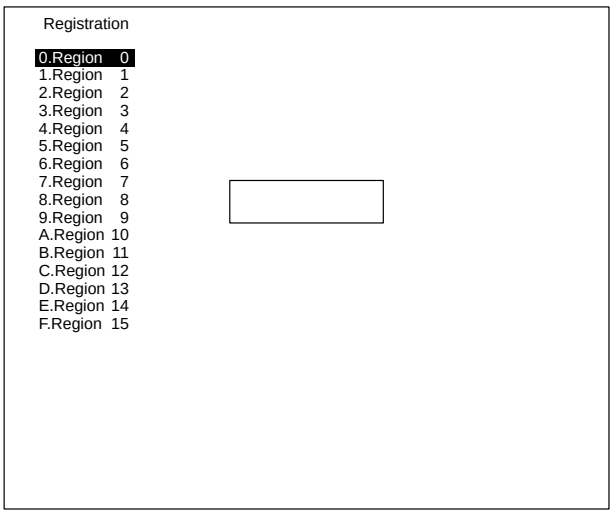


Modifying Inspection Regions

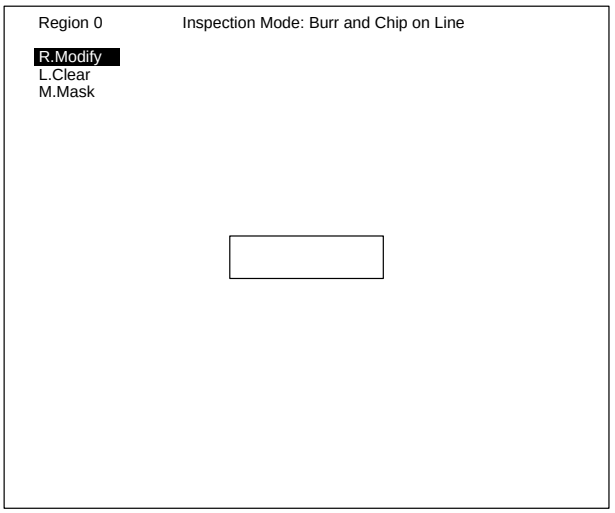
An existing inspection region can be modified. The inspection mode, however, cannot be changed. If you want to change it, you must clear the inspection region and draw a new one. When the cursor is moved to select a inspection region number, the inspection region at the cursor position is displayed with solid lines.

Procedure

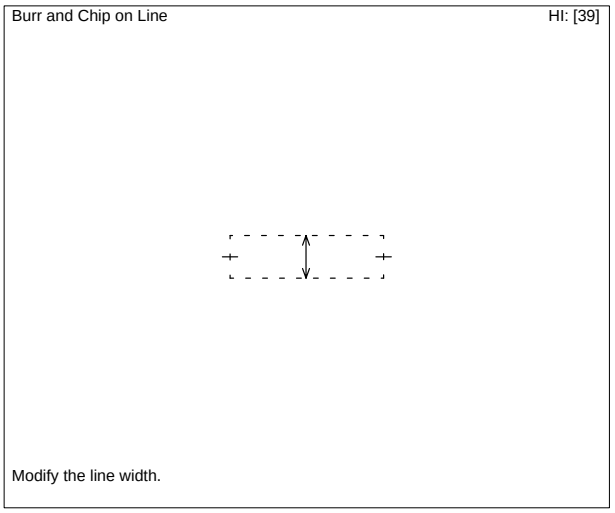
1, 2, 3... 1. Select the region number.



2. Select “R.Modify.”



3. Modify the inspection region. The modified inspection region will be registered.

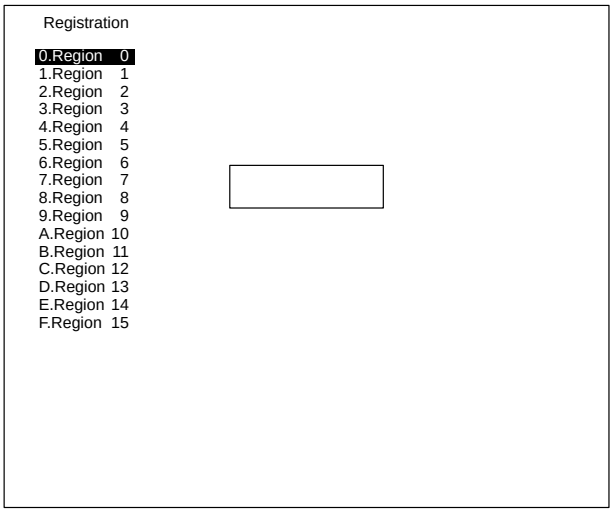


Clearing Inspection Regions

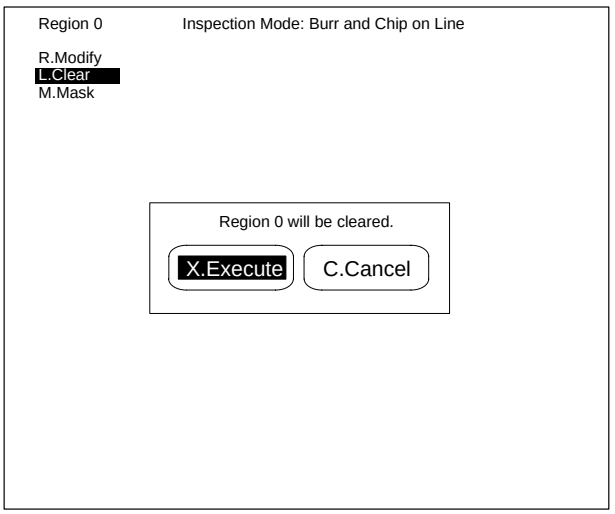
Use the following procedure to clear an unnecessary inspection region. (i.e., a region not being used for inspection)

Procedure

1, 2, 3... 1. Select the region number.



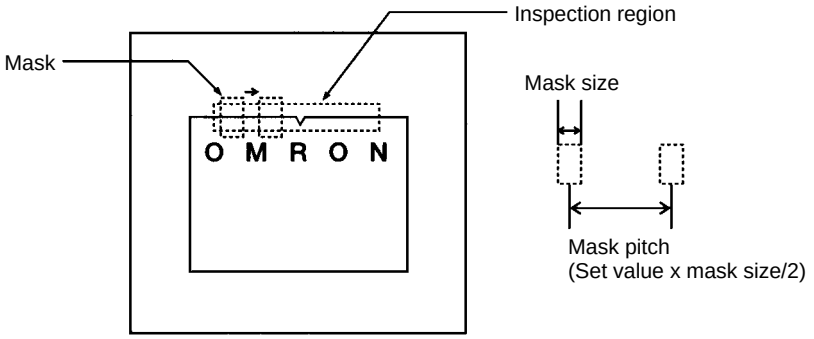
2. Select “L.Clear.” A confirmation message will be displayed.
3. Select “X.Execute” after rechecking the inspection region number. The inspection region will be cleared.



Changing Mask Size and Pitch

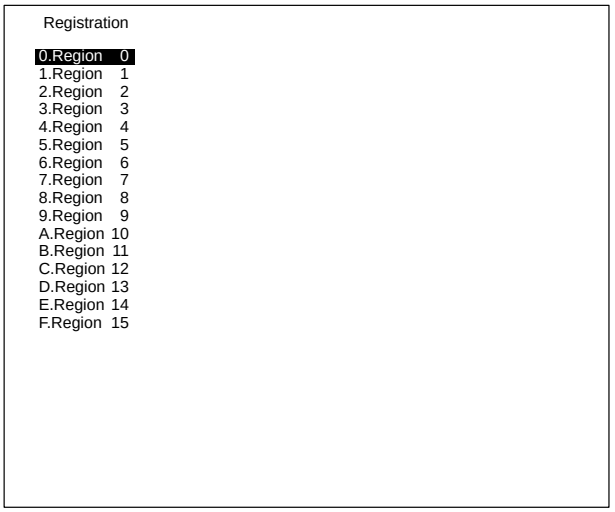
With burr and chip on line inspection, the mask in the rectangular inspection region is moved little by little to detect the most defective positions. Use the following procedure to set mask size and pitch.

Item	Details
Mask size	When inspection regions are newly drawn, the default mask size is 10. Set the mask size between 4 and 80, according to the sizes of the burrs and chips to be detected. The larger the mask size, the shorter the processing time will be.
Mask pitch	This sets the pitch for moving the mask. The default mask pitch for a inspection region is 4. Set the mask pitch between 1 and 6 according to the sizes of the burrs and chips to be detected. The mask pitch does not affect the processing time.



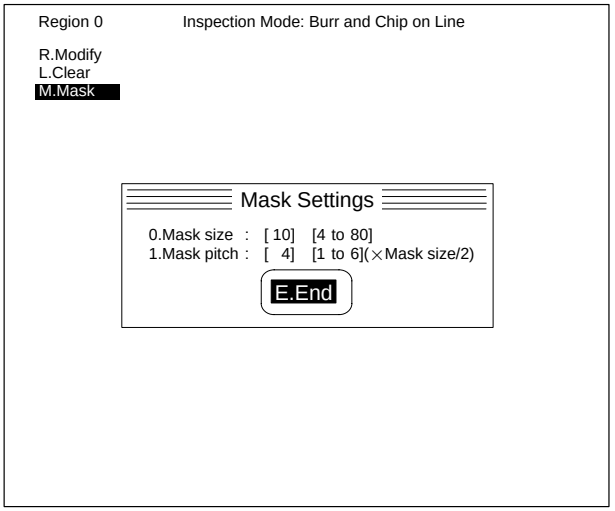
Procedure

1, 2, 3... 1. Select the region number.



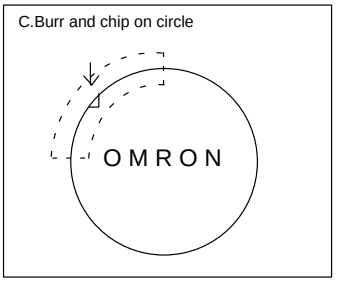
2. Select “M.Mask.”
3. Correct the mask size and mask pitch.

4. Select “E.End.”

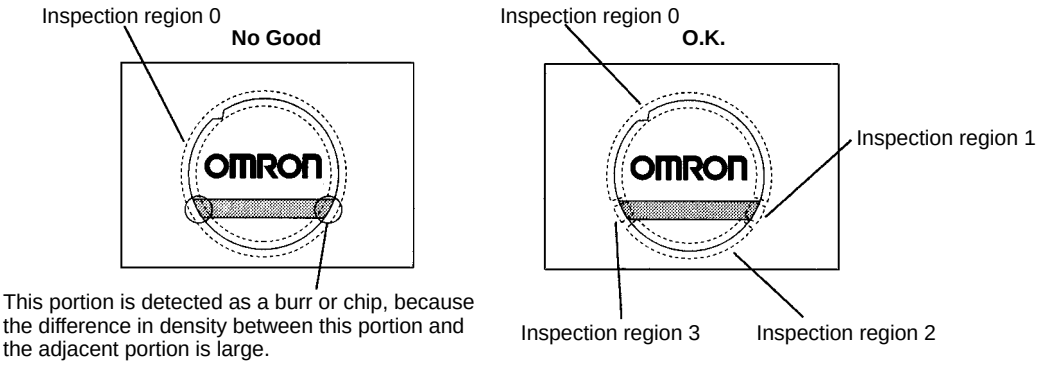


4-13-2 Drawing Inspection Regions for Burr and Chip Inspection on Circular Lines: C.Burr and Chip on Circle

“C.Burr and Chip on Circle” inspects for chips and burrs along the circular edge of a workpiece. Draw the inspection regions.



Important Do not draw the inspection region to include any mark or pattern, otherwise incorrect inspection will result because marks and patterns inside the inspection region cannot be differentiated from chips and burrs.



Use the following figures to draw inspection regions.

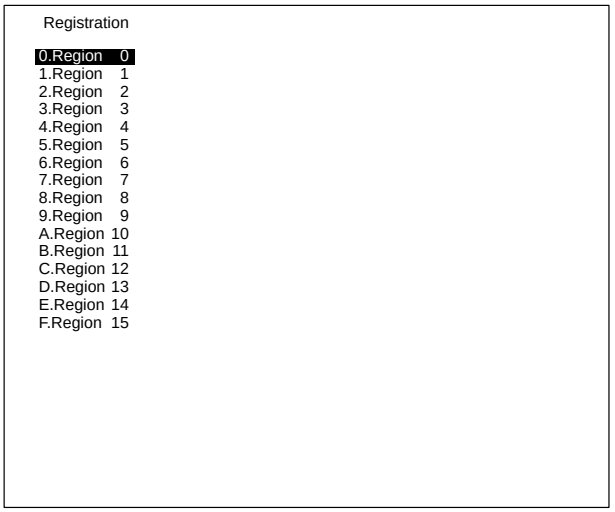
Figure type	Drawing method
C.Circle	Specify the center of the circle, a point on the circle, and the circle width.
P.Arc	Specify the start and end points of the arc, a point on the arc, and the arc width.

Drawing New Inspection Regions

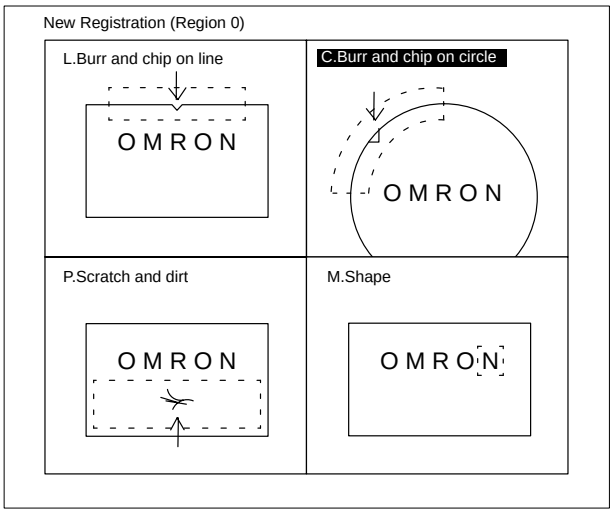
Use the following procedure to draw a new inspection region.

Procedure

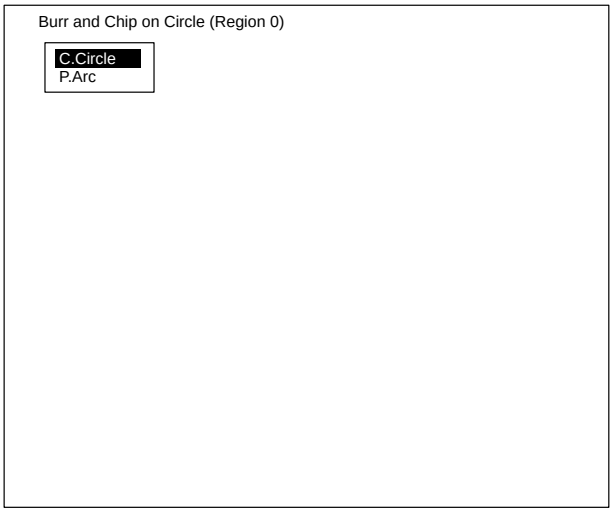
1, 2, 3... 1. Select the region number. A list of inspection modes will be displayed.



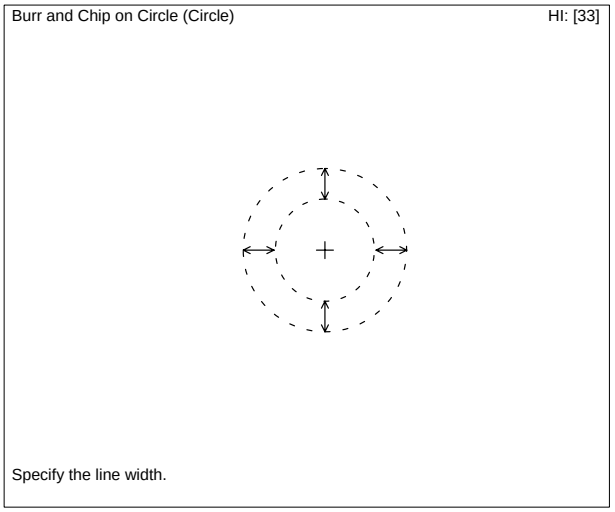
2. Select “C.Burr and chip on circle.”



3. Select the figure. An arrow cursor will be displayed in the center of the screen.



4. Draw the inspection region. The region that is drawn will be registered as the inspection region.

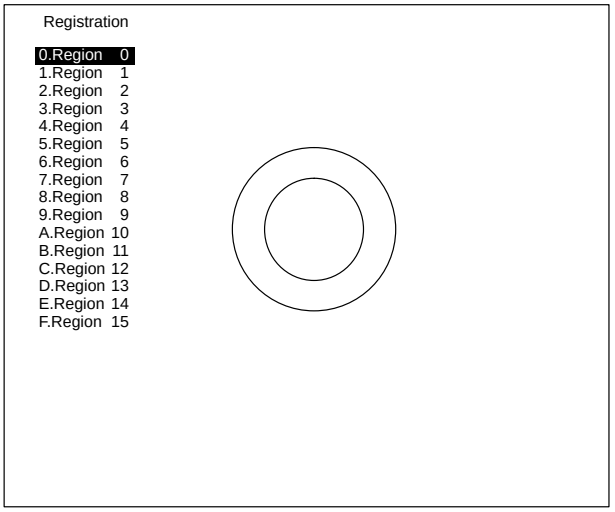


Modifying Inspection Regions

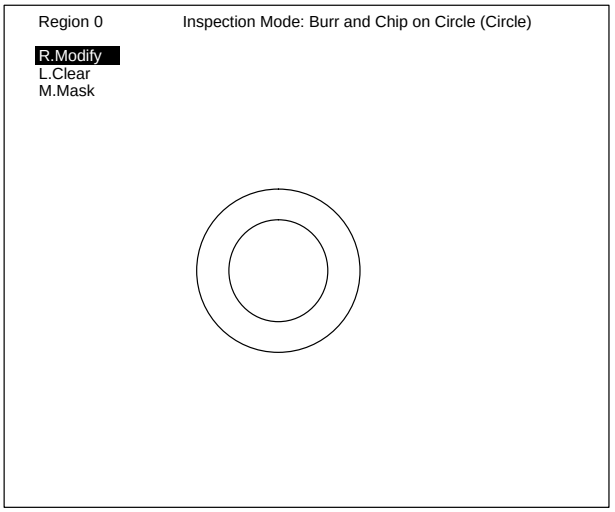
An existing inspection region can be modified. The inspection mode, however, cannot be changed. If you want to change it, you must clear the inspection region and draw a new inspection region. When the cursor is moved to select a inspection region number, the inspection region of the cursor position is displayed with solid lines.

Procedure

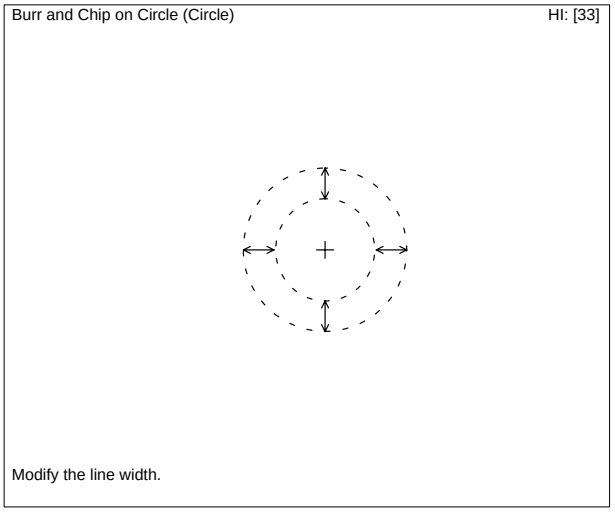
1, 2, 3... 1. Select the region number.



2. Select “R.Modify.”



3. Modify the inspection region. The specified inspection region will be registered.

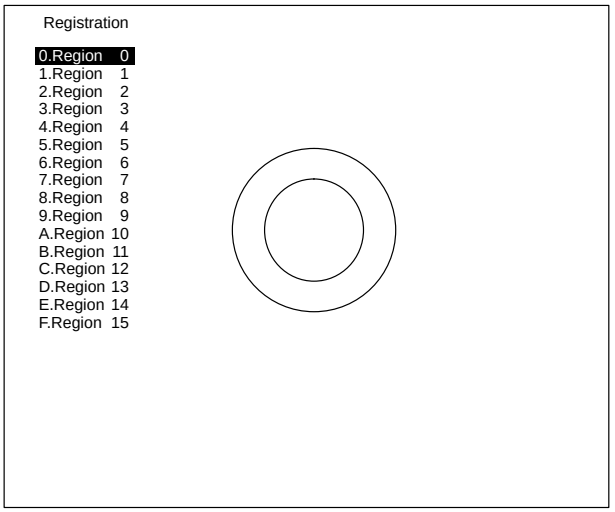


Clearing Inspection Regions

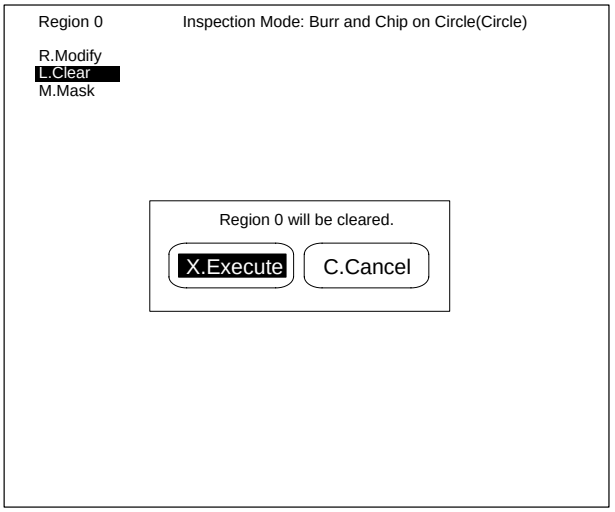
Use the following procedure to clear an unnecessary inspection region. (i.e., region not being used for inspection)

Procedure

1, 2, 3... 1. Select the region number.



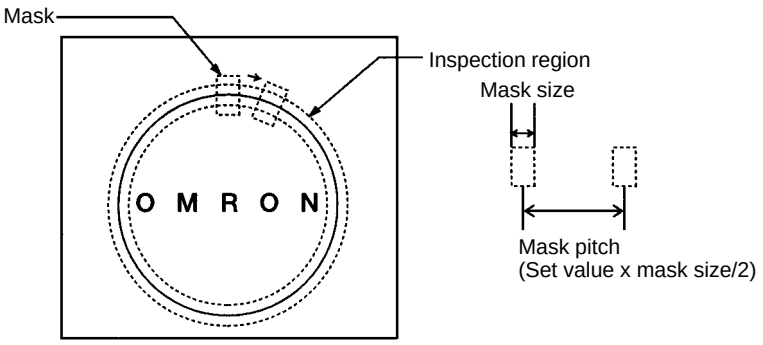
2. Select “L.Clear.” A confirmation message will be displayed.
3. Select “X.Execute” after rechecking the inspection region number. The inspection region will be cleared.



Changing Mask Size and Pitch

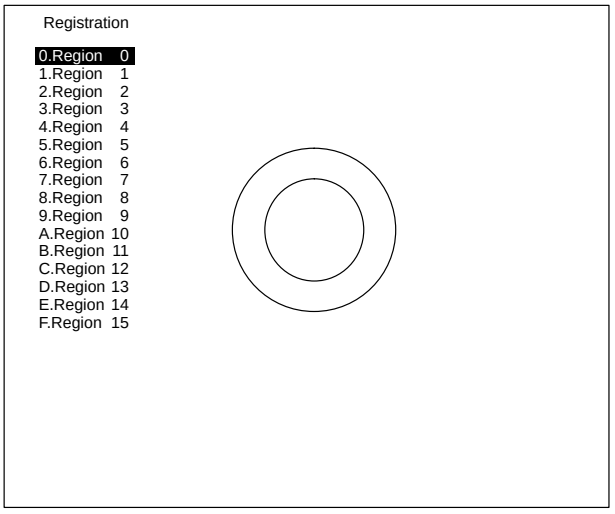
With burr and chip on circle inspection, the mask in the circular inspection region is moved little by little to detect the most defective positions. Use the following procedure to set mask size and pitch.

Item	Details
Mask size	When inspection regions are newly drawn, the default mask size is 10. Set the mask size between 4 and 80, according to the sizes of the burrs and chips to be detected. The larger the mask size, the shorter the processing time will be.
Mask pitch	This sets the pitch for moving the mask. The default mask pitch of a inspection region is 4. Set the mask pitch between 1 and 6 according to the sizes of the burrs and chips to be detected. The mask pitch does not affect the processing time.



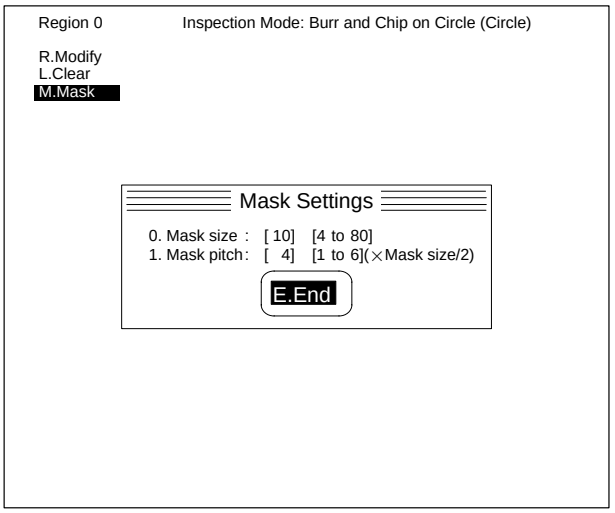
Procedure

1, 2, 3... 1. Select the region number.



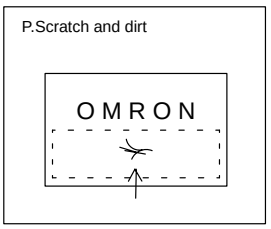
2. Select “M.Mask.”
3. Correct the mask size and mask pitch.

4. Select “E.End.”

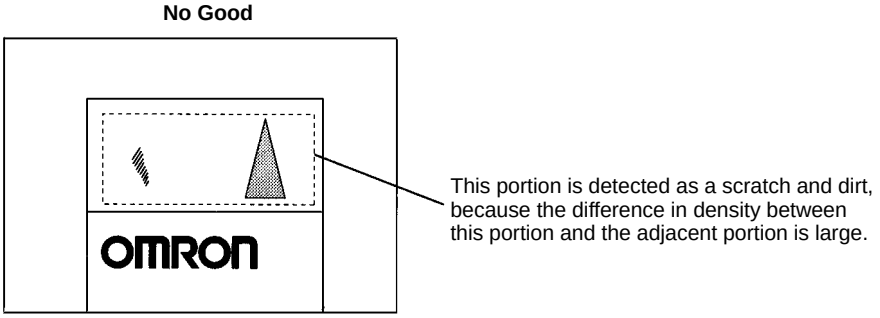


4-13-3 Drawing Inspection Regions for Scratch and Dirt Inspection: P.Scratch and Dirt

“P.Scratch and Dirt” inspects for scratches and dirt on a work piece. Draw the inspection regions.



Important Do not draw the inspection region to include any marks or patterns, otherwise incorrect inspection will result because marks and patterns inside the inspection region cannot be differentiated from scratches and dirt. Use the shape inspection to inspect for scratches and dirt in a region containing marks or patterns.



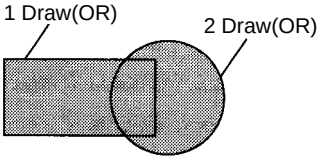
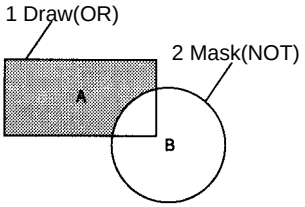
The inspection region can be drawn as a combination of the following figures.

Figure type	Drawing method
B.Box	Specify two diagonally opposed corner points
C.Circle	Specify the center, and then specify any point on the circumference.
A.Ellipse	Specify the center, and then specify any corner of the rectangle that circumscribes the ellipse.
P.Polygon	Specify adjacent corners in sequence. A maximum of 254 corners can be specified. Press the Enter Key twice after designating the last corner. The last corner will be connected to the first corner with a line to create the polygon.

To move figures that are drawn, use the following item.

Item	Action
M.Move all	Moves all figures together in parallel.

The following two modes are available for drawing figures. A combination of the modes in appropriate order makes it possible to draw complicated figures.

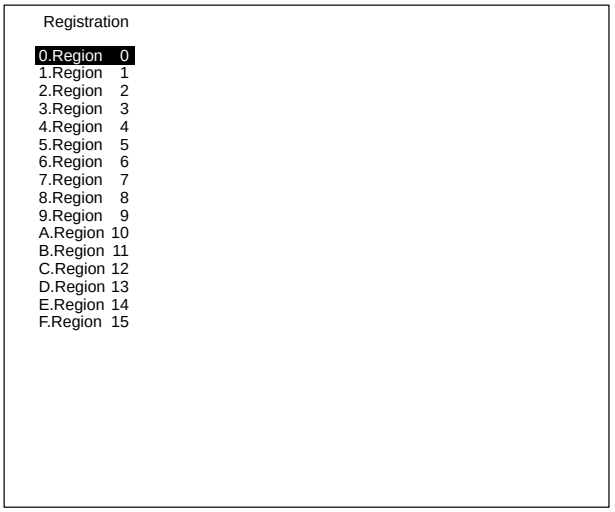
Drawing mode	Action	
O.Draw(OR)		Use this mode to draw regions which are registered as inspection regions. Multiple figures can be drawn in the same inspection region number and used as a single inspection region.
M.Mask(NOT)		Use this mode to delete parts of the inspection region. If figure B is drawn in mask mode over a previously-drawn figure A, the area inside figure B is deleted. However, the area inside figure B is not deleted if figure A is drawn after figure B is drawn in mask mode.

Drawing New Inspection Regions

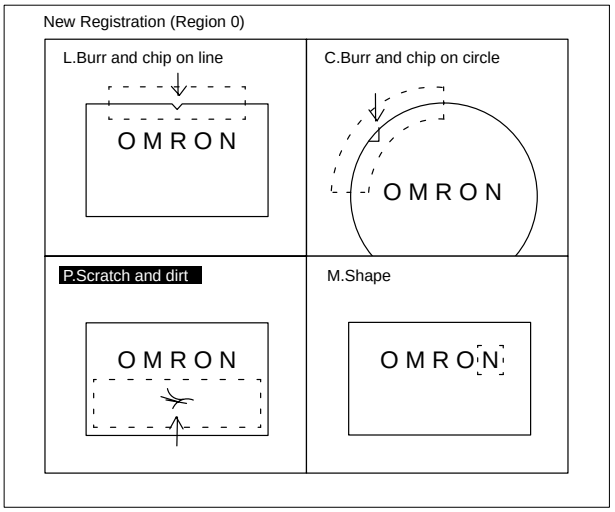
Use the following procedure to draw a new inspection region.

Procedure

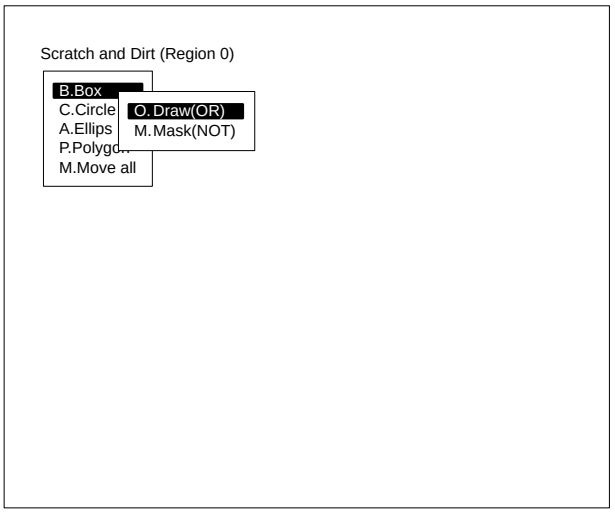
1, 2, 3... 1. Select the region number. A list of inspection mode will be displayed.



2. Select “P.Scratch and dirt.”

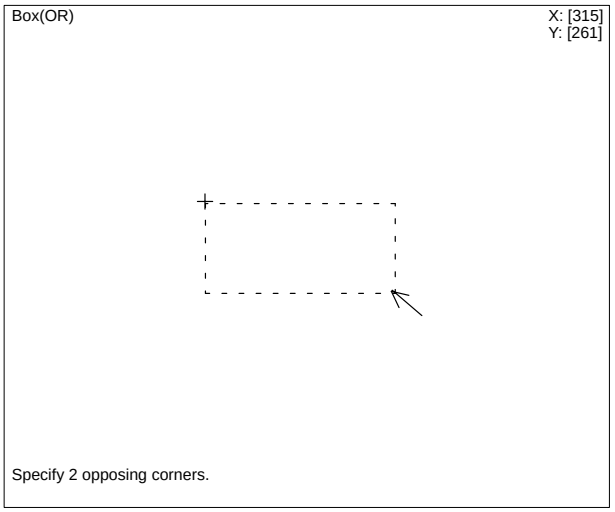


3. Select a figure.
4. Select a drawing mode. An arrow cursor will be displayed in the center of the screen.



5. Draw the inspection region. To draw two or more figures for the same inspection region number, repeat steps 3 to 5.

6. Press the Escape Key. The figure that was drawn will be registered as an inspection region.



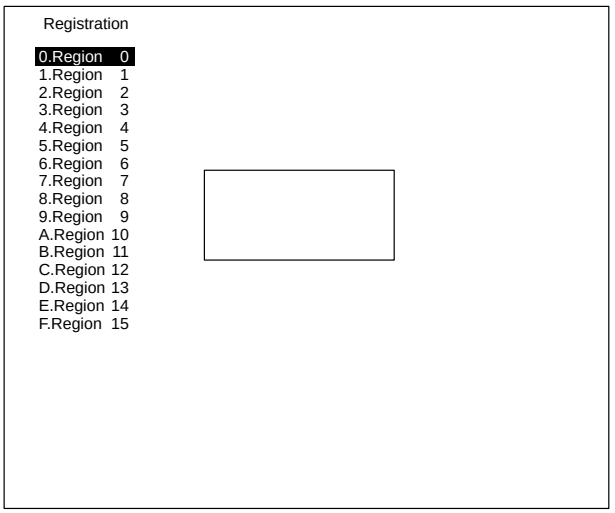
Modifying Inspection Regions

An existing inspection region can be moved, added, or modified figures that have been drawn as inspection regions. The inspection mode cannot be changed. If you want to change the mode, you must clear the inspection region and draw a new inspection region. When the cursor is moved to select an inspection region number, the inspection region of the cursor position is displayed with solid lines.

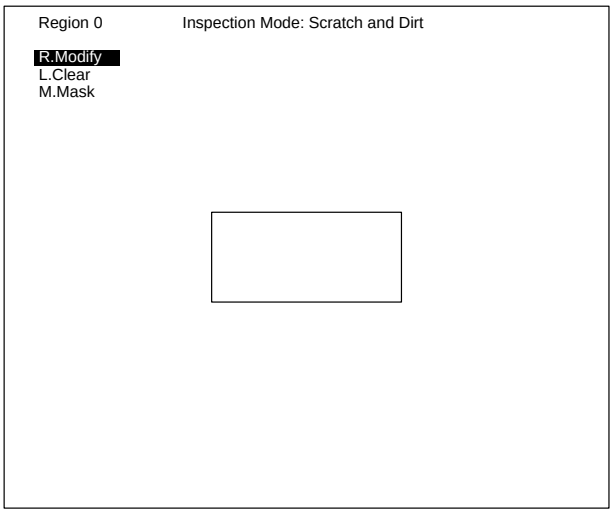
To delete all the figures in the inspection region, execute “L.Clear.” To delete part of the figures, specify the part with mask mode (NOT).

Procedure

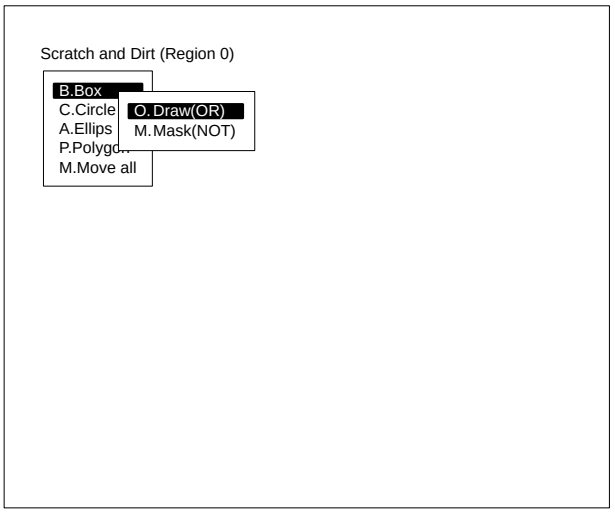
1, 2, 3... 1. Select the region number. The inspection regions that have already been drawn will be displayed.



2. Select “R.Modify.”

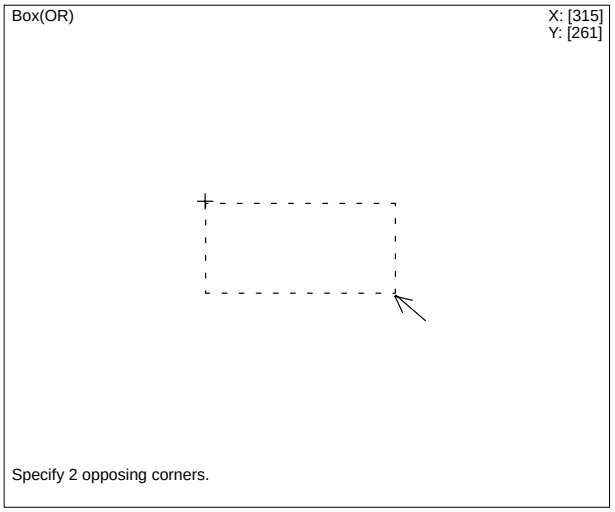


3. Select the figure.
4. Select the drawing mode. An arrow cursor will be displayed in the center of the screen.



5. Draw the inspection region. To draw two or more figures for the same inspection region number, repeat steps 3 to 5.

6. Press the Escape Key. The modified inspection region will be registered.

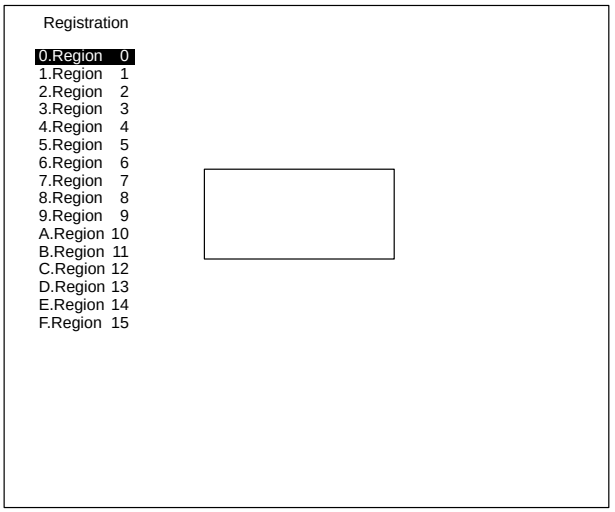


Clearing Inspection Regions

Use the following procedure to clear unnecessary inspection regions. (i.e., regions not being used for inspection)

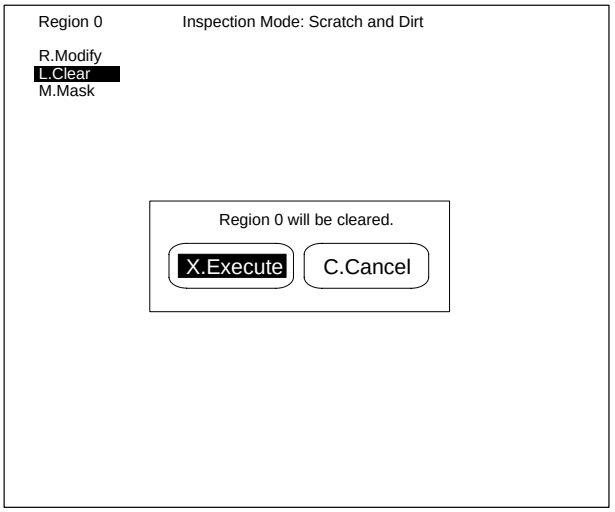
Procedure

1, 2, 3... 1. Select the region number.



2. Select “L.Clear.” A confirmation message will be displayed.

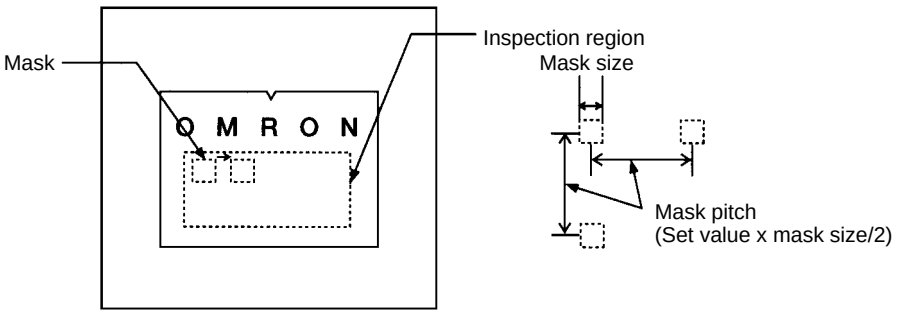
3. Recheck the inspection region number and then select “X.Execute.” The region will be cleared.



Changing Mask Sizes and Mask Pitches

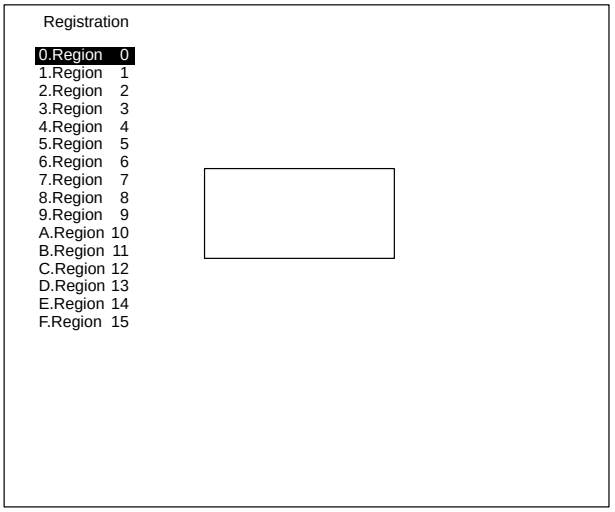
With scratch and dirt inspection, the mask in the inspection region is moved little by little to detect the most defective positions. Use the following procedure to set mask size and pitch.

Item	Details
Mask size	When inspection regions are newly drawn, the default mask size is 10. Set the mask size between 4 and 80, according to the sizes of the scratch and dirt to be detected. The larger the mask size, the shorter the processing time will be.
Mask pitch	This sets the pitch for moving the mask. The default mask pitch of a inspection region is 4. Set the mask pitch between 1 and 6 according to the sizes of the scratch and dirt to be detected. The mask pitch does not affect the processing time.

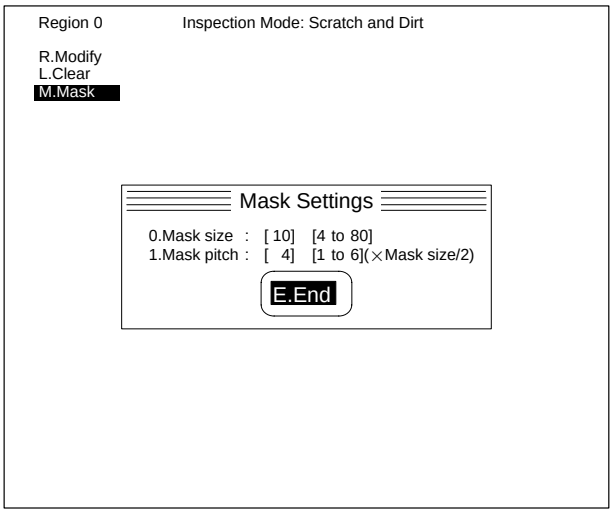


Procedure

1, 2, 3... 1. Select the region number.



2. Select “M.Mask.”
3. Modify the mask size and mask pitch.
4. Select “E.End.”

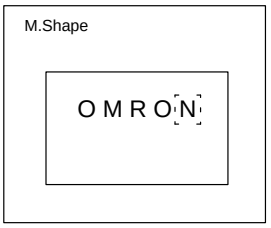


4-13-4 Drawing Inspection Regions for Shape Inspection for Model Registration: M.Shape

“M.Shape” inspects shapes by evaluating as OK or NG the correlation between the inspection model and the input image. Draw the inspection region. Register an image in the inspection region as the model. The inspection is conducted by searching the range ±10 pixels around the inspection region. If position compensation is used, the inspection is conducted by searching the range ±10 pixels around the position -compensated inspection region.

Important Correct measurement is not possible if different filtering and background suppression levels are used during measurement than those used when model was registered. Ensure that any required filtering and background suppression lev-

els are set before registering the models. Refer to *4-4-2 Selecting Filtering* and *4-4-3 Setting Background Suppression Levels.*



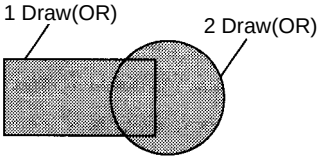
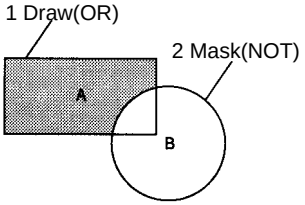
The inspection region can be drawn as a combination of the following figures.

Figure type	Drawing method
B.Box	Specify two diagonally opposed corner points
C.Circle	Specify the center, and then specify any point on the circumference.
A.Ellipse	Specify the center, and then specify any corner of the rectangle that circumscribes the ellipse.
P.Polygon	Specify the adjacent corners in sequence. A maximum of 254 corners can be specified. Press the Enter Key twice after designating the last corner. The last corner will be connected to the first corner with a line to create the polygon.

To move figures that are drawn, use the following item.

Item	Action
M.Move all	Moves all figures together in parallel.

The following two modes are available for drawing figures. A combination of the modes in appropriate order makes it possible to draw complicated figures.

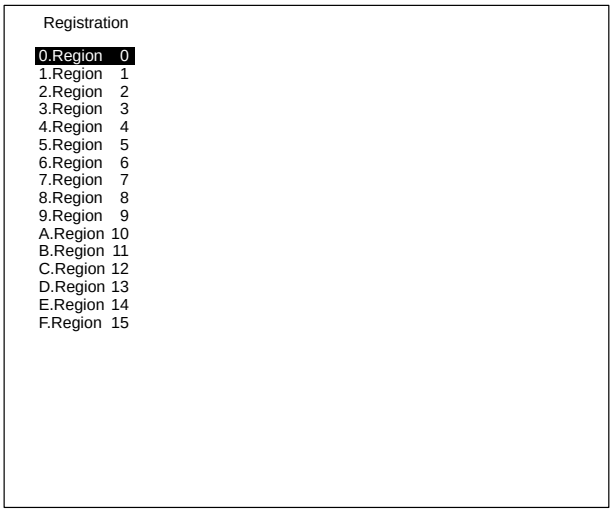
Drawing mode	Action	
O.Draw(OR)		Use this mode to draw regions which are registered as inspection regions. Multiple figures can be drawn in the same inspection region number and used as a single inspection region.
M.Mask(NOT)		Use this mode to delete parts of the inspection region. If figure B is drawn in mask mode over a previously-drawn figure A, the area inside figure B is deleted. However, the area inside figure B is not deleted if figure A is drawn after figure B is drawn in mask mode.

Drawing New Inspection Regions

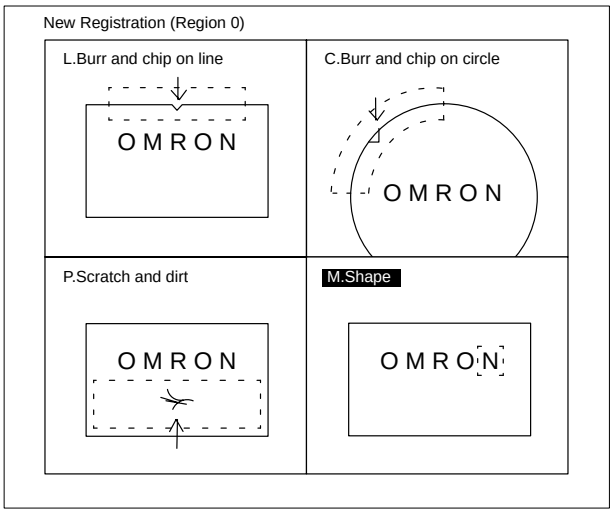
Use the following procedure to draw a new inspection region.

Procedure

1, 2, 3... 1. Select the region number. A list of inspection regions will be displayed.

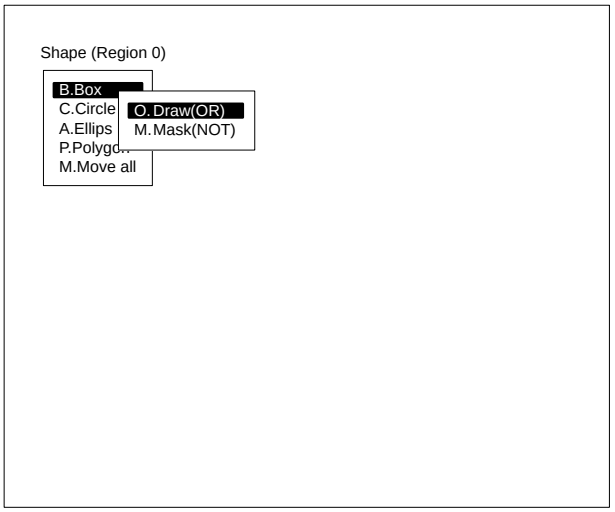


2. Select “M.Shape.”

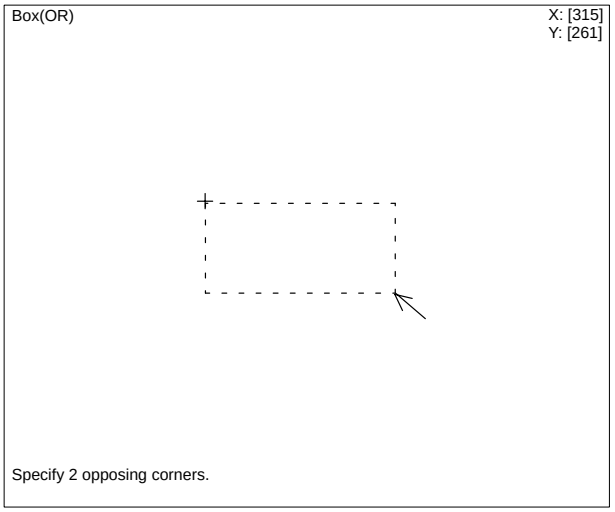


3. Select the figure.

4. Select the drawing mode. An arrow cursor will be displayed in the center of the screen.

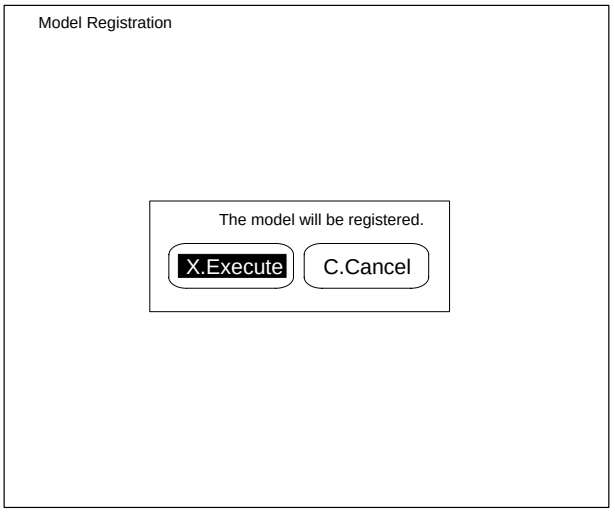


5. Draw the inspection region. To draw two or more figures for the same inspection region number, repeat steps 3 to 5.



6. Press the Escape Key. A confirmation message will be displayed.

7. Select “X.Execute.” The region that was drawn will be registered as a inspection region, and the images in that region will be registered as models.



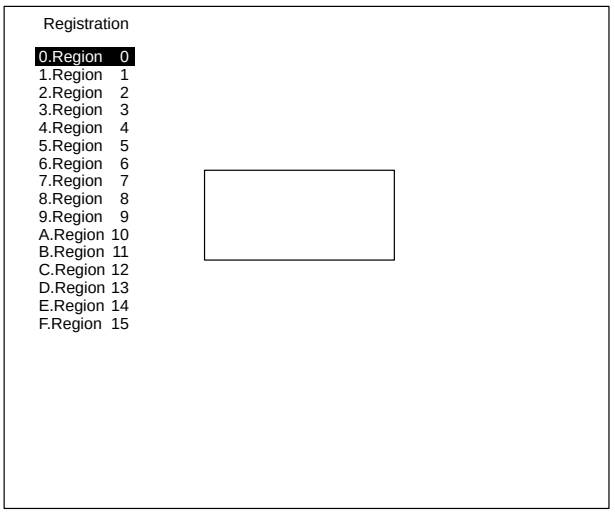
Modifying Inspection Regions

An existing inspection region can be moved, added, or modified figures that have been drawn as inspection regions. The inspection mode cannot be changed. If you want to change the mode, you must clear the inspection region and draw a new inspection region. When the cursor is moved to select a inspection region number, the inspection region of the cursor position is displayed with solid lines.

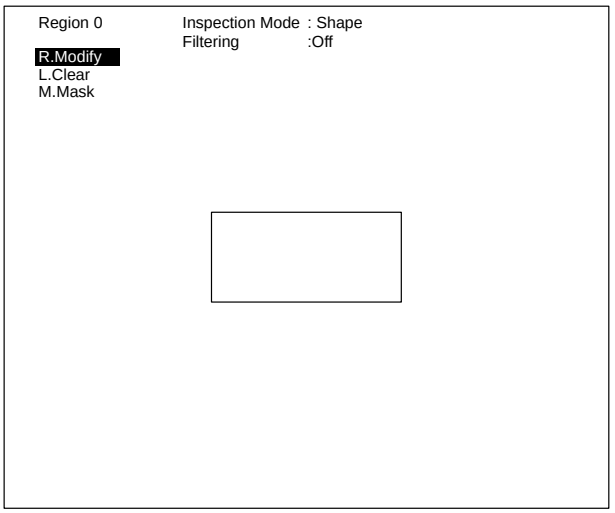
To delete all the figures in the inspection region, execute “L.Clear.” To delete part of the figures, specify the part with mask mode (NOT).

Procedure

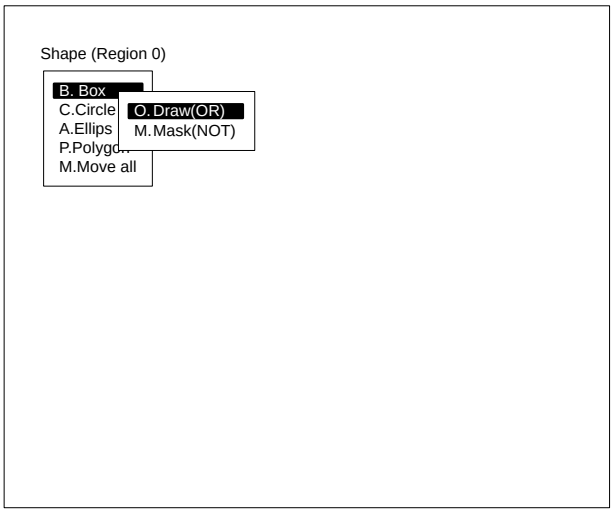
1, 2, 3... 1. Select the region number. The inspection region and corresponding model will be displayed.



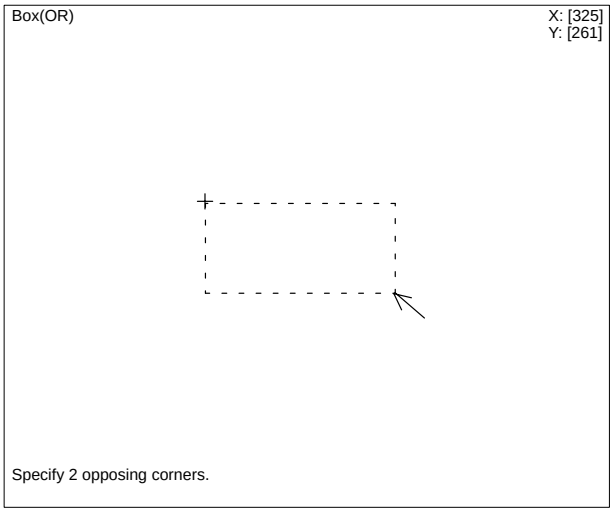
2. Select “R.Modify.”



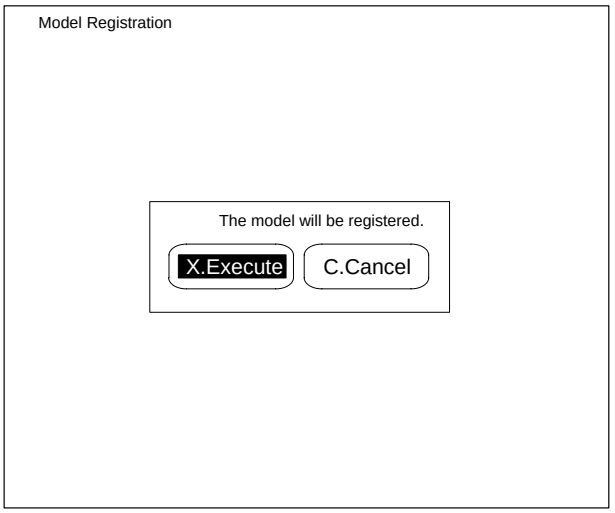
3. Select the figure.
4. Select the drawing mode. An arrow cursor will be displayed in the center of the screen.



5. Draw the inspection region. To draw two or more figures for the same inspection region, repeat steps 3 to 5.



6. Press the Escape Key. A confirmation message will be displayed.
7. Select “X.Execute.” The modified inspection region will be registered and the images in the inspection region will be registered as models.

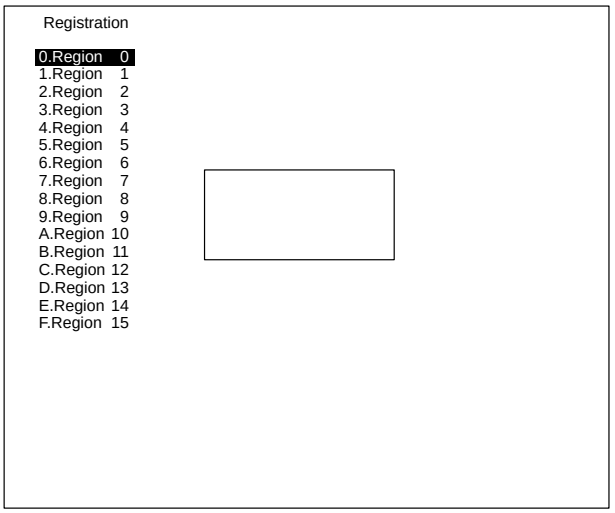


Clearing Inspection Regions

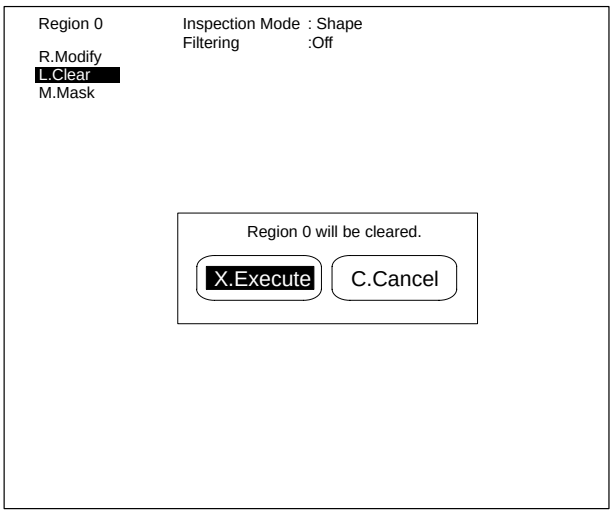
Use the following procedure to clear all figures drawn for an unnecessary inspection region (i.e., a region not being used for inspection), and to clear all models registered for the region.

Procedure

1, 2, 3... 1. Select the region number. The inspection region and corresponding model will be displayed.



2. Select “L.Clear.” A confirmation message will be displayed.
3. Recheck the inspection region number and then select “X.Execute.” The region and models will be cleared.

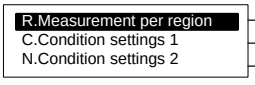


Changing Mask Size and Pitch

Shape inspection does not require mask size or mask pitch settings.

4-14 K.Surface A/C.Conditions

“K.Surface A/C.Conditions” detects chips, burrs, scratches, and dirt in inspection regions. Use “C.Conditions” to set inspection items and evaluation criteria for each inspection region.



Checking Measurement Values Page 119
Setting Measurement Conditions Page 123
Setting Measurement Conditions with Number of Defects Page 124

4-14-1 Checking Measurement Values: R.Measurement Per Region

"R.Measurement per region" inspects images and obtains measurement values. The threshold between the measurement values for acceptable products and those for defective products is set as the criteria. Therefore, sample some acceptable and defective products and obtain their measurement values before setting the criteria. Items to be inspected vary with the mode set with the "R.Registration" item.

Large Defects

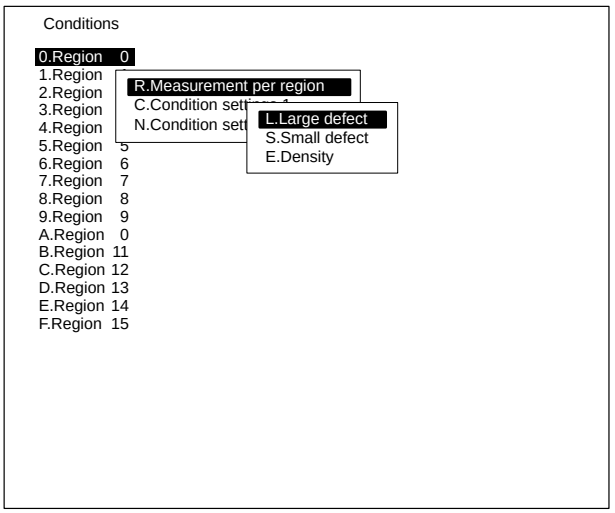
When the mode is set for burr and chip inspection on straight or circular lines or scratch and dirt inspection, use the following procedure to detect any chip, burr, scratch, or dirt that is large in size. The cursor will indicate the most defective part in the inspection region and the screen will display the defect value between 0 and 255. The clearer the chip, burr, scratch, or dirt is, the larger the defect value will be.

The "S.Small defect" item can be used for more stable detection when chips, burrs, scratches, or dirt are relatively small in size.

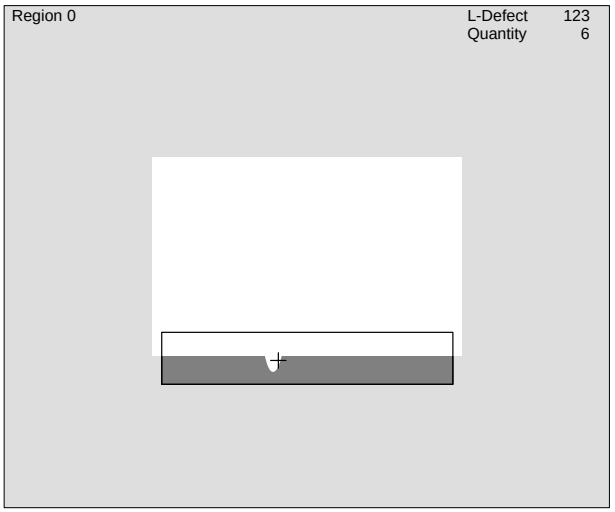
Procedure

1, 2, 3...

1. Select the region number.
2. Select "R.Measurement per region."



3. Select “L.Large defect.” The measurement runs continually and the degree of large defect is displayed. If the defect quantity flag is set to ON with the “N.Condition settings 2,” the number of defects is displayed.



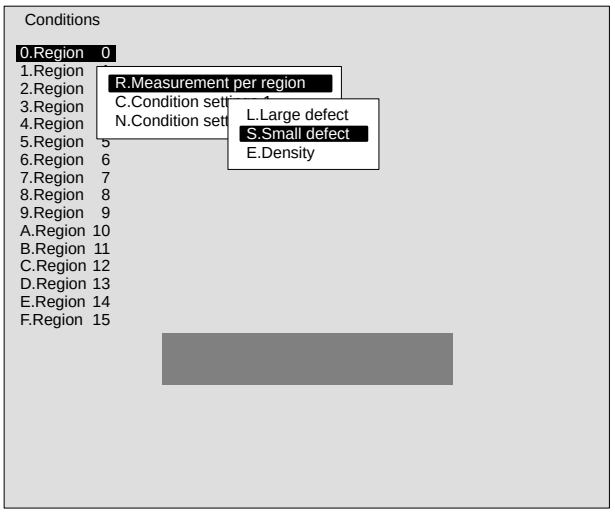
Small Defects

When the mode is set for burr and chip inspection on straight or circular lines or scratch and dirt inspection, use the following procedure to detect any chip, burr, scratch, or dirt that is small in size. The cursor will indicate the most defective part in the inspection region and the screen will display the defect value between 0 and 255. The clearer the chip, burr, scratch, or dirt is, the higher the defect value will be. In comparison with “L.Large defect,” the “S.Small defect” item can be used for more stable detection when chips, burrs, scratches, or dirt are relatively small in size.

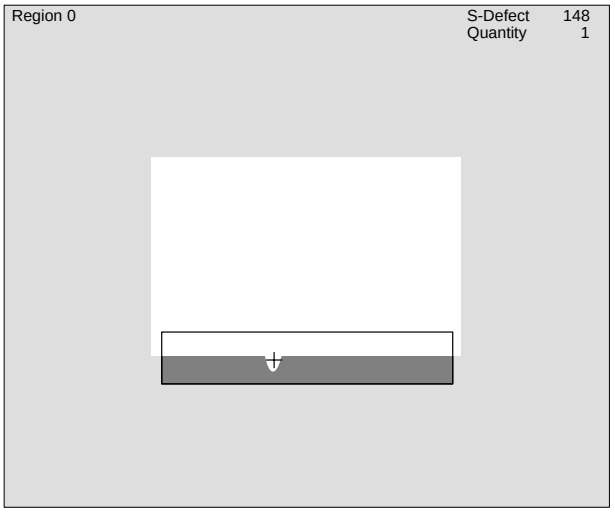
Procedure

1, 2, 3...

1. Select the region number.
2. Select “R.Measurement per region.”



3. Select “S.Small defect.” The measurement runs continually and the degree of small defect is displayed. If the defect quantity flag is set to ON with the “N.Condition settings 2,” the number of defects is displayed.



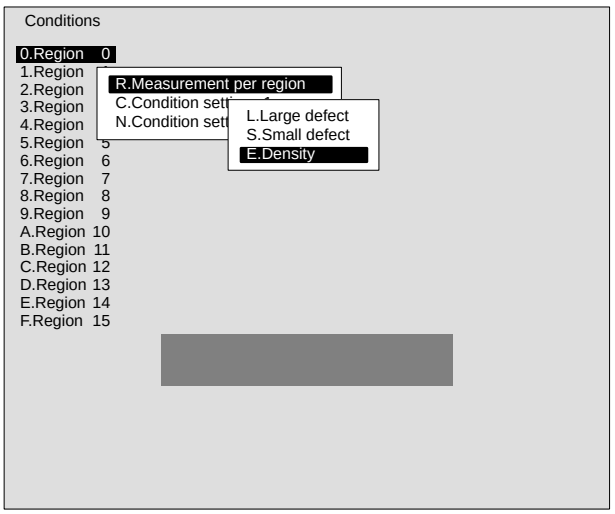
Density

When the mode is set for burr and chip inspection on straight or circular lines or scratch and dirt inspection, use the following procedure to obtain the density in a inspection region in order to confirm whether there is an object in the inspection region. The screen will display the maximum density and minimum density between 0 and 255.

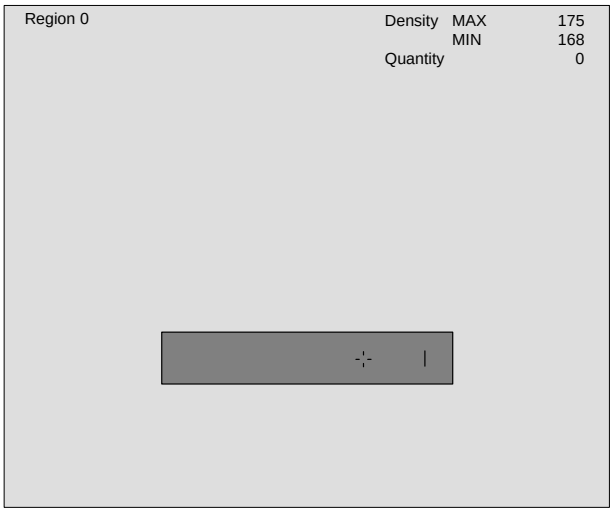
Procedure

1, 2, 3...

1. Select the region number.
2. Select “R.Measurement per region.”



3. Select “E.Density.” The measurement runs continually and the maximum and minimum densities are displayed. If the defect quantity flag is set to ON with the “N.Condition settings 2,” the number of defects is displayed.

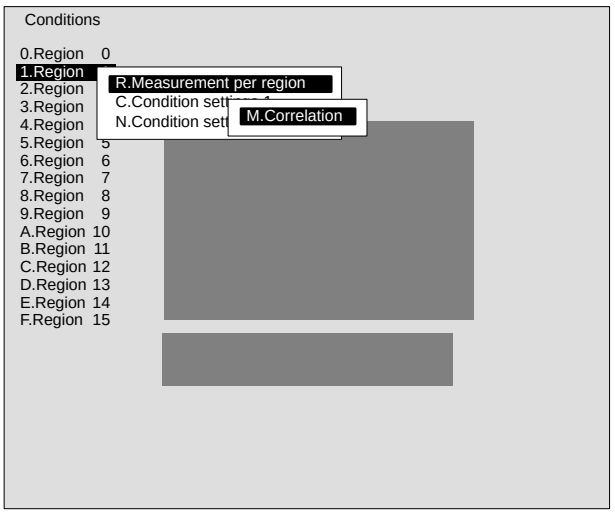


Density Correlation Values

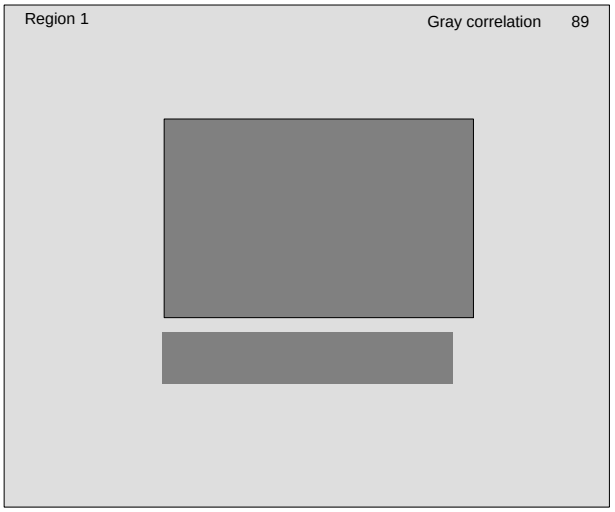
When the mode is set for shape inspection, the following procedure can be used to check the density correlation with a pre-registered model, and to display the correlation value as a value from 0 to 100.

1, 2, 3...

1. Select the region number.
2. Select “R.Measurement per region.”



3. Select “M.Correlation.” The measurement runs continually and the density correlation value with the model is displayed.



4-14-2 Setting Measurement Conditions: C.Condition Settings 1

“C.Condition Settings 1” sets measurement conditions and criteria to judge whether measurement values are OK or NG. Items to be inspected vary according to the mode set with the “R.Registration” item. Set the measurement conditions according to the values checked with the “R.Measurement per region” item. Set the defect quantity flag to ON with “N.Condition settings 2” so that the screen will indicate OK or NG as a result of the number of defects found. Refer to *4-14-3 Setting Measurement Conditions with Number of Defects*.

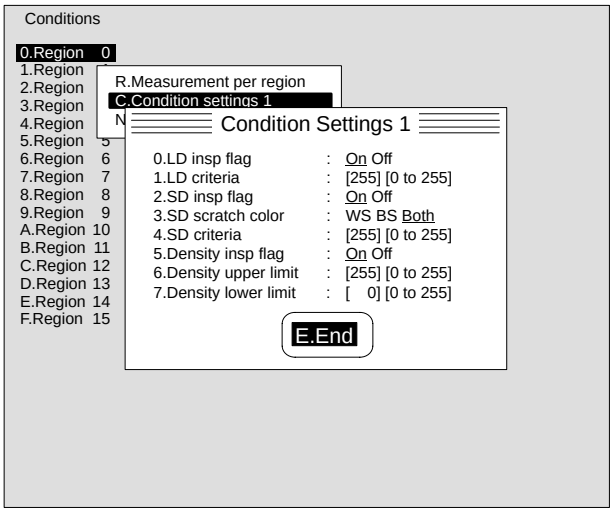
Item		Details
Large defect	Inspection flag	Detects large chips, burrs, scratches, and dirt when the LD inspection flag is set to ON and the mode is set for burr and chip inspection on straight or circular lines or scratch and dirt inspection. The “S.Small defect” item can be used for more stable detection when chips, burrs, scratches, or dirt are relatively small in size.
	Criteria	Set between 0 and 255. A product is judged OK if all the detected defects on the product are equal to or less than the criteria, otherwise the product is judged NG.
Small defect	Inspection flag	Detects small chip, burr, scratch, or dirt that is small in size when the SD inspection flag is set to ON and the mode is set for burr and chip inspection on straight or circular lines or scratch and dirt inspection.
	Scratch color	Selects a scratch color to be detected on density images.
	Criteria	Set between 0 and 255. A product is judged OK if all the detected defects on the product are equal to or less than the criteria; otherwise the product is judged NG.
Density	Inspection flag	The maximum and minimum densities are measured inside the inspection region to determine whether an object is present, when the density inspection flag is set to ON and the mode is set for burr and chip inspection on straight or circular lines or scratch and dirt inspection.
	Upper and lower limits	Set between 0 and 255. An product is judged OK if the maximum density and minimum density of the product are within the range, inclusive; otherwise the product is judged NG.
Density correlation value		When the mode is set for shape inspection, the correlation value with a registered model is found and the shape is inspected. Set between 0 and 100. An product is judged OK if the density correlation value is equal to or greater than the criteria; otherwise the product is judged NG.

The required processing time based on the set data can be checked. Refer to *4-15 M.Measure/O.Measure Monitor* and *4-25-1 Entering Measurement Screens*.

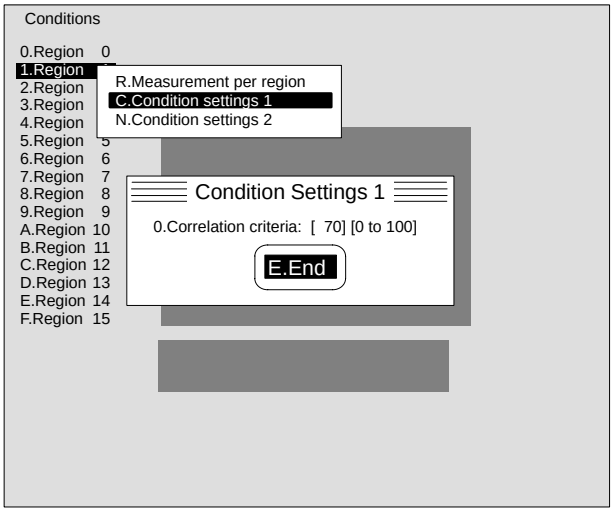
Procedure

1, 2, 3... 1. Select the region number.

2. Select “C.Condition settings 1.”
3. Set the conditions. Set the upper limit and lower limit so that the upper limit is equal to or larger than the lower limit.



4. Select “E.End.” The conditions will be set.



4-14-3 Setting Measurement Conditions with Number of Defects: N.Condition Settings 2

When the mode is set for burr and chip inspection on straight or circular lines or scratch and dirt inspection, use this item to count the number of masks with defects or density values that have been judged NG (i.e., the defect quantity of the masks). The number of defects are only counted here. Use “C.Condition settings 1” to set the conditions for defects and judgement criteria. Refer to *4-14-2 Setting Measurement Conditions*.

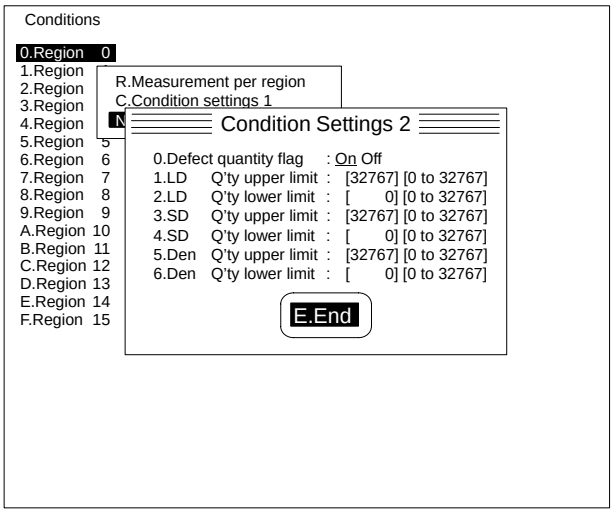
Item		Details
Defect quantity flag		Set to ON to count the number of defects on product and judge whether the number is OK or NG. When this flag is ON, the degree of defects and density values are not judged even if the LD or SD inspection flag or density inspection flag is set to ON with the “C.Setting conditions 1” item. The output of a OK or NG judgement depends on the number of defects found.
Large defect	Quantity upper limit and lower limit	Set between 0 and 32767. An product is judged OK if the number of masks with large defects is within the range, inclusive; otherwise the product is judged NG.
Small defect	Quantity upper limit and lower limit	Set between 0 and 32767. An product is judged OK if the number of masks with small defects is within the range, inclusive; otherwise the product is judged NG.
Density	Quantity upper limit and lower limit	Set between 0 and 32767. An product is judged OK if the number of masks with improper density is within the range, inclusive; otherwise the product is judged NG.

Judging the quantity of defective masks requires a longer processing time. The required processing time based on the set data can be checked. Refer to *4-15 M.Measure/O.Measure Monitor* and *4-25-1 Entering Measurement Screens*.

Procedure

1, 2, 3...

1. Select the region number.
2. Select “N.Condition settings 2.”
3. Set the conditions. Set the upper and lower limits so that each upper limit will be greater than or equal to the corresponding lower limit.
4. Select “E.End.”



4-15 M.Measure/O.Measure Monitor

"M.Measure/O.Measure monitor" can be used to monitor measurement values and times before performing actual measurements.

O.Measure monitor
M.Measure
Checking Measurement Values and Measurement Times Page 126
Refer to *4-25 M.Measure M.Measure* Page 203

4-15-1 Checking Measurement Values and Measurement Times: O.Measure Monitor

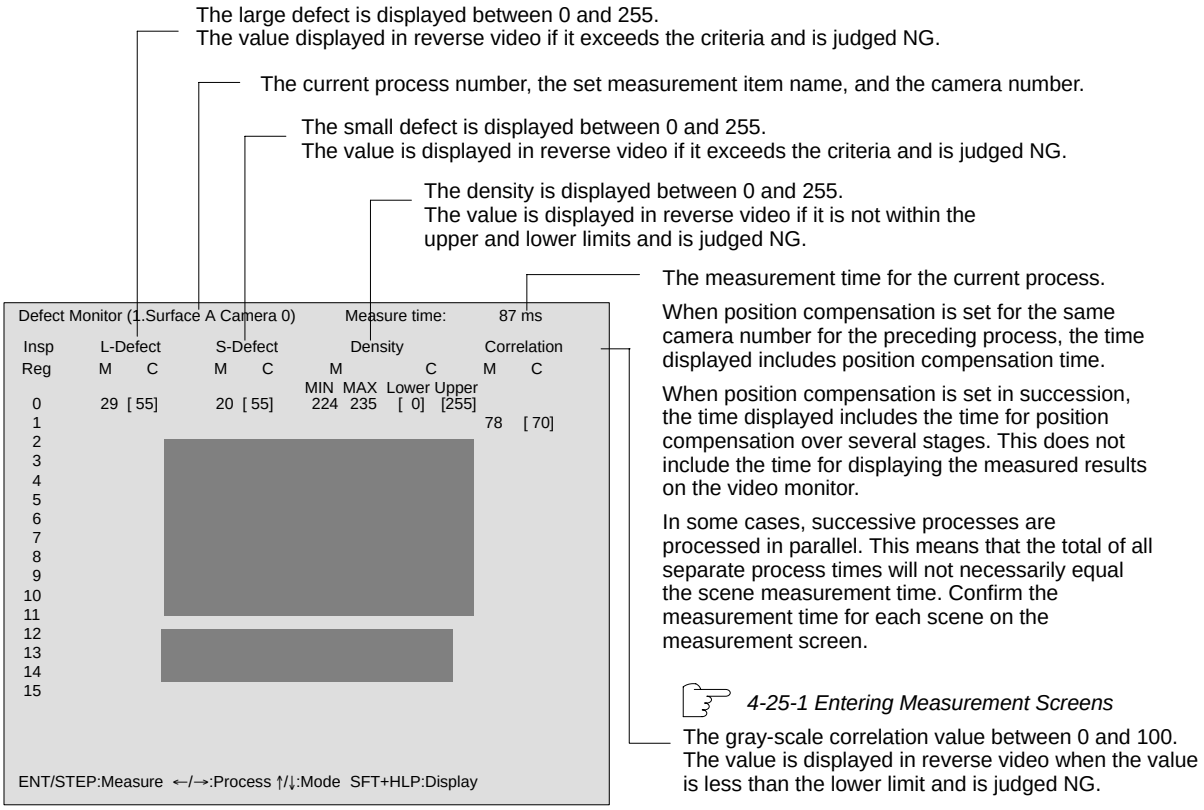
"O.Measure monitor" monitors measurement values based on the set data. Measured results are output to the Video Monitor only, even when a Parallel I/O Unit or Terminal Block Unit is mounted. The measurement time for each process is also displayed on the Video Monitor. When several processes are set, the measurement time for each can be monitored by switching between them.

Important

Instruction Input Timing

The next instruction must not be input while an instruction is being executed. Neither the instruction currently being executed nor the next instruction will be properly executed. When a Terminal Block Unit or Parallel I/O Unit is mounted, the BUSY signal will turn ON during instruction execution. Check to be sure that the BUSY signal is OFF before inputting the next instruction.

Defect Monitor



Quantity Monitor

The number of masks with large defects exceeding the criteria.
If the value is not within the upper and lower limits and is judged NG, it is displayed in reverse video.

The current process number, the set measurement item name, and the camera number.

The number of masks with small defects exceeding the criteria.
If the value is not within the upper and lower limits and is judged NG, it is displayed in reverse video.

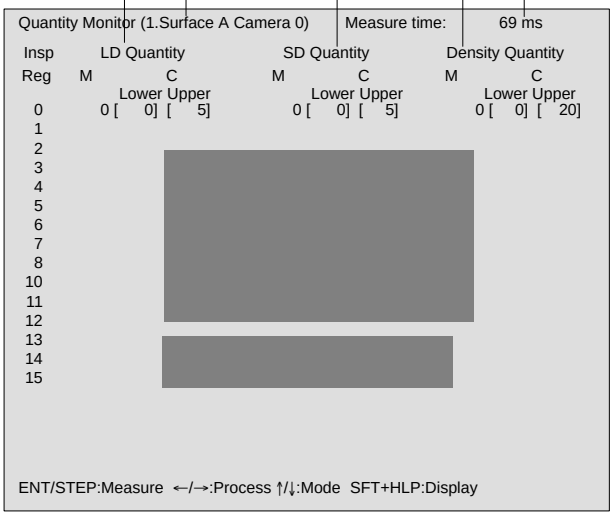
The number of masks with density values not within the upper and lower limits.
If the number of defects is not within the upper and lower limits and is judged NG, the value is displayed in reverse video

The measurement time for the current process.

When position compensation is set for the same camera number for the preceding process, the time displayed includes position compensation time.

When position compensation is set in succession, the time displayed includes the time for position compensation over several stages. This does not include the time for displaying the measured results on the video monitor.

In some cases, successive processes are processed in parallel. This means that the total of all separate process times will not necessarily equal the scene measurement time. Confirm the measurement time for each scene on the measurement screen.



4-25-1 Entering Measurement Screens

Console

All Monitor Modes

The following instructions can be input from the Console.

Instruction	Key	Action
Measure	ENT	Executes a measurement. When position compensation is set for the same camera number for the preceding process, the measurement is executed after position compensation.
Switch process	◀ / ▶	Switches the process and executes the measurement item as set. Process which have no set data are skipped. When position compensation is set for the same camera number for the preceding process, the measurement is executed after the position compensation.
Switch mode	▲/▼	Switches the defect, or quantity monitor mode.
Character display	SHIFT + HELP	Switches between displaying and not displaying characters. If the judgment is NG for burr and chip inspection on straight or circular lines or scratch and dirt inspection, the cursor will be displayed to indicate the most defective part. If the judgement is NG for shape inspections, a cursor will be displayed at the center of a rectangle circumscribing the inspection area. This instruction can be used to turn off character displays so that these cursors are easier to see.
Quit measurement	ESC	Quits the measure monitor screen.

RS-232C

The following instructions can be input via the RS-232C. Attach a delimiter to the input code (ASCII). Ensure that it matches the communications specifications of

the F350 and the external devices. Refer to *5-2-3 Setting the RS-232C Communications Specifications* in the *F350 Setup Menu Operation Manual*.

Important Set the instruction delimiter to CR, or CR + LF. Always use channel 0. Channel 1 on the RS-232C Unit cannot be used.

All Monitor Modes

Measure

M m	Delimiter

Measurement is executed once. When position compensation is set for the same camera number for the preceding process, the measurement is executed after position compensation.

Quit measurement

Q q	Delimiter

Quits the measure monitor screen.

Parallel I/O

The following instruction can be input from a Parallel I/O Unit or Terminal Block Unit. Connect and wire the external devices. The leading edge (OFF to ON) of the STEP signal is indicated by ↓.

Refer to *2-4 Connecting Peripheral Devices* in the *Setup Menu Operation Manual*.

All Monitor Modes

Instruction	Input data STEP DI: 76543210	Action
Measure	↓	Executes a measurement one time in sync with the STEP signal's leading edge (OFF to ON). When position compensation is set for the same camera number for the preceding process, the measurement is executed after the position compensation.

■ Surface Defect Inspection B

Surface defect inspection B appears on the menus as simply “E.Surface B.”

“E.Surface B” detects scratched and dirt in an inspection region from the density deviation in the inspection region if the background is even. Four modes are available for detecting these defects. Select the most suitable mode according to the type of inspection part.

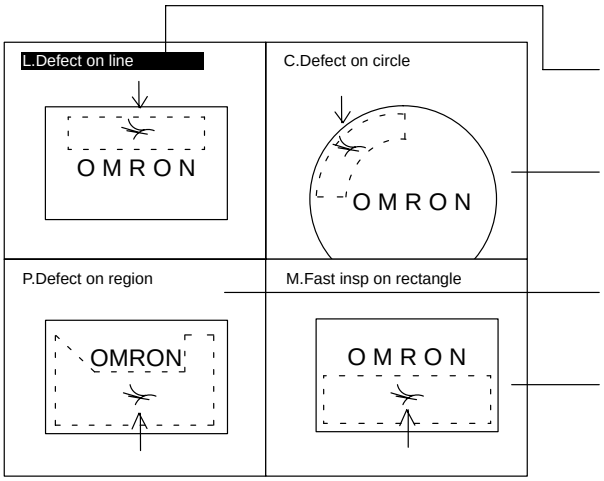
Surface defect inspection B must be set for a process number before it can be used. Refer to *4-3 U.Process*.

Select the camera number before setting the inspection region. Refer to *4-4-1 Selecting the Camera Number*.

4-16 E.Surface B/R.Registration

Four modes are available to detect the scratches and dirt in an inspection region. “R.Registration” selects the most suitable mode according to the type of inspection before drawing the inspection region. Use the position compensation function if the position or angle of the inspection part is not stable. Refer to *4-23 P.Position Compensation*.

When using the position compensation function, display a still (freeze) image after position compensation and then draw the inspection region. Refer to *4-2-3 Inputting Images After Position Compensation*.



Drawing Inspection Regions for Defect Inspection on Straight Lines Page 129

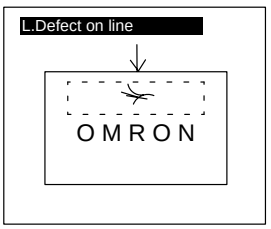
Drawing Inspection Regions for Defect Inspection on Circular Lines Page 134

Drawing Inspection Regions for Defect Inspection on Regions Page 140

Drawing Inspection Regions for Fast Inspection on Rectangle Page 147

4-16-1 Drawing Inspection Regions for Defect Inspection on Straight Lines: L.Defect on Line

“L.Defect on line” inspects for scratches and dirt in the rectangular region. Draw the inspection regions. Specify the start point, end point, and width of the region.

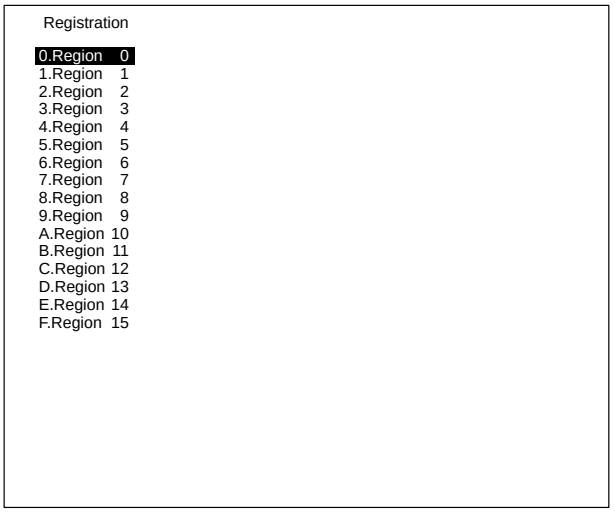


Drawing New Inspection Regions

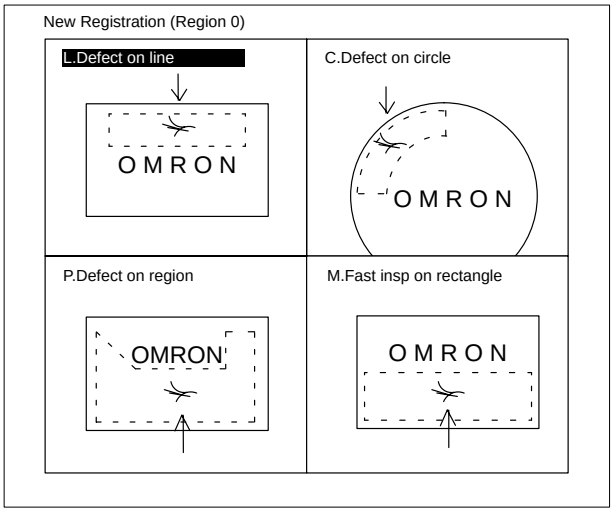
Use the following procedure to draw a new inspection region.

Procedure

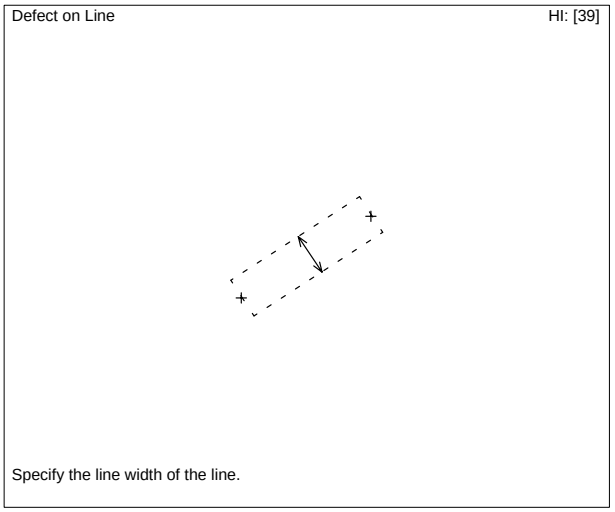
1, 2, 3... 1. Select the region number. A list of inspection mode will be displayed.



2. Select “L.Defect on line.” An arrow cursor will be displayed in the center of the screen.



3. Draw the inspection region. The rectangular region that is drawn will be registered as the inspection region.

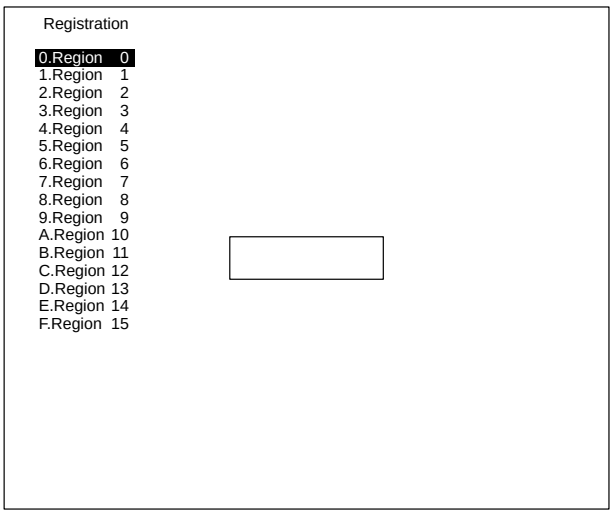


Modifying Inspection Regions

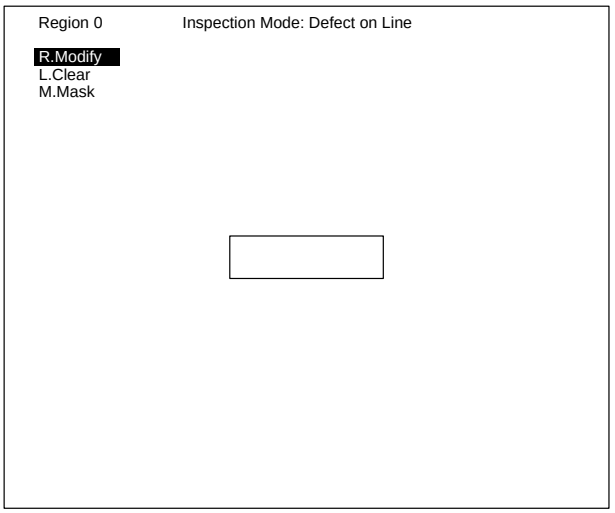
An existing inspection region can be modified. The inspection mode, however, cannot be changed. If you want to change it, you must clear the inspection region and draw a new inspection region. When the cursor is moved to select a inspection region number, the inspection region of the cursor position is displayed with solid lines.

Procedure

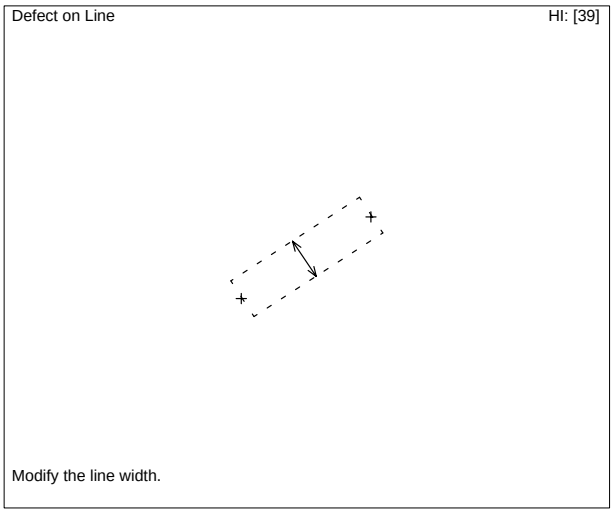
1, 2, 3... 1. Select the region number.



2. Select “R.Modify.”



3. Modify the inspection region. The modified inspection region will be registered.

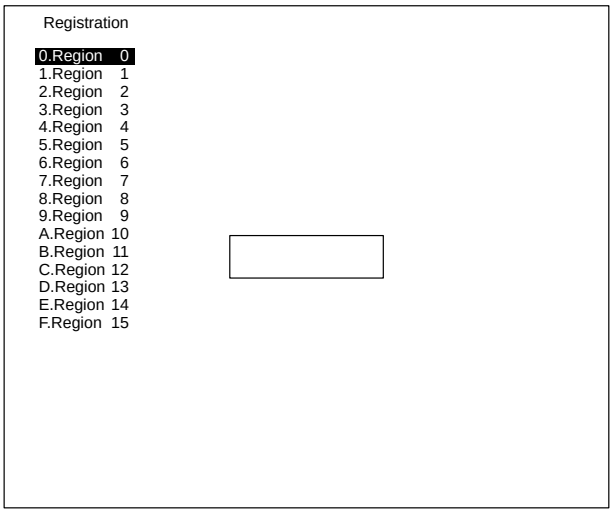


Clearing Inspection Regions

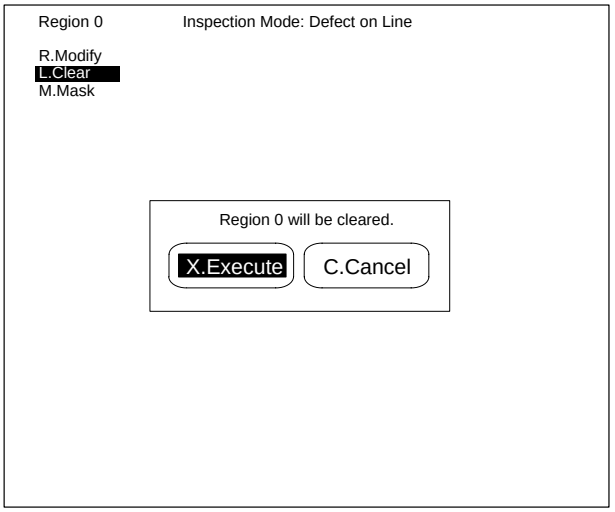
Use the following procedure to clear an unnecessary inspection region (i.e., a region not being used for inspection).

Procedure

1, 2, 3... 1. Select the region number.



2. Select “L.Clear.” A confirmation message will be displayed.
3. Recheck the inspection region number and then select “X.Execute.” The region will be cleared.

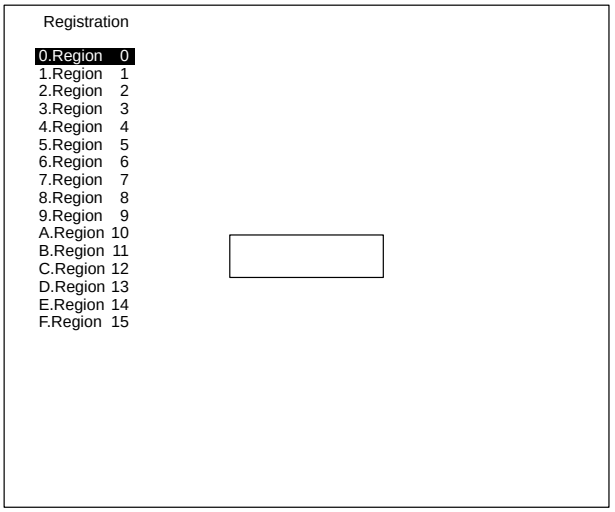


Changing Mask Size

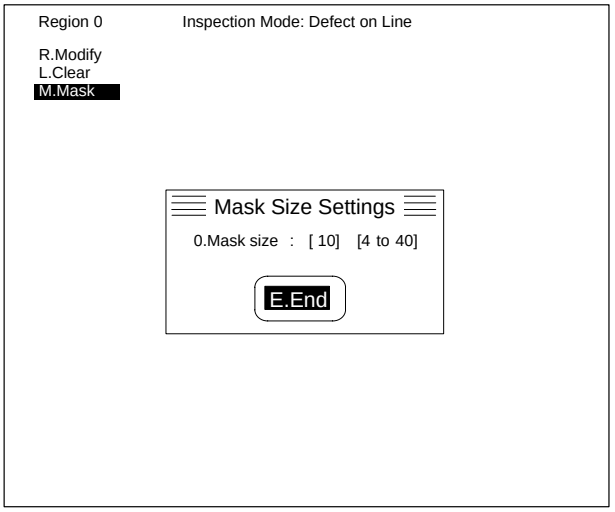
Dirt is detected from the density deviation of each mask in the inspection region. When drawing a new inspection region, the default mask size is 10. Set the mask size between 4 and 80 according to the size of dirt to be detected. The larger the mask size is, the shorter the processing time will be.

Procedure

1, 2, 3... 1. Select the region number.

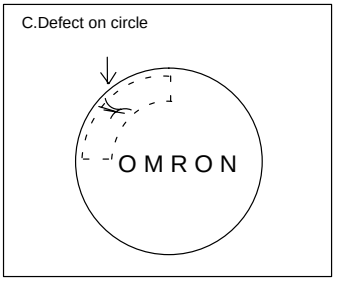


2. Select “M.Mask.”
3. Change the mask size.
4. Select “E.End.”



4-16-2 Drawing Inspection Regions for Defect Inspection on Circular Lines: C.Defect on Circle

“C.Defect on circle” inspects for scratches and dirt on circles. Draw the inspection regions.



Use the following figures to draw inspection regions.

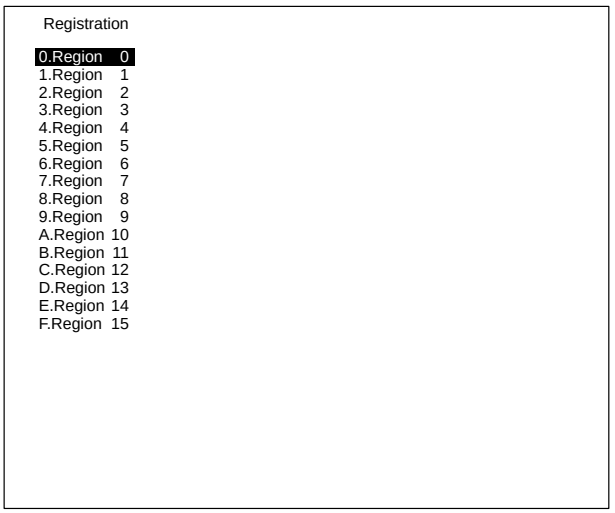
Figure type	Drawing method
C.Circle	Specify the center of the circle, a point on the circle, and the circle width.
P.Arc	Specify the start and end points of the arc, a point on the arc, and the arc width.

Drawing New Inspection Regions

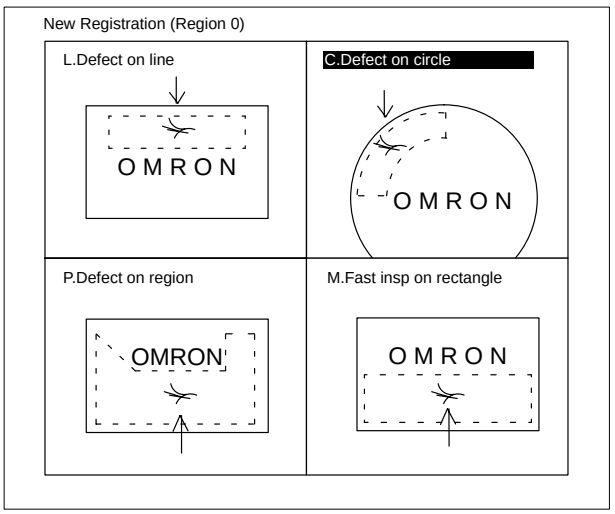
Use the following procedure to draw a new inspection region.

Procedure

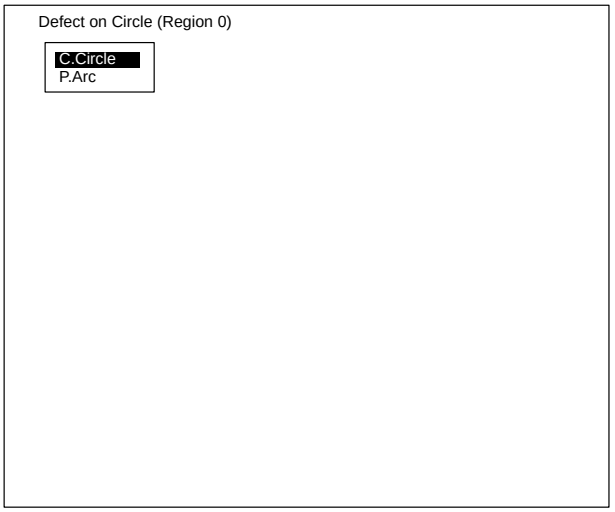
1, 2, 3... 1. Select the region number. A list of inspection mode will be displayed.



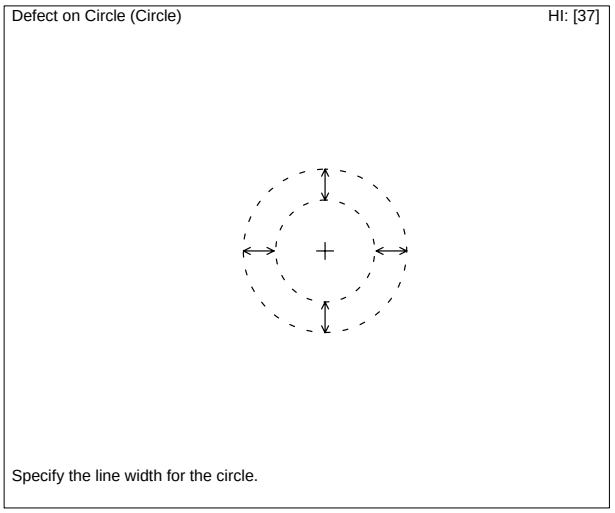
2. Select “C.Defect on circle.”



3. Select the figure. An arrow cursor will be displayed in the center of the screen.



4. Draw the inspection region. This inspection region will be registered.

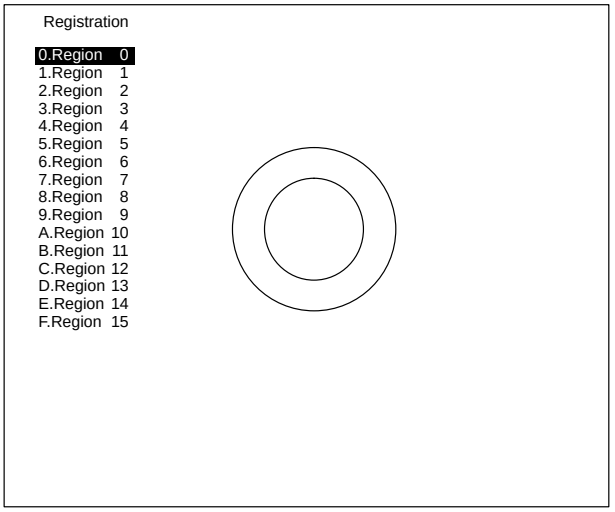


Modifying Inspection Regions

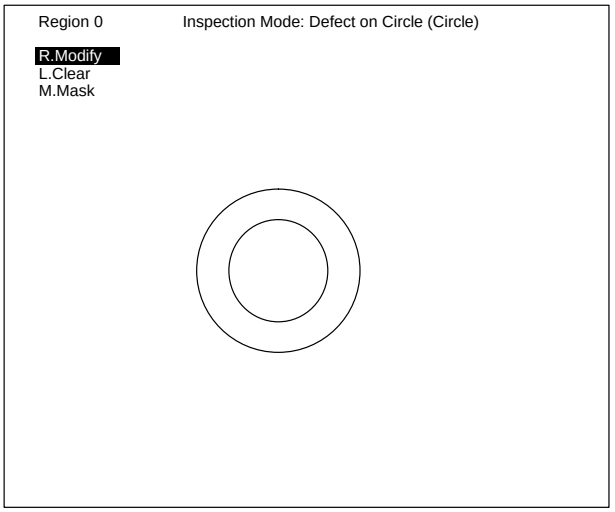
An existing inspection region can be modified. The inspection mode, however, cannot be changed. If you want to change it, you must clear the inspection region and draw a new inspection region. When the cursor is moved to select a inspection region number, the inspection region of the cursor position is displayed with solid lines.

Procedure

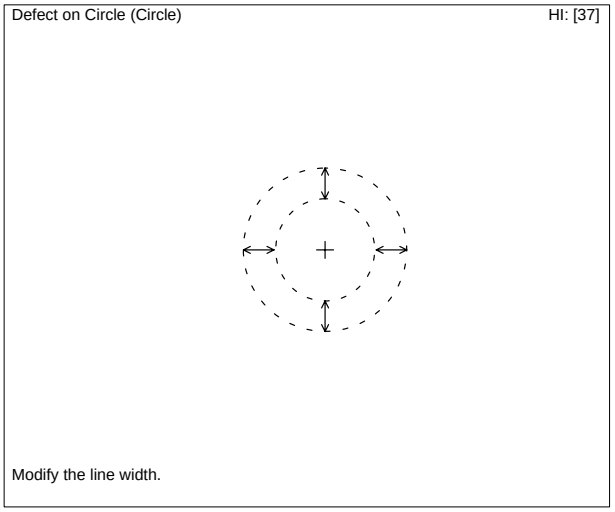
1, 2, 3... 1. Select the region number.



2. Select “R.Modify.”



3. Modify the inspection region. The modified inspection region will be registered.

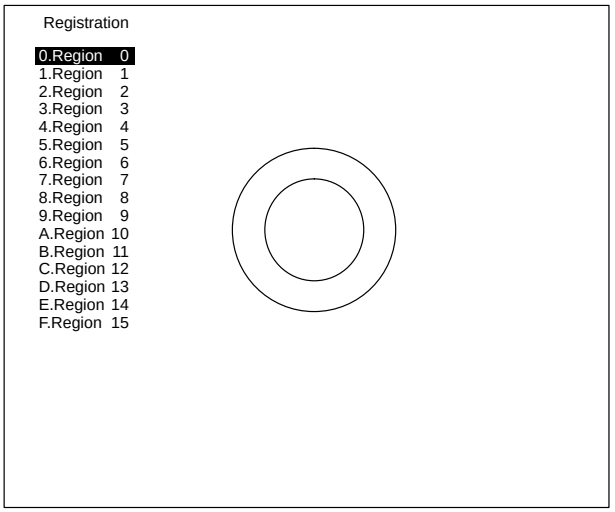


Clearing Inspection Regions

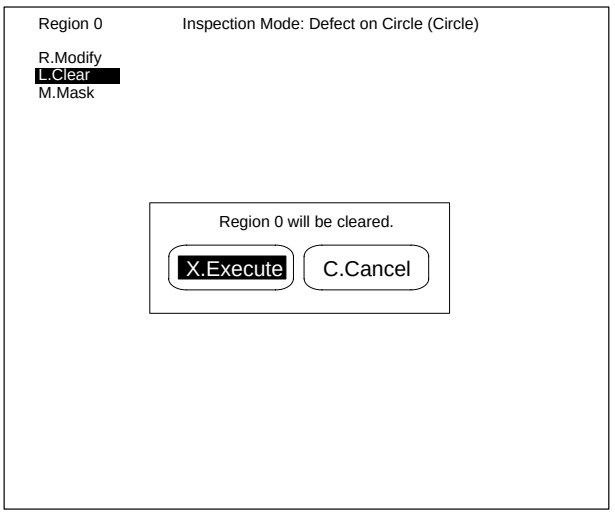
Use the following procedure to clear unnecessary inspection regions (i.e., regions not being used for inspection).

Procedure

1, 2, 3... 1. Select the region number.



2. Select “L.Clear.” A confirmation message will be displayed.
3. Recheck the inspection region number and then select “X.Execute.” The region will be cleared.

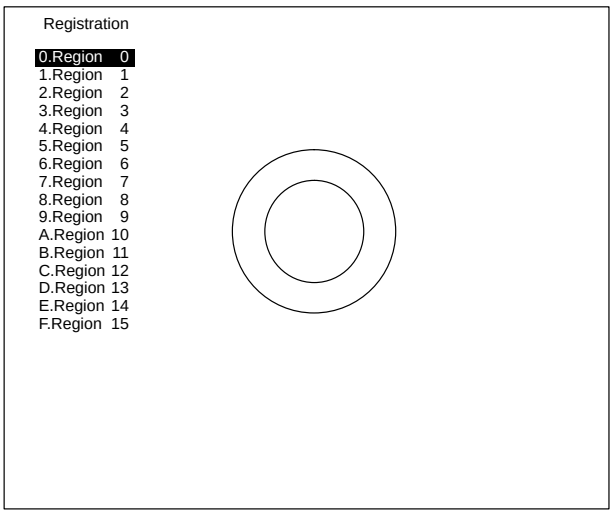


Changing Mask Size

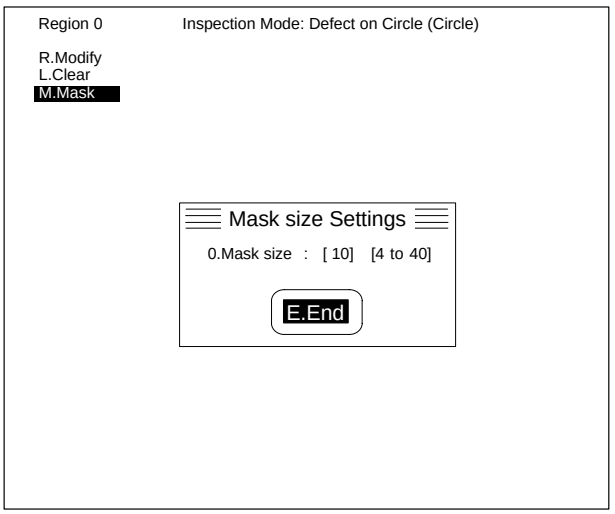
Dirt is detected from the density deviation of each mask in the inspection region. When drawing a new inspection region, the default mask size is 10. Set the mask size between 4 and 80 according to the size of dirt to be detected. The larger the mask size is, the shorter the processing time will be.

Procedure

1, 2, 3... 1. Select the region number.

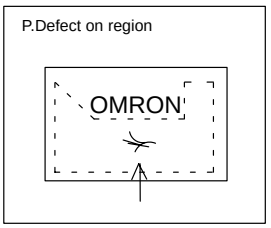


2. Select “M.Mask.”
3. Change the mask size.
4. Select “E.End.”



4-16-3 Drawing Inspection Regions for Defect Inspection on Regions: P.Defect On Region

"P.Defect on region" inspects for scratches and dirt on a workpiece. Draw the inspection regions.



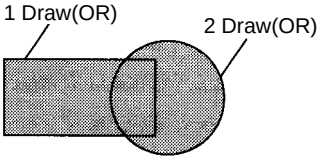
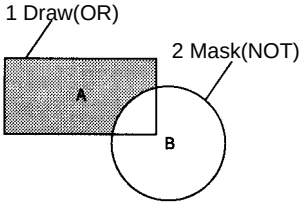
The inspection region can be drawn as a combination of the following figures.

Figure type	Drawing method
B.Box	Specify two diagonally opposed corner points
C.Circle	Specify the center, and then specify any point on the circumference.
A.Ellipse	Specify the center, and then specify any corner of the rectangle that circumscribes the ellipse.
P.Polygon	Specify the adjacent corners in sequence. A maximum of 254 corners can be specified. Press the Enter Key twice after designating the last corner. The last corner will be connected to the first corner with a line to create the polygon.

To move figures that are drawn, use the following item.

Item	Action
M.Move all	Moves all figures together in parallel.

The following two modes are available for drawing figures. A combination of the modes in appropriate order makes it possible to draw complicated figures.

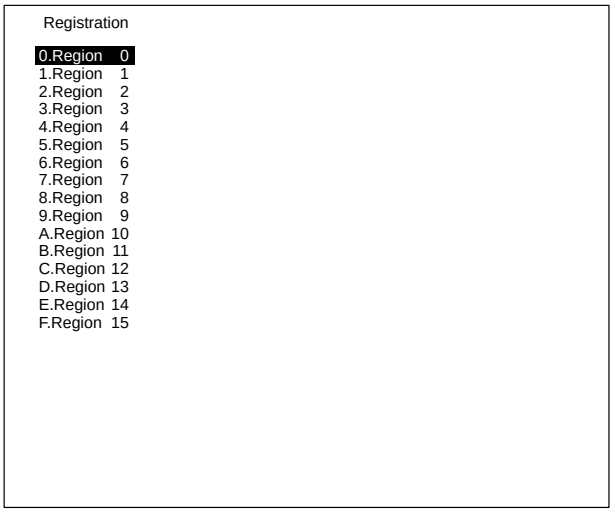
Drawing mode	Action	
O.Draw(OR)		Used this mode to draw regions which are registered as inspection regions. Multiple figures can be drawn in the same inspection region number and used as a single inspection region.
M.Mask(NOT)		Used this mode to delete parts of the inspection region. If figure B is drawn in mask mode over a previously-drawn figure A, the area inside figure B is deleted. However, the area inside figure B is not deleted if figure A is drawn after figure B is drawn in mask mode.

Drawing New Inspection Regions

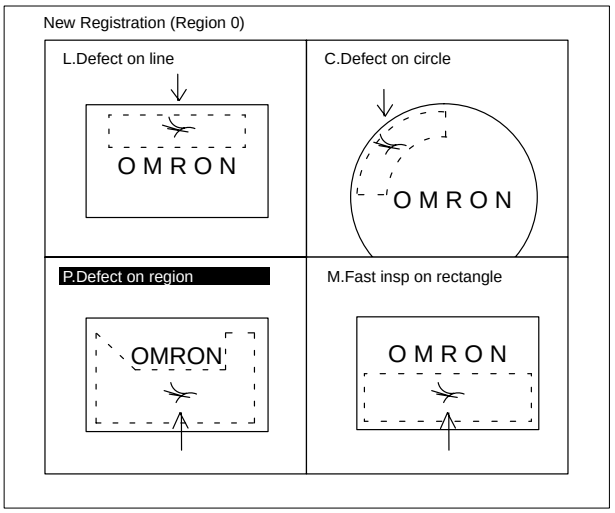
Use the following procedure to draw a new inspection region.

Procedure

1, 2, 3... 1. Select the region number. A list of inspection mode will be displayed.

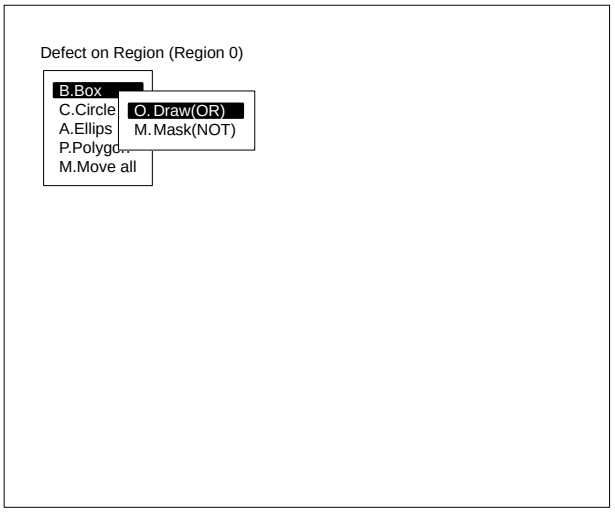


2. Select “P.Defect on region.”

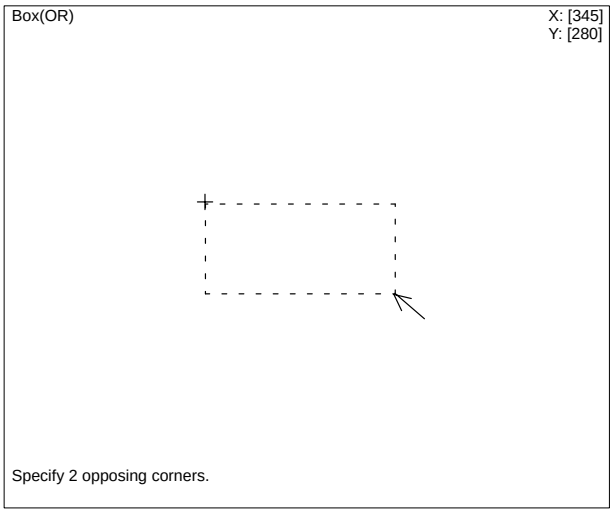


3. Select the figure.

4. Select the drawing mode. An arrow cursor will be displayed in the center of the screen.



5. Draw the inspection region. To draw two or more figures for the same inspection region number, repeat steps 3 to 5.
6. Press the Escape Key. The specified inspection region will be registered.



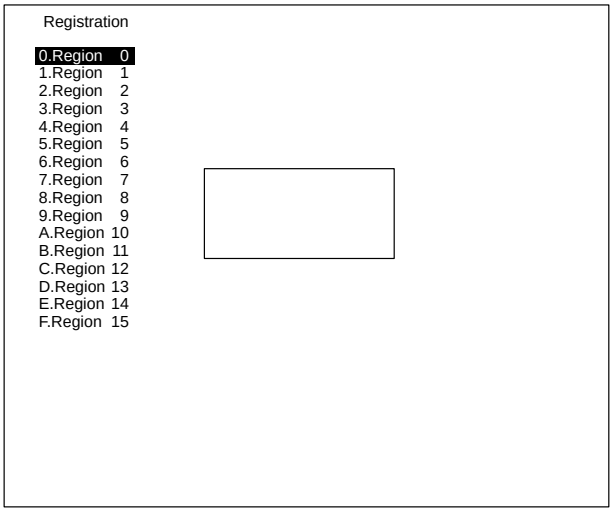
Modifying Inspection Regions

An existing inspection region can be moved, added, or modified figures that have been drawn as inspection regions. The inspection mode cannot be changed. If you want to change the mode, you must clear the inspection region and draw a new inspection region. When the cursor is moved to select a inspection region number, the inspection region of the cursor position is displayed with solid lines.

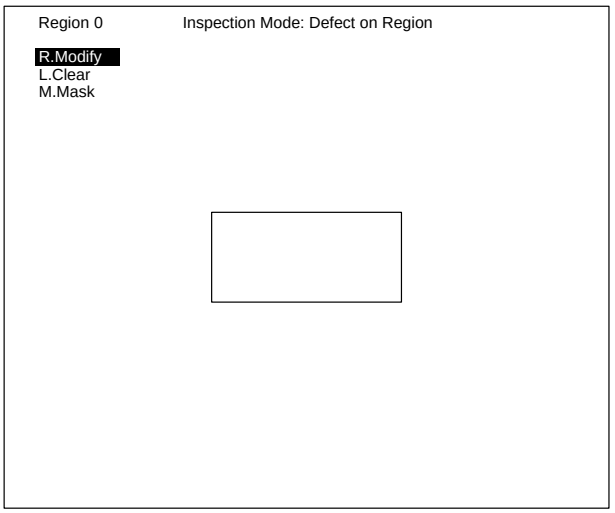
To delete all the figures in the inspection region, execute “L.Clear.” To delete part of the figures, specify the part with mask mode (NOT).

Procedure

1, 2, 3... 1. Select the region number.

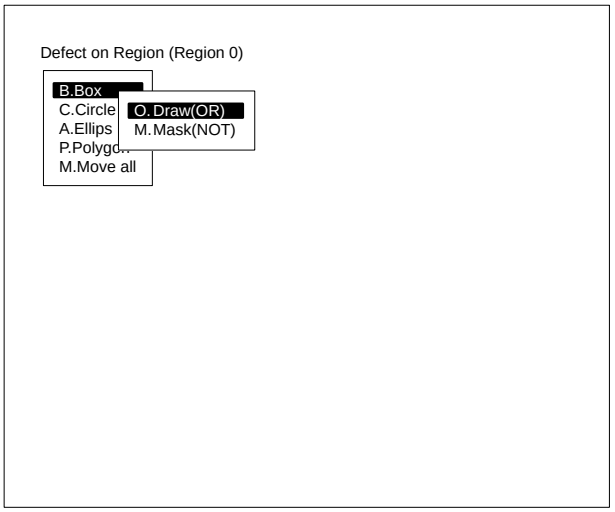


2. Select “R.Modify.”

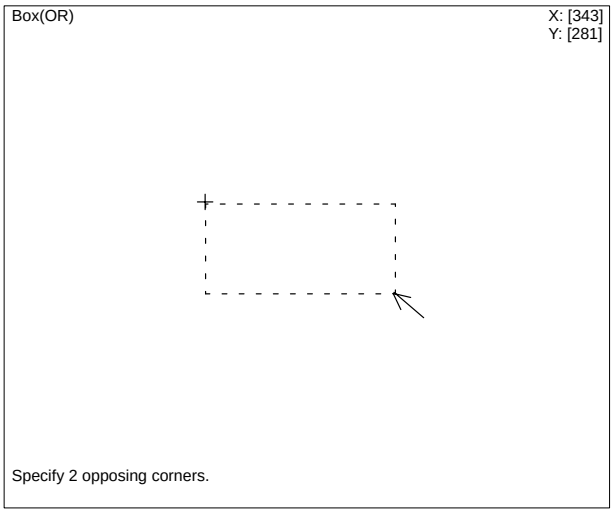


3. Select the figure.

4. Select the drawing mode. An arrow cursor will be displayed in the center of the screen.



5. Draw the inspection region. To draw two or more figures for the same inspection number, repeat steps 3 to 5.
6. Press the Escape Key. The modified inspection region will be registered.

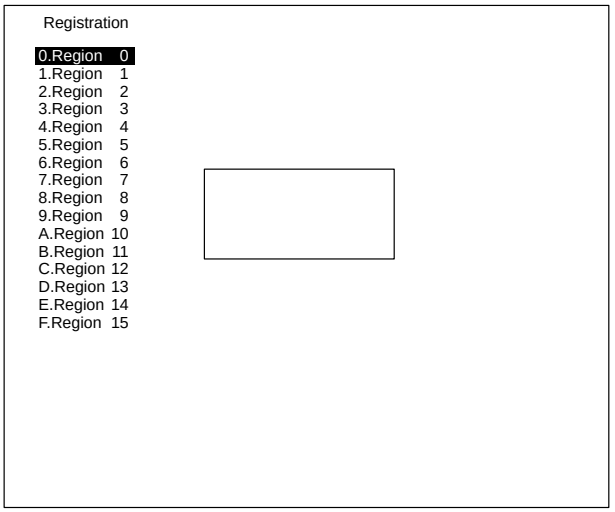


Clearing Inspection Regions

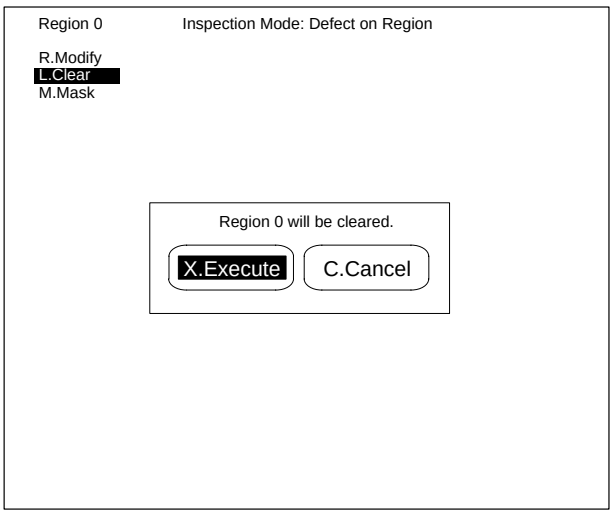
Use the following procedure to clear unnecessary inspection regions (i.e., regions not being used for inspection).

Procedure

1, 2, 3... 1. Select the region number.



2. Select “L.Clear.” A confirmation message will be displayed.
3. Recheck the inspection region number and then select “X.Execute.” The region will be cleared.

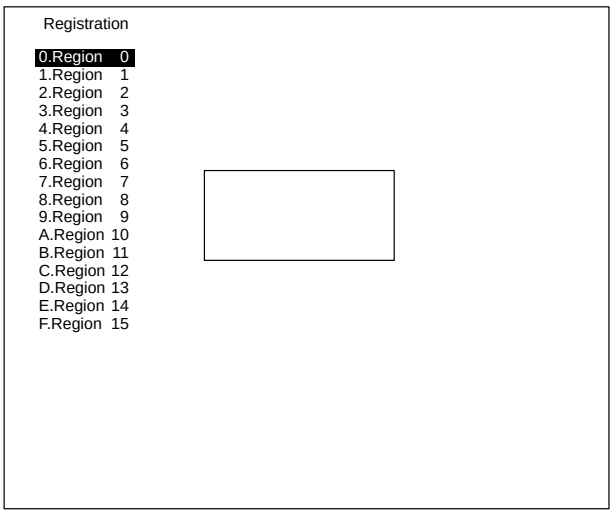


Changing Mask Size

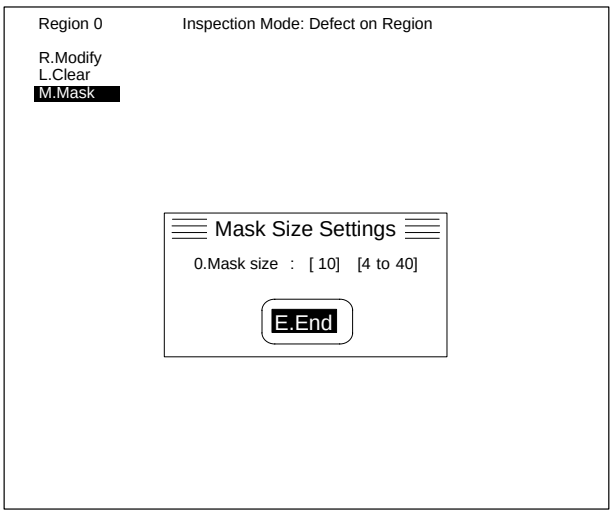
Dirt is detected from the density deviation of each mask in the inspection region. When drawing a new inspection region, the default mask size is 10. Set the mask size between 4 and 80 according to the size of dirt to be detected. The larger the mask size is, the shorter the processing time will be.

Procedure

1, 2, 3... 1. Select the region number.



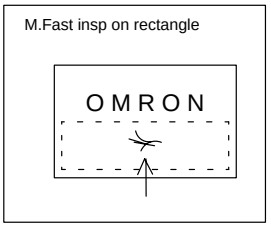
2. Select “M.Mask.”
3. Correct the mask size.
4. Select “E.End.”



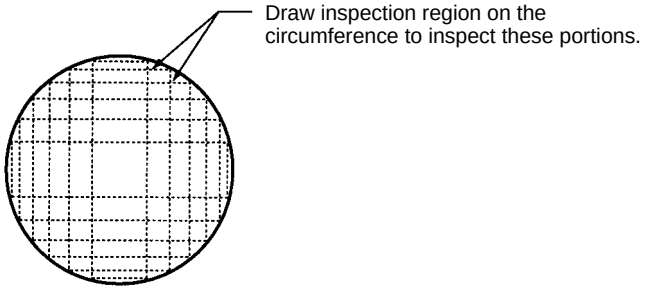
4-16-4 Drawing Inspection Regions for Fast Defect Inspection on Rectangle: M.Fast Inspection on Rectangle

"M.Fast inspection on rectangle" inspects for scratches and dirt on rectangle at high speed. Draws the rectangular and circle inspection region. The required processing time is constant regardless of the inspection region size.

Camera Unit	Processing time
F300-A20 Normal Camera I/F Unit F300-A22S Normal Simultaneously Camera I/F Unit F300-A23RS Frame Shutter Camera I/F Unit	33.3 ms
F300-A20R Shutter Camera I/F Unit F300-A22RS Shutter Simultaneously Camera I/F Unit	16.7 ms



A circle drawn with the "C.Circle" item is divided into 12 rectangular regions, and some portions of the circumference of the circle cannot be inspected. It is recommended that the "C.Defect on circle" item be used to inspect these portions.



Use a combination of the following figures to draw a inspection region.

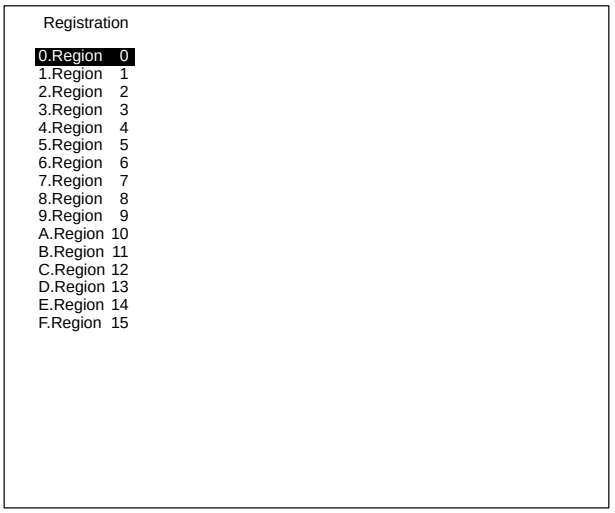
Figure type	Drawing method
B.Box	Specify two diagonally opposed corner points.
C.Circle	Specify the center, and then specify any point on the circumference.

Drawing New Inspection Regions

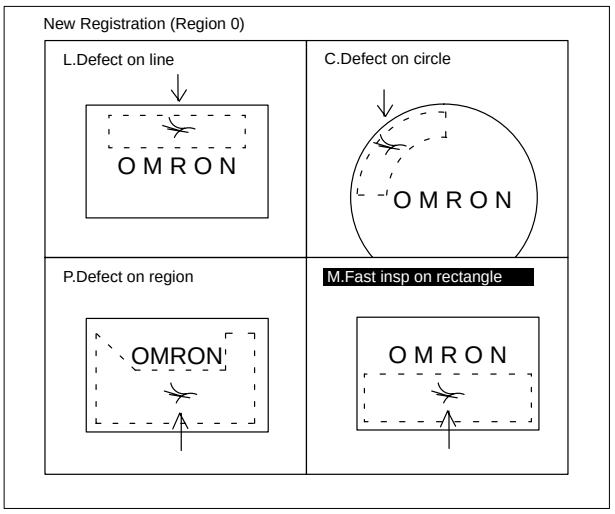
Use the following procedure to draw a new inspection region.

Procedure

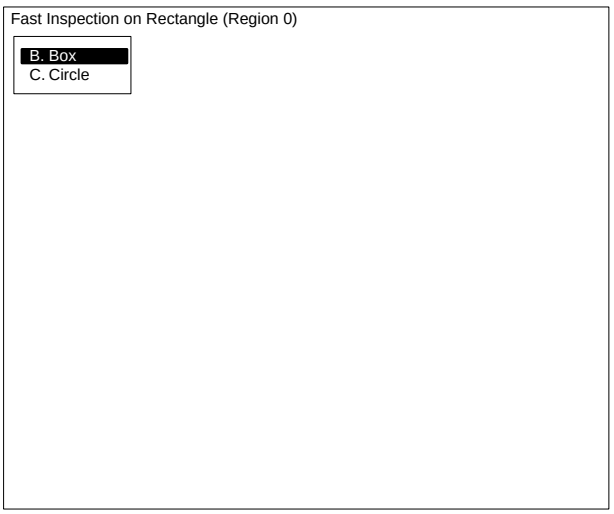
1, 2, 3... 1. Select the region number. A list of inspection mode will be displayed.



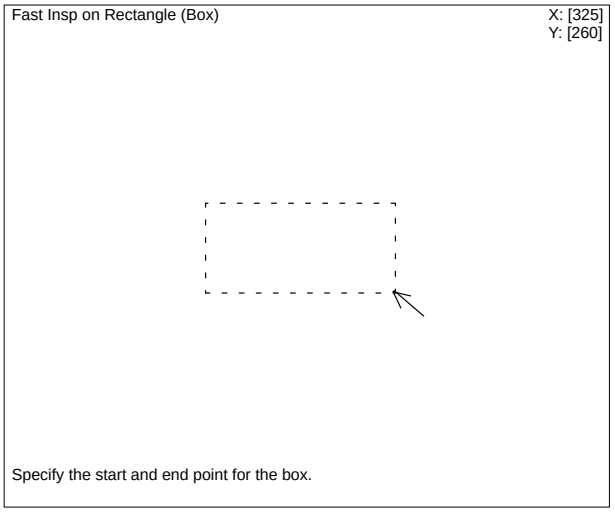
2. Select “M.Fast insp on rectangle.”



3. Select the figure. An arrow cursor will be displayed.



4. Draw the inspection region. This region that is drawn will be registered as the inspection region.

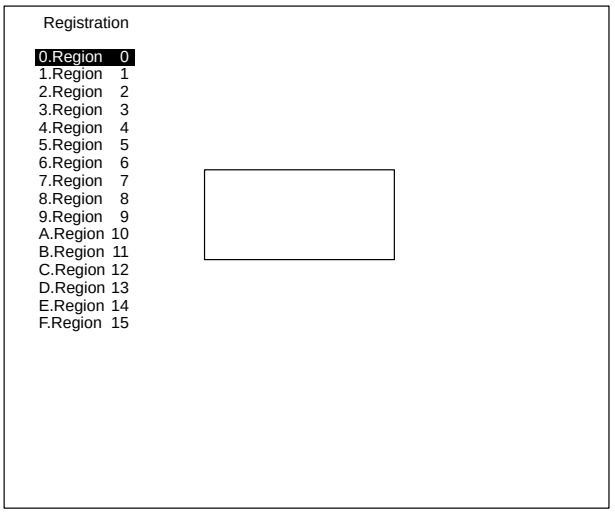


Modifying Inspection Regions

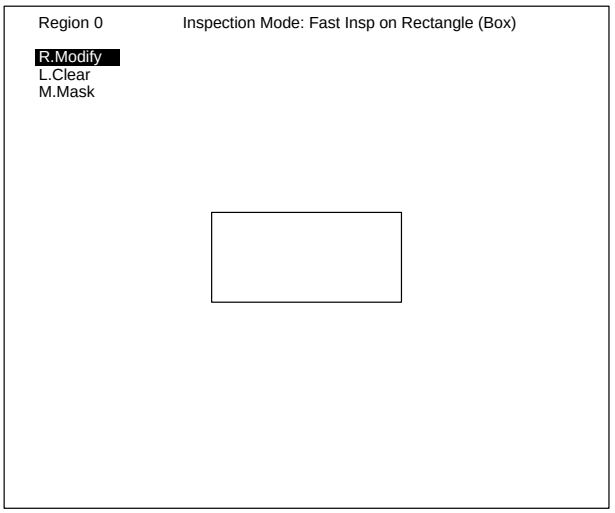
An existing inspection region can be moved, added, or modified figures that have been drawn as inspection regions. The inspection mode cannot be changed. If you want to change the mode, you must clear the inspection region and draw a new inspection region. When the cursor is moved to select an inspection region number, the inspection region of the cursor position is displayed with solid lines.

Procedure

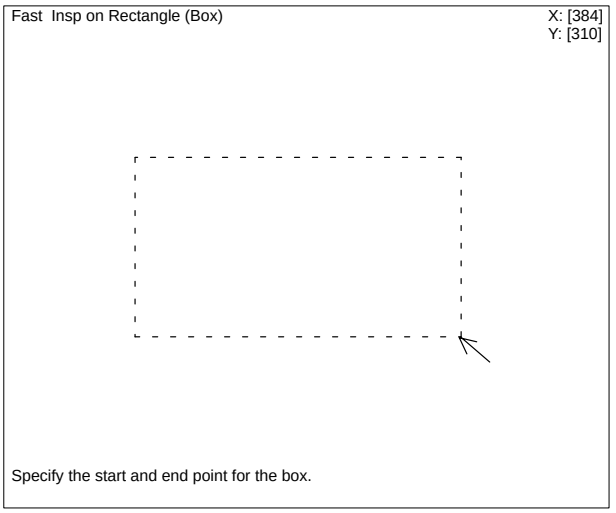
1, 2, 3... 1. Select the region number.



2. Select “R.Modify.”



3. Draw the inspection region. The modified inspection region will be registered.

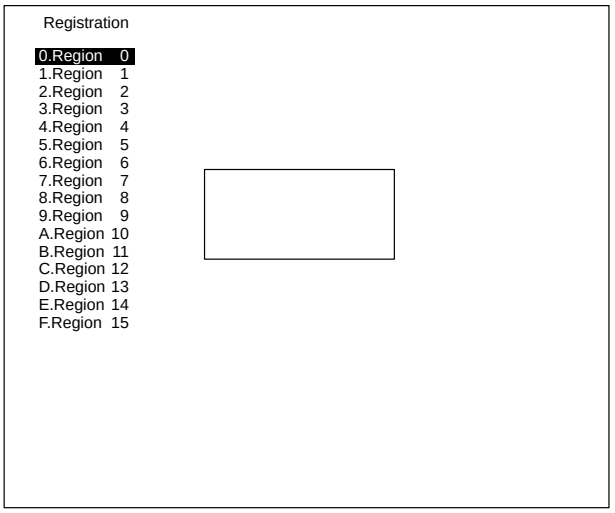


Clearing Inspection Regions

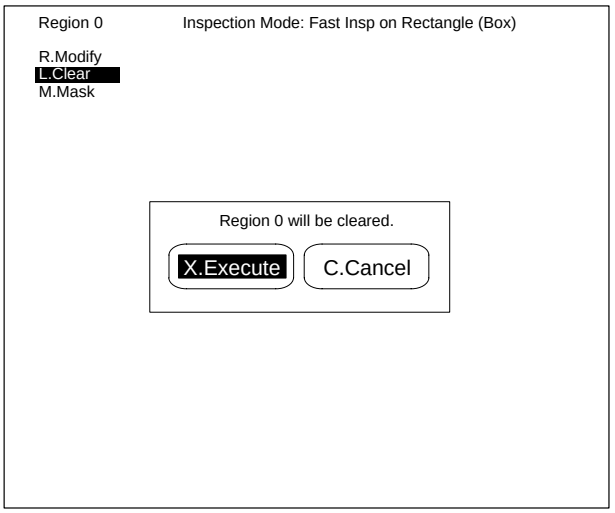
Use the following procedure to clear unnecessary inspection regions (i.e., regions not being used for inspection).

Procedure

1, 2, 3... 1. Select the region number.



2. Select “L.Clear.” A confirmation message will be displayed.
3. Recheck the inspection region number and then select “X.Execute.” The region will be cleared.

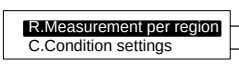


Mask Sizes

The mask size is always 19 x 23 for fast inspection on rectangle.

4-17 E.Surface B/C.Conditions

When the background in a inspection region is even, with no pattern, use “E.Surface B/C.Conditions” to detect scratches and dirt in the region. The dirt is detected by finding variations in the density deviation in the inspection region. Use the “C.Conditions” item to set measurement conditions and criteria.



Checking Measurement Values Page 152
Setting Measurement Conditions Page 153

4-17-1 Checking Measurement Values: R.Measurement Per Region

"R.Measurement per region" can be used to inspect images and obtain measurement values. The threshold between the measurement values for acceptable products and those for defective products is set as the criteria. Therefore, sample some acceptable and defective products and obtain their measurement values before setting the criteria.

Density Deviation

The density deviation of each mask in inspection regions can be checked. A cursor is displayed in the position of the highest density deviation and the density deviation is displayed between 0 and 128.

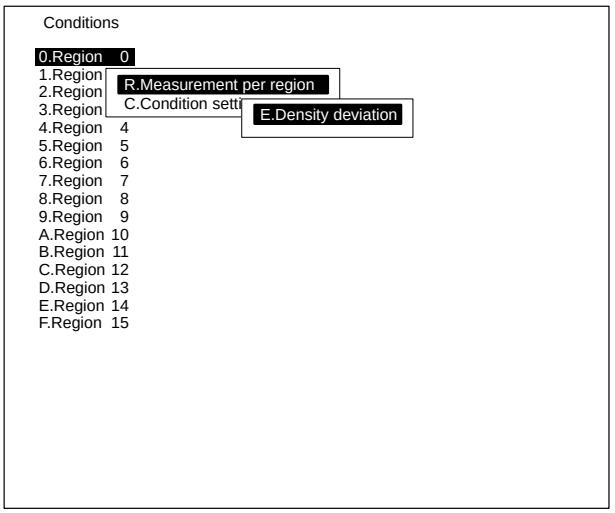
Defect Quantity

The number of defective masks can be checked. The number of masks with density deviation values exceeding the criteria is displayed after the density deviation of each mask is measured.

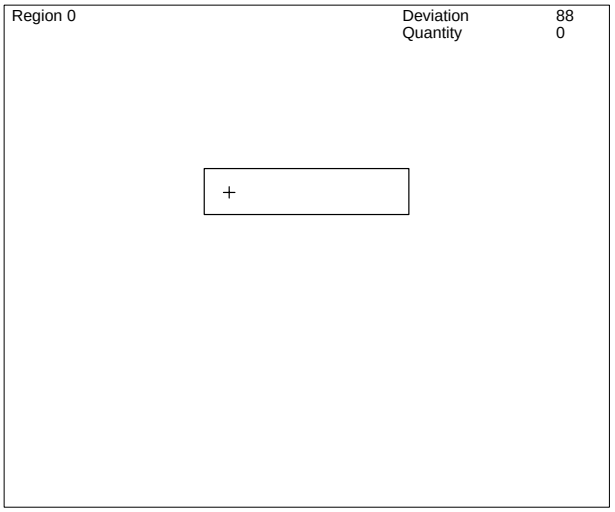
Procedure

1, 2, 3...

1. Select the region number.
2. Select "R.Measurement per region."



3. Select "E.Density deviation." The measurement runs continually and the density deviation value is displayed. If the defect quantity flag is set to ON with "C.Condition settings," the number of defects is displayed.



4-17-2 Setting Measurement Conditions: C.Condition Settings

"C.Condition settings" sets measurement conditions and criteria to judge whether measurement values are OK or NG. Set the measurement conditions according to the values checked with the "R.Measurement per region" item.

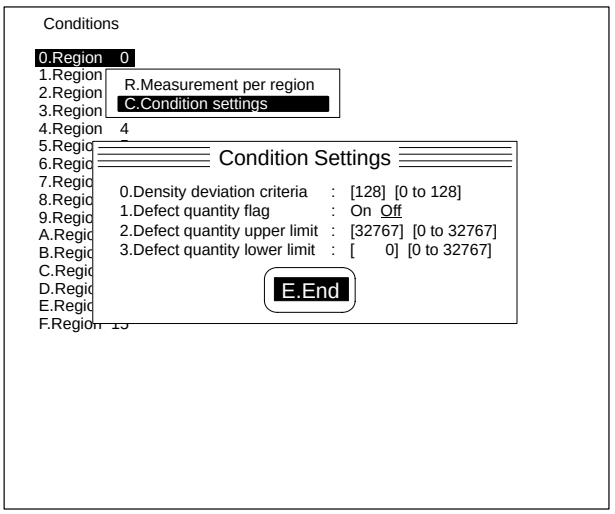
Item		Details
Density deviation	Criteria	Set between 0 and 128. An product is judged OK if the density deviation of all masks is equal to or less than the criteria. If the density deviation of one or more of the masks is exceed the criteria, the product is judged NG.
	Defect quantity flag	Set to ON to count the number of masks with density deviation values exceeding the criteria and judge whether the number is OK or NG. When the density quantity flag is set to ON, OK and NG are not judged by the density deviation criteria. Only judgements based on the number of defects will be output.
	Defect quantity upper limit and lower limit	Set between 0 and 32767. An product is judged OK if the number of defective masks is within the range, inclusive; otherwise the product is judged NG.

Judging the quantity of defective masks requires a longer processing time. The required processing time based on the set data can be checked. Refer to *4-18 M.Measure/O.Measure Monitor* and *4-25-1 Entering Measurement Screens*.

Procedure

1, 2, 3...

1. Select the region number.
2. Select "C.Condition settings."
3. Set the conditions. Set the defect quantity upper limit and lower limit so that the upper limit will be greater than or equal to the lower limit.
4. Select "E.End." The conditions will be set.



4-18 M.Measure/O.Measure Monitor

"M.Measure/O.Measure monitor" can be used to monitor measurement values and times before performing actual measurements. The criteria can also be changed, while referring to the correlation value.

O.Measure monitor
M.Measure

Checking Measurement Values and Measurement Times Page 153
Refer to *4-25 M.Measure/M.Measure* Page 203

4-18-1 Checking Measurement Values and Measurement Times: O.Measure Monitor

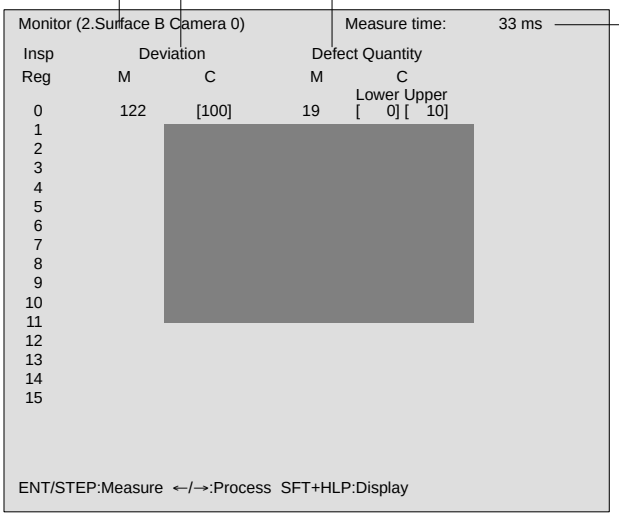
"O.Measure monitor" monitors measurement values based on the set data. Measured results are output to the Video Monitor only, even when a Parallel I/O

Unit or Terminal Block Unit is mounted. The measurement time for each process is also displayed on the Video Monitor. When several processes are set, the measurement time for each can be monitored by switching between them.

Important

Instruction Input Timing

The next instruction must not be input while an instruction is being executed. Neither the instruction currently being executed nor the next instruction will be properly executed. When a Terminal Block Unit or Parallel I/O Unit is mounted, the BUSY signal will turn ON during instruction execution. Check to be sure that the BUSY signal is OFF before inputting the next instruction.



The current process number, the set measurement item name, and the camera number.

The highest density deviation among all masks between 0 and 128.
The value is displayed in reverse video if the value exceeds the criteria and is judged NG.

The number of masks with density deviation values exceeding the criteria between 0 and 32767.
The value is displayed in reverse video if the value is not within the upper and lower limits.

The measurement time for the current process.

When position compensation is set for the same camera number for the preceding process, the time displayed includes position compensation time.

When position compensation is set in succession, the time displayed includes the time for position compensation over several stages. This does not include the time for displaying the measured results on the video monitor.

In some cases, successive processes are processed in parallel. This means that the total of all separate process times will not necessarily equal the scene measurement time. Confirm the measurement time for each scene on the measurement screen.

☞ *4-25-1 Entering Measurement Screens*

Console

The following instructions can be input from the Console.

Instruction	Key	Action
Measure	ENT	Executes a measurement. When position compensation is set for the same camera number for the preceding process, the measurement is executed after position compensation.
Switch process	◀ / ▶	Switches the process and executes the measurement item as set. Process which have no set data are skipped. When position compensation is set for the same camera number for the preceding process, the measurement is executed after the position compensation.
Character display	SHIFT + HELP	Switches between displaying and not displaying characters. If the judgment is NG for density deviation inspection, the cursor will be displayed to indicate the position with the highest density deviation value. This instruction can be used to turn off character displays so that these cursors are easier to see.
Quit measurement	ESC	Quits the measure monitor screen.

RS-232C

The following instructions can be input via the RS-232C. Attach a delimiter to the input code (ASCII). Ensure that it matches the communications specifications of the F350 and the external devices. Refer to *5-2-3 Setting the RS-232C Communications Specifications* in the *F350 Setup Menu Operation Manual*.

Important Set the instruction delimiter to CR, or CR + LF. Always use channel 0. Channel 1 on the RS-232C Unit cannot be used.

Measure

M m	Delimiter

Measurement is executed once. When position compensation is set for the same camera number for the preceding process, the measurement is executed after position compensation.

Quit measurement

Q q	Delimiter

Quits the measure monitor screen.

Parallel I/O

The following instruction can be input from a Parallel I/O Unit or Terminal Block Unit. Connect and wire the external devices. The leading edge (OFF to ON) of the STEP signal is indicated by ↓.

Refer to *2-4 Connecting Peripheral Devices* in the *Setup Menu Operation Manual*.

Instruction	Input data STEP DI: 76543210	Action
Measure	↓	Executes a measurement one time in sync with the STEP signal's leading edge (OFF to ON). When position compensation is set for the same camera number for the preceding process, the measurement is executed after the position compensation.

■ Surface Defect Inspection C

Surface defect inspection C appears on the menus as simply “B.Surface C.”

“B.Surface C” measures the white pixels of a binary image of a product, obtains the area and the center of gravity of the image, and detects faults. Set the binary level and draw window.

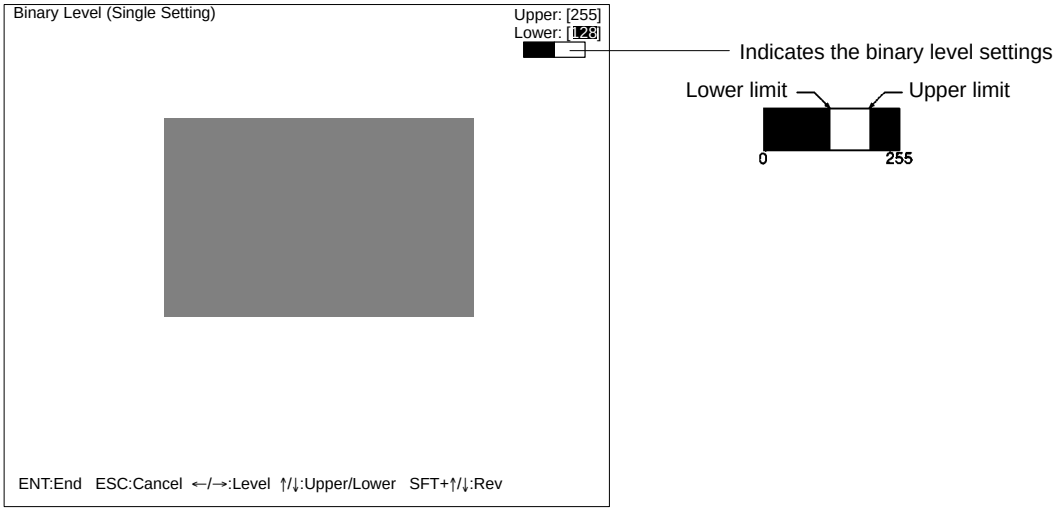
Surface defect inspection C must be set for a process number before it can be used. Refer to *4-3 U.Process*.

Select the camera number before setting the window. Refer to *4-4-1 Selecting the Camera Number*.

4-19 B.Surface C/B.Binary Level

Use the following procedure to set the upper and lower limits of the most suitable binary level for all windows. The default upper and lower limits are 255 and 128 with no reverse. Set the most suitable limits while observing the binary image.

The filtering and background suppression level that can be set before the binary level settings make it possible to obtain more stable binary images. Refer to *4-4-2 Selecting Filtering* and *4-4-3 Setting Background Suppression Levels*.

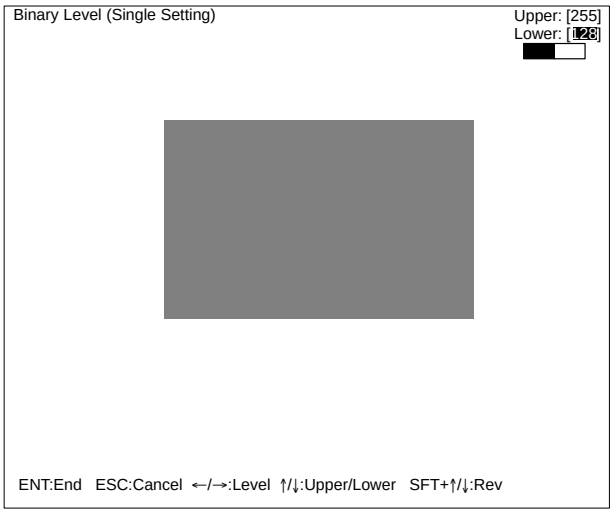


Key	Action
◀ / ▶	Used to change the binary level.
SHIFT + ◀ / ▶	Used to change the binary level quickly.
▲ / ▼	Used to switch between the upper and lower limits
SHIFT + ▲ / ▼	Reverses the white and black pixels.

For instructions on setting a different binary level for each window, refer to *4-21-1 Setting the Binary Level for Windows*.

Procedure

1, 2, 3... 1. Set the most suitable upper and lower limits for the binary image.
2. Press the Enter Key. The binary level will be set.



4-20 B.Surface C/W.Window

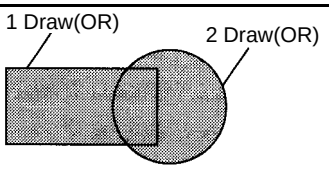
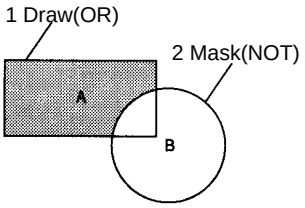
Use a combination of the following figures to draw a window to obtain the areas and the centers of gravity of images to be inspected.

Figure type	Drawing method
B.Box	Specify two diagonally oppose corner points.
C.Circle	Specify the center, and then specify any point on the circumference.
A.Ellipse	Specify the center, and then specify any corner of the rectangle that circumscribes the ellipse.
P.Polygon	Specify the adjacent corners in sequence. A maximum of 254 corners can be specified. Press the Enter Key twice after designating the last corner. The last corner will be connected to the first corner with a line to create the polygon.

To move figures that are drawn, use the following item.

Item	Action
M.Move all	Moves all figures together in parallel.

The following two modes are available for drawing figures. A combination of the modes in appropriate order makes it possible to draw complicated figures.

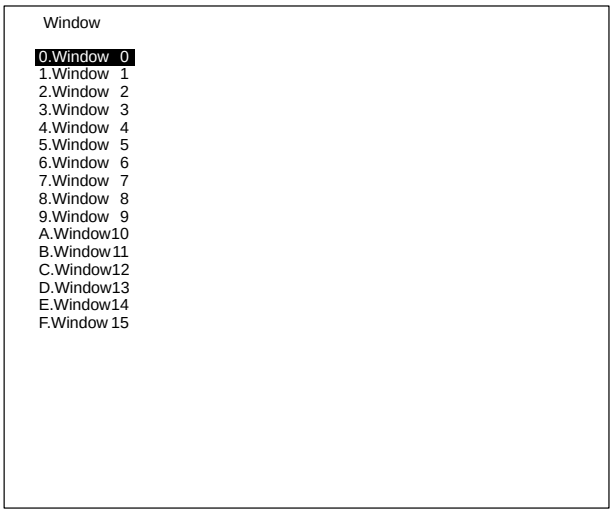
Drawing mode	Action
O.Draw(OR)	 Use this mode to draw windows. Multiple figures can be drawn in the same window number and used as a single window.
M.Mask(NOT)	 Use this mode to delete parts of the window. If figure B is drawn in mask mode over a previously-drawn figure A, the area inside figure B is deleted. However, the area inside figure B is not deleted if figure A is drawn after figure B is drawn in mask mode.

Drawing New Windows

Use the following procedure to draw a new window.

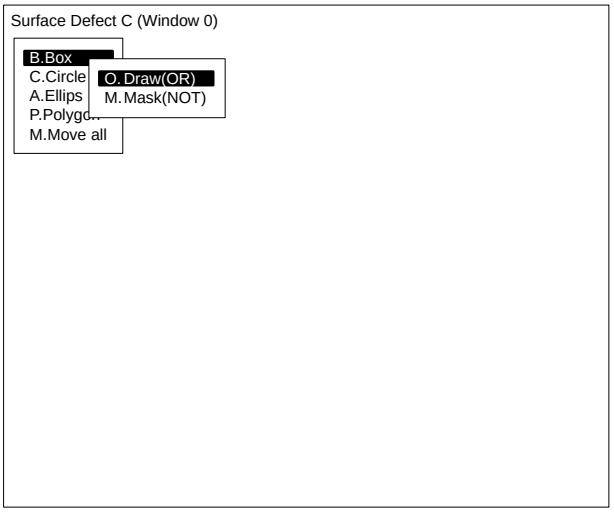
Procedure

1, 2, 3... 1. Select the window number.

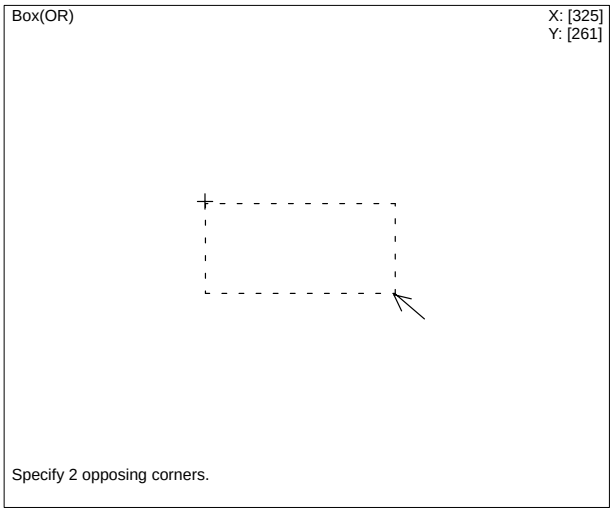


2. Select the figure.

3. Select the drawing mode. An arrow cursor will be displayed in the center of the screen.



4. Draw the window. To draw two or more figures for the same window number, repeat steps 2 to 4.



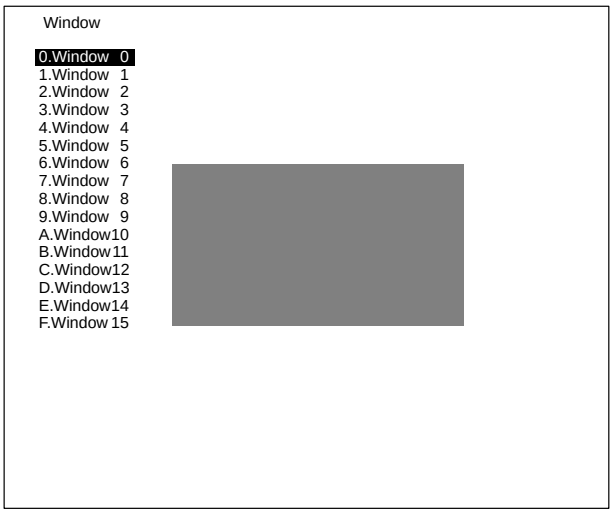
Modifying Windows

An existing window can be moved, added, or modified figures that have been drawn as windows. When the cursor is moved to select a window number, the window of the cursor position is displayed with solid lines.

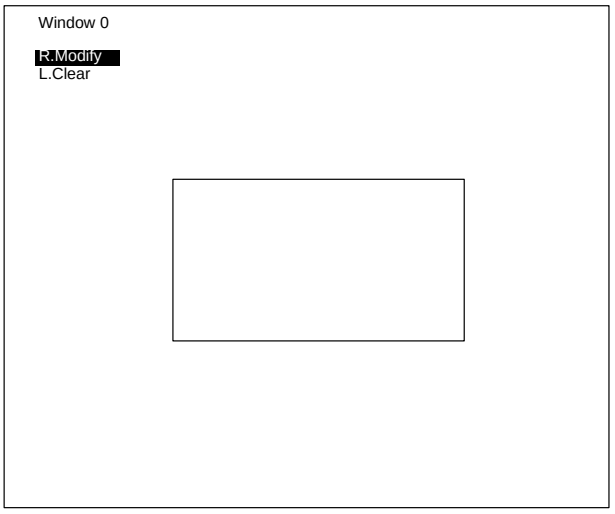
To delete all the figures in the window, execute “L.Clear.” To delete part of the figures, specify the part with mask mode (NOT).

Procedure

1, 2, 3... 1. Select the window number.

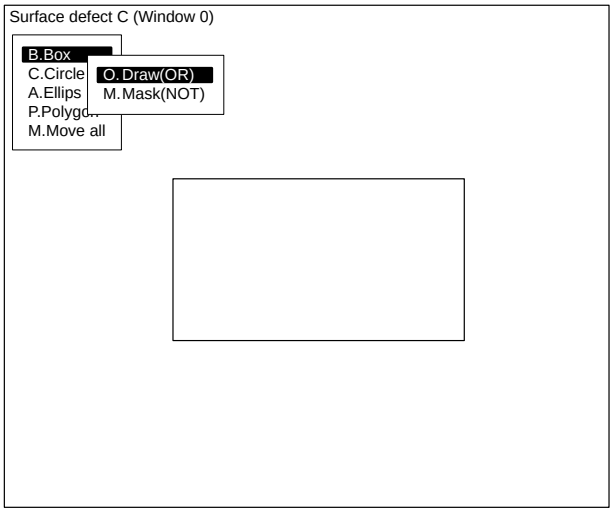


2. Select “R.Modify.”

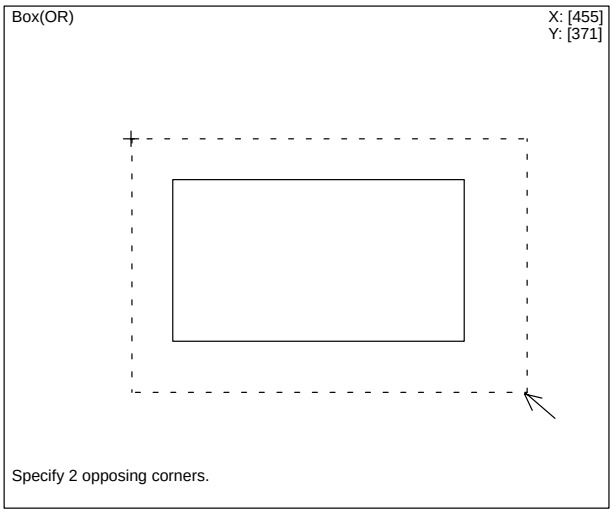


3. Select the figure. To move all the figures, select “M.Move all.”

4. Select the drawing mode. An arrow cursor will be displayed in the center of the screen.



5. Draw the window. To draw two or more figures as a window, repeat steps 3 to 5.

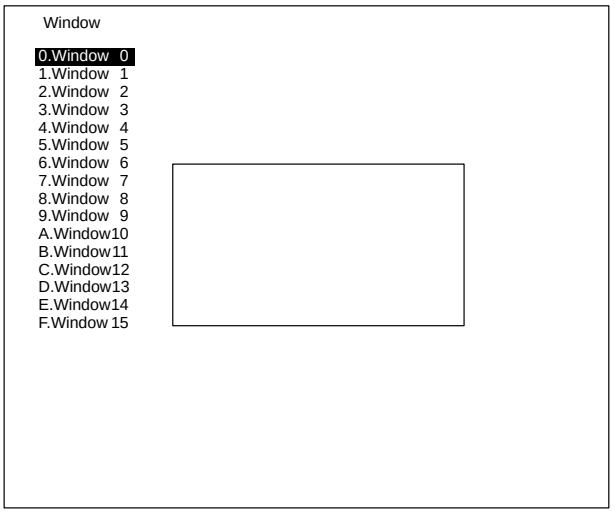


Clearing Windows

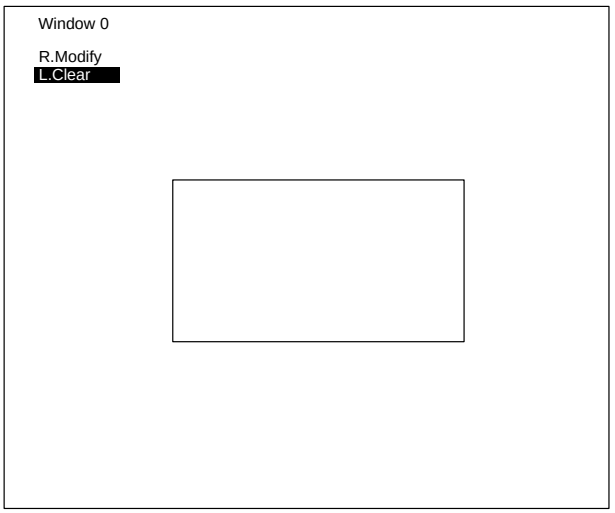
Use the following procedure to clear unnecessary windows. (i.e., windows not being used for inspection)

Procedure

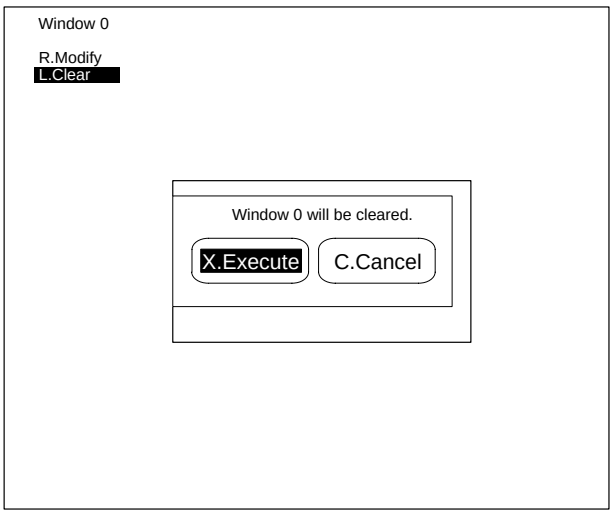
1, 2, 3... 1. Select the window number.



2. Select “L.Clear.” A confirmation message will be displayed.

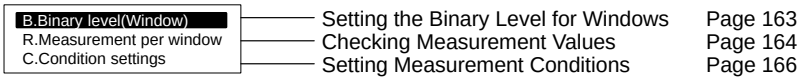


3. Recheck the window number and then select “X.Execute.”



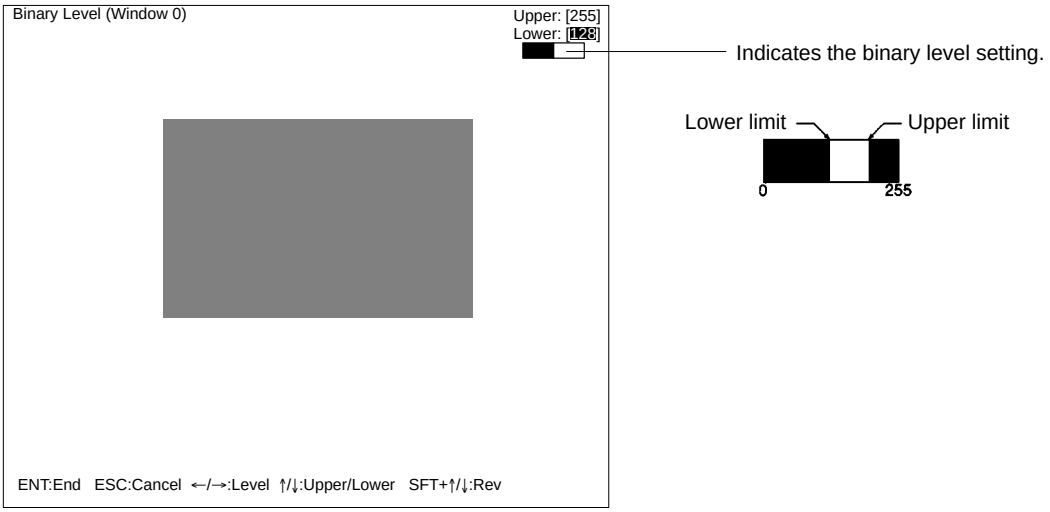
4-21 B.Surface C/C.Condition Settings

"C.Condition settings" sets the measurement conditions and criteria for windows individually.



4-21-1 Setting the Binary Level for Windows: B.Binary Level (Window)

The "B.Binary level" item sets the upper and lower limits for the binary level for individual windows. The default upper and lower limits are 255 and 128, respectively, without reverse. Set the suitable upper and lower limits while observing the binary image.



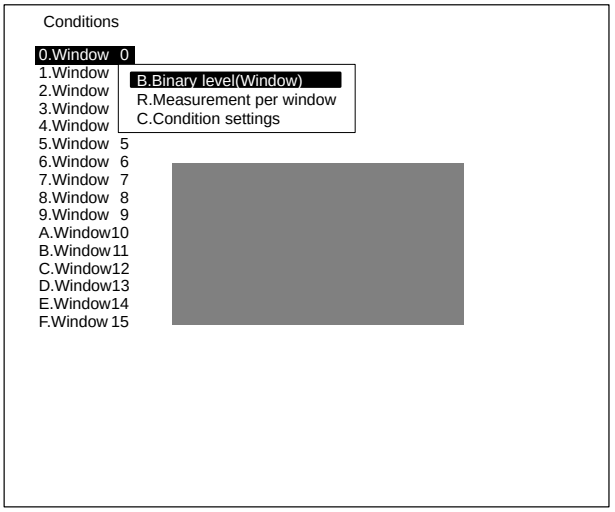
The filtering and background suppression level that can be set before the binary level settings make it possible to obtain more stable binary images. Refer to *4-4-2 Selecting Filtering* and *4-4-3 Setting Background Suppression Levels*.

Key	Action
◀ / ▶	Used to change the binary level.
SHIFT + ◀ / ▶	Used to change the binary level quickly.
▲ / ▼	Used to switch between the upper and lower limits.
SHIFT + ▲ / ▼	Used for screen color reversal.

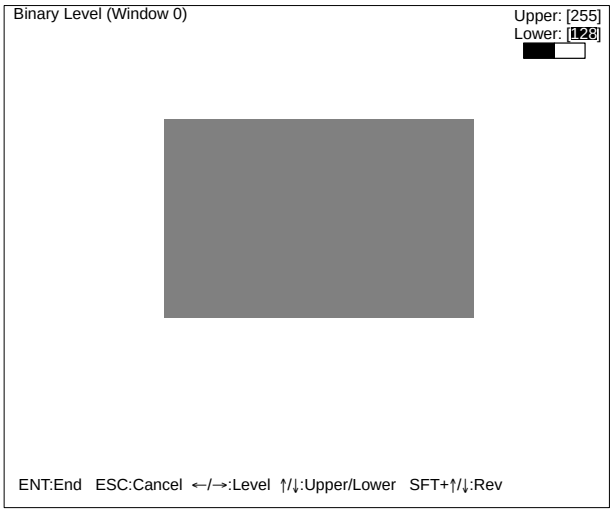
Procedure

1, 2, 3... 1. Select the window number.

2. Select “B.Binary level (Window).”

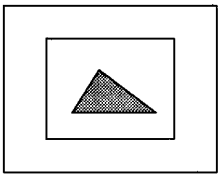
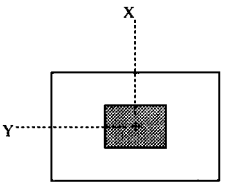


3. Set the most suitable upper and lower limits according to the binary image.
4. Press the Enter Key. The binary level will be set.



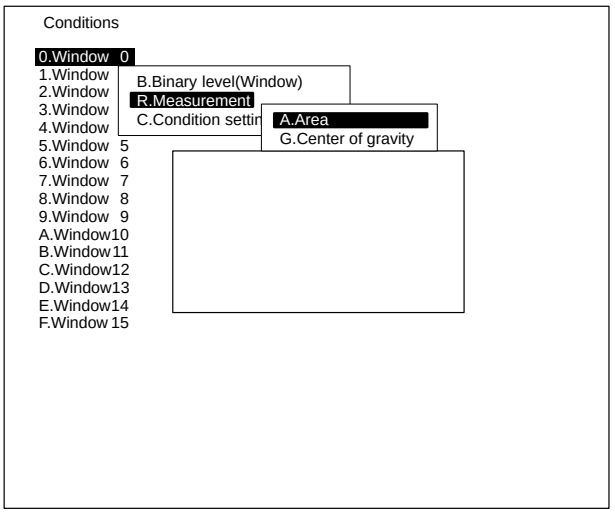
4-21-2 Checking Measurement Values: R.Measurement Per Window

“R.Measurement per window” inspects images and obtains measurement values. Sample some proper and improper products and obtain the measurement values to use as criteria.

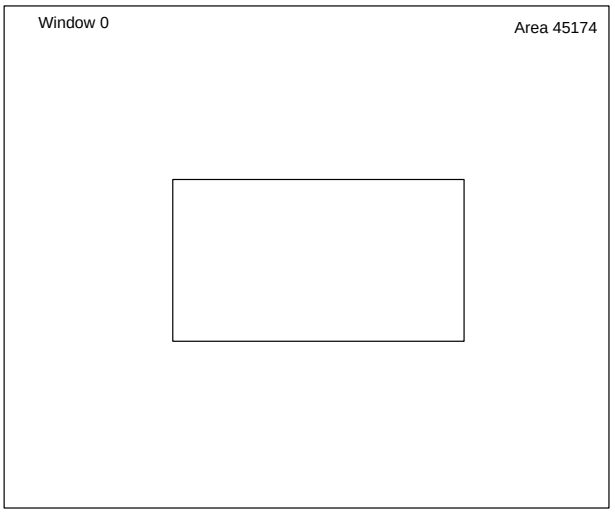
Item	Details	
Area		Measures the areas of white pixels in windows.
Center of gravity		Measures the center-of-gravity X and Y coordinates of the white pixels in windows. If the position compensation function is used, the coordinates on the corrected images are output.

Procedure

1, 2, 3... 1. Select the window number.

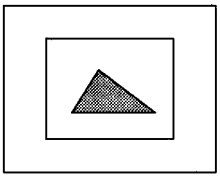
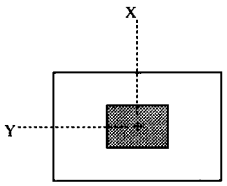


2. Select the measurement item. The measurement runs continually and the measurement value is displayed.



4-21-3 Setting Measurement Conditions: C.Condition Settings

Use the following procedure to set measurement conditions and criteria to judge whether measurement values are OK or NG. Set the measurement conditions according to the values checked with the “R.Measurement per region” item.

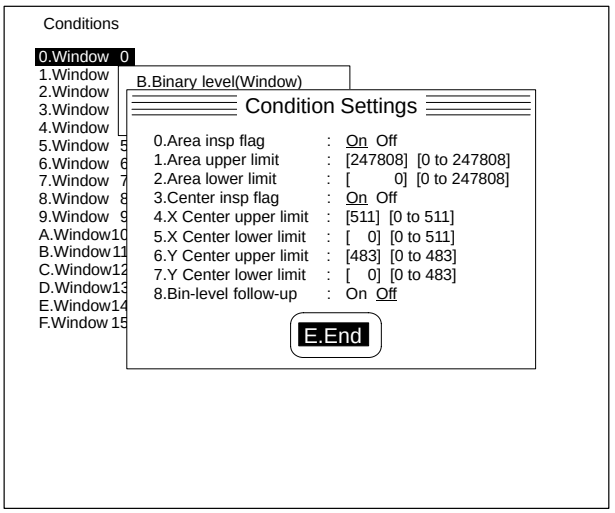
Item		Details
Area	Area inspection flag	 Set to ON to measure the areas of white pixels in the window.
	Area upper limit and lower limit	Set the limits so that measurement values will be judged OK if the measurement values are within the limits, inclusive.
Center-of-gravity X and Y coordinates	Center inspection flag	 Set to ON to measure the center-of-gravity X and Y coordinates of the white pixels in the window.
	Center upper limit and lower limit	Set the limits so that measurement values will be judged OK if the measurement values are within the limits, inclusive.
Binary-level follow-up		Set to ON for automatic binary level adjustment by obtaining the difference between the average density in the window when the measurement command is input and the average density that has been registered. The average density of a window is registered when the window is drawn.

The required processing time based on the set data can be checked. Refer to *4-22 M.Measure/O.Measure Monitor* and *4-25-1 Entering Measurement Screens*.

Procedure

1, 2, 3...

1. Select the window number.
2. Select “C.Condition settings.”
3. Set the conditions. Set the upper limit and lower limit so that the upper limit is greater than or equal to the lower limit.
4. Select “E.End.” The conditions will be set.



4-22 M.Measure/O.Measure Monitor

"M.Measure/O.Measure monitor" can be used to monitor measurement values and times before performing actual measurements.

O.Measure monitor
M.Measure
Checking Measurement Values and Measurement Times Page 167
Refer to *4-25 M.Measure/M.Measure* Page 203

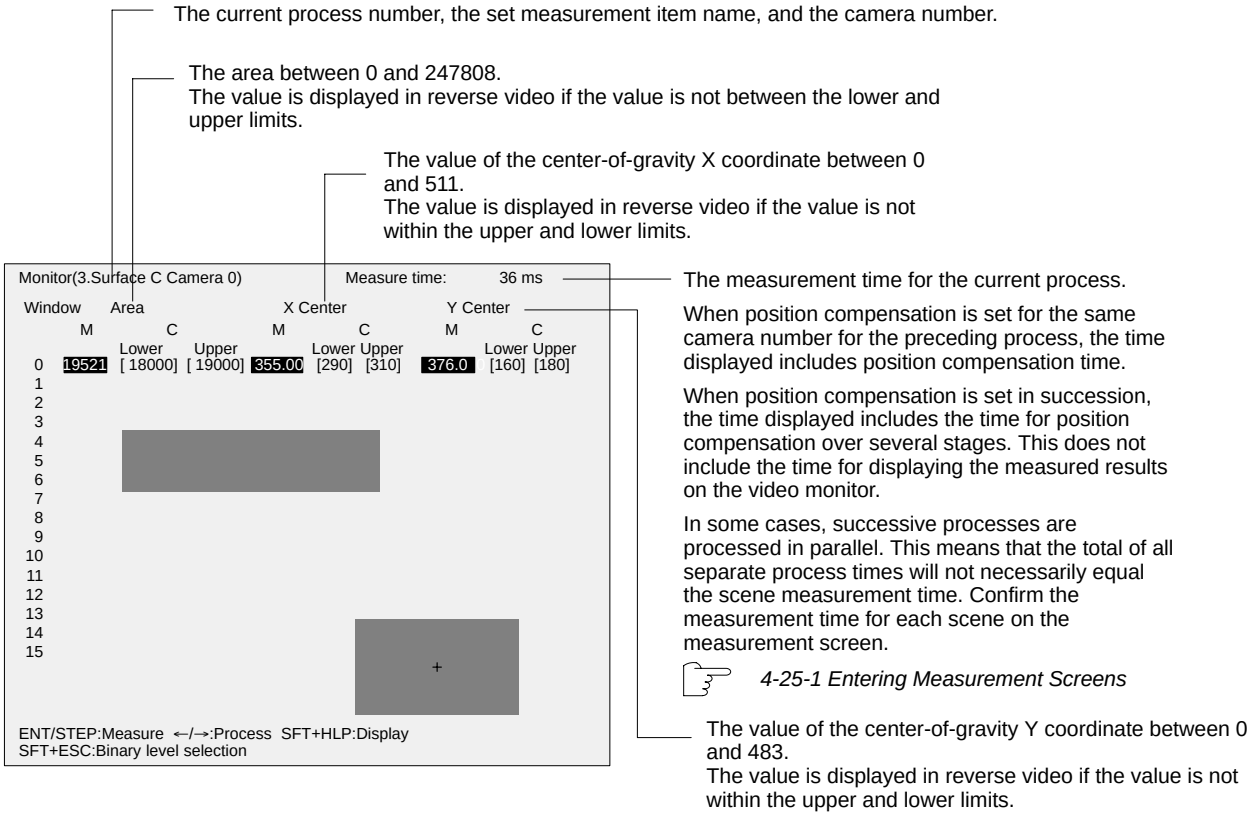
4-22-1 Checking Measurement Values and Measurement Times: O.Measure Monitor

"O.Measure monitor" is used to monitor measurement values based on the set data. Measured results are output to the Video Monitor only, even when a Parallel I/O Unit or Terminal Block Unit is mounted. The measurement time for each process is also displayed on the Video Monitor. When several processes are set, the measurement time for each can be monitored by switching between them.

Important

Instruction Input Timing

The next instruction must not be input while an instruction is being executed. Neither the instruction currently being executed nor the next instruction will be properly executed. When a Terminal Block Unit or Parallel I/O Unit is mounted, the BUSY signal will turn ON during instruction execution. Check to be sure that the BUSY signal is OFF before inputting the next instruction.



Console

The following instructions can be input from the Console.

Instruction	Key	Action
Measure	ENT	Executes a measurement. When position compensation is set for the same camera number for the preceding process, the measurement is executed after position compensation.
Switch process	◀ / ▶	Switches the process and executes the measurement item as set. Process which have no set data are skipped. When position compensation is set for the same camera number for the preceding process, the measurement is executed after the position compensation.
Character display	SHIFT + HELP	Switches between displaying and not displaying characters. If a portion is judged NG as a result of inspection, a cursor is displayed in the center of gravity of the portion. This instruction can be used to turn off character displays so that these cursors are easier to see.
Select binary level	SHIFT + ESC	Selects a window and displays the binary image of the window if different binary levels have been set for all windows individually. The selected binary image of the window is displayed on the measurement screen. It is impossible to select any window number with no window drawn.
Quit measurement	ESC	Quits the measure monitor screen.

RS-232C

The following instructions can be input via the RS-232C. Attach a delimiter to the input code (ASCII). Ensure that it matches the communications specifications of the F350 and the external devices. Refer to *5-2-3 Setting the RS-232C Communications Specifications* in the *F350 Setup Menu Operation Manual*.

Important Set the instruction delimiter to CR, or CR + LF. Always use channel 0. Channel 1 on the RS-232C Unit cannot be used.

Measure

M m	Delimiter

Measurement is executed once. When position compensation is set for the same camera number for the preceding process, the measurement is executed after position compensation.

Quit measurement

Q q	Delimiter

Quits the measure monitor screen.

Parallel I/O

The following instruction can be input from a Parallel I/O Unit or Terminal Block Unit. Connect and wire the external devices. The leading edge (OFF to ON) of the STEP signal is indicated by ↓.

Refer to *2-4 Connecting Peripheral Devices* in the *Setup Menu Operation Manual*.

Instruction	Input data STEP DI: 76543210	Action
Measure	↓	Executes a measurement one time in sync with the STEP signal's leading edge (OFF to ON). When position compensation is set for the same camera number for the preceding process, the measurement is executed after the position compensation.

■ Position Compensation

Use position compensation when the position and orientation of the object to be measured are not fixed.

Position compensation must be set for a process number before it can be used. Refer to *4-3 U.Process*.

When position compensation is used, the amount of deviation between the measurement object and the reference object is calculated and the image is automatically scrolled before the measurement is performed.

Select the camera number before setting the measurement conditions. Refer to *4-4-1 Selecting the Camera Number*.

The following procedure is used to execute position compensation.

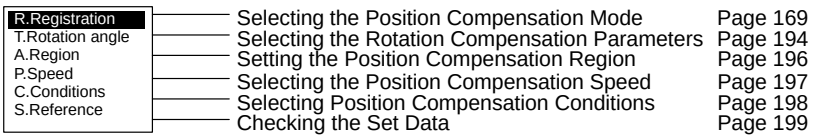
1, 2, 3...

1. The position compensation model is registered. The registered position will be used as the reference position.
2. The model is searched for in the input image.
3. The displacement between the position where the model was found and the reference position is calculated.
4. The image is scrolled by the calculated displacement.
5. A measurement is executed after position compensation has been completed.

4-23 P.Position Compensation

"P.Position Compensation" sets the data for position compensation.

- Two stages of position compensation can be executed for each camera. Even when the rotation range is 360°, high-speed position compensation can be executed by reducing the number of registered rotation models.
- When images of multiple workpieces are input by a single camera, position compensation can be executed for the respective workpieces. Refer to *4-3-1 Setting Measurement Items*.



4-23-1 Selecting the Position Compensation Mode: R.Registration

Select the mode for position compensation and register a reference model in order to determine the amount of displacement. There are three modes of position compensation.

- **One-model Positioning**
  One feature (corner or mark) on the measured object is used to determine the position and rotation of the object.
- **Two-model Positioning**
  Two features are connected, and the center coordinates of the lines joining these features between these lines are used to determine the position (including rotation).
- **Circle Positioning**
  Four points on the circumference of a circular workpiece are used to determine the position of the workpiece (including rotation).

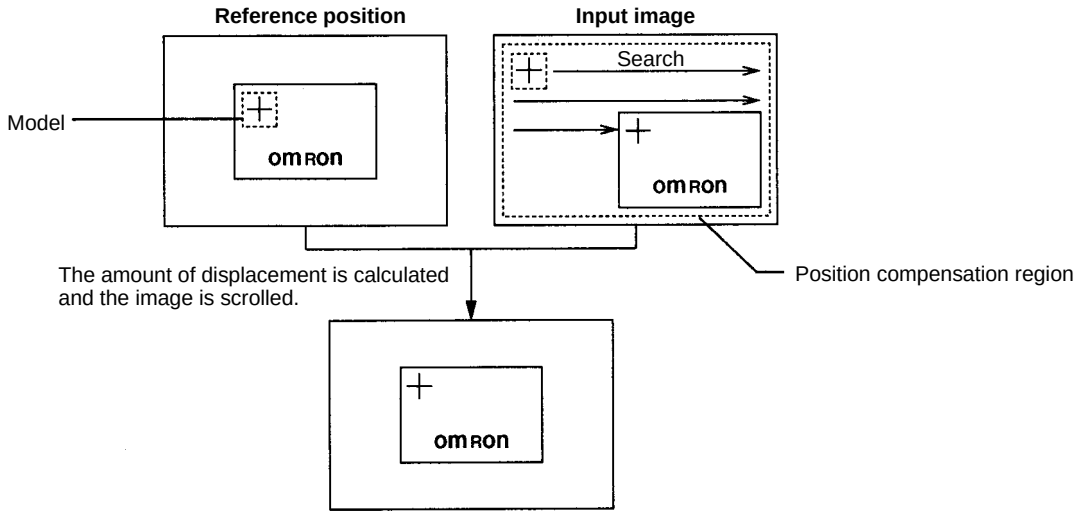
To select a new position compensation mode or to change a previously set position compensation mode, set the position compensation settings.

Item	Details
0.Search verification	Searches for position compensation models inside the search region for candidates. Verifies whether or not these candidates are correct. Required Register any size model. This is called the verification model. The rectangular region containing the features will be cut automatically from the region specified as the model. This is called the search model. 1. "0.Search Verification" searches for search models inside the search region and detects candidates. All candidates with correlation values greater than the criteria will be detected. Set the criteria for detecting candidates in "P.Position compensation/ C.Conditions." Refer to *Section 4-23-5 Setting Position Compensation Conditions*. 2. For each candidate, verification is executed using the verification model and positions with the highest correlation values are found. Although high-accuracy position compensation can be executed, the processing speed will become slower depending on the verification model used. Refer to *4-24 M.Measure/O.Measure Monitor*. Not required Register any size model. This is called the search model. Search models are searched for in the search region and positions with the highest correlation values will be found.
1.Auto-registration	Automatically cuts the region most suitable for position compensation and registers it as a position compensation model. If circle positioning is selected as the position compensation mode, however, automatic registration cannot be performed. Set to "No."

One-model Positioning

One-model positioning registers one characteristic part of the workpiece as a model. The model is searched for in the position compensation region. The displacement (X,Y) is detected between the reference position coordinates and the coordinates with the highest correlation to the model, and the image scrolls by the detected amount of displacement. The registered position of the model is set as the reference position.

The rotation model must be registered to execute rotational position compensation (θ). Refer to *4-23-2 Selecting the Rotation Compensation Parameters*.



Important Correct measurement is not possible if the filtering and background suppression levels used during measurement are different from those that were used when the model was registered. Set the required filtering and background suppression levels for each camera number before registering models. Refer to *4-4-2 Selecting Filtering* and *4-4-3 Setting Background Suppression Levels*.

Automatic Model Registration

When “1.Automatic-registration” is set to “Yes” on the settings screen, the most suitable region for position compensation will be cut automatically and can be registered as a position compensation model.

Important Set the search correlation values before registering the models. Refer to *4-23-5 Setting Position Compensation Conditions*.

To detect the direction of rotation of the measurement object, execute automatic model registration using the following procedure.

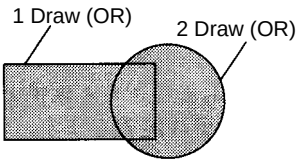
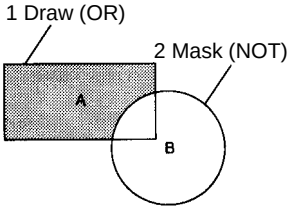
1, 2, 3...

1. Register the provisional model. Either automatic or manual registration can be used.
2. Set the rotation angle and the pitch angle of the rotation model. Refer to *4-23-2 Setting the Rotation Compensation Parameters*.
3. Execute automatic model registration once the model is in the correct position. If the rotation angle or the pitch angle are changed after auto-registration, measurement will be incorrect.

The automatic registration regions are drawn as a combination of the following figures. A total of 10 figures can be drawn.

Figure type	Drawing method
B.Box	Specify 2 opposing corners.
C.Circle	After specifying the center of the circle, specify any point on the circumference.
A.Ellipse	After specifying the center of the circle, specify any corner of the circumscribing rectangle.
T.Triangle	Specify the 3 vertices of the triangle.

To draw these figures, select a drawing mode: Draw or Mask.

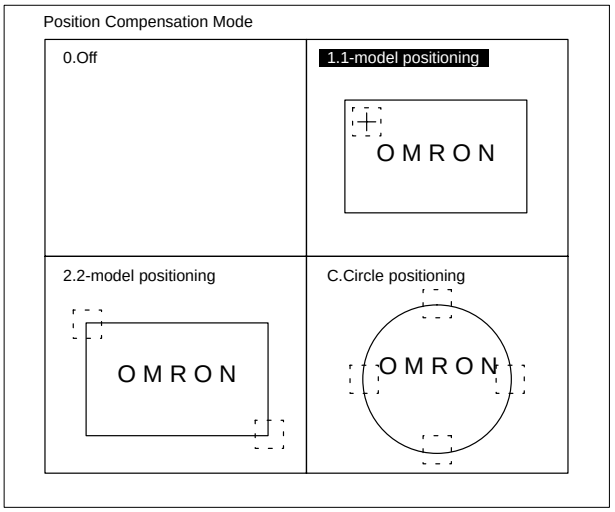
Drawing mode	Action	
O.Draw (OR)		Use this mode when drawing the automatic registration region. The region drawn will be set as the automatic registration region. When several figures are drawn, a model can be cut which incorporates all the figures as one automatic registration region.
M.Mask (NOT)		Used to delete one section of an automatic registration region. If figure B is drawn over the existing figure A using the mask mode, the contents of figure B will be deleted. If figure A is drawn after figure B has been drawn using mask mode, the contents of figure B will not be deleted.

When “D.Delete all” is selected all the drawn figures can be deleted.

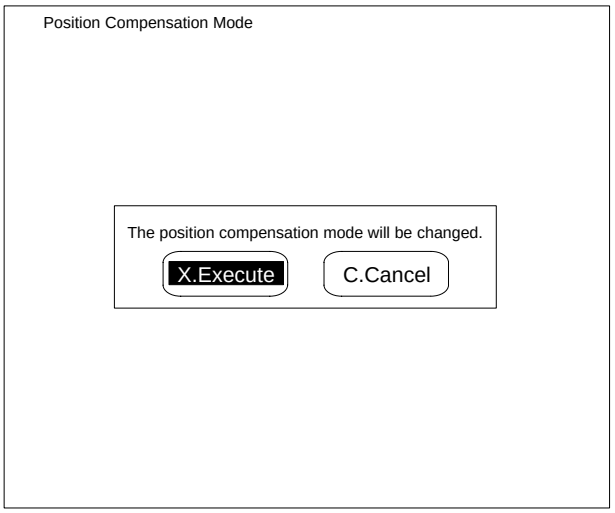
Procedure

1, 2, 3...

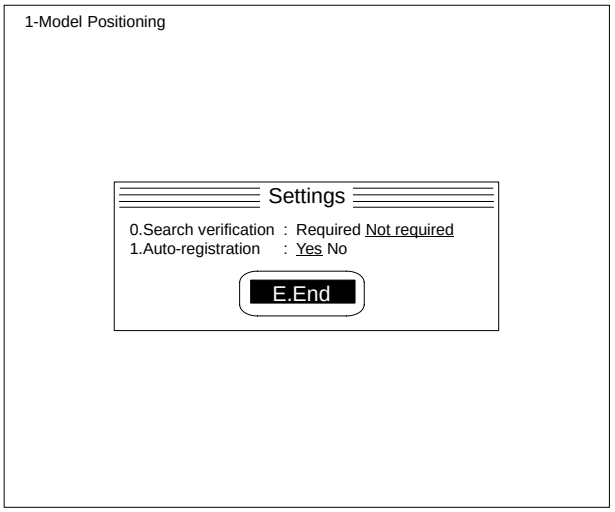
1. Select “R.Registration.” Position compensation mode will be displayed.
2. Select “1.1-model positioning.” When the position compensation mode needs to be changed, carry out steps 3 and 4. When the mode is already set to “1.1-model positioning,” go to step 5.



3. Select “X.Execute.”

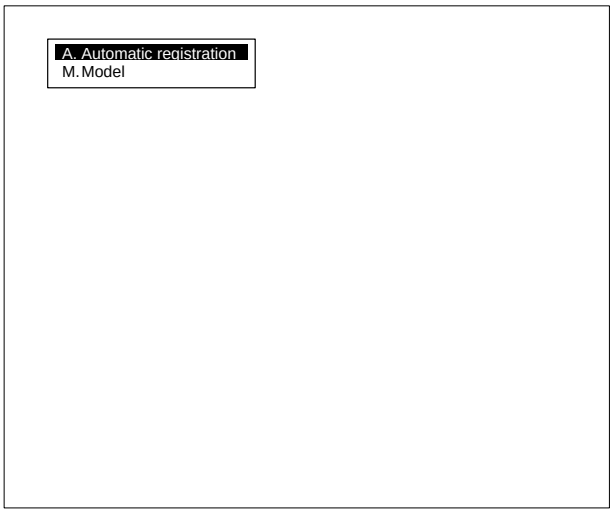


4. Set the position compensation settings. Set “1.Auto-registration” to “Yes.” Set “0.Search verification” to “Required” or “Not required.”



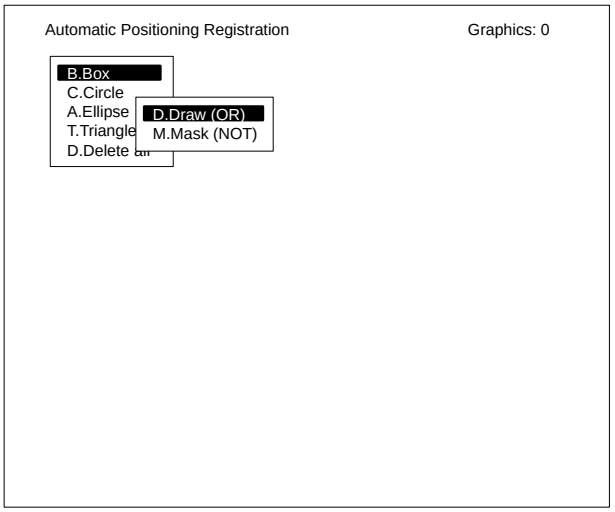
5. Select “A.Automatic registration.”

   When modifying an automatically registered model, select “M.Model.” Refer to page 175 “Manual Model Registration” for operating procedures.

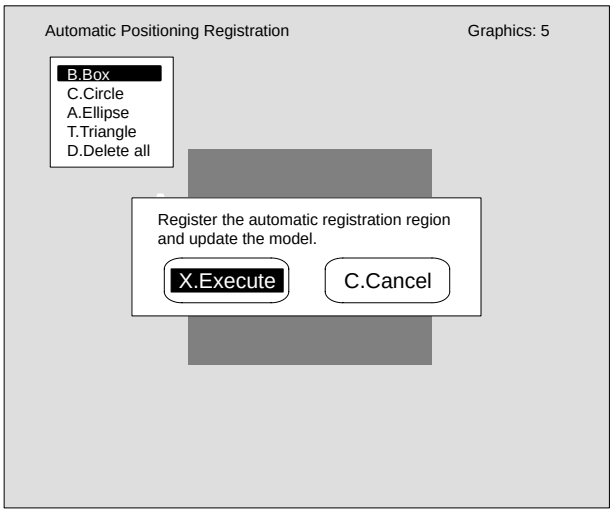


6. Select a figure.
7. Select a drawing mode.

8. Draw the automatic registration region. When drawing several figures repeat steps 6 to 8.



9. Press the Escape Key. A confirmation message will be displayed.
10. Select “X.Execute.” The appropriate region for the position compensation model will be automatically cut and registered.

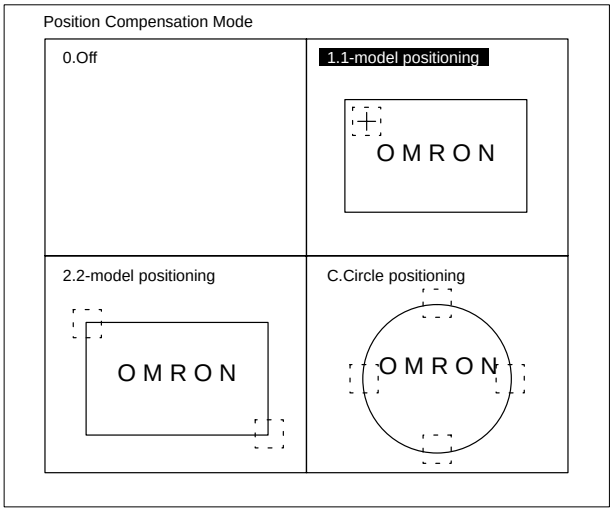


Manual Model Registration Set the region to be registered as the model.

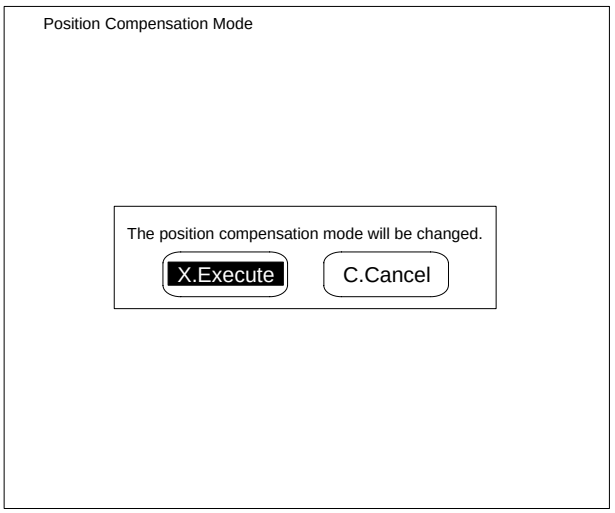
Procedure

1, 2, 3... 1. Select “R.Registration.”

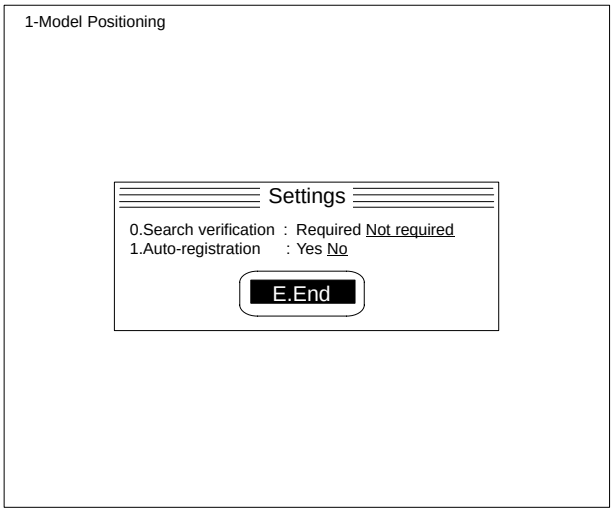
2. Select “1.1-model positioning.” When the position compensation mode needs to be change, carry out steps 3 and 4. When the mode is already set to “1.1-model positioning” go to step 5.



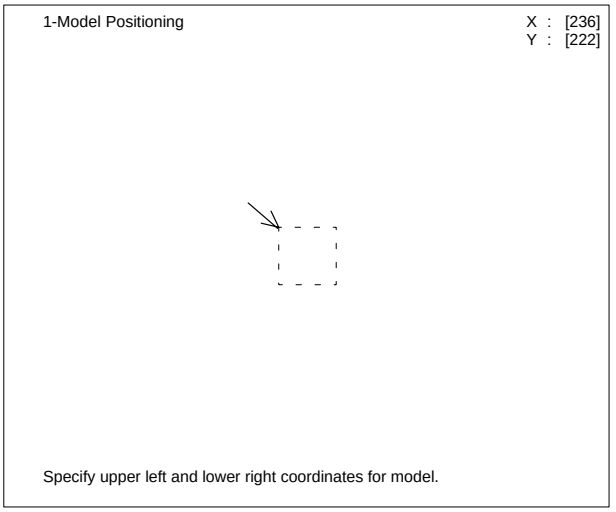
3. Select “X.Execute.”



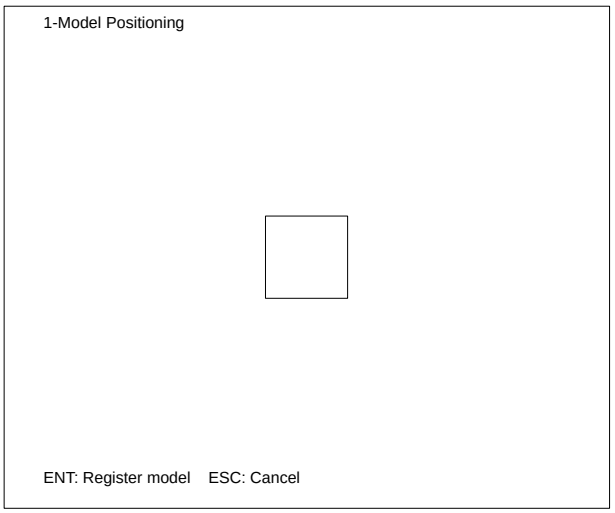
4. Set the position compensation settings. Set “1.Automatic registration” to “No.” Set “0.Search verification” to “Required” or “Not required.”



5. Set the top-left coordinates of the region to be registered as the model by moving the arrow cursor and pressing the Enter Key.
6. Set the bottom-right coordinates of the region to be registered as the model by moving the arrow cursor and pressing the Enter Key.



7. Before registering the model, confirm that the measurement object is in the correct position. Press the Enter Key. The image in the specified region will be registered as the model.

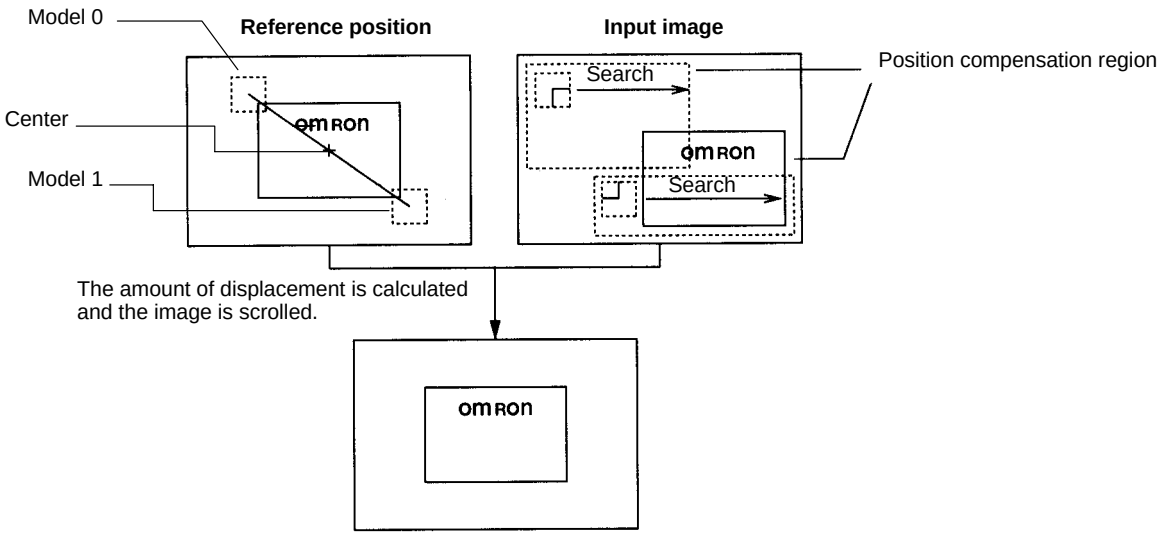


Two-model Positioning

Two-model positioning registers two characteristic parts of the workpiece as the models and searches within each position compensation region for these models. Positions with high correlation values to models 0 and 1 (the center point of the models) are searched for. The displacement (X,Y,) is detected between the coordinates of the center of the line joining the centers of models 0 and 1 and the coordinates of the center of the reference position. The image scrolls by the detected amount of displacement.

A rotation model must be registered to execute rotational position compensation. A rotation model with the same angle as models 0 and 1 is used to search for positions (the center of the models) with the highest correlation value. The amount of displacement (X,Y,θ) between the coordinates of the center of the line joining the models and the reference position coordinates is detected. The image scrolls by the detected amount of displacement.

The registered position of the model becomes the reference position.



Important Correct measurement is not possible if the filtering and background suppression levels used during measurement are different from those that were used when the model was registered. Set the required filtering and background suppression levels for each camera number before registering models. Refer to *4-4-2 Selecting Filtering* and *4-4-3 Setting Background Suppression Levels*.

Automatic Model Registration

When "1.Automatic registration" is set to "Yes" on the position compensation setting screen, the most suitable region for position compensation will be cut automatically and can be registered as a position compensation model. For the registration procedure refer to *One-model Positioning*.

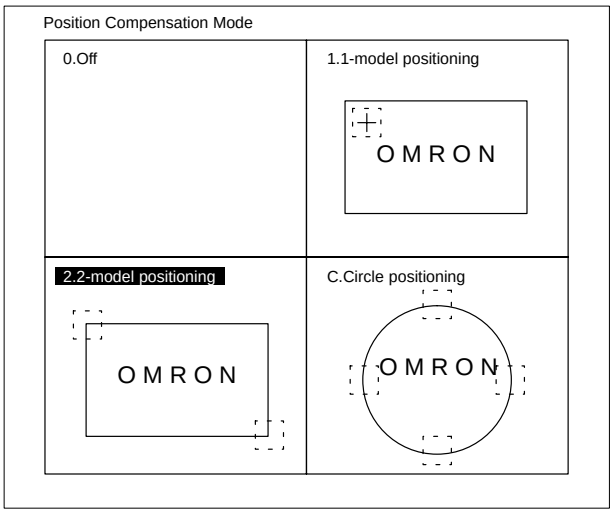
Manual Model Registration

Set the region to be registered as the model.

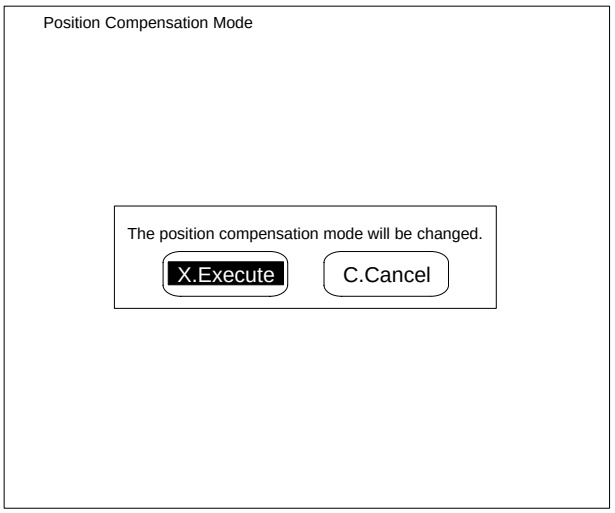
Procedure

1, 2, 3...

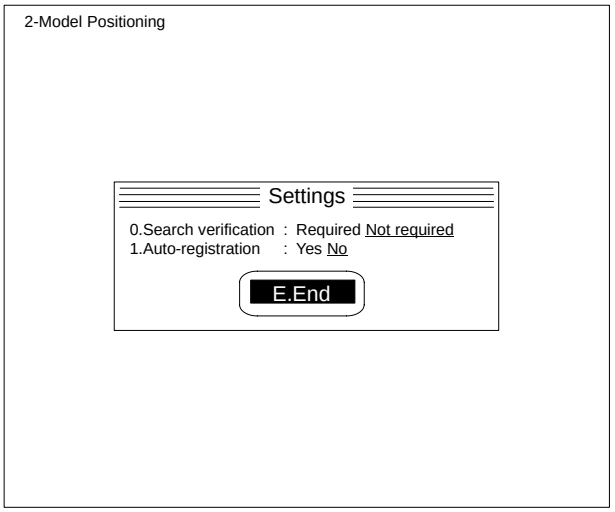
1. Select "R.Registration."
2. Select "2.2-model positioning." When the position compensation mode needs to be changed, carry out steps 3 and 4. When the mode is already set on "2.2-model positioning" go to step 5.



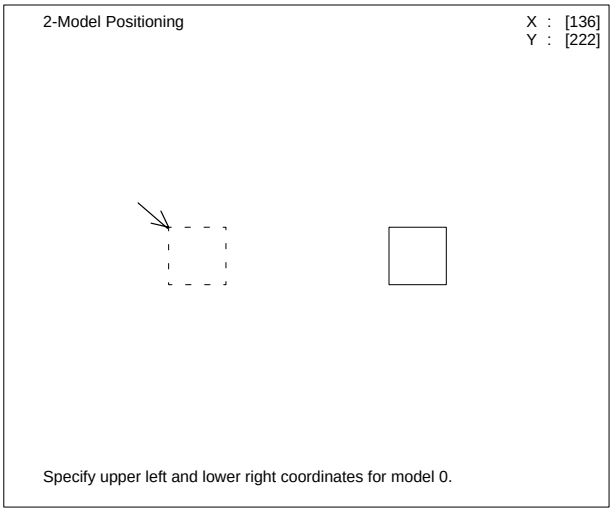
3. Select "X.Execute."



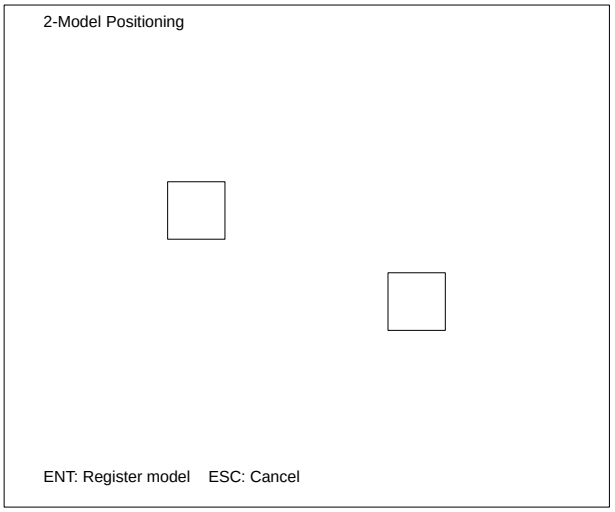
4. Set the position compensation settings. Set “1.Auto-registration” to “No.” Set “0.Search verification” to “Required” or “Not required.”



5. Set the top-left coordinates of the region registered as model 0. Move the arrow cursor and press the Enter Key.
6. Set the bottom-right coordinates of the region registered as model 0. Move the arrow cursor and press the Enter Key.
7. Specify the region to be registered as model 1 in the same way as for model 0.

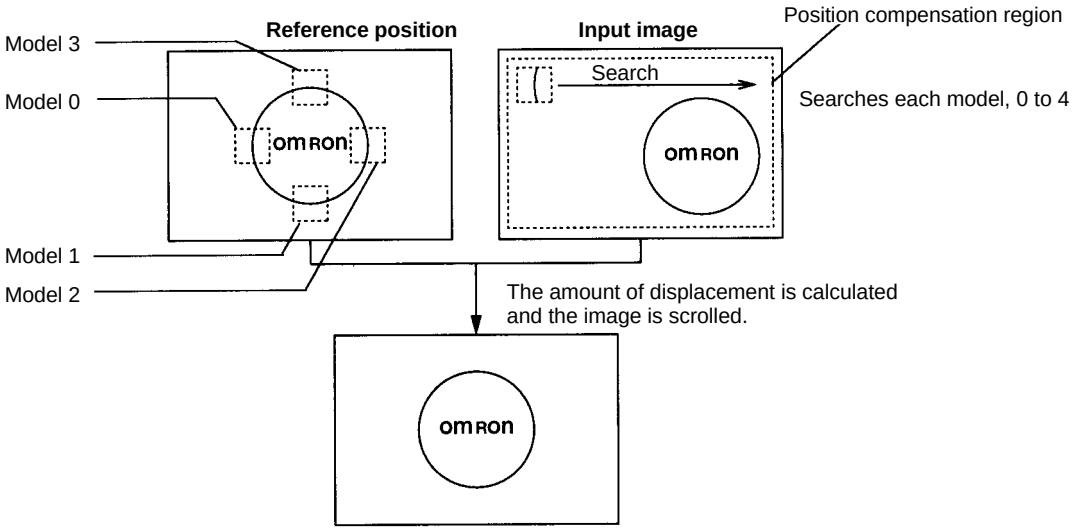


8. Press the Enter Key. The images in the specified region will be registered as the models.



Circle Positioning

Circle positioning registers four regions on the workpiece circumference as models. Positions with the highest correlation values to each model (the center of the models) are searched for. The center coordinates (X,Y) of the circle are detected from the position of these 4 models, and the image scrolls by the detected amount of displacement. Rotational position compensation can also be executed. The registered position of the model becomes the reference position.



Important Correct measurement is not possible if the filtering and background suppression levels used during measurement are different from those that were used when the model was registered. Set the required filtering and background suppression levels for each camera number before registering models. Refer to *4-4-2 Selecting Filtering* and *4-4-3 Setting Background Suppression Levels*.

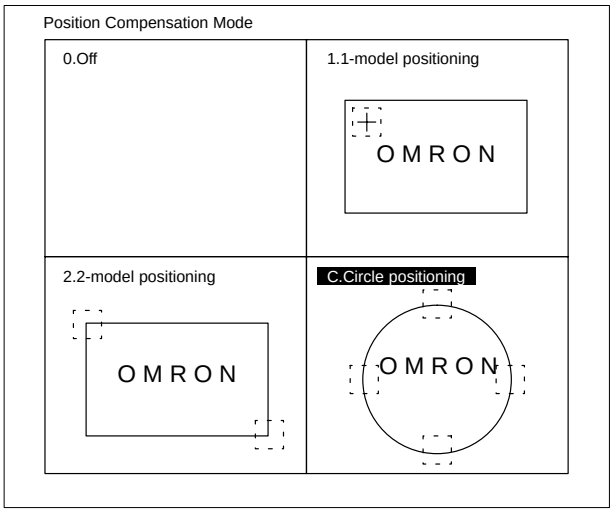
No Rotation

Only X,Y direction position compensation is executed.

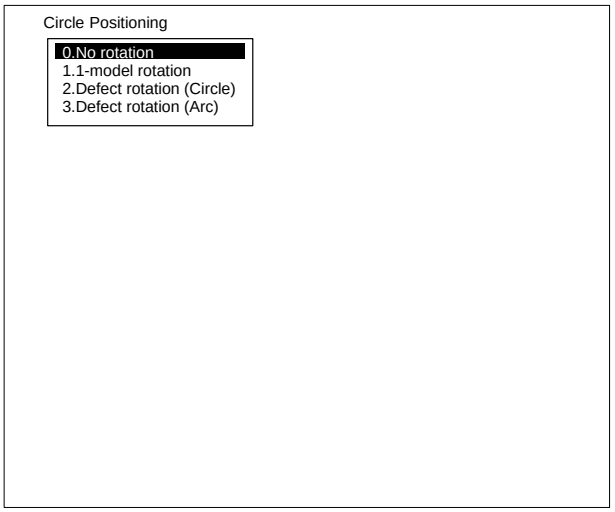
Procedure

1, 2, 3...

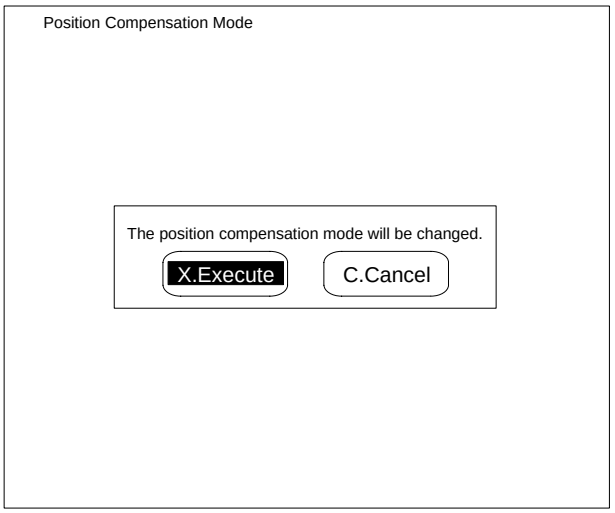
1. Select “R.Registration.”
2. Select “C.Circle positioning.”



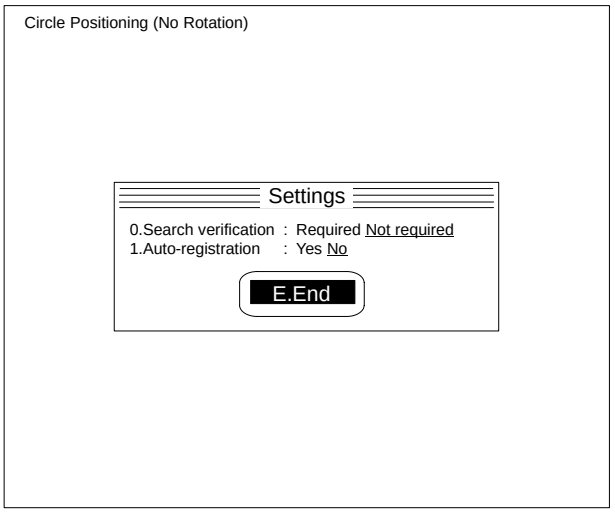
3. Select “0.No rotation.” When the position compensation mode needs to be changed, carry out steps 4 and 5. When the mode is already set on “0.No Rotation” go to step 6.



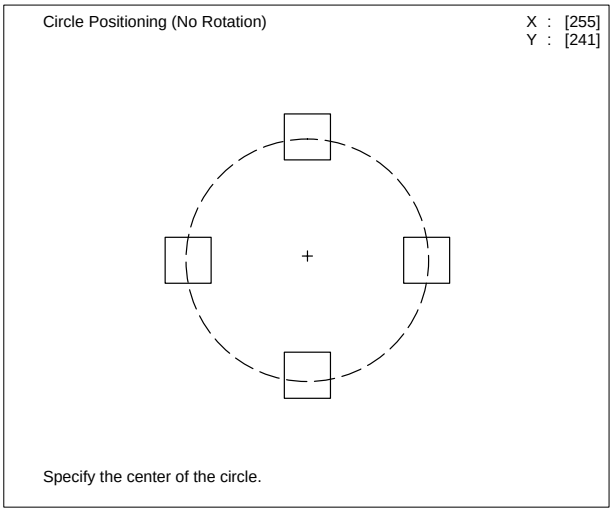
4. Select “X.Execute.”



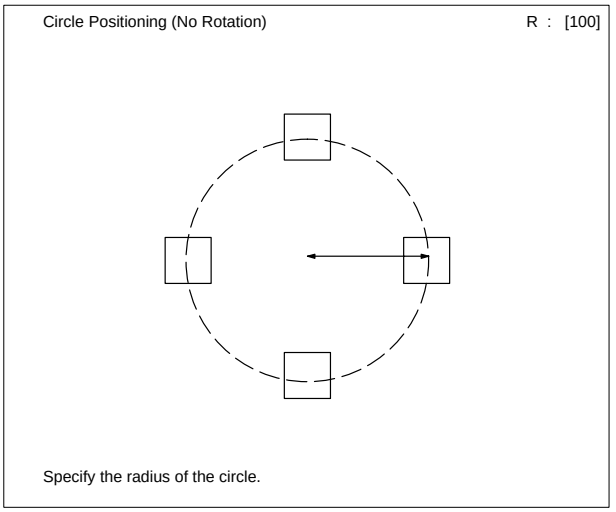
5. Set the position compensation settings. Set “1.Auto-registration” to “No.” Set “0.Search verification” to “Required” or “Not required.”



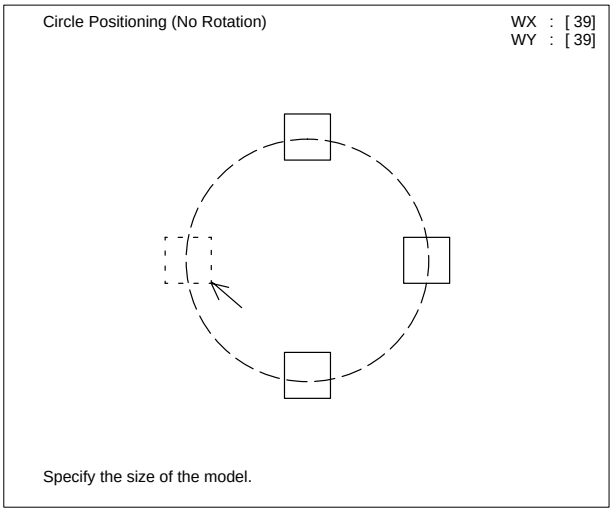
6. Specify the center of the circle by moving the cross cursor and pressing the Enter Key.



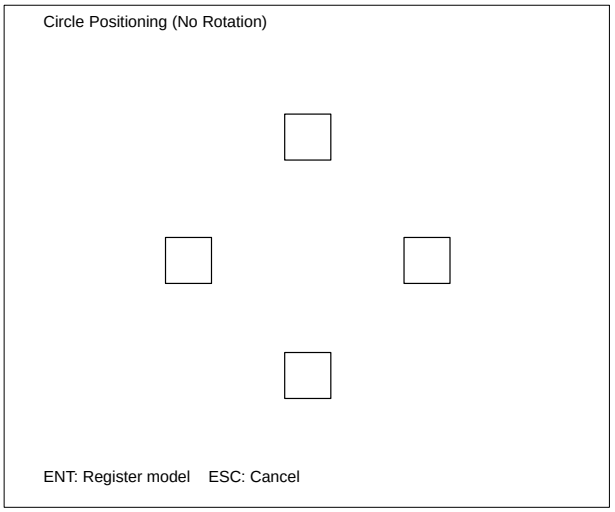
7. Specify the radius of the circle by moving the arrow cursor and pressing the Enter Key.



8. Specify the model size. Only model 0 will be displayed in the dotted line frame. When the arrow cursor is moved, the size of all models will change. Press the Enter Key.



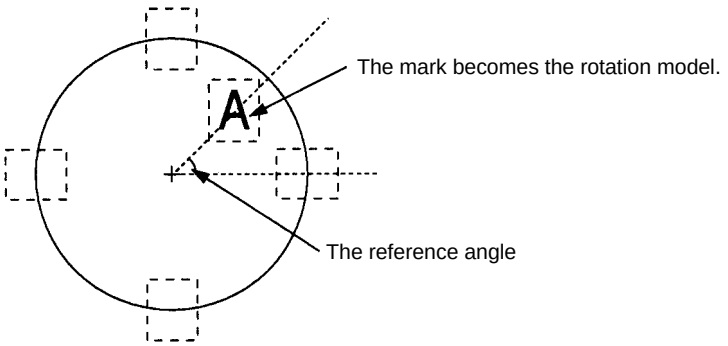
9. Press the Enter Key. The images of the four specified regions will be registered as models.



One-model Rotation

One-model rotation executes position compensation for the X , Y and the rotation directions. When the measurement object (the circle) rotates, any mark on the circle is registered as the rotation model. Rotational direction compensation can be determined from the angle formed by a line joining the position of the mark and the center of the circle.

Set the rotation angle and the pitch angle of the rotation model. Refer to *4-23-2 Setting the Rotation Compensation Parameters*.

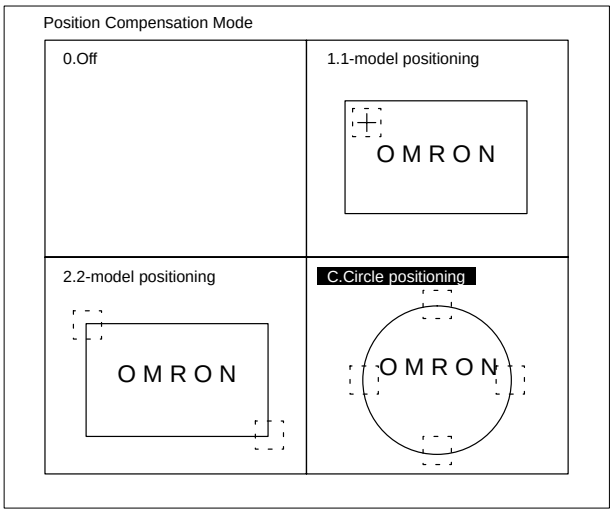


Note Greater stability is possible in position compensation if the rotation model is registered as far away from the center as possible.

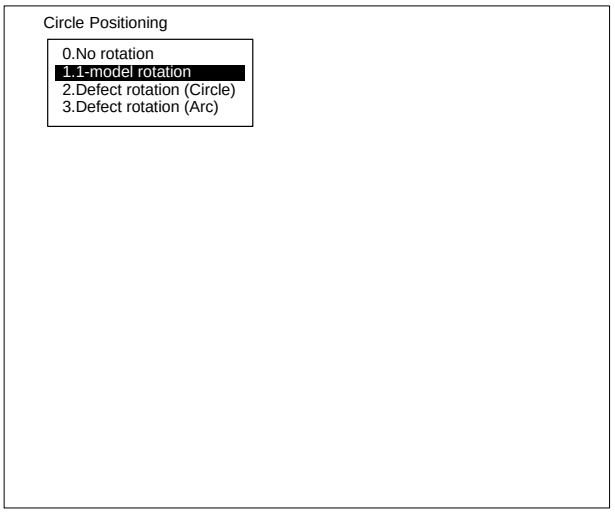
Procedure

1, 2, 3... 1. Select “R.Registration.”

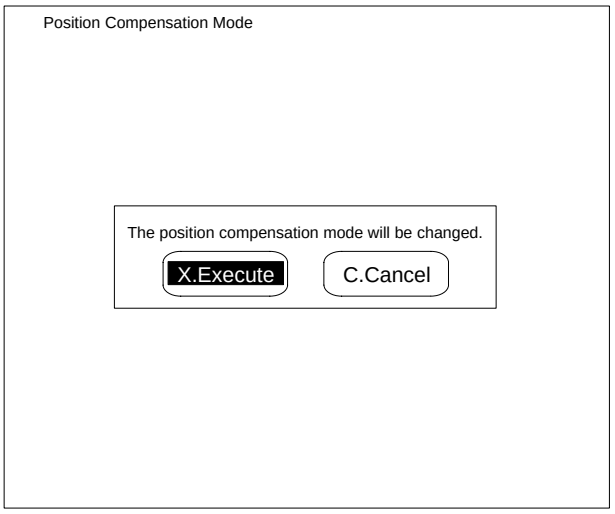
2. Select “C.Circle positioning.”



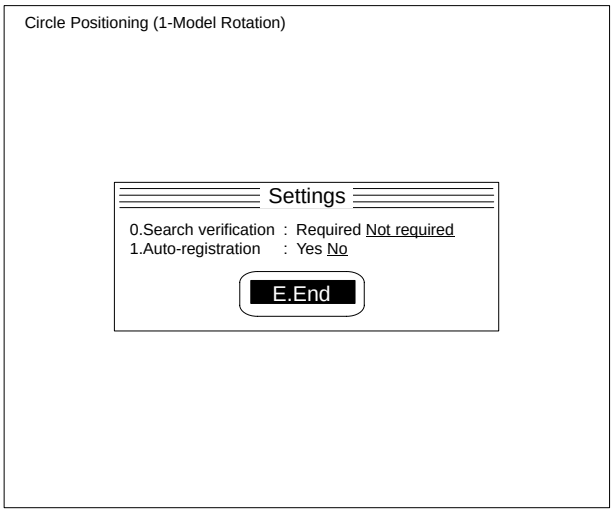
3. Select “1.1-model positioning.” When the position compensation mode needs to be changed, carry out steps 4 and 5. When the mode is already set on “1.1-model rotation” go to step 6.



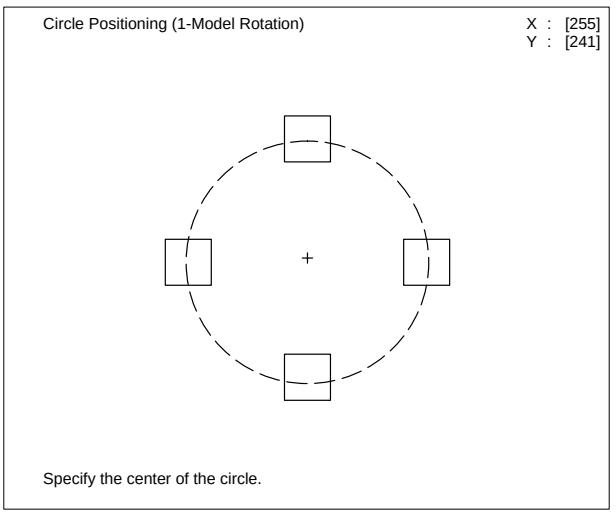
4. Select “X.Execute.”



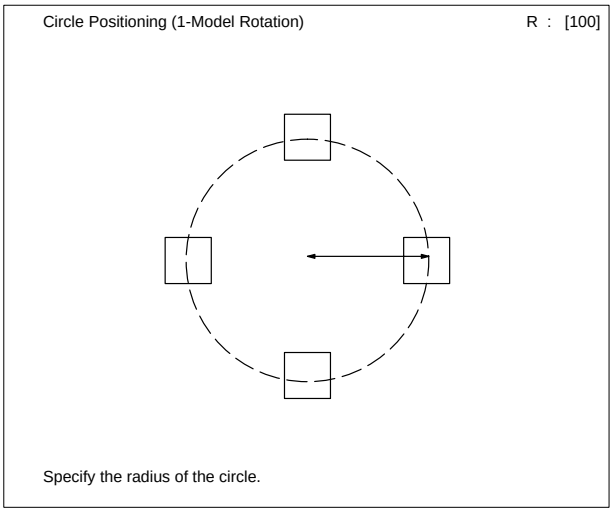
5. Set the position compensation settings. Set “1.Auto-registration” to “No.” Set “0.Search verification” to “Required” or “Not required.”



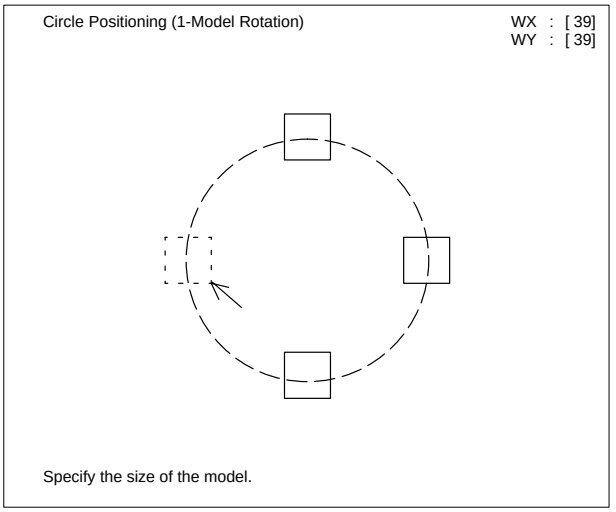
6. Specify the center of the circle. Move the cross cursor and press the Enter Key.



7. Specify the radius of the circle. Move the arrow cursor and press the Enter Key.

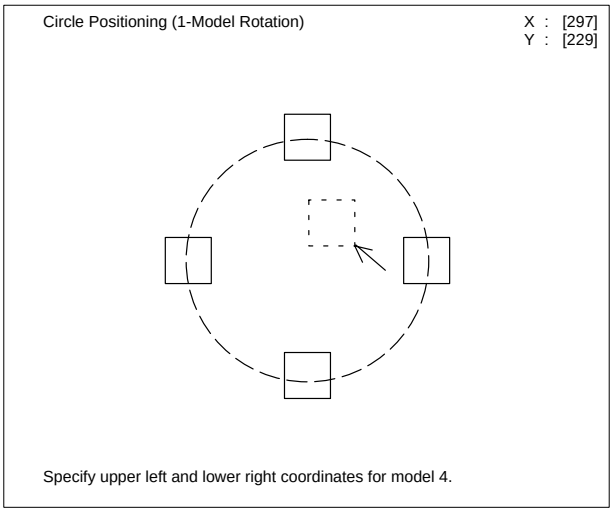


8. Specify the size of the model. Only model 0 will be displayed in the dotted line frame. When the arrow cursor is moved and the size of models 0 to 3 will be changed. Press the Enter Key.

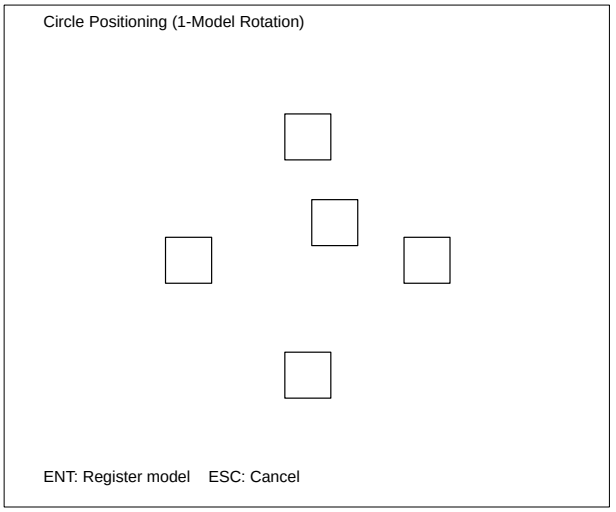


9. Specify the top-left coordinates of the region to be registered as model 4 (the rotation model). Move the arrow cursor and press the Enter Key.

10. Specify the bottom-right coordinates of the region to be registered as model 4. Move the arrow cursor and press the Enter Key.

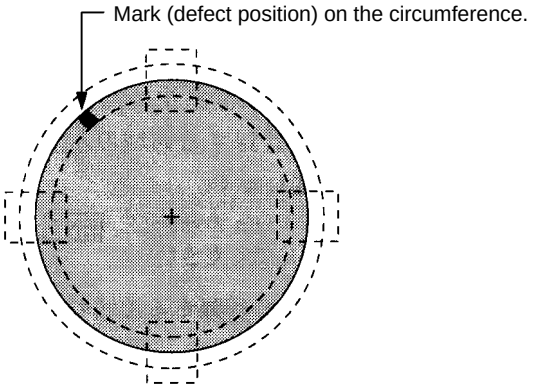


11. Press the Enter Key. The images of the five specified regions will be registered as models.

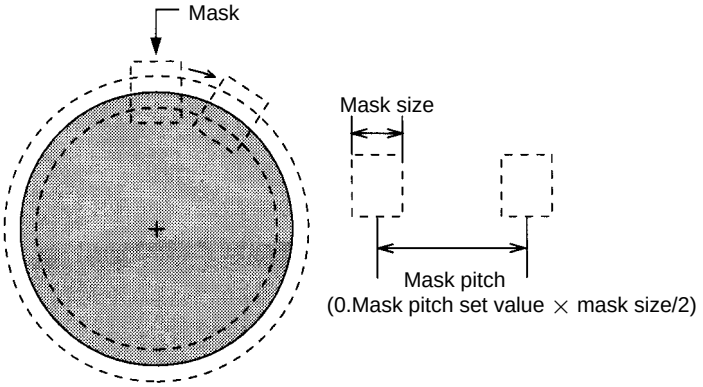


Defect Rotation: Circle/Arc

Defect rotation executes position compensation for the X, Y, and rotation directions. When the measurement object (the circle) rotates, rotation direction position compensation can be executed from the angle formed by a line joining a position on the circumference of the circle with defects, to the center of the circle (and the original rotation model). Defect positions when the rotation region was set will be the reference position. Set the conditions for detecting a mark on the circumference as the defect position.



Item	Details
0.Scratch color	Selects the color of the mark for detecting chips and scratches. Select the color of the gray image.
1.Mask size	Set the size of this mask. Set from 4 to 80. Set the mask size according to the size of the mark. The larger the mask size, the slower the processing speed. The mask is moved a little within the region drawn on the circumference to detect defect positions (mark).
2.Mask pitch	Sets the pitch for moving the mask. Set from 1 to 6. Set the mask size according to the size of the mark. There is no relationship between the mask pitch and processing speed.



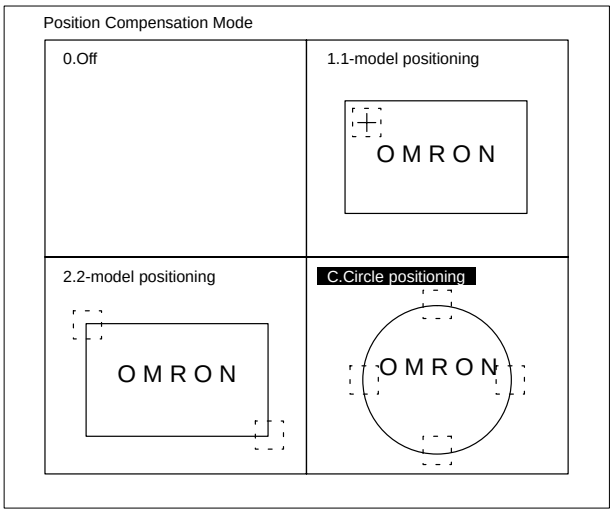
The rotation parameters are indicated below.

Position compensation mode	Rotation parameters
Defect rotation (circle)	All angles
Defect rotation (arc)	From the first point to the last point of the arc.

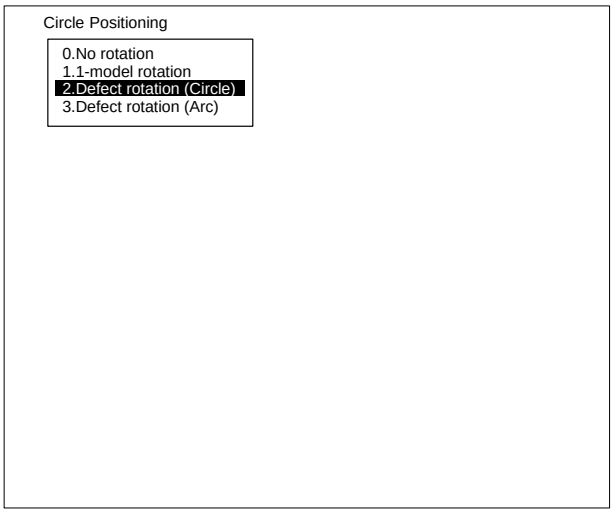
Procedure

1, 2, 3... 1. Select “R.Registration.”

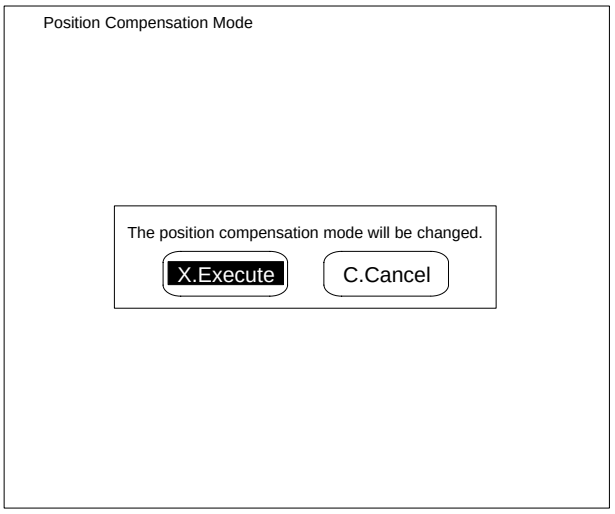
2. Select “C.Circle positioning.”



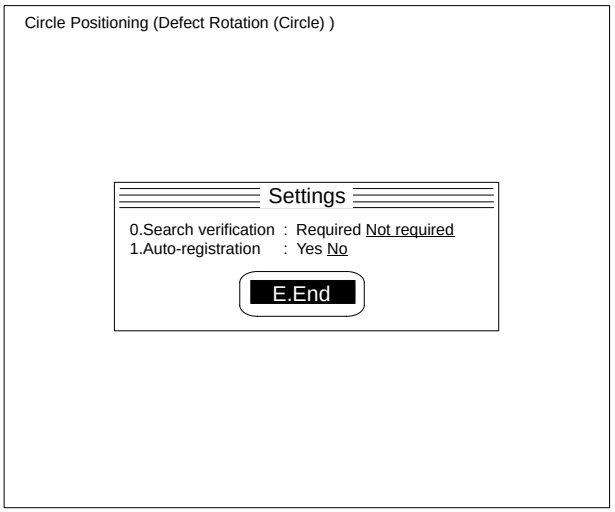
3. Select “2.Defect rotation (Circle/Arc).” When the position compensation mode needs to be changed, carry out steps 4 and 5. When the mode is already set on “2.Defect rotation (Circle/Arc)” go to step 6.



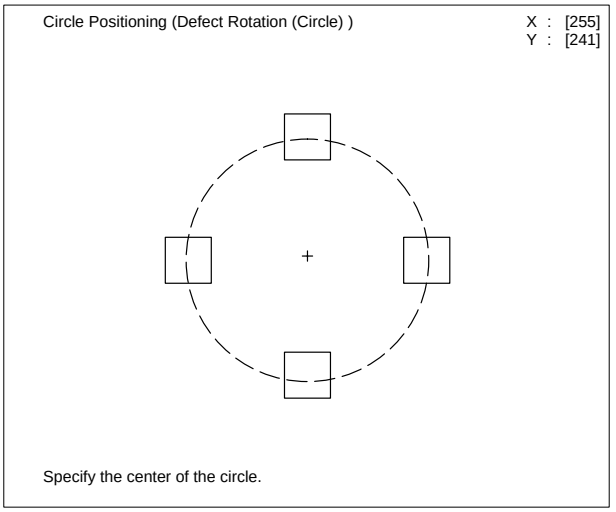
4. Select “X.Execute.”



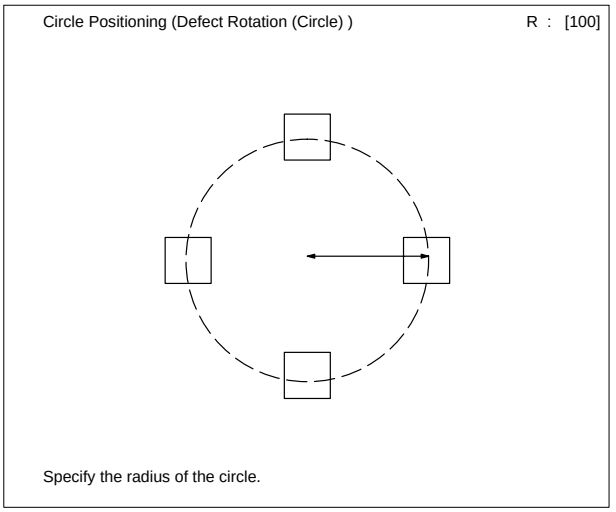
5. Set the position compensation settings. Set “1.Auto-registration” to “No.” Set “O.Search verification” to “Required” or “Not required.”



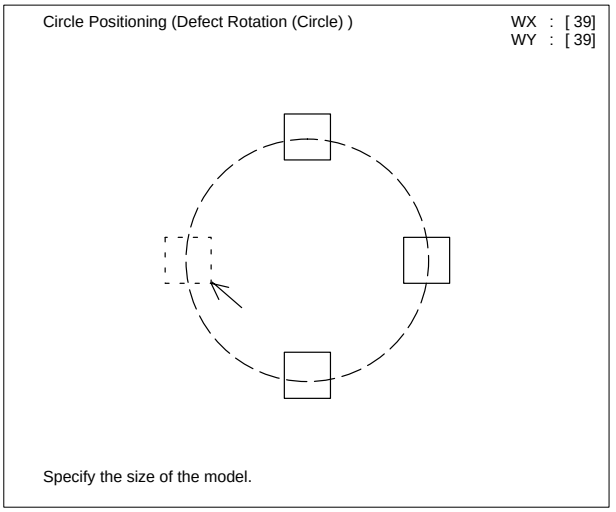
6. Specify the center of the circle by moving the cross cursor and pressing the Enter Key.



7. Specify the radius of the circle by moving the arrow cursor and pressing the Enter Key.

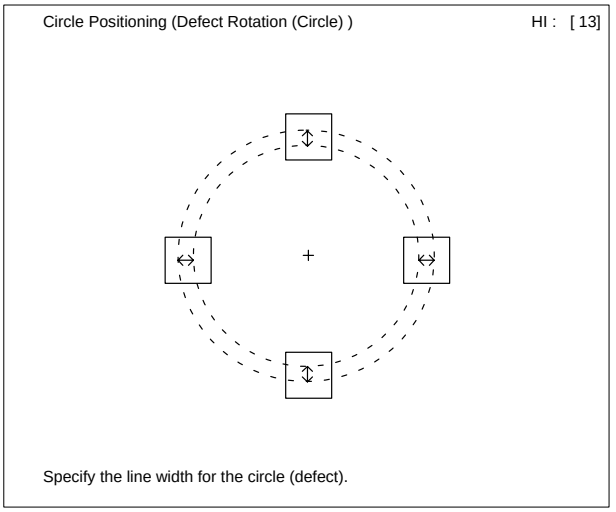


8. Specify the size of the model. Only model 0 will be displayed in the dotted box. When the arrow cursor is moved, the size of models 0 to 3 will be changed. Press the Enter Key.

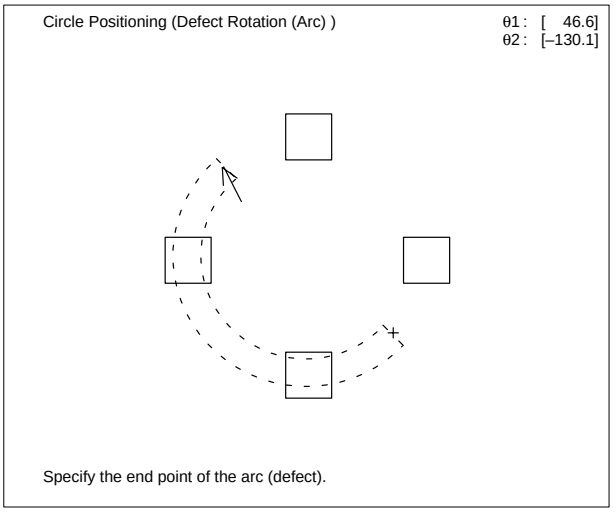


9. Specify the line width and radius of the circumference to be set as the rotation model. Move the arrow cursor and press the Enter Key. When “3.Defect

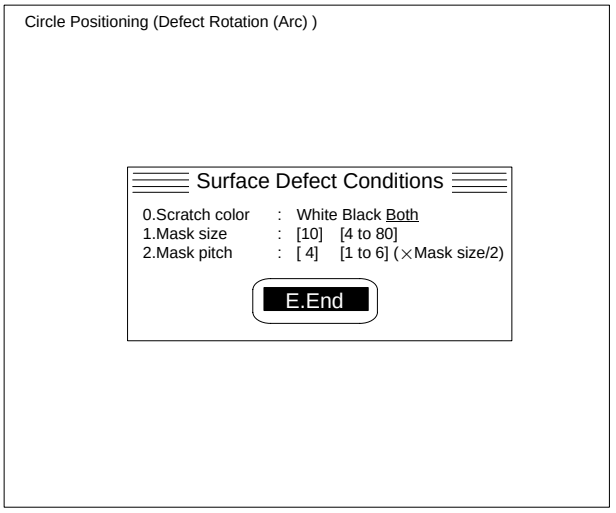
rotation (arc)" is selected, carry out step 10. When "2.Defect rotation (circle)" is selected, go to step 11.



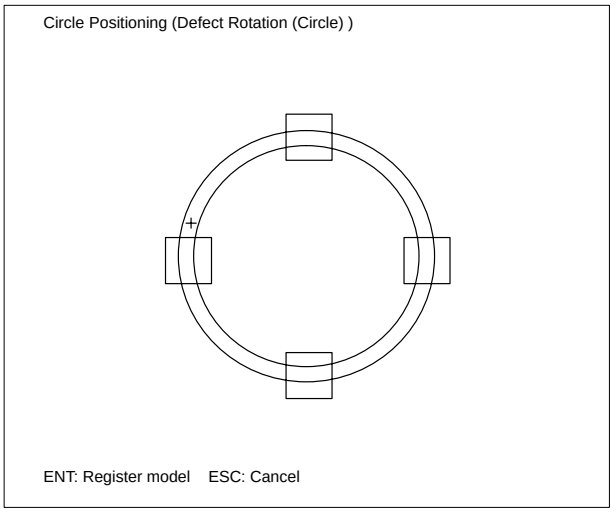
10. Specify the start point and end point of the arc. Move the arrow cursor and press the Enter Key.



11. Set the conditions for detecting the mark on the circumference as a chip or scratch.



12. Press the Enter Key. The image in the specified region will be registered as the model. A cross cursor will be displayed in the defect position of the rotation region, and this will registered as the reference position.

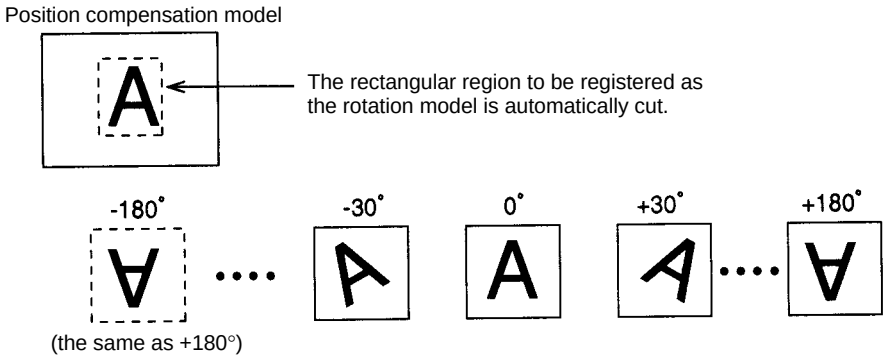


4-23-2 Selecting the Rotation Compensation Parameters: T.Rotation Angle

"T.Rotation angle" is used to set the corresponding rotation angle when the rotation of the measurement object is not consistent. The position models registered in "P.Position compensation/R.Registration" are each rotated by the pitch angle inside this parameter and registered. When the measurement object is rotated further than the "T.Rotation angle," position compensation will not be possible.

Example

Rotation angle: All angles
Pitch angle: 30°



With a rotation angle of "all angles" and a pitch angle of 30°, 12 models that have been rotated by 30° each are registered as rotation models. Rotation models are searched for in the search regions and the image is scrolled by the rotation angle of the model with the highest correlation value. After position compensation according to the rotation model, slight adjustment is made according to the position compensation model.

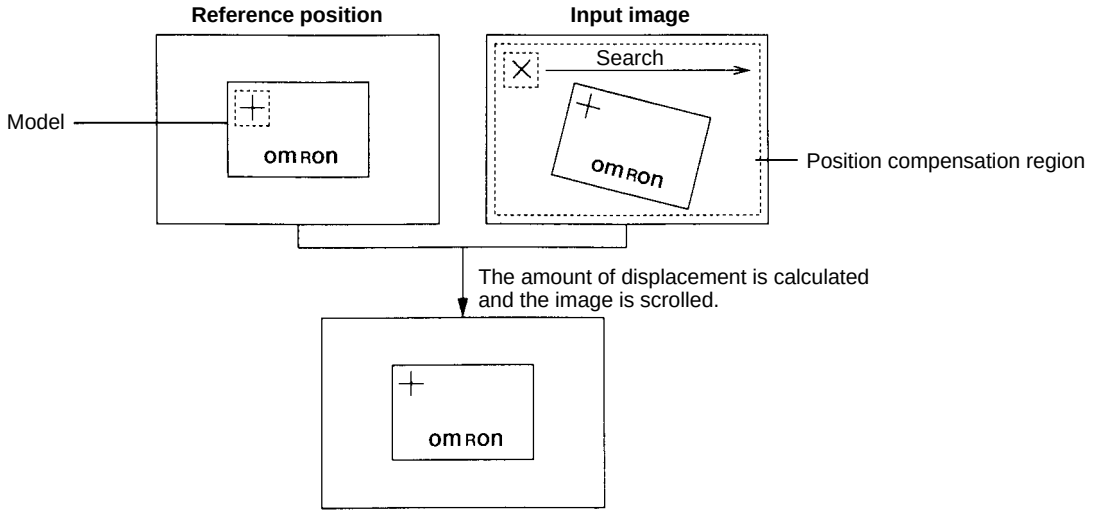
Registering Models Automatically

Automatically register models using the following procedure.

1, 2, 3...

1. Register a provisional model.
   Either automatic or manual registration can be used.
2. Set the rotation angle and pitch angle of the rotation model.
3. Execute automatic model registration once the model is in the correct position.

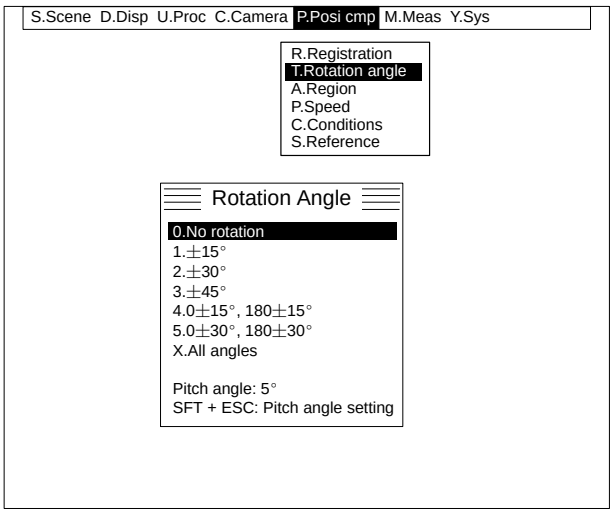
If the rotation angle and pitch angle of the rotation model are changed after auto-registration, measurement will be incorrect.



Processing time based on set data can be monitored on the video monitor. Refer to *4-24 M.Measure/O.Measure monitor* and *4-25-1 Entering Measurement Screens*.

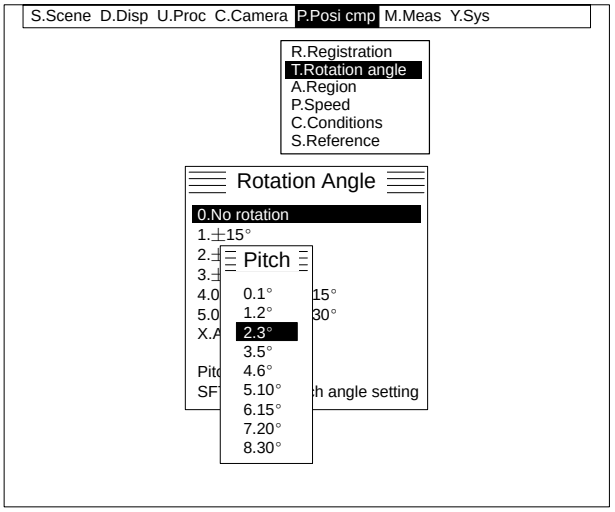
Procedure

1, 2, 3... 1. Select “T.Rotation angle.” To make changes to the set pitch angle, carry out steps 2 and 3. When there are no changes, go to step 4.

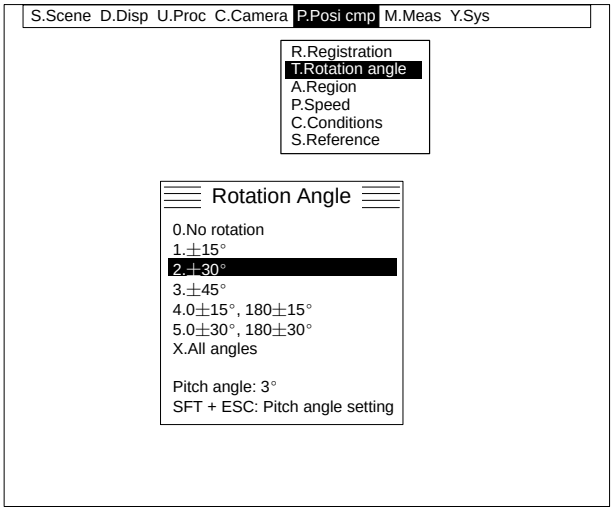


2. Press the Shift+Escape Keys. The pitch angle setting screen will be displayed.

3. Select the pitch angle.



4. Select the rotation angle.



4-23-3 Setting the Position Compensation Region: A.Region

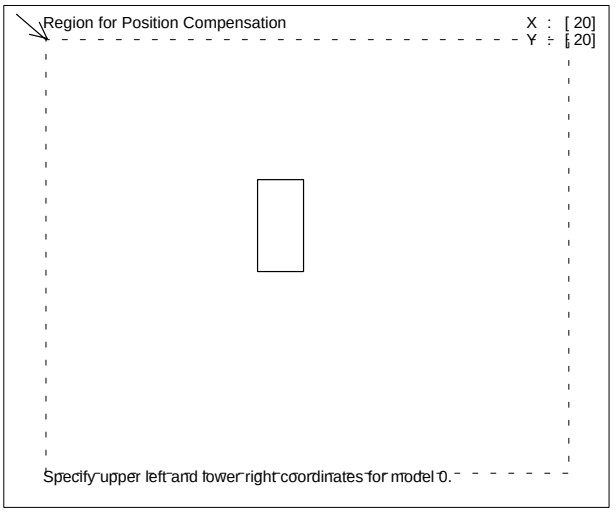
"A.Region" sets the region for searching for the position compensation models. When setting either "2-model positioning" or "C.Circle positioning" under "P.Position compensation/R.Registration," set the position compensation region for models 0 onwards in sequence. Set the region so that position compensation models can be found even if the measurement object moves. Correct position compensation cannot be executed if position compensation models cannot be found in the position compensation region.

Procedure

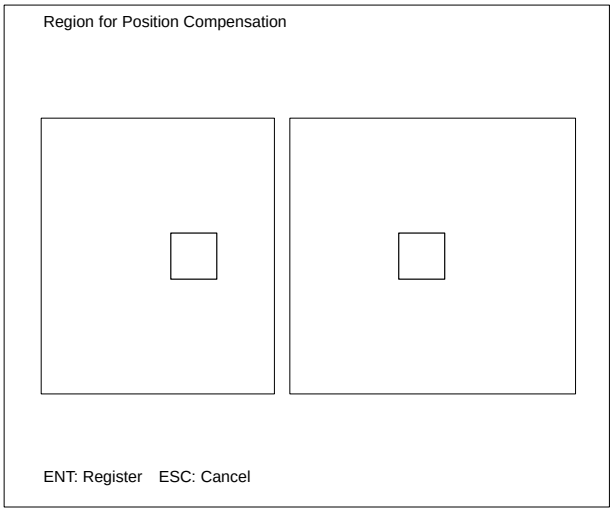
1, 2, 3...

1. Select "A.Region." The position compensation region will be displayed in the dotted line frame. The region registered as the position compensation model will be displayed in the solid line frame.
2. Specify the top-left coordinates of the position compensation region. Move the arrow cursor and press the Enter Key.

3. Specify the bottom-right coordinates of the position compensation region. Move the arrow cursor and press the Enter Key. When registering several models, repeat steps 2 and 3.



4. Press the Enter Key. The specified region will be registered as the position compensation region.



4-23-4 Selecting the Position Compensation Speed: P.Speed

"P.Speed" selects the speed at which position compensation is executed. The position compensation processing speed is set for the currently displayed process number. The processing speed of position compensation set for other process numbers cannot be changed.

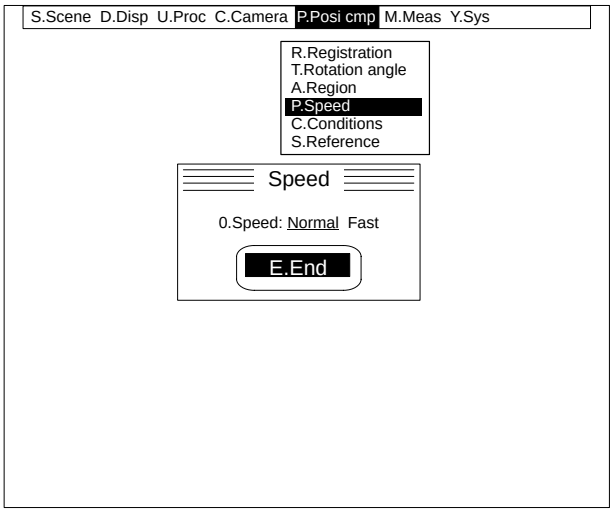
Position compensation speed	Details
Normal	Executes position compensation for the image within the frame (33 ms 512×484). The processing speed varies according to factors such as the position compensation mode, the rotation parameters, the pitch angle, and whether search verification is needed.
Fast	Executes position compensation for the image within the field (16.7 ms 512×242). The processing speed varies according to factors such as, the position compensation mode, the rotation parameters, the pitch angle, and whether search verification is needed. If there is no affect on positioning even if vertical resolution is halved, then select "fast" to reduce the time required for measurements. For the F300-A20R Shutter Camera I/F Unit and the F300-A20RS/A22RS Single Shutter Simultaneously Camera I/F Unit, only the fast speed can be selected.

Processing time based on set data can be monitored on the video monitor. Refer to *4-24 M.Measure/O.Measure Monitor* and *4-25-1 Entering Measurement Screens*.

Procedure

1, 2, 3...

1. Select “P.Speed.”
2. Select the speed.
3. Select “E.End.”



4-23-5 Selecting Position Compensation Conditions: C.Conditions

The conditions set here are used to judge OK/NG for the correlation values of position compensation models found in the position compensation region. Set the “judgement flag” to “ON” for position compensation judgements to be made during measurement. Set the search correlation value to 100 for images which match the models exactly.

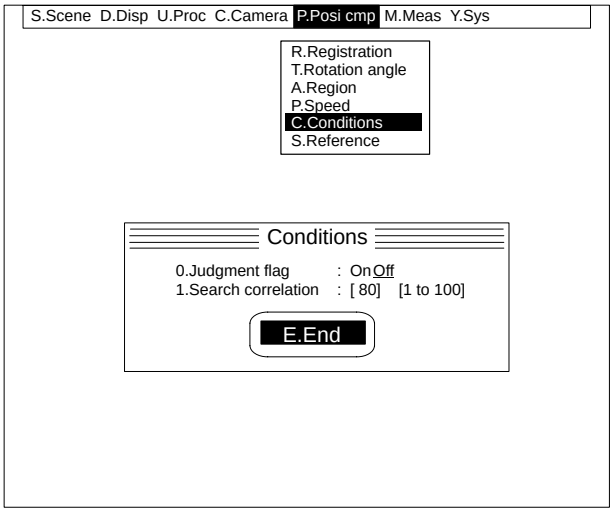
In the following situations, set the “1.Search correlation” value regardless of whether the “O.Judgement flag” is set.

- **Registering a Position Compensation Model Automatically**
  Set the “1.Search correlation” before executing automatic registration for the model. The F350 uses this setting to cut the appropriate position compensation region.
- **“Search Verification” Set to “Required” in the Settings Mode**
  The F350 detects as candidates areas with correlation values greater than the search correlation values.

Procedure

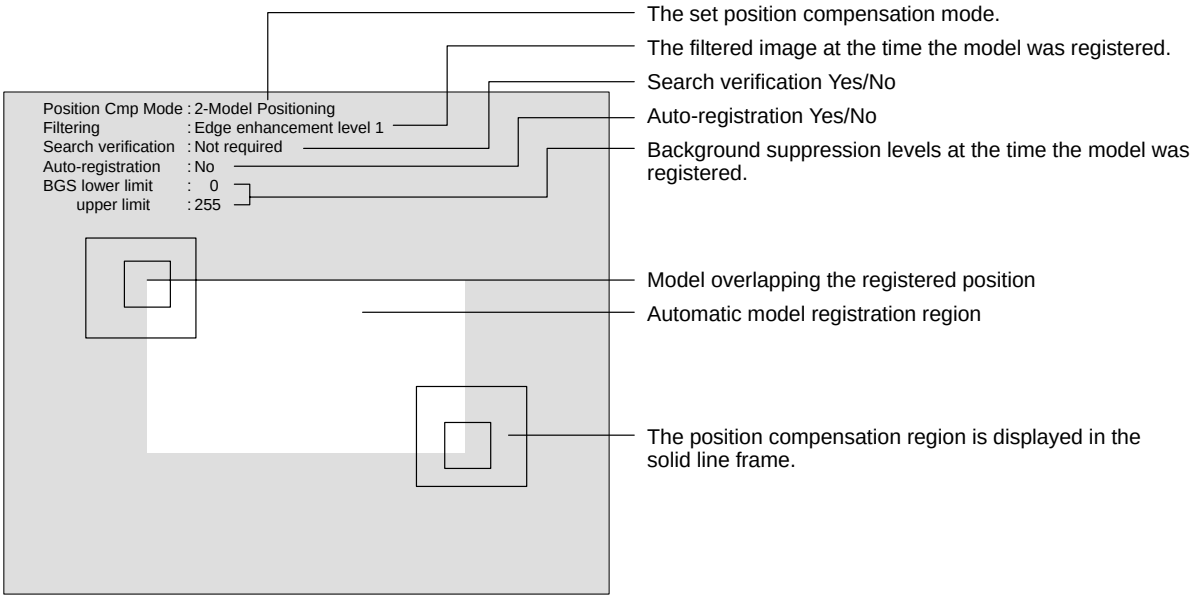
1, 2, 3... 1. Select “C.Condition.”

2. Sets the conditions for position compensation.



4-23-6 Checking the Set Data: S.Reference

“S.Reference” is used to display and monitor data set under position compensation. Data cannot be changed.

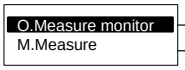


The accuracy of position compensation can be monitored by using the following procedure.

1. Select “D.Display/P.Input image after position compensation” and input the image. Refer to *4-2-3 Inputting Images After Position Compensation*.
2. Select “P.Position compensation/S.Reference.”

4-24 M.Measure/O.Measure Monitor

"M.Measure/O.Measure Monitor" can be used to monitor measurement values and times before performing actual measurements.



4-24-1 Checking Measurement Values and Times: O.Measure Monitor

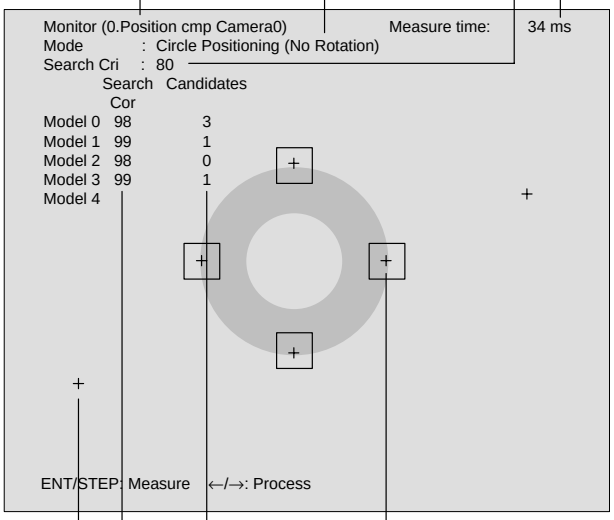
"O.Measure monitor" monitors measurement values based on the set data. Measured results are output to the Video Monitor only, even when a Parallel I/O Unit or Terminal Block Unit is mounted. The measurement time for each process is also displayed on the Video Monitor. When several processes are set, the measurement time for each can be monitored by switching between them.

Important

Instruction Input Timing

The next instruction must not be input while an instruction is being executed. Neither the instruction currently being executed nor the next instruction will be properly executed. When a Terminal Block Unit or Parallel I/O Unit is mounted,

the BUSY signal will turn ON during instruction execution. Check to be sure that the BUSY signal is OFF before inputting the next instruction.



The current process number, the set measurement items name, and the camera number.

The position compensation mode.

The criteria for determining OK or NG.

The measurement time for the current process.

When position compensation is set for the same camera number for the preceding process, the time displayed includes position compensation time.

When position compensation is set in succession, the time displayed includes the time for position compensation over several stages. This does not include the time for displaying the measured results on the video monitor.

In some cases, successive processes are processed in parallel. This means that the total of all separate process times will not necessarily equal the scene measurement time. Confirm the measurement time for each scene on the measurement screen.

Refer to *4-25-1 Entering Measurement Screens*.

Without search verification:
The model frame and cross cursor are displayed at the position that has the highest correlation with the search model.

With search verification:
The model frame and cross cursor are displayed at the position that has the highest correlation with the verification model.

Without search verification: “0” is always displayed.

With search verification:
Positions for which the correlation with the search model is greater than or equal to the criteria are displayed as the candidate points.

The correlation with the position compensation model is displayed. If the measured value is less than the criteria, NG is determined. In that case, “NG” is displayed here in reverse video.

Without search verification:
The correlation value of the position that has the highest correlation with the search model is displayed.

With search verification:
The correlation value of the position that has the highest correlation with the verification model is displayed.

When search verification is required, the cross cursor is displayed at the search candidate point.

Console

The following instructions can be input from the Console.

Instruction	Key	Action
Measure	ENT	Executes position compensation. When position compensation is set for the same camera number for the preceding process, (or position compensation is set in succession), position compensation is executed over several stages.
Switch process	◀ / ▶	Switches the process and executes the measurement items as set. Processes with no data set are skipped over. When position compensation is set for the same camera number for the preceding process, position compensation is executed over several stages.
Quit measurement	ESC	Quits the measure monitor screen.

RS-232C

The following instructions can be input via RS-232C. Attach a delimiter to the input code (ASCII). Ensure that it matches the communications specifications of the F350 and the external device.

Refer to *5-2-3 Setting RS-232C Communications Specifications* in the *F350 Setup Menu Operation Manual*.

Important Set the instruction delimiter to CR, or CR + LF. Always use channel 0. Channel 1 on the RS-232C Unit cannot be used.

Measure

M m	Delimiter

Executes position compensation once. When position compensation is set for the same camera number for the preceding process, position compensation is executed over several stages.

Quit Measurement

Q q	Delimiter

Quits the measure monitor screen.

Parallel I/O

The following instruction can be input from a Parallel I/O Unit or Terminal Block Unit. Connect and wire the external devices. The leading edge (OFF to ON) of the STEP signal is indicated by ↓.

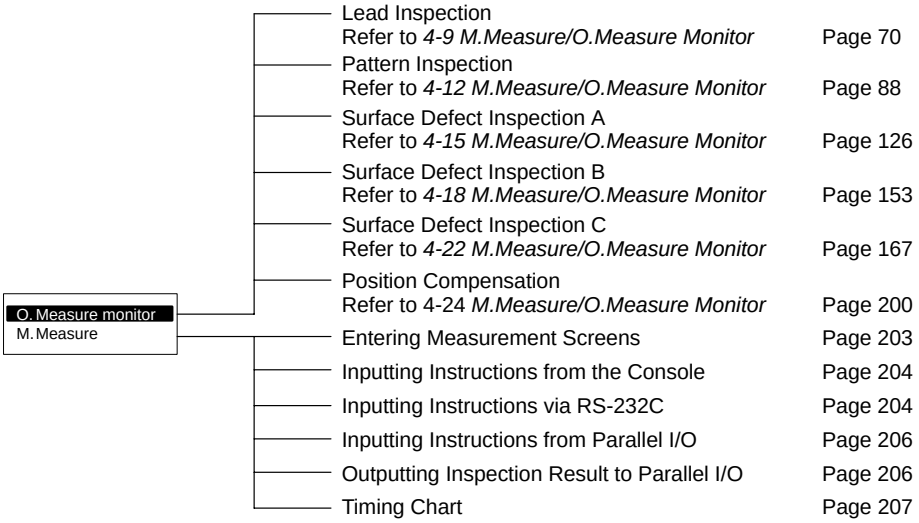
Refer to *2-4 Connecting Peripheral Devices* in the *Setup Menu Operation Manual*.

Instruction	Input data STEP DI: 76543210	Action
Measure	↓	Executes position compensation once in sync with the STEP signal's leading edge (OFF to ON). When position compensation is set for the same camera number for the preceding process, (or position compensation is set in succession), position compensation is executed over several stages.

■ Measurements

4-25 M.Measure/M.Measure

"M.Measure" performs measurement based on the conditions that have been set.



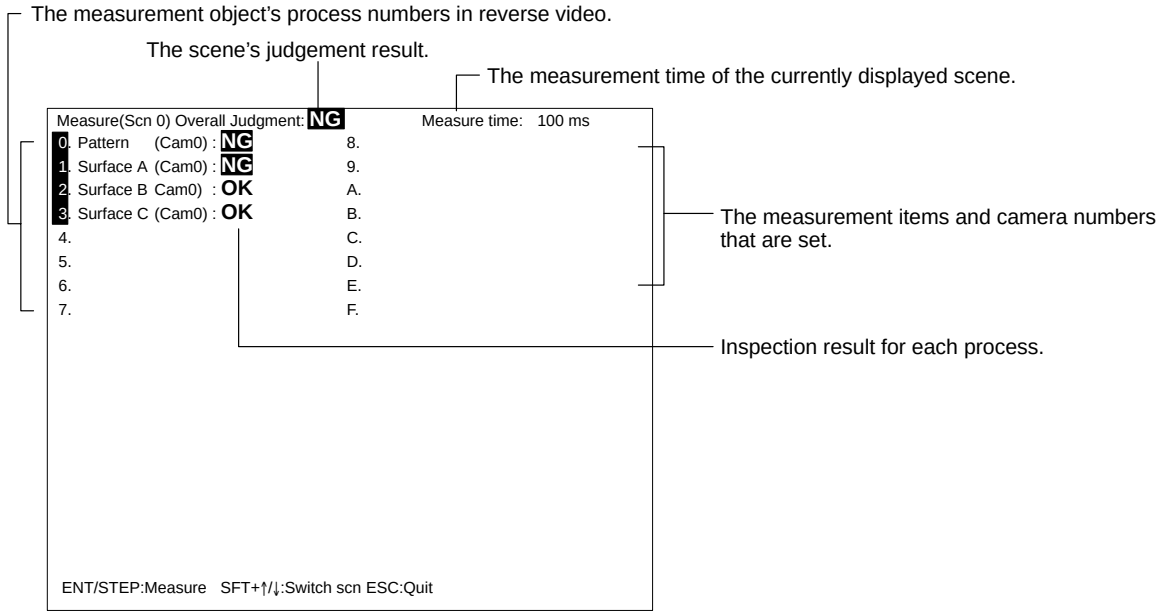
4-25-1 Entering Measurement Screens

Measurement is executed on the measurement screen according to instructions. Inspection results are output to the Video Monitor and Parallel I/O Unit or Terminal Block Unit. A scene is judged OK only if all the judgement results of processes are OK.

Important When using an F350-C12E IMP Unit, it is necessary to insert a scene data backup Memory Card in order to use multiple scenes. Insert the Memory Card before selecting "M.Measure/M.Measure."

When an error occurs at the F350 during a measurement, the IMP Unit's ERROR indicator lights and the ERR signal turns ON. The type of error, however, cannot be distinguished. The appropriate countermeasure depends on the instruction that was input.

The ERR signal remains ON until the measurement screen is quit. You must exit the measurement screen to turn off the error output. Refer to *Section 5 Troubleshooting*.



The measurement screen can be displayed at startup so that instructions can be input immediately. Refer to *4-26-1 Automatic Measurements*.

4-25-2 Inputting Instructions from the Console

All Measurement Items

The following commands can be input from the Console.

Instruction	Key	Action
Measure	ENT	Executes the measurement.
Switch scene	SHIFT + ▲/▼	Increments or decrements the currently displayed scene number.
Quit measure	ESC	Quits the measurement screen.

4-25-3 Inputting Instructions via RS-232C

The following instructions can be input via RS-232C. Attach a delimiter to the input ASCII code. Ensure that it matches the communications specifications of the F350 and the external device. No inspection results, however, can be output to the RS-232C Unit.

Refer to *5-2-3 Setting RS-232C Communications Specifications* in the *Setup Manual*.

Important Set the instruction delimiter to CR, or CR + LF. Always use channel 0. Channel 1 on the RS-232C I/F Unit cannot be used.

All Measurement Items

Measure

M m	Delimiter	

Executes one measurement.

Switch Scene

S s	Scene No.	Delimiter	

Switches to the specified scene number.

Switch Camera

C c	Process number	Delimiter	

Switches to the camera for the specified process number.

Specify Process

U u	Beginning process number	,	Ending process number	Delimiter

Set so that the measurement items for only the specified processes are measured.

Load Scene Data

OF of	Filename (no extension)	Delimiter

Loads scene data from the specified file on the Memory Card to the currently displayed scene number.

Quit Measure

Q q	Delimiter

Quits the measurement screen.

Position Compensation

Automatic Register

R r	Process number	Delimiter

When automatic registration is specified, the region most suitable for position compensation is cut from the automatic registration region and re-registered as the position compensation model.

Lead Inspection

Lead Condition Settings

I i	Process number	,	Pitch	,	Pitch criteria	,	Pin width	,	Pin length criteria	,	Number of pins in horizontal row 1	,	Number of pins in horizontal row 2	,	Number of pins in vertical row 1	,	Number of pins in vertical row 2	Delimiter

Set the conditions for automatic model generation and registration.

Automatic Register

R r	Process number	Delimiter

Automatically generates and re-registers a pin model based on the conditions set with “L.Lead inspection/I.Lead conditions.” If lead conditions are sent through RS-232C, they are used, and the conditions set with “L.Lead inspection/I.Lead conditions” are changed to those received through RS-232C.

The following response is output when an instruction other than a measurement instruction is input.

When ended normally:

O	K	Delimiter

When ended abnormally:

E	R	Delimiter	Input instruction	Delimiter

4-25-4 Inputting Instructions from Parallel I/O

The commands shown in the following table can be input from a Parallel I/O Unit or a Terminal Block Unit.

ON status of bits is indicated by “1” and OFF status by “0.” An asterisk (*) indicates that either is possible.
Set DI 0 to 6 and then turn on DI 7 1 ms later.
The leading edge (OFF to ON) of the STEP signal is indicated by ↓. Connect and wire the external devices.

Refer to *2-4 Connecting Peripheral Devices* in the *Setup Manual*.

All Measurement Items

Instruction	Input data STEP DI: 7 6 5 4 3 2 1 0	Action
Measure	↓	Executes a single measurement in sync with the STEP signal’s leading edge (OFF to ON).
	1 0 0 1 * * * *	Executes continuous measurement while instruction is being input.
Switch scene	1 0 1 0 (Scene #) (Example:) 1 0 1 0 0 0 1 0	Switches scene for measurement. This example switches to scene 2.
Switch camera	1 0 1 1 (Process#) (Example:) 1 0 1 1 0 0 1 1	Switches to the camera for the specified process number. This example switches to the camera set for process 3.
Specify beginning process number	1 1 0 1 (Process#)	Set so that measurements are executed from the specified process number through process #15 (or the ending process number). If a number greater than the ending process number is specified, then the ending process number will be changed to the same number as the beginning process number. This setting is valid only for the scene number that is currently being displayed.
Specify ending process number	1 1 1 0 (Process#)	Set so that measurements are executed from process #0 (or the beginning process number) through the specified process number. If a number smaller than the beginning process number is specified, then the beginning process number will be changed to the same number as the ending process number. This setting is valid only for the scene number that is currently being displayed.

Position Compensation

Instruction	Input data STEP DI: 7 6 5 4 3 2 1 0	Action
Automatic registration	1 1 0 0 (Process#)	When automatic registration is specified, the region most suitable for position compensation is cut from the automatic registration region and re-registered as the position compensation model.

Lead Inspection

Instruction	Input data STEP DI: 7 6 5 4 3 2 1 0	Action
Automatic registration	1 1 0 0 (Process#)	Automatically generates and re-registers a pin model based on the conditions set with “L.Lead/I.Lead conditions.” If lead conditions are sent through RS-232C, they are used, and the conditions set with “L.Lead/I.Lead conditions” are changed to those received through RS-232C.

4-25-5 Outputting Inspection Result to Parallel I/O

Connect a peripheral device. Refer to *2-4 Connecting Peripheral Devices* in the *Setup Menu Operation Manual*. Set the output specifications with the setup

menu. Refer to *5-2-4 Setting the Output Specifications for Parallel Data: P.I/O Unit* in the *Setup Menu Operation Manual*. The output format varies with the peripheral device.

Parallel I/O Unit

The following inspection results are output to the Parallel I/O Unit.

All Measurement Items

DO	Output
0 to 15	Results of processes 0 to 15 (OFF (0): OK; ON (1): NG)
16	Results of all processes that have been set. OFF: All processes are OK. ON: At least an process is NG.

Terminal Block Unit

The following inspection results are output to the Terminal Block Unit.

All Measurement Items

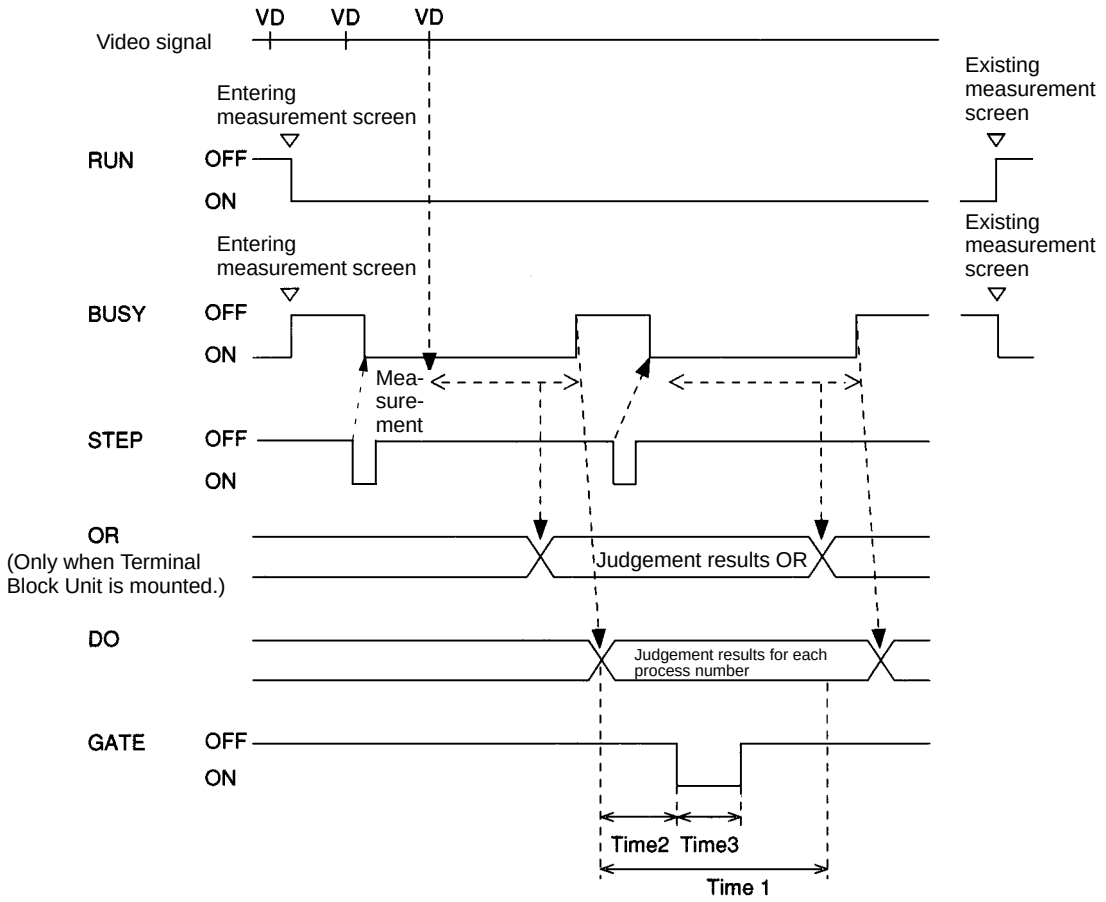
DO	Output
0 to 7	Results of processes 0 to 7 (OFF (0): OK; ON (1): NG)

If a single Terminal Block Unit is used, only the results of processes 0 to 7 are output. To output the results of processes 8 to 15, use the Parallel I/O Unit or two Terminal Block Units.

4-25-6 Timing Charts

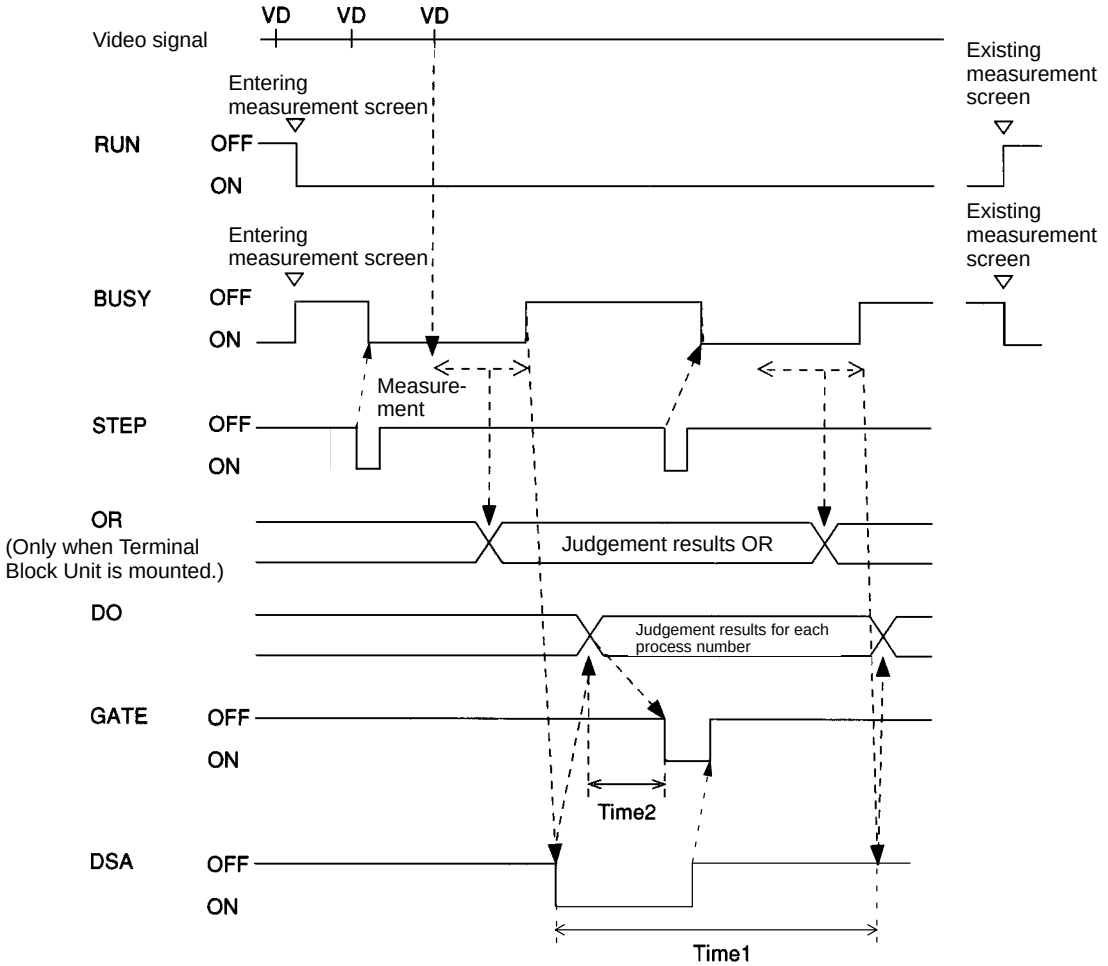
The timing for processing using Parallel I/O is illustrated in the following charts.

Measurement by STEP Input without Handshaking



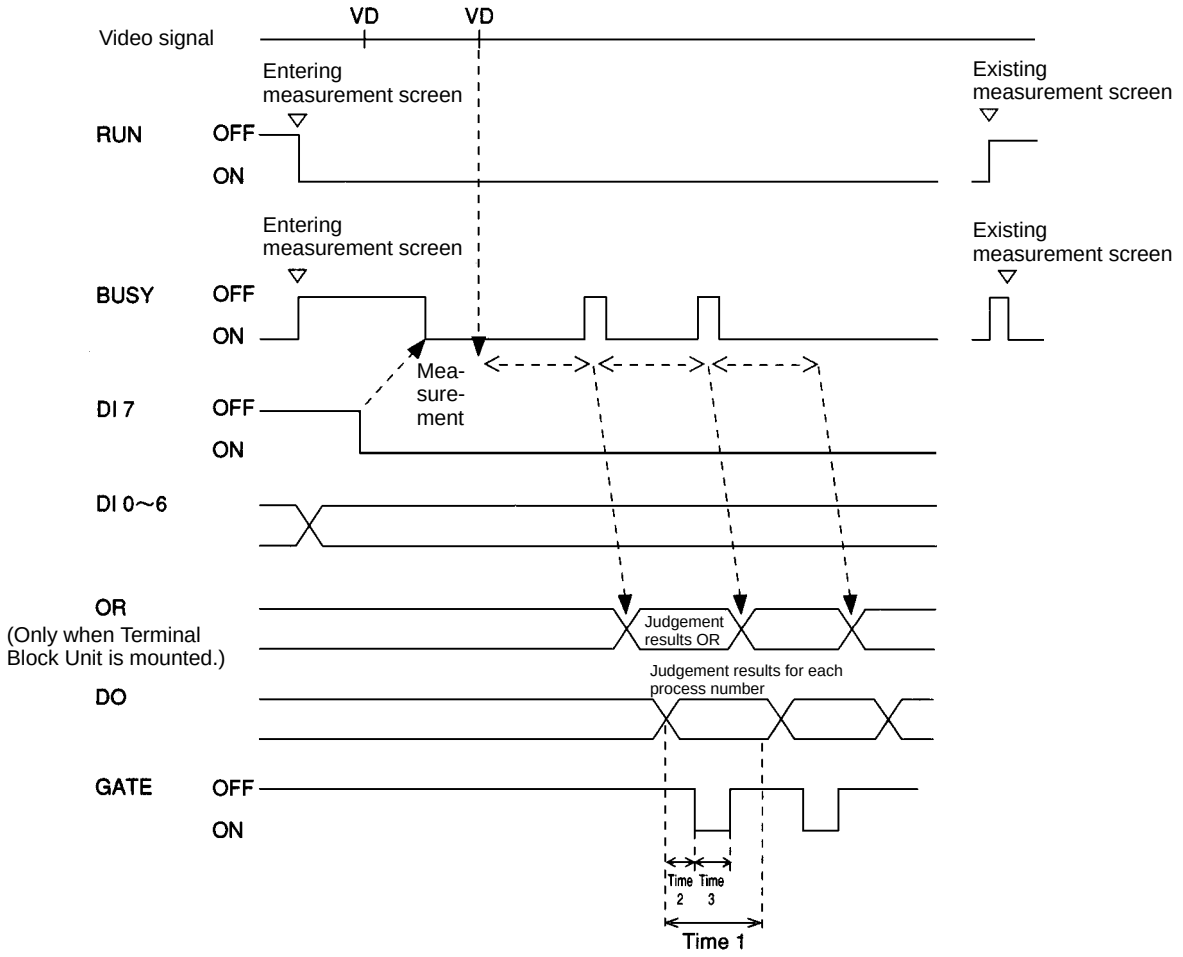
Terminal	Action
RUN	ON while measurement screen is entered.
BUSY	ON while instruction is being processed in the measurement screen. **Important** Do not input the next instruction while the BUSY signal is ON, or neither the current processing nor the instruction that is input will be properly executed.
STEP	Executes a single measurement in synchronicity with the STEP signal's leading edge (OFF to ON).
OR	When a Terminal Block Unit is mounted, a logical OR of the judgement results for all processes is output to the OR terminal. The OR signal turns ON if even one of the results is NG.
DO	Outputs data.
GATE	Used to control the timing to obtain data. The output period, delay time, and output time are set with the setup menu so that GATE will be ON until the data is obtained. Time1 (C.Output period): Sets the period outputting data. Time2 (D.Delay time): Sets the time from the moment when data is output to the moment when the GATE signal is turned on. Time3 (O.Output time): Sets the time during which the GATE signal is turned on. Refer to *5-2-4 Setting the Output Specifications for Parallel Data: P.I/O Unit* in the *Setup Menu Operation Manual*. Obtain the data while the GATE signal is ON.

Measurement by STEP Input with Handshaking



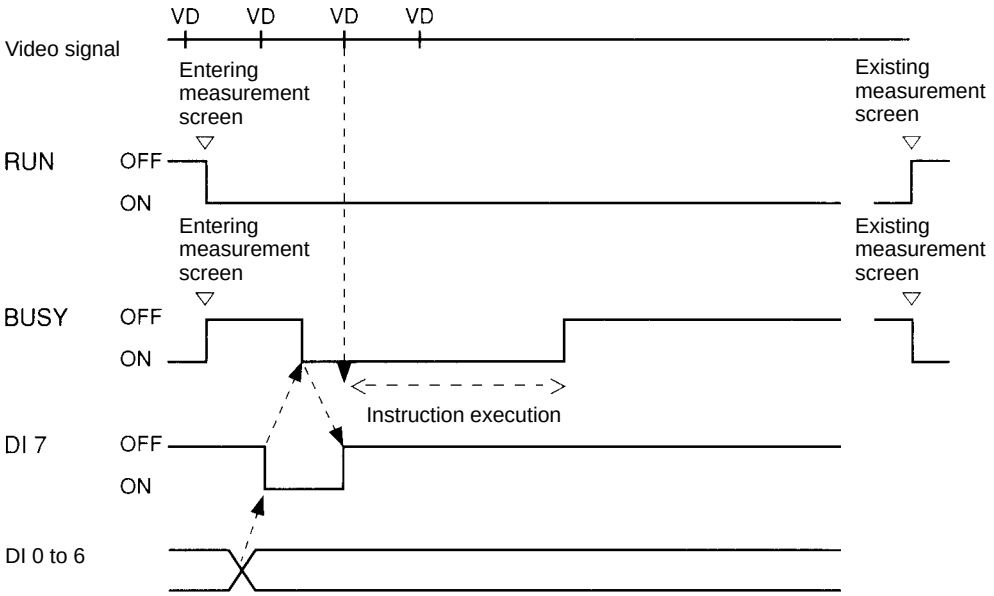
Terminal	Action
RUN	ON while measurement screen is entered.
BUSY	ON while instruction is being processed in the measurement screen. **Important** Do not input the next instruction while the BUSY signal is ON, or neither the current processing nor the instruction that is input will be properly executed.
STEP	Executes a single measurement in synchronicity with the STEP signal's leading edge (OFF to ON).
OR	When a Terminal Block Unit is mounted, a logical OR of the judgement results for all processes is output to the OR terminal. The OR signal turns ON if even one of the results is NG.
DO	Outputs data.
GATE	Used to control the timing to obtain data. The delay time is set with the setup menu so that they will be ON until the data is obtained. Time2 (D.Delay time): Sets the time from the moment when the data is output to the moment when the GATE signal is turned on. Obtain data while the GATE signal is turned on. Refer to *5-2-4 Setting the Output Specifications for Parallel Data: P.I/O Unit* in the *Setup Menu Operation Manual*.
DSA	Used to request the next data output from the external device. Turn this on when the external device is ready to receive the next data. The F350 does not output data until the DSA signal changes from OFF to ON (i.e., until rise is detected). If the time-out function is set, a time-out error occurs under the following condition. The DSA signal does not change from off to on within the time-out period. Time1: Time-out period Sets the period from the moment when the DSA signal turns on to the moment when the DSA signal turns on again. Refer to 5–2–4 Setting the Output Specifications for Parallel Data: P.I/O Unit in the Setup Menu Operation Manual.

Continuous Measurement



Terminal	Action
RUN	ON while measurement screen is entered.
BUSY	ON while instruction is being processed in the measurement screen.
DI	Inputs measurement instructions. Set DI0 to DI6, and turn ON DI7 after 1 ms.
OR	When a Terminal Block Unit is mounted, a logical OR of the judgement results for all processes is output to the OR terminal. The OR signal turns ON if even one of the results is NG.
DO	Outputs data.
GATE	Used to control the timing to obtain data. The output period, delay time, and output time are set with the setup menu so that GATE will be ON until the data is obtained. Time1 (C.Output period): Sets the period outputting data. Time2 (D.Delay time): Sets the time from the moment when data is output to the moment when the GATE signal is turned on. Time3 (O.Output time): Sets the time during which the GATE signal is turned on. Refer to *5-2-4 Setting the Output Specifications for Parallel Data: P.I/O Unit* in the *Setup Menu Operation Manual*. Obtain the data while the GATE signal is ON.

Instructions for Other than Measurements



Terminal	Action
RUN	ON while measurement screen is entered.
BUSY	ON while instruction is being processed in the measurement screen. **Important** Do not input the next instruction while the BUSY signal is ON, or neither the current processing nor the instruction that is input will be properly executed.
DI	Inputs the instruction. Set DI0 to DI6, and turn ON DI7 after 1 ms.

■ System

4-26 Y.System

"Y.System" saves the set scene data and set the environment data. The data set using "Y.System" does not directly affect the measurement conditions.

4-26-1 Automatic Measurement: M.Initial Mode

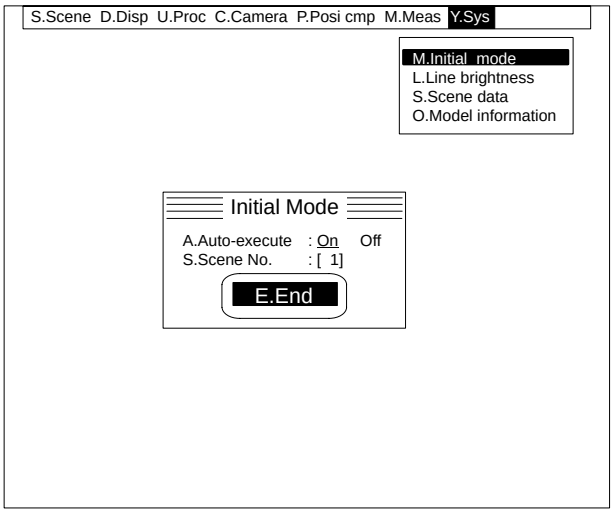
"M.Initial mode" is used to display the measurement screen automatically at startup. Measurements will be started as soon as measurement instructions are input. Use "M.Initial mode" for actual operation after all measurement conditions (i.e. all scene data) have been set.

Procedure

1, 2, 3... 1. Select “M.Initial mode.”

2. Set “A.Automatic execution” ON.

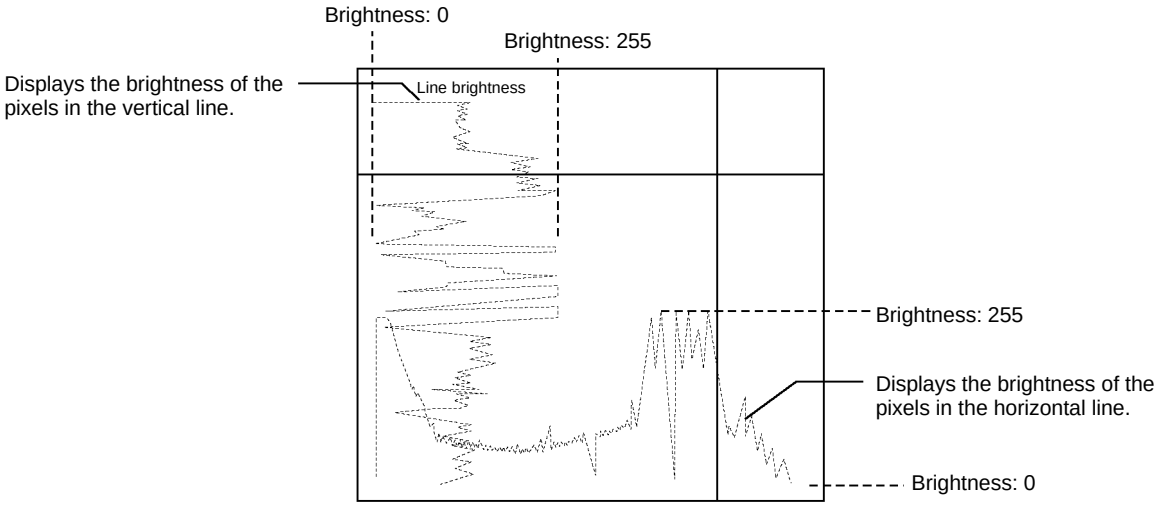
3. Set the scene number in “S.Scene.” The measurement screen for the specified screen number will be automatically displayed the next time the system is started.



4. Select “E.End.”

4-26-2 Displaying the Line Brightness: L.Line Brightness

Line brightness is the name given to a graph which indicates the brightness distribution along a line through the image. The line brightness can be displayed for any arbitrary vertical or horizontal lines through the image.

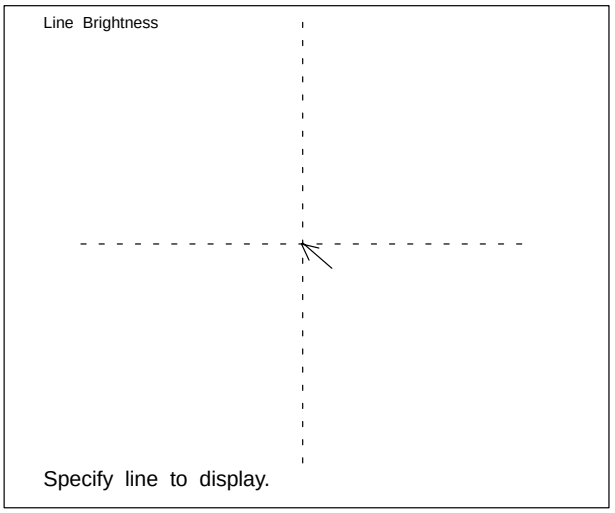


Procedure

1, 2, 3... 1. Select “L.Line brightness.”

Dotted lines are displayed vertically and horizontally through the cursor.

A static (freeze) image is displayed when “L.Line brightness” is selected. If “D.Display/F.Freeze” is set to “U.Unfreeze,” display the required image before selecting “L.Line brightness.”



2. Select the line. Move the cursor to the line and press the Enter Key. The line brightness will be displayed for the selected vertical and horizontal lines.
3. Press the Enter Key or the Escape Key to return to the menu.

4-26-3 Saving and Loading Scene Data: S.Scene Data

“S.Scene data” loads and saves data to and from the Memory Card. The “Y.System/M.Initial mode” setting does not include scene data. The scene data contents differ depending on the menu.

Saving Scene Data

“S.Scene data/S.Save” saves scene data to a Memory Card. The extension “.SCN/.MDL/.VAR” is automatically appended to the saved file name.

When using a new Memory Card for the first time, initialize it using the Setup Menu. Refer to *5-4-1 Initializing Memory Cards* in the *F350 Setup Menu Operation Manual*.

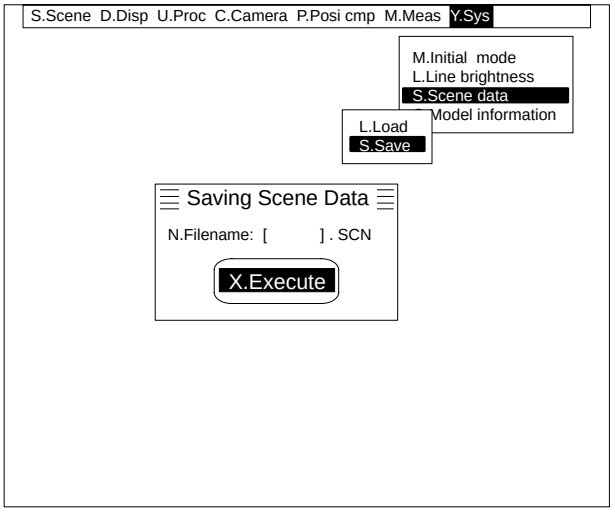
Important When an F350-C12E IMP Unit is used, a Memory Card is required in order to use multiple scenes. Use a separate Memory Card for saving scene data.

Use Memory Cards with enough space available for the data that is set. Standard sizes for scene data are provided in *Appendix B*.

Procedure

1, 2, 3... 1. Select “S.Scene data.”
2. Select “S.Save.”

3. Input the save destination file name for “N.Filename.”



4. Select “X.Execute.” The data from the specified scene number will be saved in the memory card under the specified file name.

Important Do not turn the power supply switch OFF while data is being saved, or the data will not be saved correctly.

Loading Scene Data

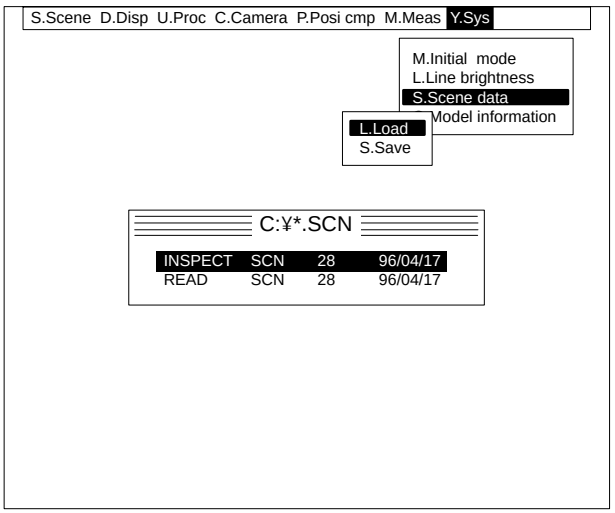
“S.Scene data/L.Load” loads saved scene data from a Memory Card. Insert a Memory Card containing the saved scene data. When the scene data is loaded, it overwrites the scene data for the currently displayed scene number. Display the load destination scene number before loading.

Important Scene data cannot be loaded if the measurement items installed at the time of loading are different from those installed at the time of saving. Be sure to install the same measurement items as at the time of saving. Refer to 2-2 *Starting and Quitting an Application Program*.

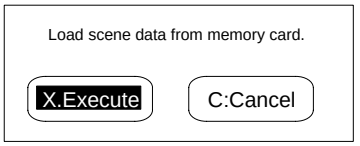
Procedure

1, 2, 3...

1. Select “S.Scene data.”
2. Select “L.Load.” A list of the scene data file names in the root directory will be displayed. The names of any existing sub-directories will also be displayed.



3. Select the file name. A confirmation message will be displayed.

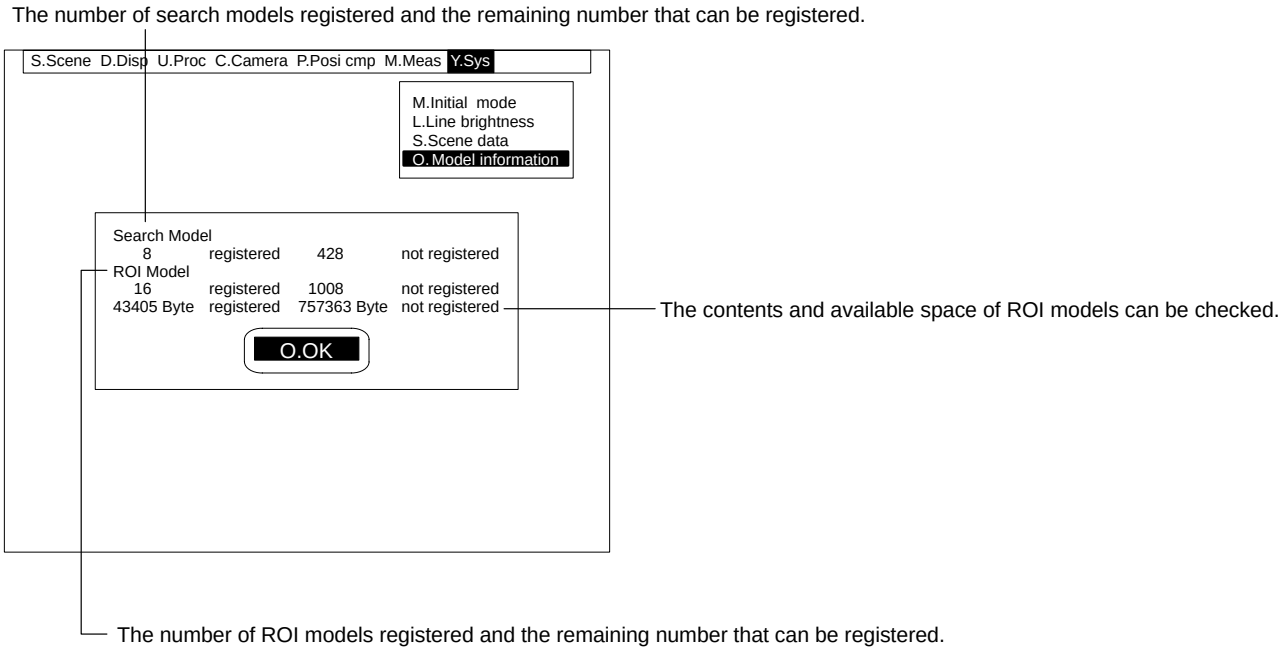


4. Select “X.Execute.” The selected scene data will be loaded to the currently displayed scene number.

Important Do not turn off the power while loading data. If power is turned off while loading data, memory contents will be destroyed and the F350 will malfunction when it is turned on again.

4-26-4 Checking Model Registration Conditions: O.Model Information

O.Model information displays model registration conditions. It can be used to check the number of models that are registered and the number of remaining models that can be registered.



Procedure

1, 2, 3...

1. Select “O.Model information.” The model information will be displayed.
2. Select “O.OK.”

SECTION 5
Troubleshooting

This section provides a list of error messages, and the causes and probable remedies for the errors that they indicate.

Errors and error messages for IC package inspection are listed here in alphabetical order, along with the probable remedied for the errors which the indicate. Refer to this table when explanations of errors are needed.

ERR Signal ON

Error message	Cause and remedy
Insufficient results storage area error	Measurement results cannot be properly obtained because of insufficient storage space. Either raise the search level and reduce the number of search candidate points, or reduce the number of models by deleting any not being used for measurements (including those set for other process numbers).
Model auto-registration error	No more models can be registered, because there are too many models or there is insufficient space in the model registration region. Delete any models that are not being used for measurement (including those set for other process numbers). The models are not changed. Any previously registered models are saved.
	An IC pin model generated according to the set data cannot be registered due to the following reasons. • All IC pin images are not inside the screen. • Each IC pin image does not consist of 50 x 50 pixels. • The IC pin pitch or pin width image consists of less than two pixels. Correct the lead condition settings with the “L.Lead/I.Lead condition” menu and the calibration data with the “C.Camera/A.Calibration” menu, otherwise the model cannot overwrite a registered model.
	Models cannot be cut because the image is either completely black or completely white and is unsuitable for registration as a model. Take images that can be cut as models.
	The position compensation mode is OFF. Models cannot be registered. The models are not changed. Any previously registered models are saved.
	The position compensation mode is set for circle positioning. Models cannot be auto-registered in this mode. The models are not changed. Any previously registered models are saved.
Scene data load error	The Memory Card is not correctly inserted. Insert the Memory Card correctly.
	There is no scene data saved on the Memory Card. Insert the Memory Card on which the scene data is saved.
	No more models can be registered, because there are too many models or there is insufficient space in the model registration region. Delete any models that are not being used for measurement.
Scene switching error	The Memory Card is not correctly inserted. Insert the Memory Card correctly.
	The scene data is not backed up on a Memory Card. Insert a Memory Card for backing up the scene data.
	No more models can be registered, because there are too many models or there is insufficient space in the model registration region. Delete any models that are not being used for measurement.
Timeout error	A timeout error occurred while data was being output to a Parallel I/O Unit or a Terminal Block Unit. Quit the measurement screen and check the external connections and output specifications.

Error Messages

Error message	Cause and remedy
All inspection flags cannot be OFF.	All inspection flags cannot be turned OFF. Set at least one of the inspection flags.
Already registered as reference model.	The model has been already registered as a reference model for relative position inspection. A model can be registered as the reference model for only one relative position inspection. Select another model.

Error message	Cause and remedy
Automatic model registration failed.	An IC pin model generated according to the set data cannot be registered due to the following reasons. • All IC pin images are not inside the screen. • Each IC pin image does not consist of 50 x 50 pixels. • The IC pin pitch or pin width image consists of less than two pixels. Correct the lead condition settings with the “L.Lead/I.Lead condition” menu and the calibration data with the “C.Camera/A.Calibration” menu, otherwise the model cannot overwrite the registered model.
Calibration failed.	The correlation value between the model and workpiece is less than the correlation criteria. Check if the workpiece is proper or register the model again.
Camera magnification is outside the specified range.	Calibrate so that the camera magnification will be within a range from 0.001 and 9.999 (mm/pixel).
Cannot be registered. No space in model registration region.	No more models can be registered. Either reduce the size of model regions or delete any unnecessary models in the region.
Cannot copy to the same process number.	The process number is the same for the copy source and the copy destination. Specify different process numbers.
Cannot copy to the same scene number.	The scene number is the same for the copy source and the copy destination. Specify different scene numbers.
Cannot save to Memory Card. Not sufficient space.	The Memory Card does not have enough free space to save to. Insert a Memory Card with sufficient free space and try again.
Cannot switch scenes due to lack of space in the scene data area.	The currently displayed scene data is too large. Reduce its size by deleting some models or by clearing any unnecessary scene data, and then try again.
Circle positioning set for position compensation mode. Cannot use auto-registration.	Auto-registration cannot be used for circular workpiece positioning. Either perform registration manually or use 1-model or 2-model positioning.
Failed to access the scene switching file.	There is no available space on the Memory Card. Either delete any unnecessary scene data, or use the setup menu to delete unnecessary files. Then try again.
	The file could not be created because the Memory Card was not correctly inserted. Insert the Memory Card correctly, and then try again.
	The Memory Card is not initialized. Use a Memory Card that has been initialized.
	The Memory Card is write protected. Clear the write protection and then try again.
Failed to clear scene.	The scene clearing operation was cancelled because the Memory Card was not correctly inserted. Insert the Memory Card correctly, and then try again.
Failed to copy scene data due to lack of space in the scene data area. The scene data in the copy destination area will be cleared.	There is no available space in the scene data area. Delete any unnecessary scene data.
	The scene copying operation was cancelled because the Memory Card was not correctly inserted. Insert the Memory Card correctly, and then try again.
Fast inspection on rectangle can only be set to the regions 0 to 7.	Set the inspection region within a range between 0 and 7.
File does not exist.	There is no scene data file. Insert the Memory Card which contains the scene data.
	The Memory Card is not formatted. Format the Memory Card before using it.
Inspection mode is set to Fast inspection on rectangle. Mask setting not required for this inspection.	It is not necessary to set masks for fast inspection on rectangle.
Inspection mode is set to shape inspection. Condition settings 2 not required for shape inspection.	Do not select condition settings 2 because a shape inspection does not check the number of defective workpieces.
Inspection mode is set to shape inspection. Mask setting not required for figure inspection.	It is not necessary to set masks for shape inspection.
Mask size or mask pitch setting is inappropriate.	The mask does not match the size of the rotation positioning region. Either reduce the size of the mask or increase the diameter of the circle (or arc).
	The mask and inspection region are different to each other in size. Reduce the mask or increase the inspection region in size.

Error message	Cause and remedy
Mask size setting is inappropriate.	The mask and inspection region are different to each other in size. Reduce the mask or increase the inspection region in size.
Measurement item is not set.	There is no measurement item set for the currently displayed process number. Set a measurement item. Refer to *4-3-1 Setting Measurement Items*.
Measurement item is not set in the copy source.	There is no data set for the process number specified as the copy source. Specify a process number for which data is set.
No inspection conditions are set.	Select a number that has been set to relative position inspection.
No memory card inserted.	The operation is not possible because no memory card is inserted. Insert a memory card and try again.
No model registered.	No reference model is registered. Register a reference model first.
	Inspection is impossible if no model is registered. Register a model first.
	Calibration is impossible if no calibration model is registered. Register a calibration model.
No registration. Too many models. Reduce rotational region.	No more models can be registered. Reduce the rotational region (i.e., the rotation parameters).
No registration. Too small region.	The mask and inspection region are different to each other in size. Reduce the mask or increase the inspection region in size.
Number of search items cannot be set for the number of pins.	There are too many models or no more space exists in the model registration region, so some pins cannot be found. Delete all unused models including those set for other processes.
Optimum model was not found.	The region setting for automatic registration is too small, or the image is completely black or completely white. Adjust the region setting or take the optimum image as the model.
Part of the region will be outside the screen.	Part of the region that was created is outside of the screen. Create the region so that it lies completely within the screen.
Pitch angle setting is inappropriate.	The following combination of pitch angle and rotation parameters cannot be set. **Rotation parameters** / **Pitch angle** ±15 ° or 0±15°, 180±15° / 20° or 30° ±45 ° / 20°
Position compensation mode is set to circle positioning (no rotation or defect rotation). Rotation angle is invalid.	The rotation angle setting is not required when either circle positioning with no rotation or defect rotation is set for the position compensation mode. Specify this parameter for a position compensation mode for which the rotation parameters are valid is set.
Registration is not possible: Nothing has been cut or the maximum number registered has been exceeded.	The number of extracted models is 0 or exceeds the maximum number. Reduce the extraction region in size or increase the maximum number of models for automatic registration conditions.
Same position cannot be specified.	A figure cannot be drawn if the same point is specified. Specify different points.
Scene data is different.	This is not the scene data for the currently installed application program. Insert the memory card that contains the correct scene data.
Scene data loading cancelled due to an error. Scene data will be cleared.	Loading was cancelled because the memory card was not correctly inserted. Insert the memory card correctly and load the scene data again.
	The scene data in the subdirectory cannot be loaded. Load the scene data in the root directory.
Scene data saving cancelled due to an error.	Saving was cancelled because the memory card was not correctly inserted. Insert the memory card correctly and save the scene data again.
	Saving not possible because the memory card is not initialized. Save the scene data again using an initialized memory card.
	The operation cannot be executed because the Memory Card is write protected. Clear the write protection and try the operation again.
Set criteria so that the upper limit ≧ the lower limit.	The settings are incorrect. Set the values so that the upper limit is the same as or larger than the lower limit.

Error message	Cause and remedy
Settings required for measurement have not been completed.	Not even one model has been set for the process. Set the models.
	A numeric overflow has occur and proper inspection is not possible when the pitch or pin length criteria for “L.Lead/I.Lead condition” is converted to pixels using calibration data. Correct the pitch or pin length criteria or the calibration data and repeat the inspection.
The calibration or criteria setting is wrong.	Set the calibration data or IC pitch and pin length criteria properly. If the present calibration data is used to convert the IC pin pitch and pin length criteria to pixels, the pixels will overflow.
The position compensation mode is turned Off.	Rotation parameters, position compensation region, position compensation speed, conditions, or referencing was executed without the position compensation registration having been performed. First register the position compensation.
The reference model and relative model are the same.	The reference model number and relative model number must be different.
The region is not drawn.	Register the inspection region before setting the conditions.
The window is not drawn.	Register the window before setting the conditions.
Too many graphics. No more can be created.	No more than ten figures can be created for automatic model registration for position compensation. Do not create more than ten figures.
Too many models. No more can be registered.	No more models can be registered. Delete any unnecessary models.
Wrong model image.	The image is completely white or completely black, without features, and is unsuitable for registration as a model. Take the optimum image as the model.
	An image with a low density deviation cannot be registered. Register a high-contrast image as a model.
	All of the model region cannot be masked.

Error Codes

Error code	Cause and remedy
23	Line buffer overflow. It is possible that commands were input continuously through the RS-232C port. Check the method for inputting commands.
103	It is possible that commands were incorrectly input through the RS-232C, e.g., without a delimiter. Check the method for inputting commands.

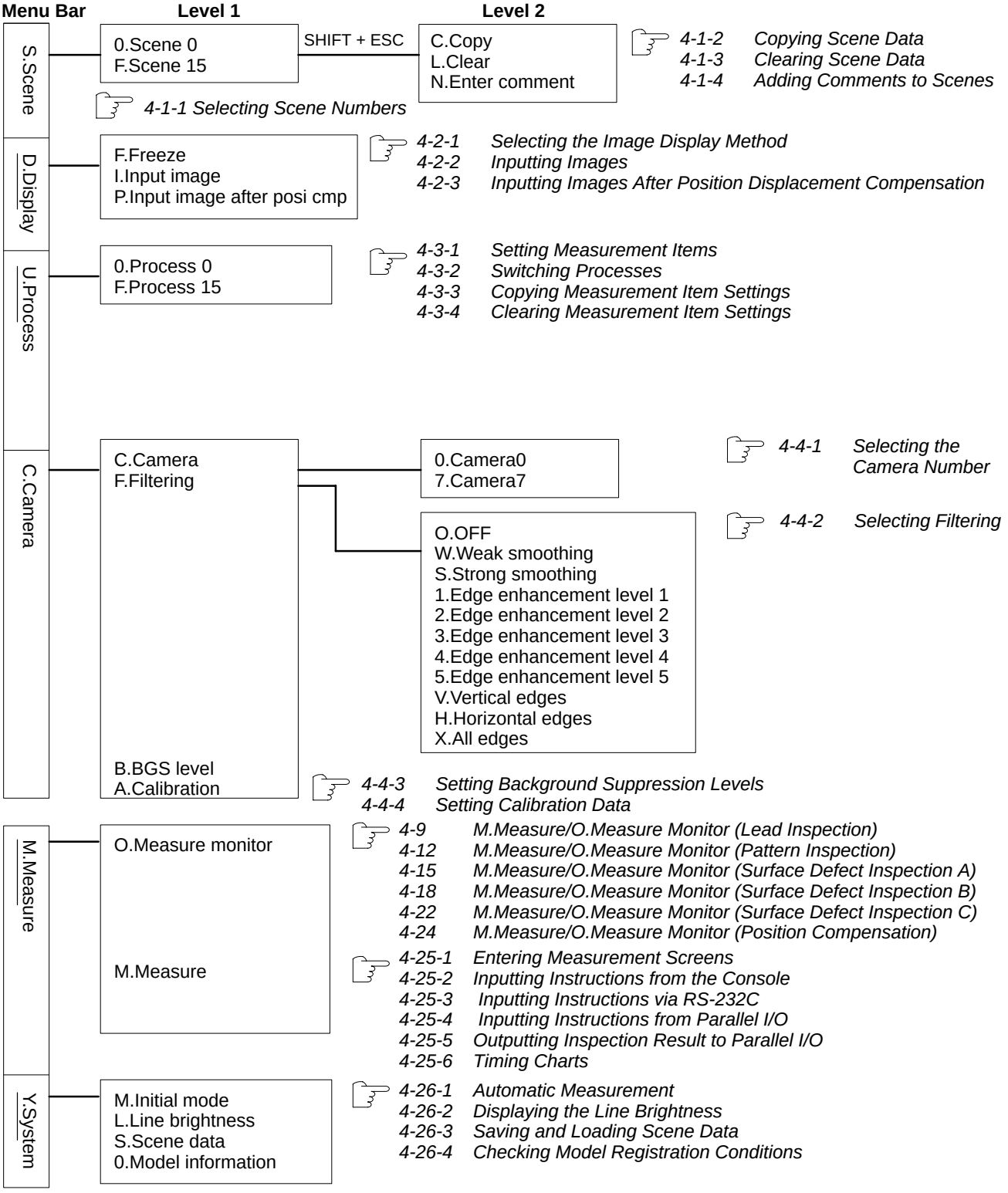
Appendix A
Menu Hierarchy Diagrams

Menu Item Notation

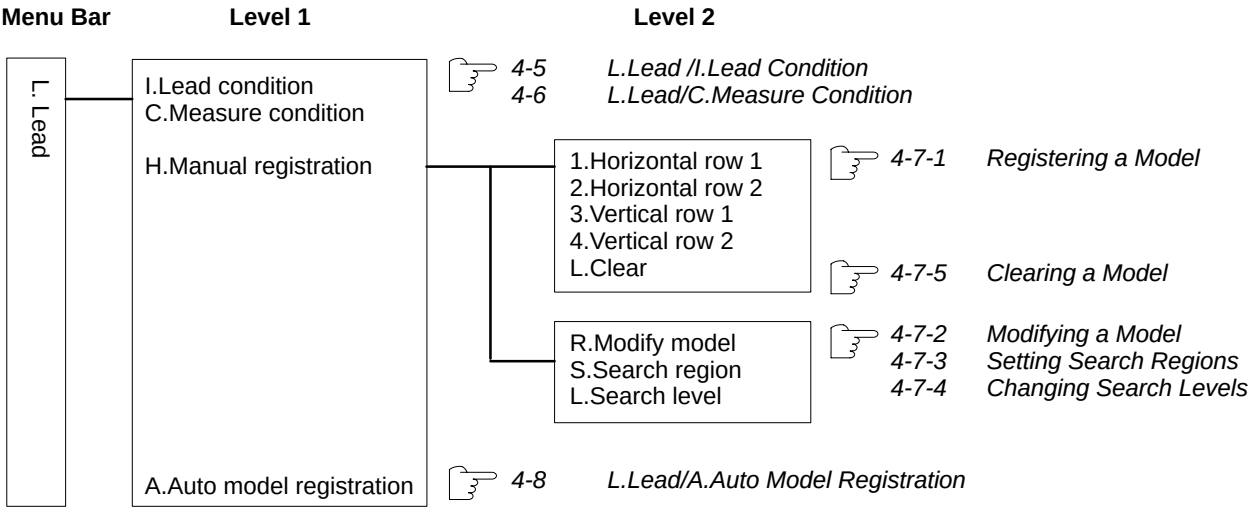
Menu items are sometimes abbreviated on the menu bar due to space limitations. In this manual, the non-abbreviated form of the menu items are used and, if an abbreviation is displayed on the menu bar, the characters that are actually displayed are underlined. If no characters are underlined, then the menu item is not abbreviated on the display.

For example, “O.Position compensation” appears on the menu display as “O.Posi cmp” and is given in this manual as “O.Position compensation.”

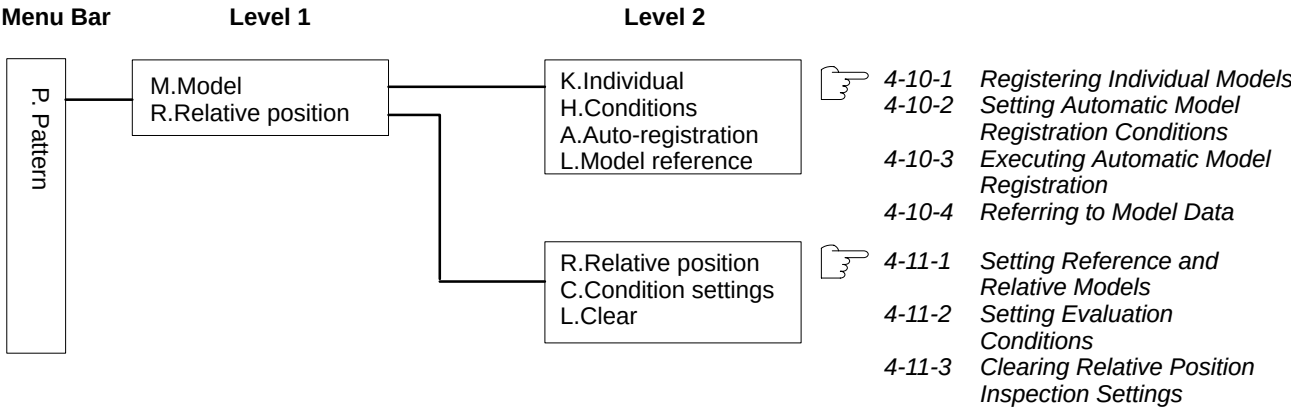
Common Items



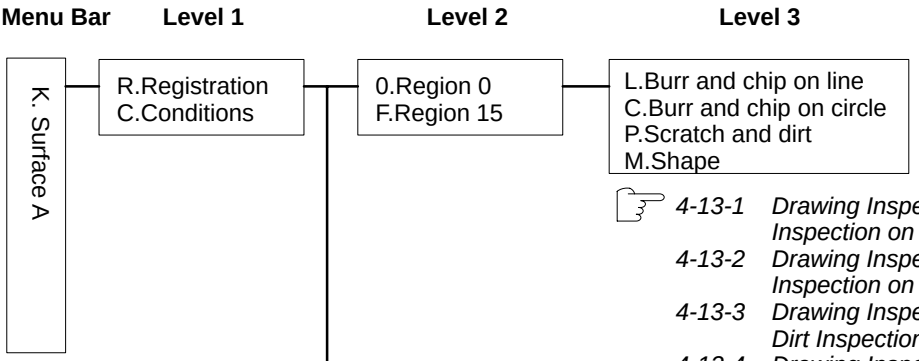
Lead Inspection



Pattern Inspection



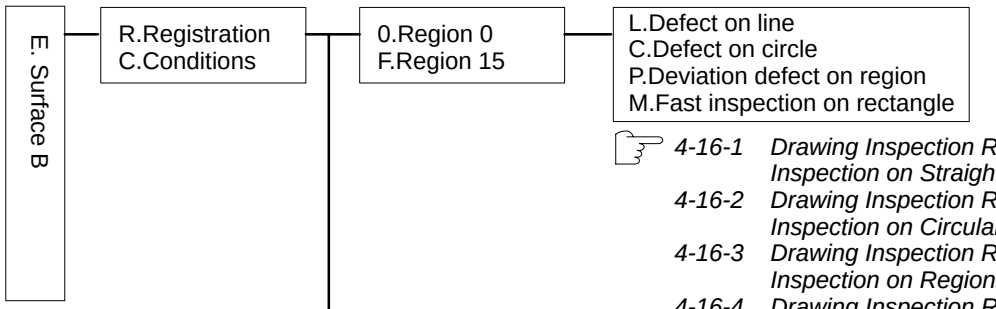
Surface Defect Inspection A



4-13-1 Drawing Inspection Regions for Burr and Chip Inspection on Straight Lines
4-13-2 Drawing Inspection Regions for Burr and Chip Inspection on Circular Lines
4-13-3 Drawing Inspection Regions for Scratch and Dirt Inspection
4-13-4 Drawing Inspection Regions for Shape Inspection for Model Registration

4-14-1 Checking Measurement Values
4-14-2 Setting Measurement Conditions
4-14-3 Setting Measurement Conditions and Number of Defects

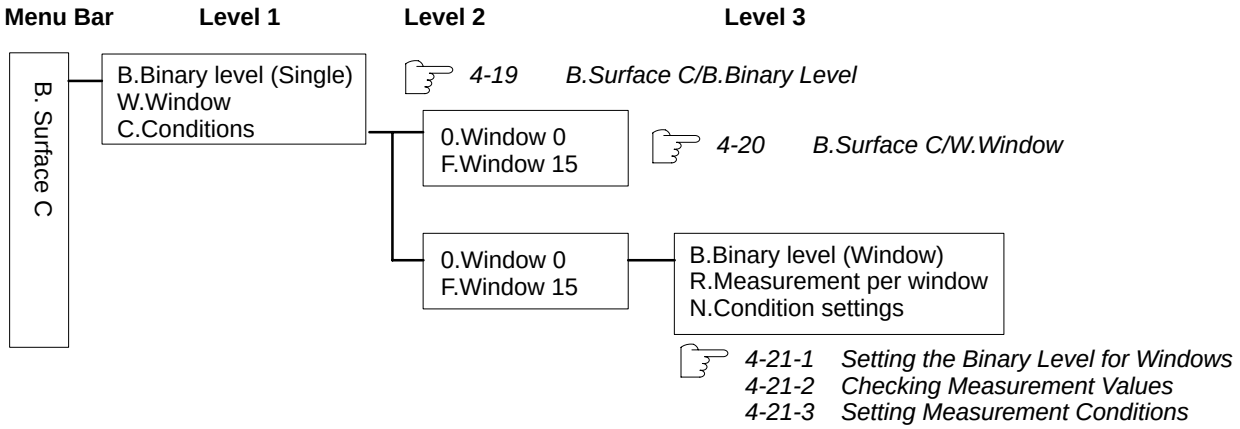
Surface Defect Inspection B



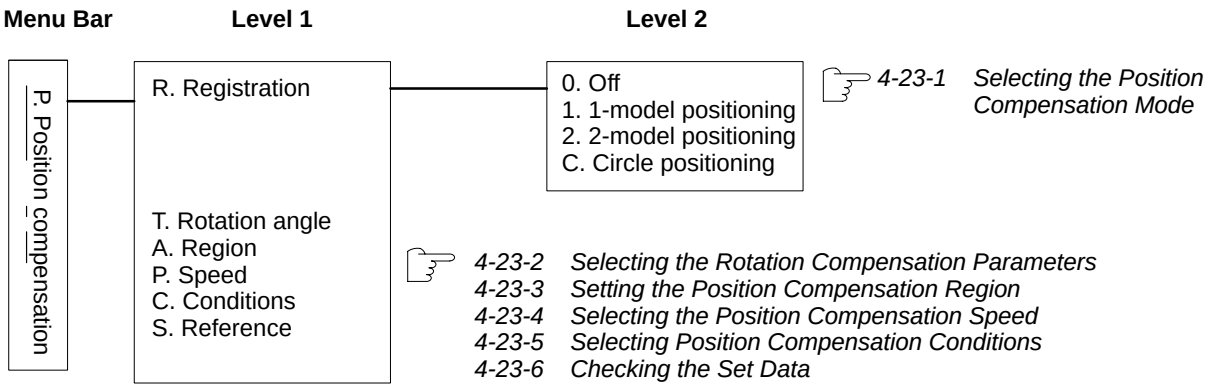
4-16-1 Drawing Inspection Regions for Defect Inspection on Straight Lines
4-16-2 Drawing Inspection Regions for Defect Inspection on Circular Lines
4-16-3 Drawing Inspection Regions for Defect Inspection on Regions
4-16-4 Drawing Inspection Regions for Fast Inspection on Rectangle

4-17-1 Checking Measurement Values
4-17-2 Setting Measurement Conditions

Surface Defect Inspection C

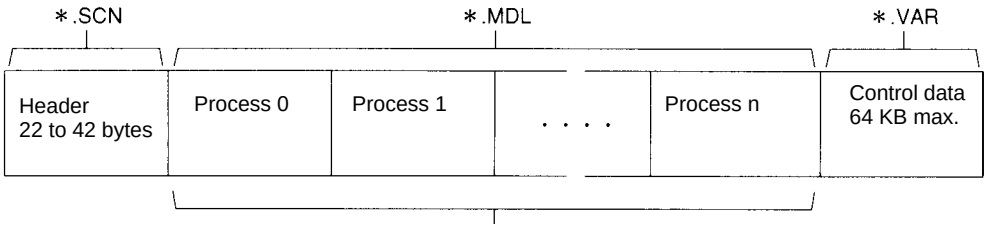


Position Compensation

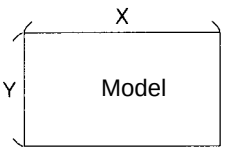
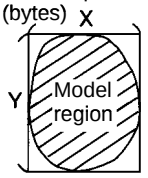
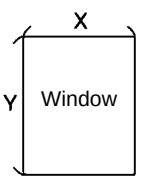


Appendix B
Scene Data Size

This appendix shows the formula for finding scene data sizes. Prepare a Memory Card with sufficient capacity for the data. The size found by means of this formula is only a reference. To make a more precise determination of scene data size, it is recommended to actually save the data and then check its size.



The calculation method differs depending on the measurement items that are set.

Measurement item	Calculation method
Position compensation	For each model: X x Y x 3 + 200 (bytes) Model image Model information 
Lead inspection Surface Defect Inspection A • Scratch and dirt inspection • Shape inspection Surface Defect Inspection B • Defect inspection on regions Pattern inspection	Each inspection region or model: X x Y + 200 (bytes)  Model image Model data
Surface Defect Inspection A • Burr and chip inspection on line • Burr and chip inspection on circle Surface Defect Inspection B • Defect on line • Defect on circle	Each inspection region: Mask size x 80 + 200 (bytes) Model image Model data (The size of the inspection region does not matter.)
Surface Defect Inspection B • Fast inspection on rectangle	Each inspection region: 200 bytes (The size of the inspection region does not matter.)
Surface Defect Inspection C	Each window: X x Y x 1.25 + 400 (bytes)  Model image Model data

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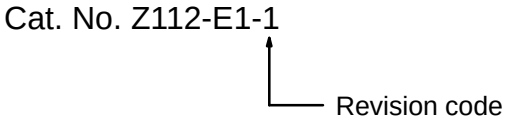
Revision History

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
1	March 1997	Original production