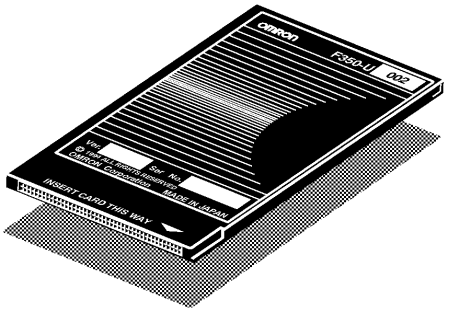
F350-U002E
Gray Inspection Software 1

Operation Manual

Produced August 1995



Notice:

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

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

⚠ DANGER! Indicates information that, if not heeded, is likely to result in loss of life or serious injury.

⚠ WARNING Indicates information that, if not heeded, could possibly result in loss of life or serious injury.

⚠ Caution Indicates information that, if not heeded, could result in relatively serious or minor injury, damage to the product, or faulty operation.

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.

The abbreviation “PLC” means Programmable Controller (Programmable Logic Controller) and is not used as an abbreviation for anything else.

Quick BASIC is a registered trademark of Microsoft Corporation.

IBM and IBM PC/AT are registered trademarks of International Business Machines Corporation.

Visual Aids

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

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

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

Symbols

The following symbols appear at the bottom of each page in *Section 4 Functions and their Operation* and indicates which Application Program(s) is effective for a particular menu operation. The symbols and their corresponding Application Program are shown below.

Surface Defect — Surface Defect Inspection Program

Pattern — Pattern Inspection Program

The following example indicates that the Surface Defect Inspection Program is effective. The other Application Program cannot be used.

Surface Defect Pattern

TABLE OF CONTENTS

About this Manual:

This manual describes the operation of the F350-U002E Gray Inspection Software 1 and includes the sections described below.

Please read this manual carefully and be sure you understand the information provided before attempting to operate the F350-U002E Gray Inspection Software 1.

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

Section 2 describes the system configuration, starting and stopping the Application Program, and basic menu operation.

Section 3 describes the gray inspection software includes two application programs, each used for a different type of inspection. The method of using each application program and the sequence of using the functions are described using typical inspections as examples.

Section 4 provides detailed explanation of the functions and their operation.

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

The **Appendix** provides menu hierarchy diagrams for this software.

⚠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 Gray Inspection Software 1.

1-1 Before Using this Manual

Copyright

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

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

Handling the System Memory Card

Do not leave the card in a dusty or wet place as this may lead to 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 shocks to the card.

1-2 Applicable Manuals

The manuals applicable to the F350 Visual Inspection System are shown in the table below, according to the procedures used. There are three kinds of F350-series manuals:

- F350 Setup Menu Operation Manual: Included with the F350-C10E IMP Unit.
- F350 Application Software Operation Manual: Included with the F350-U□□□E Application Software.
- F350 OVL Reference Manual: Included with F350-L100E OVL Unit.

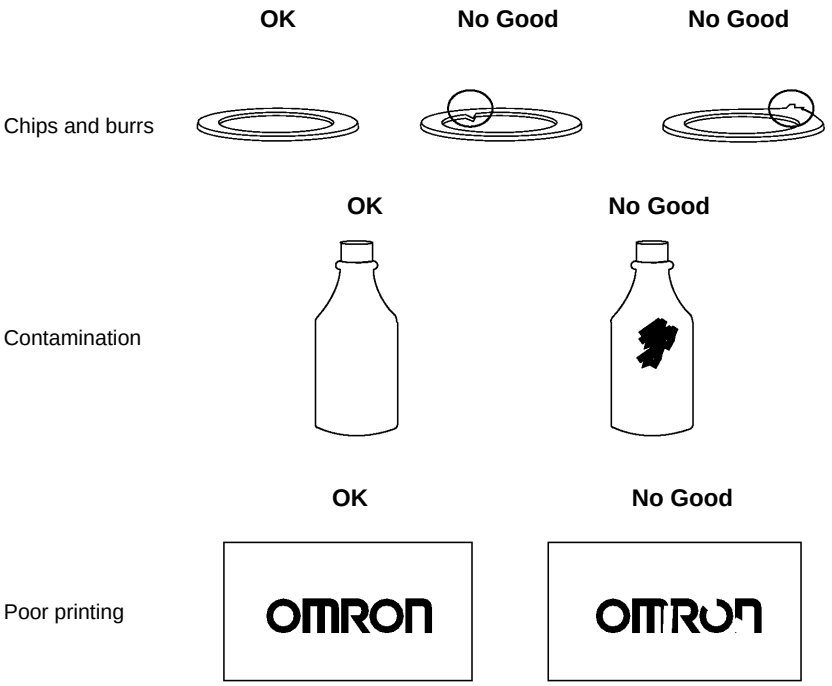
<table>
<tr><th colspan="2" rowspan="2">Procedure</th><th colspan="2">Software</th></tr>
<tr><th>Application Programs</th><th>OVL program</th></tr>
<tr><td>System design</td><td>Consider the lighting environment, I/O devices, and so on, and arrange the system configuration. Design the system carefully, taking into account variations in conditions and the objects that are to be inspected.</td><td colspan="2">F350-series catalog</td></tr>
<tr><td>Assembly/Installation</td><td>Install the F350 Visual Inspection System by assembling the hardware and wiring the power supply and peripheral devices.</td><td colspan="2">F350 Setup Menu Operation Manual</td></tr>
<tr><td>Environmental settings</td><td>Start up the software and make the settings related to the F350 Visual Inspection System and the settings for starting, communicating with I/O devices, and so on.</td><td>Make the settings using the Setup Menu which is standard with F350-C10 IMP Unit. (Refer to the F350 Setup Menu Operation Manual.)</td><td>Mount the F350-L100-E OVL Unit and program using OVL, a specialized BASIC programming language. (Refer to the F350 OVL Reference Manual.)</td></tr>
<tr><td>Inspection condition settings</td><td>Start up the software and make the settings related to inspection. Set the criteria for determining the inspection area and the acceptability of the inspected products.</td><td rowspan="2">Make the settings using the F350-U□□□-E Application Programs. Do the actual testing according to the conditions that have been set. (Refer to the relevant F350 operation manual.)</td><td rowspan="2">Mount the F350-L100-E OVL Unit and program using OVL, a specialized BASIC programming language. Do the actual testing according to the conditions that have been set. (Refer to the F350 OVL Reference Manual.)</td></tr>
<tr><td>Testing/Inspection</td><td>Do the actual testing according to the conditions that have been set. If adjustments are required, change the settings.</td></tr>
<tr><td>Maintenance</td><td>Carry out periodic inspections. This is essential in order to maintain the F350 Visual Inspection System in optimum condition.</td><td colspan="2">F350 Setup Menu Operation Manual</td></tr>
</table>

1-3 Features

This software allows the high-speed inspection of defects such as chips and burrs, inspections of displaced labels, and the inclusion of foreign objects. The unique gray processing permits applications impossible with binary inspection methods.

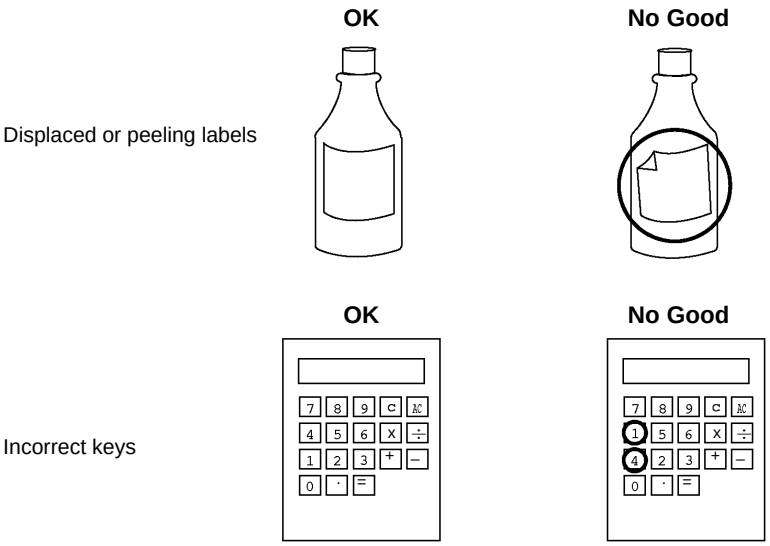
Surface Defect Inspection Program

Unique algorithms for product chipping, burrs, and contamination inspections.



Pattern Inspection Program

Inspections for displaced labels and foreign objects.



SECTION 2
Preparation for Operation

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

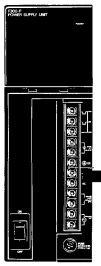
2-1 System Configuration

The number of cameras and 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-P Power Supply Unit

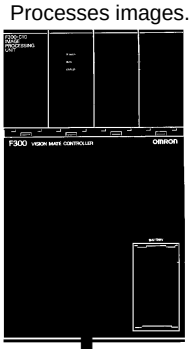
Supplies power to the entire system.



(Note: The F200-P Power Supply Unit cannot be mounted.)

F350-C10E IMP Unit

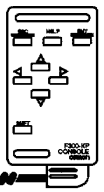
Processes images.



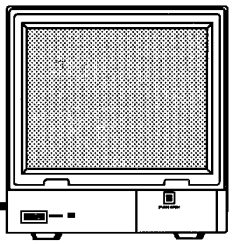
F300-FM MMI Unit

Provides Memory Card functions and menu operations via a Video Monitor and Console.

F300-KP Console

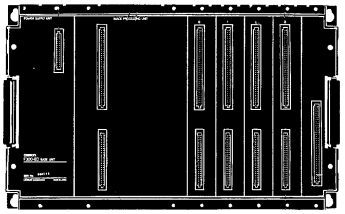


F300-M09 Video Monitor (100 VAC)



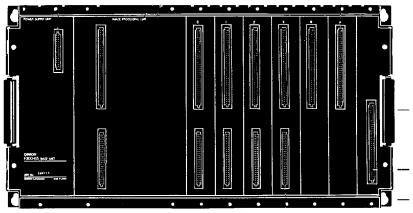
F309-VM Monitor Cable

F300-B3 (3 slots)



or

F300-B5 (5 slots)



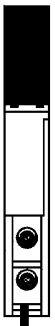
Camera I/F Units (Use four maximum)

F300-A20 Normal Camera I/F Unit

For measuring stationary objects or moving objects using a strobe.

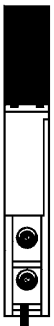
F300-A20S Normal Simultaneously Camera I/F Unit

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-A20RS (F300-A21RS) Shutter Simultaneously Camera I/F Unit

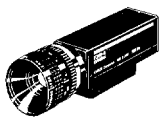
Use for the inspection of high-speed moving objects. Use to inspect multiple positions simultaneously.

F309-VS Camera Cable

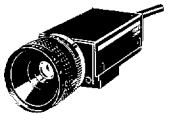
F309-VSR Shutter Camera Cable

Note: The F300-A21RS Shutter Simultaneously Camera I/F Unit is still under development and is not yet available.

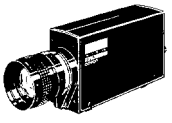
F200-S Camera



F300-S Camera



PJLG-55-Z Shutter Camera



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

Lens

Note 1: Different types of cameras and Camera I/F Units cannot be used together. Using them together can cause a faulty image to be captured.

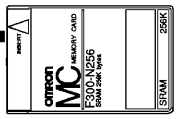
2: Strobe illumination cannot be used with the F200-S Camera.

F350-U002E Gray Inspection Software 1
Demonstration software
Surface defect inspection program
Pattern inspection program

Caution
The demonstration software is provided for training. It cannot be used for actual inspections. Use this software with the basic configuration only.

Peripheral Devices

F300-N256/N512 Memory Card
Use to store scene data.



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

F300-D Terminal Block Unit
For inputting measurement instructions and outputting judgement results via a terminal block.

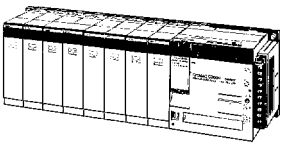
F300-DC Parallel I/O Unit
For inputting measurement instructions and outputting measurement values and judgement results via parallel I/O.

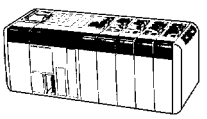
F300-FS Strobe I/F Unit
For flashing the strobe while taking images.

Up to two Strobe I/F Units can be mounted. During application software operation, all connected strobes flash. Refer to the section shown below for details about the strobe timing. Refer to *4-2-1 Selecting the Image Display: F.Freeze*.

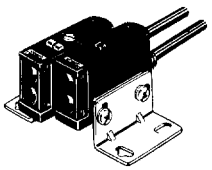
F300-G Dummy Unit
For inserting into empty slots to protect and strengthen connectors.

C200H or CQM1 Programmable Controller



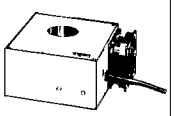


Synchronization Sensor



F309-VFS Strobe Cable

Strobe Device



2-2 Starting and Stopping

2-2-1 Starting

The application software contains three different Application Programs. Select one Application Program and start it.

The three Application Programs are described below.

Application Program	Description	File name
Demonstration Software	This software allows the user to experience the search processing, which is the basic F350 technology. It cannot be used for actual inspections. Two modes are included: the 12-pattern search mode which simultaneously searches for 12 different model patterns and displays the correlation value for each pattern, and the rotating pattern search, which searches for 1 pattern and displays the correlation value in the optimal search position. The rotating pattern search can handle the rotation of a workpiece. The 12-pattern search is displayed when the software is started. Follow the instructions displayed on the screen.	DEMO0001.DEF
Surface Defect Inspection Program	This menu searches for product defects such as chips, burrs, scratches and dirt. The inspection region can be simply set to match the shape of the product.	U002GRY1.DEF
Pattern Inspection Program	This menu inspects whether marks, patterns, and characters are present and for defects in them. The positional displacement can be measured from a reference position.	U002PAT1.DEF

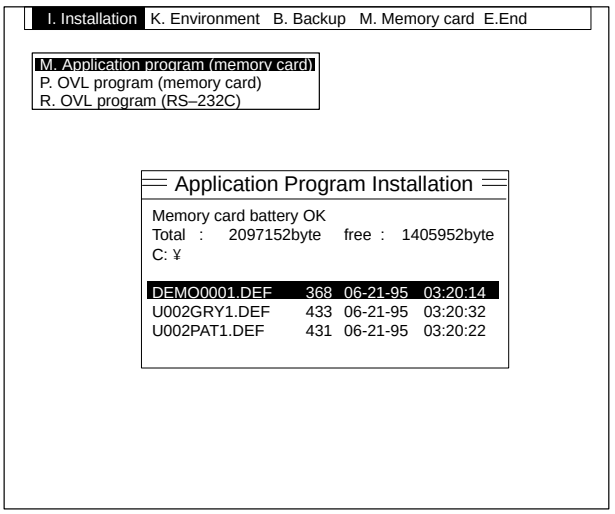
The Setup Menu is used to install and run the Application Programs. Operate the Setup Menu by referring to *3-1 Starting the Setup Menu* in the *F350 Setup Menu Operation Manual*.

Note When an Application Program is installed, previously installed software and set data are deleted from memory. Save this data, if it is required. Refer to *5.3 B.Backup* in the *F350 Setup Menu Operation Manual*.

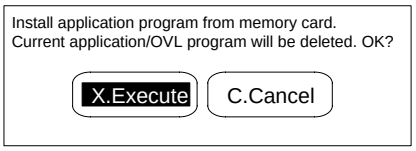
Procedure

1, 2, 3...

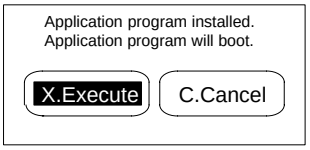
1. Select “I. Installation.”
2. Select “M. Application program (memory card).” The Application Program directory is displayed.



3. Select the file name. A confirmation message is displayed.

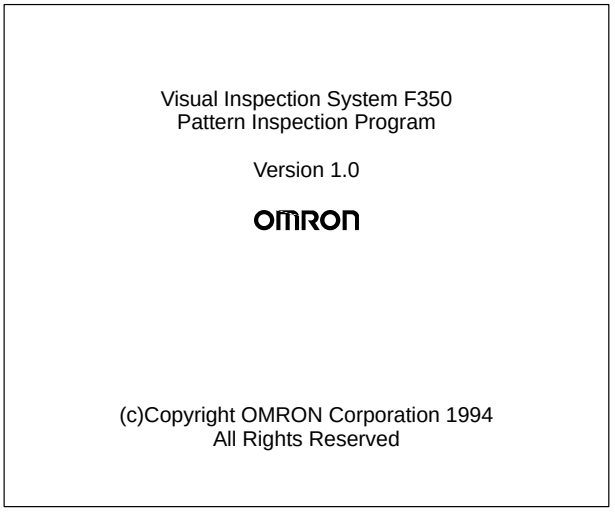


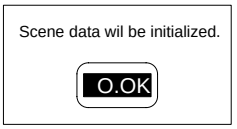
4. Select “X. Execute.” The Application Program is installed. A confirmation message is displayed when installation is complete.



5. Select “X. Execute.” The Application Program runs. A confirmation message asks if the scene data should be initialized.

   Example of Initial Screen for the Inspection Program for Pattern:



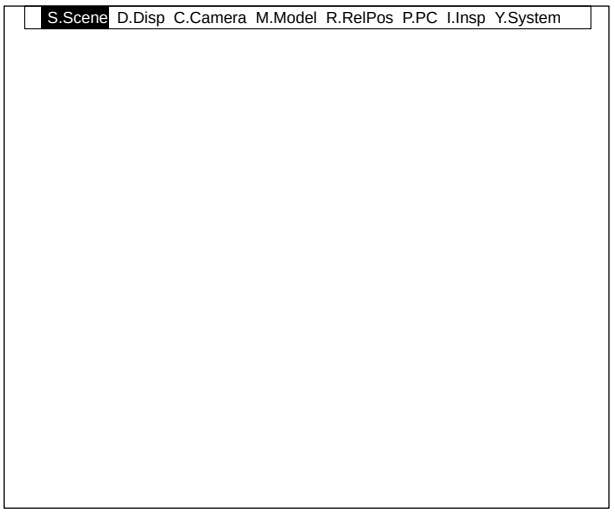


6. Select “O. OK.”

   The Application Program Basic Screen and the image from the connected camera 0 are displayed. Adjust the image focus.

If multiple cameras are connected, select the image from the camera number to be adjusted. Refer to *4-3-1 Selecting the Camera Number*.

Basic Screen: (Example) Pattern inspection program



Note Do not turn off the power during menu installation or the F350 memory contents may be destroyed and the unit will malfunction when it is turned on again.

When an Application Program is installed, it runs each time the power is turned on. Select “K. Environment” and “M. Initial Mode” in the Setup Menu to change the Application 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 Stopping

Ensure the following points before stopping the menu:

- Data is not being saved, loaded, or copied.
- The orange memory card access indicator on the MMI Unit is not lit.

Procedure

1, 2, 3...

1. Turn off the F350 power.
2. Turn off the video monitor power.

   The setting data is stored when the F350 is turned off.

Note

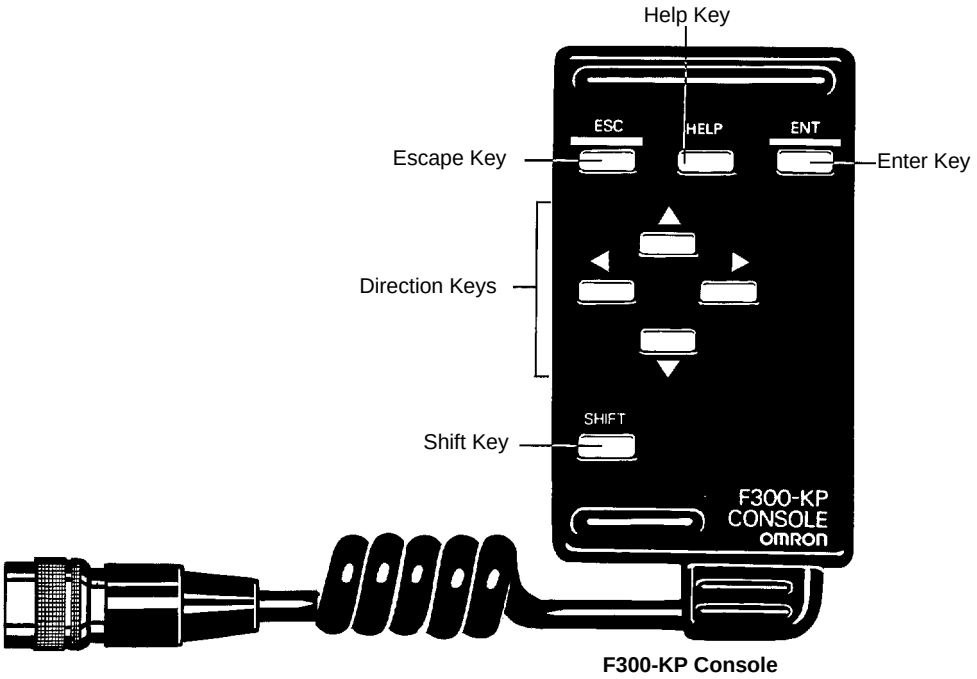
1. The Setup Menu and OVL system cannot be started using an Application Program. Quit the Application Program before starting the Setup Menu or OVL system.
2. To run the Setup Menu, turn on the power switch while holding down the Enter Key. Refer to *3-1 Starting the Setup Menu* in the F350 Setup Menu 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 programs are 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. In this case, the key function is described in the comment line of the screen.

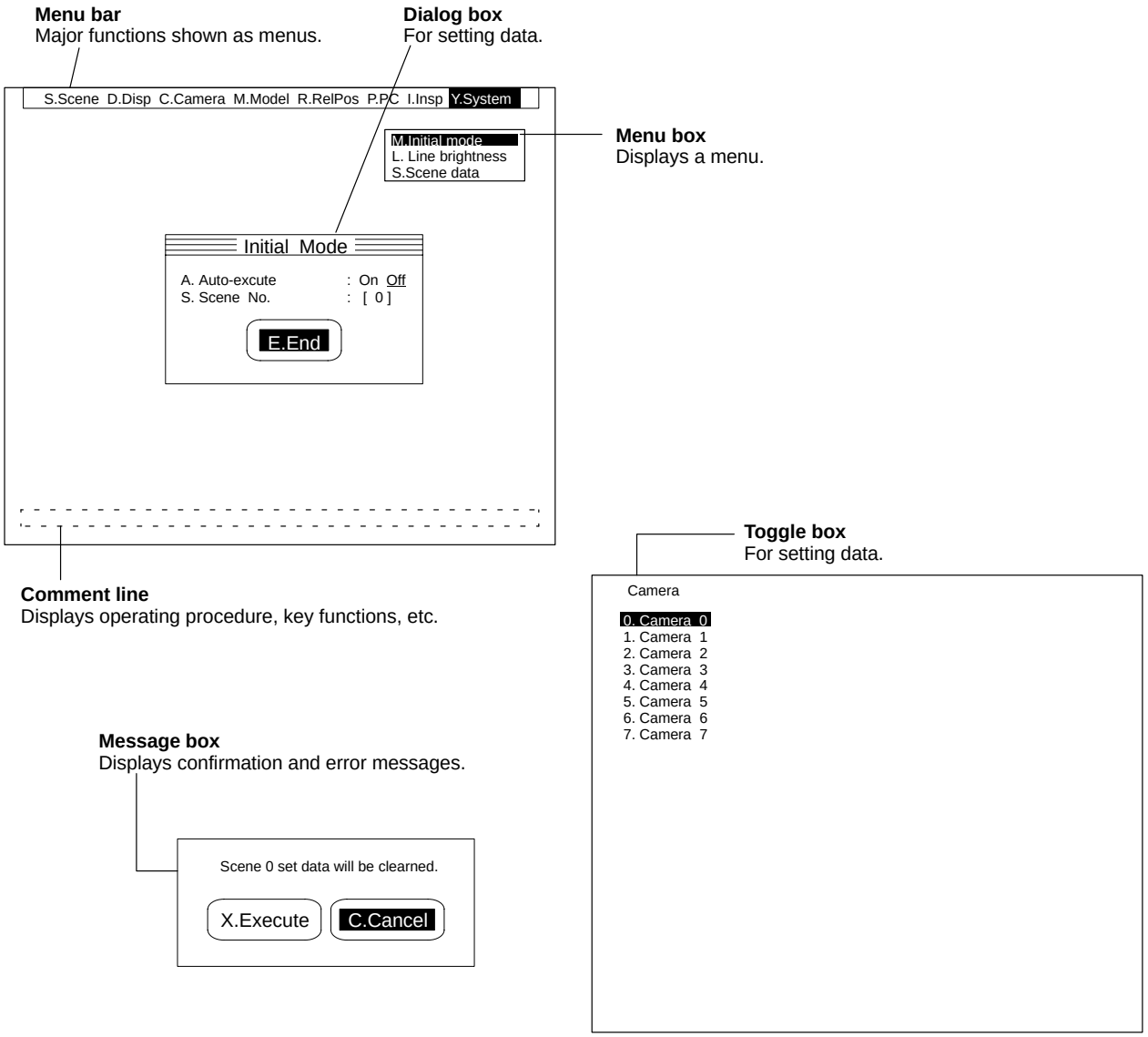


F300-KP Console

Marking	Name	Function
ESC	Escape Key	Interrupts processing and displays previous menu level.
HELP	Help Key	Assigned a different function in each menu. For example, it switches modes for the demonstration software.
ENT	Enter Key	Executes the function at the cursor position. If a menu is displayed, the next menu level of the cursor position is displayed. Set input data during data input.
▲ ▼	Direction Keys	Move the cursor up and down. In numerical input mode, the Direction Keys increase or decrease a number by 1. In character input mode, the Direction Keys change the character in ascending or descending order of character code.
▶ ◀		Move the cursor left and right.
SHIFT	Shift Key	Has no effect when pressed alone but changes the function of other keys when pressed simultaneously. The menus assign functions to combinations of the Shift Key with other keys.
Example: SHIFT+ESC		Displays the extended menu, if any exist.

2-3-2 Key to the Screens

The menus and their functions are described below.



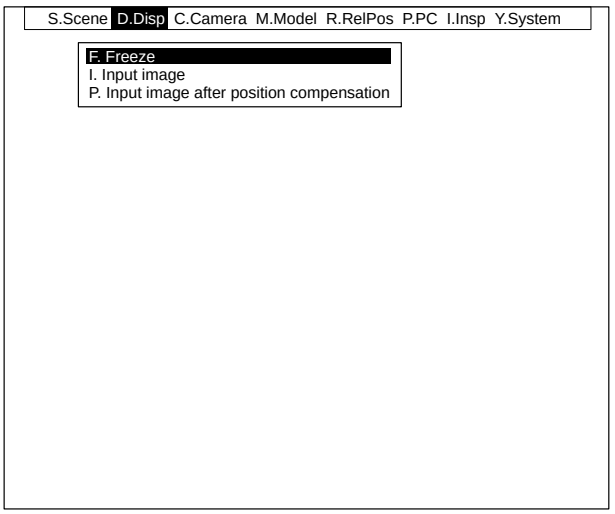
2-3-3 Selecting a Menu

The application programs are hierarchical and it is necessary to select related menus to set the data. Select the appropriate menu for operations such as setting data or conducting inspections. Refer to the menu hierarchical diagram 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 is displayed. Repeat the procedure to move down another level.

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



2-3-4 Setting Data

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 the initial values at the factory. Change the settings as required.

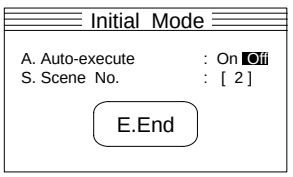
Setting Data in a Dialog Box

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

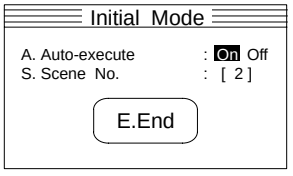
Procedure

1, 2, 3...

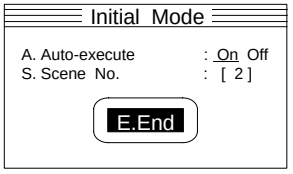
1. Press the Up/Down Keys to move the cursor to the setting to be changed. The cursor moves to the current setting.



2. Press the Up/Down Keys to move the cursor to the required new data setting.



3. Move the cursor to “E. End” and press the Enter Key. The selected data is set.

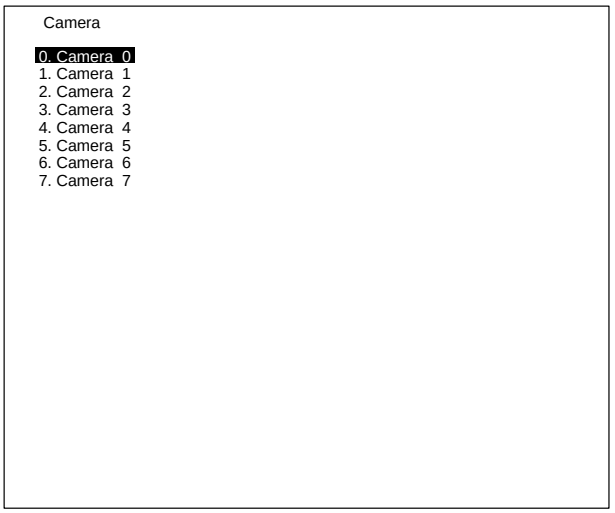


Setting Data in a Toggle Box

The cursor is 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 data is set.

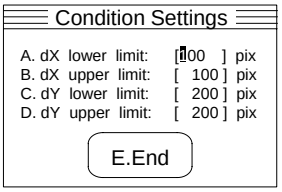


2-3-5 Inputting Numbers

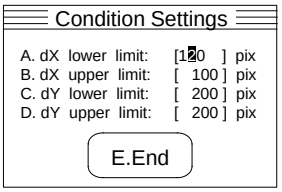
The method of inputting numbers to set scene numbers and evaluation criterion is described below. All settings are set to the initial values at the factory. Change the settings as required.

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 is selected.



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

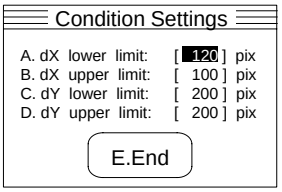


3. Press the Up/Down Keys to increase or decrease the number.

   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 values are input.



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 table below.

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

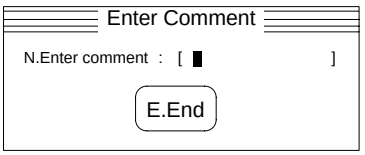
2-3-6 Inputting Characters

The method of inputting characters for scene comments or file names is described below.

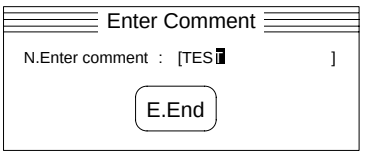
Procedure

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 is selected.

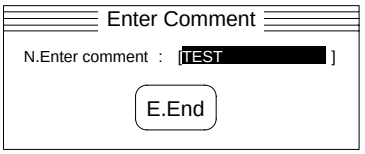


2. Move the cursor to the position where the character is to be input.



3. Press the Up/Down Keys to sequentially display the characters. The available characters are displayed in order of character code.

   Repeat steps 2 and 3 above to input multiple characters.



4. Press the Enter Key.

SECTION 3
Procedure for Using the Menus

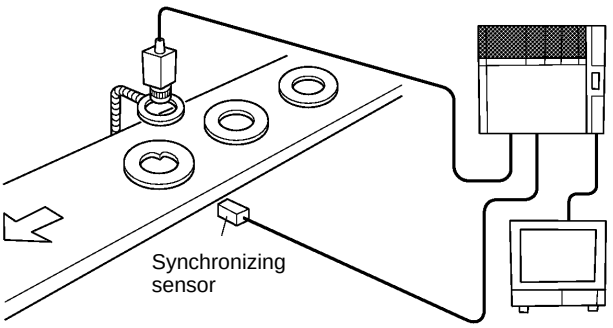
This section describes the gray inspection software includes two application programs, each used for a different type of inspection. The method of using each application program and the sequence of using the functions are described using typical inspections as examples.

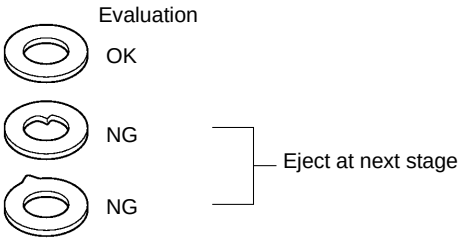
3-1 Surface Defect Inspection Program

In this example, products are inspected for chips and burrs at the edges.

The OK or NG (No Good) inspection result is output to the Terminal Block Unit to allow ejection of defective products at the next stage.

The STEP signal is input from the synchronizing sensor when a test object arrives at the inspection position. The F350 synchronizes the inspection with the STEP signal.





Procedure

1, 2, 3... 1. **Select Scene Number**

Select scene #0. Subsequent data settings will apply to scene #0. Refer to *4-1-1 Selecting Scene Number: S.Scene*.

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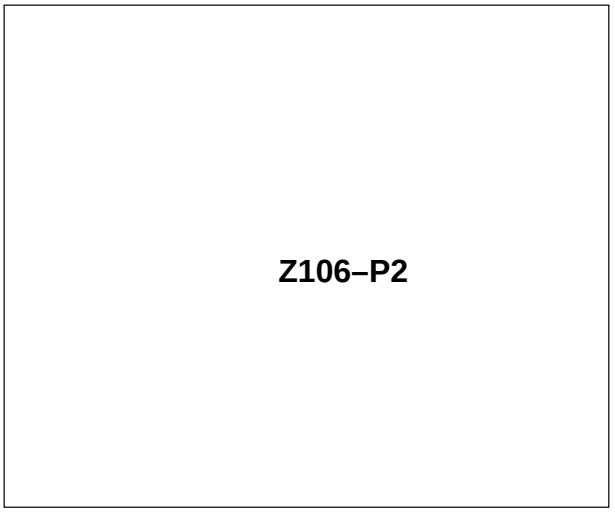
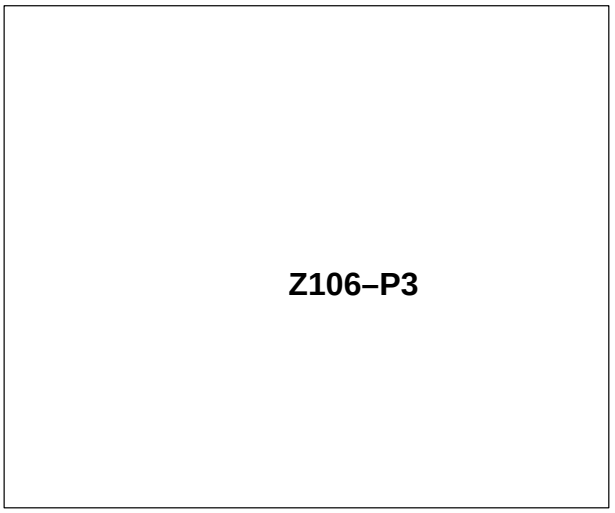
2. **Select Camera Number**

   Select camera #0. Select the camera number used for the inspection. Refer to *4-3-1 Selecting the Camera Number: C.Camera*.



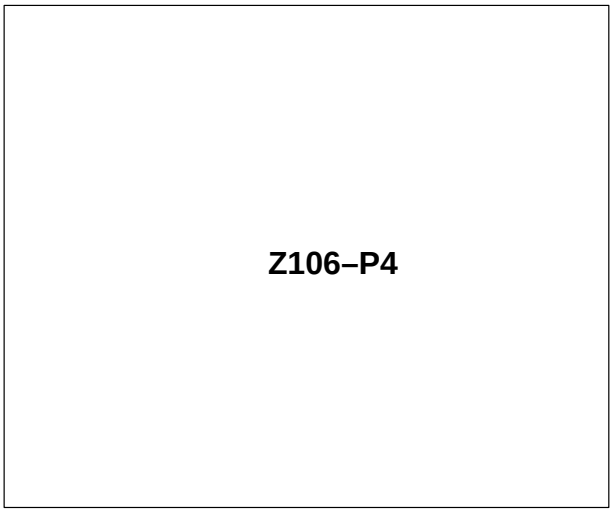
3. **Select Filtering**

   Select edge enhancement level 3. Enhances and stabilizes the edges. Refer to *4-3-2 Selecting the Filtering: F.Filtering*.



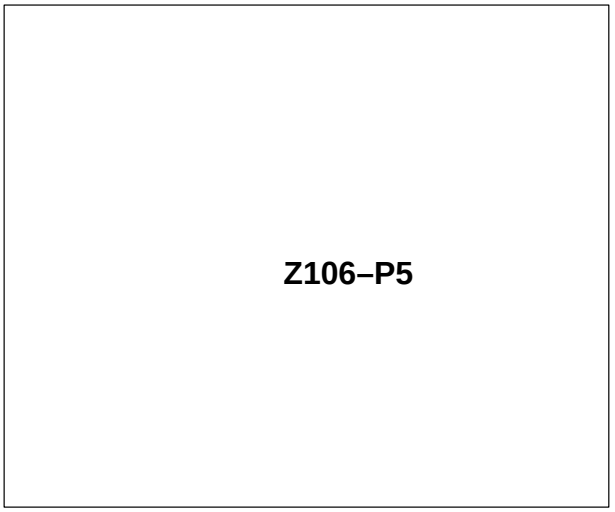
4. **Draw Inspection Region**

   Select the the burr and chip on circle inspection mode and draw the inspection region. Draw inspection region 0 and inspection region 1. Refer to *4-4-2 Drawing Burr and Chip on Circle Inspection Region: C.Burr and chip on circle inspection*.



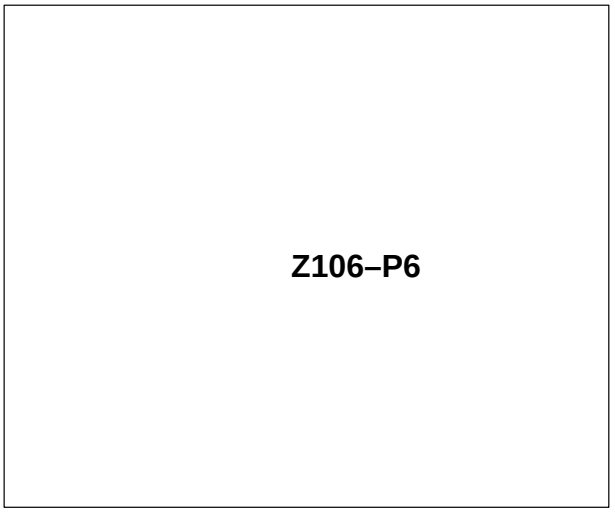
5. **Set Positional Compensation Data**

   Select the position compensation mode. Select “C. Circle positioning.” Refer to *4-8-1 Selecting the Position Compensation Mode: R.Position compensation registration*.



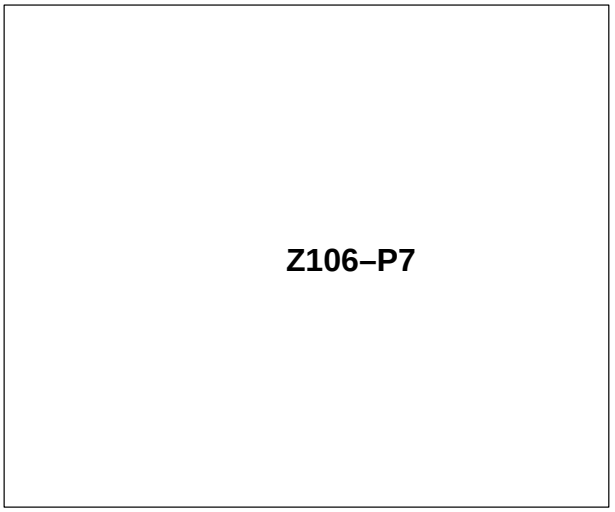
6. **Register the Position Compensation Model**

   Register the circle center and radius and the model size. Refer to *4-8-1 Selecting the Position Compensation Mode: R.Position compensation registration*.



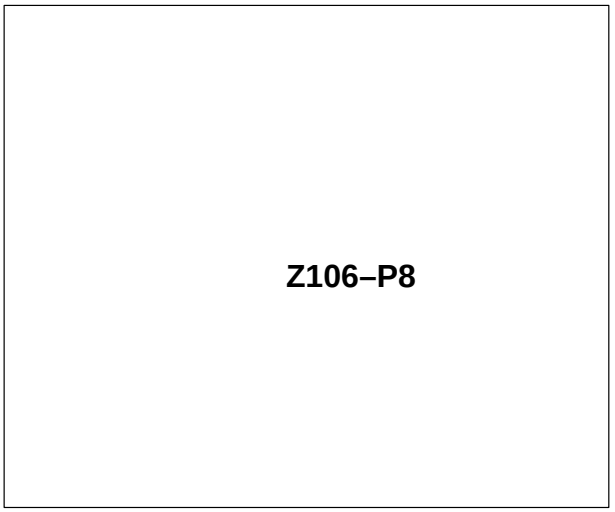
7. **Draw the Position Compensation Region**

   Set the region to search for the position compensation model. Set the position compensation region such that all products do not protrude outside it even if the products deviate in position. Refer to *4-8-3 Setting the Position Compensation Region: A.Position compensation region*.



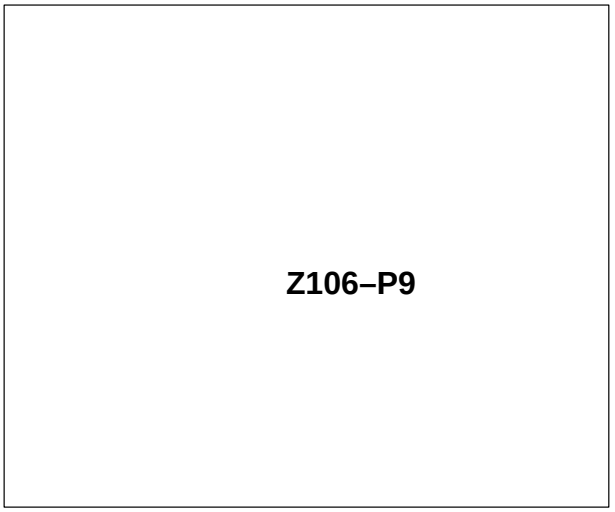
8. **Setting the Inspection Conditions**

   Measure the degree of defect in each inspection region. Measure the degree of defect in satisfactory and defective products to determine the appropriate value. Refer to *4-6-1 Checking Measured Values: R.Measurement per inspection region*.



9. **Set the Inspection Items and Evaluation Criterion**

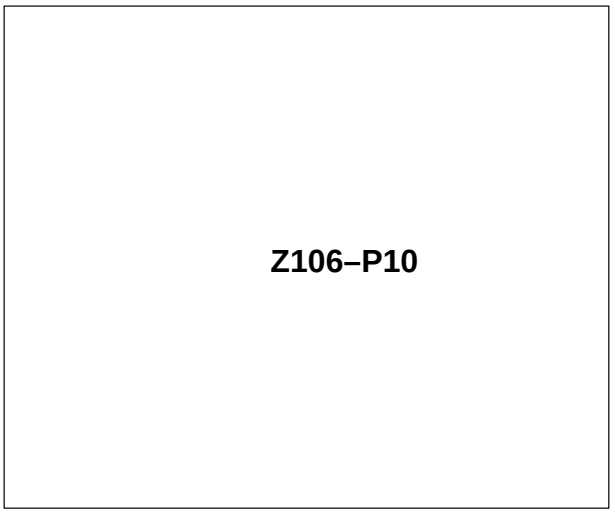
   Turn ON the “O.LD insp flag.” Set the evaluation criterion to the borderline value between a satisfactory and defective product, determined at step 8. Refer to *4-6-2 Setting Inspection Conditions: C.Condition settings*.



10. **Inspection**

The inspection is synchronized with the input of the STEP signal.

The position compensation function is set to allow inspection for chips and burrs when the position of the product deviates from the inspection position. The inspection results are output to the video monitor and the Terminal Block Unit. Refer to *4-9-3 Running the Inspection: I.Inspection*.

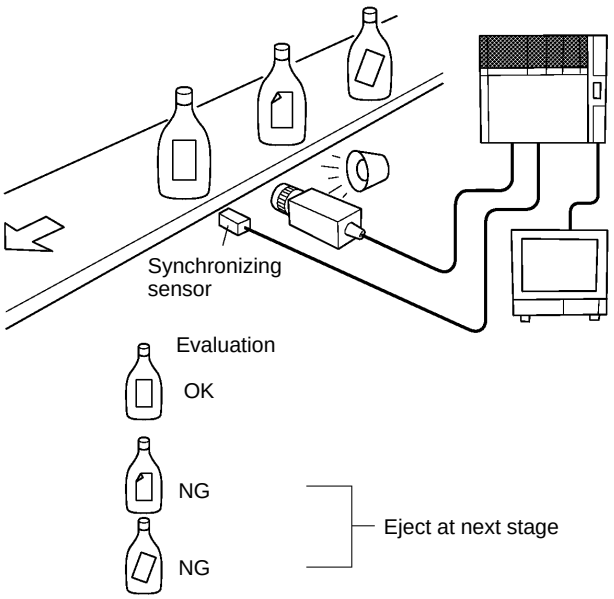


3-2 Pattern Inspection Program

In this example, bottles are checked that labels are stuck at the correct position.

The OK or NG inspection result is output to the Terminal Block Unit to allow ejection of defective products at the next stage.

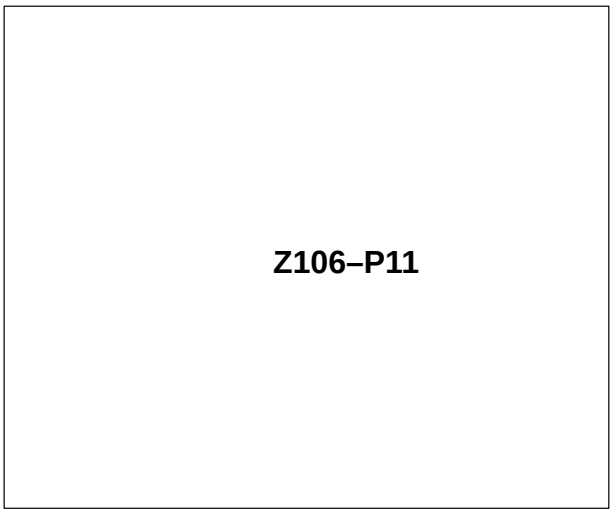
The STEP signal is input from the synchronizing sensor when a test object arrives at the inspection position. The F350 synchronizes the inspection with the STEP signal.



Procedure

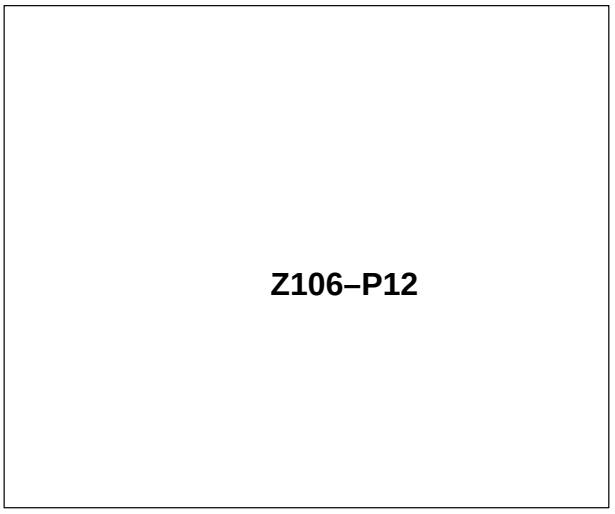
1, 2, 3... 1. **Select Scene Number**

Select scene #1. Subsequent data settings will apply to scene #1. Refer to *4-1-1 Selecting Scene Number: S.Scene*.



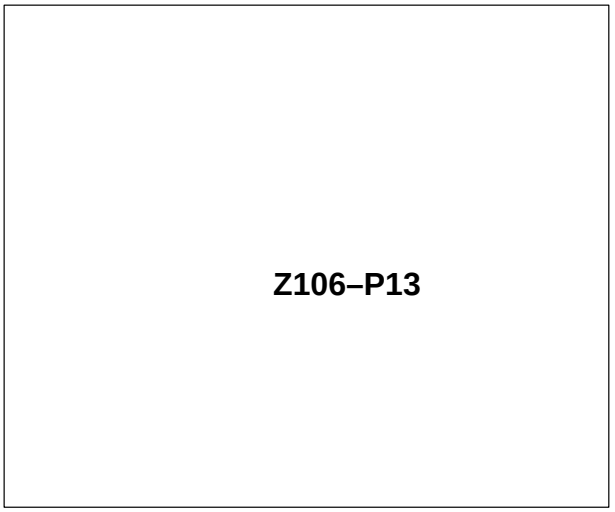
2. **Select the Camera Number**

Select camera 0. Select the camera number used for the inspection. Refer to *4-3-1 Selecting the Camera Number: C.Camera*.



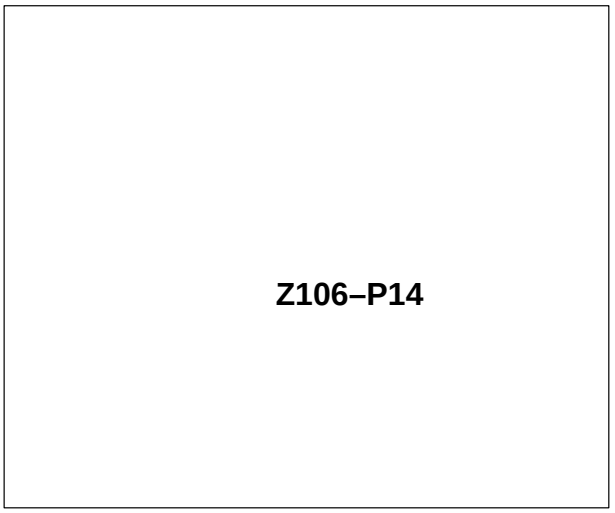
3. **Register the Inspection Reference Model**

   Register model 0. Register a rectangle enclosing a distinctive edge of the bottle as model 0. Refer to *4-5-1 Registering Models: M.Model*.



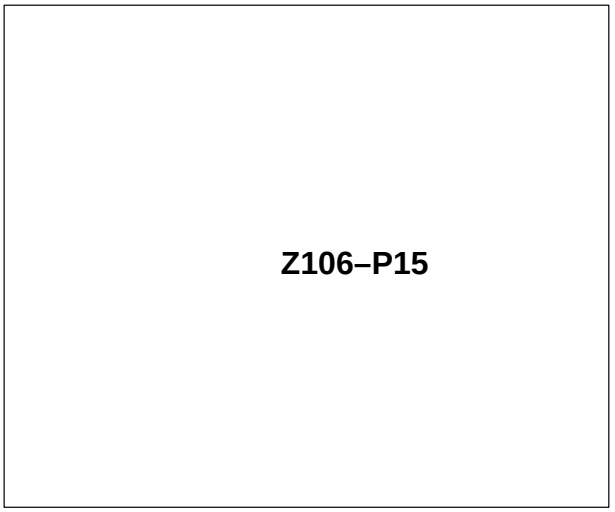
4. **Draw the Search Region**

   Set the region in which model 0 is to be searched for. Refer to *4-5-3 Setting the Search Region: S.Search region*.



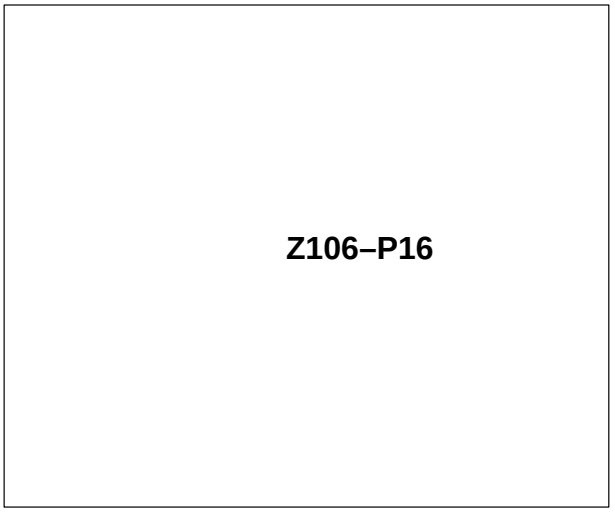
5. **Set the Evaluation Criterion**

   Set the evaluation criterion, which is the limit of the correlation value between the input image and model 0. Refer to *4-5-4 Setting the Evaluation Conditions: C.Conditions*.



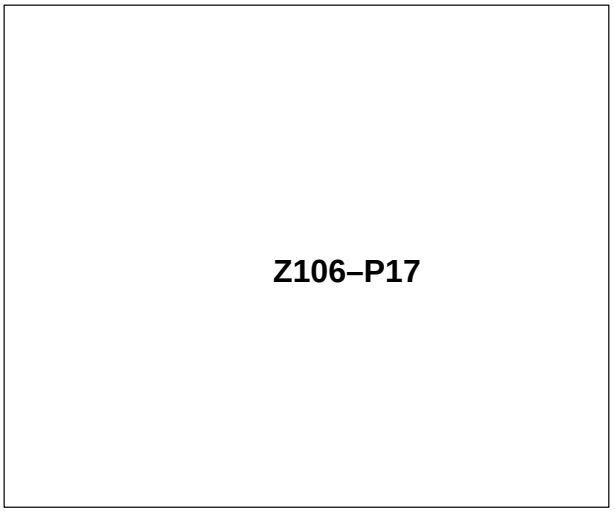
6. **Register Model 1**

   Register a rectangle enclosing a distinctive edge of the label as model 1. Refer to *4-5-1 Registering Models: M.Model*. Set the search region and evaluation criterion, as described for model 0.



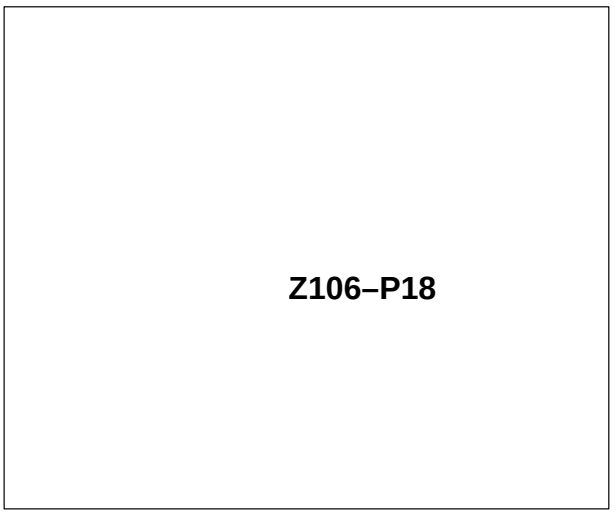
7. **Set the Data for Relative Position Inspections**

   Select the relative position inspection number. Select number 0. Refer to *4-7-1 Setting the Reference Model and Relative Model: R.Relative position*.



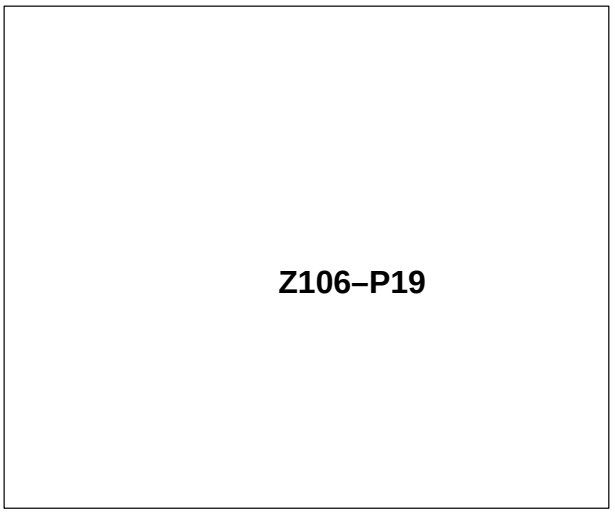
8. **Select the Reference Model**

   Set the position of this model as the reference for the inspection of the relative positions between two models. Refer to *4-7-1 Setting the Reference Model and Relative Model: R.Relative position*.



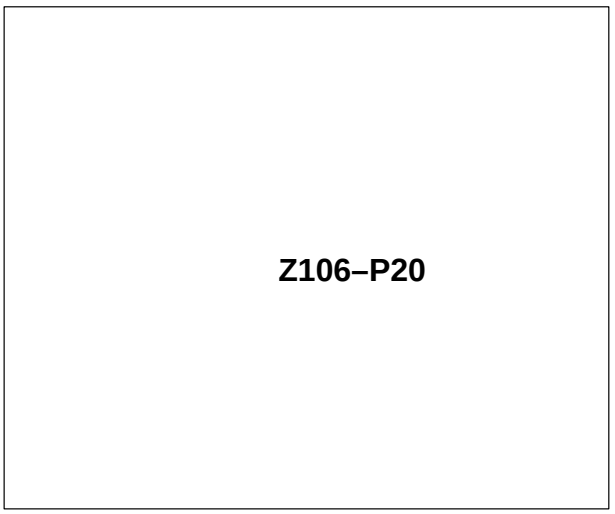
9. **Select the Relative Model**

   Select model 1 as the relative model. Refer to *4-7-1 Setting the Reference Model and Relative Model: R.Relative position*.



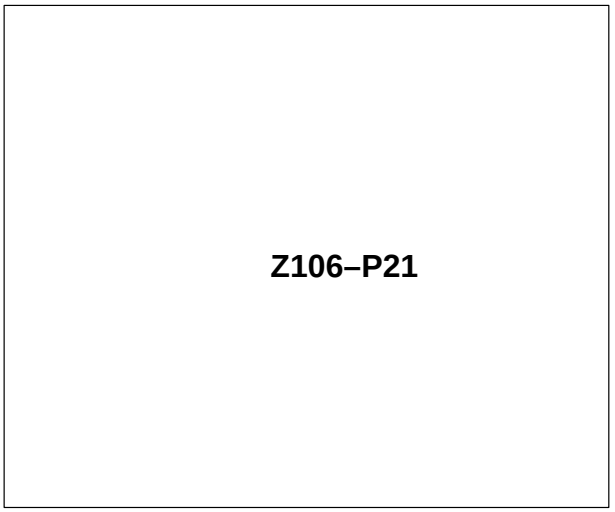
10. **Set the Evaluation Criterion**

    Set the evaluation criterion between the relative positions of the two models. Set the permitted displacement of the label in sub-pixels. Refer to *4-7-2 Setting the Evaluation Conditions: C.Condition settings*.



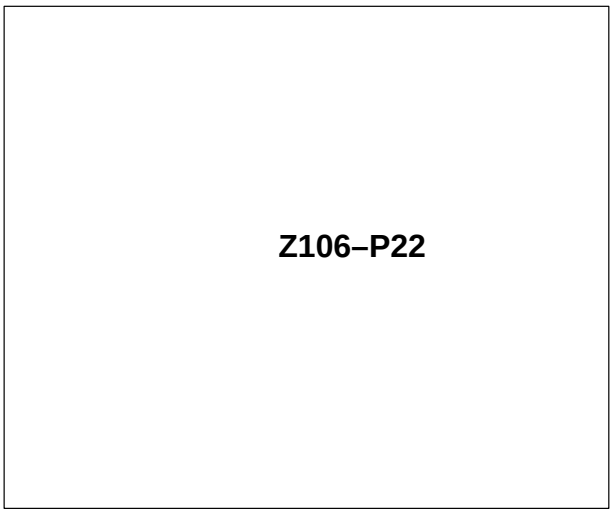
11. **Inspection**

Check the measured values and inspection times using the inspection monitor. Refer to the measured values on the relative position monitor and adjust the evaluation criterion. Refer to *4-9-2 Checking Measured Values and Inspection Times (Pattern Inspection Program): M.Inspection monitor*.



12. **Run the Inspection**

The inspection is synchronized with the input of the STEP signal. Even if the bottle position is displaced, the relative position of the edge of the bottle (model 0) and the edge of the label (model 1) is inspected to determine if the label position is correct. The inspection results are output to the video monitor and the Terminal Block Unit. Refer to *4-9-3 Running the Inspection*.



SECTION 4
Functions and their Operation

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

4-1 S.Scene

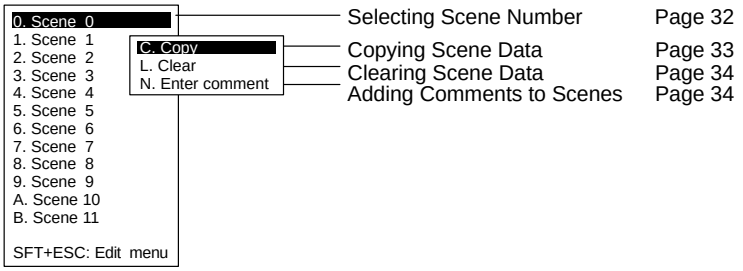
Gray inspection software 1 allows multiple inspection conditions (scenes) to be set and stored. This data is known as scene data and is identified by a scene number.

Note that the number of scenes differs for each menu.

Menu	Number of scenes
Surface Defect Inspection Program	8 scenes
Pattern Inspection Program	12 scenes

Set inspection conditions can be stored as a scene. Refer to *4-10-3 Saving and Loading Scene Data: S.Scene data*.

The S.Scene functions allow switching of scene numbers and editing of scene data.



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

Select the scene number to display. The inspection conditions can be set for this scene number and the inspection conducted according to the set inspection conditions.

Scene Number Displayed at Start Up

The scene number displayed after start up is the same scene number displayed when the Application Program was previously shut down.

The factory 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 inspection screen is displayed for the set scene number.

Refer to *4-10-1 Automatic Inspection: M.Initial mode*.

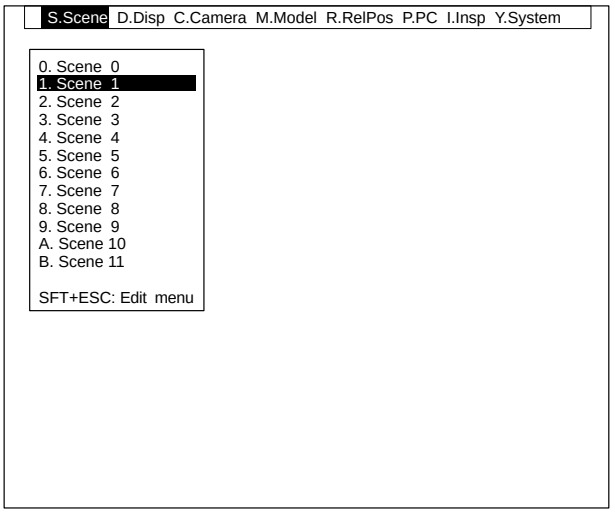
Display of Scene Comments

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: N.Enter comment*.

Procedure

Select the scene number. The selected scene is displayed.



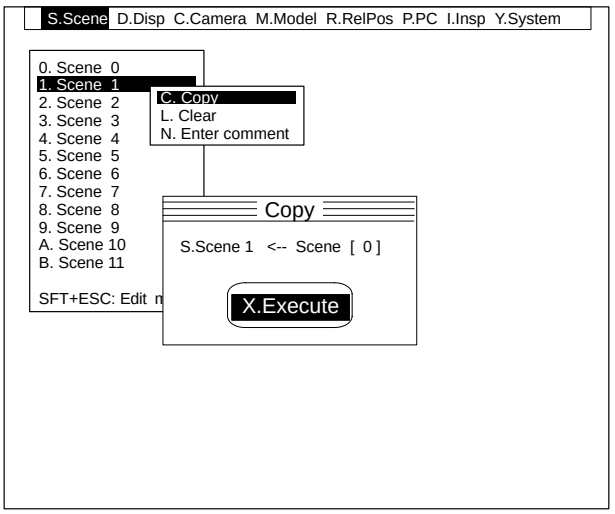
4-1-2 Copying Scene Data: C.Copy

Write the scene data of the selected scene number to a different scene number. This function 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 source scene number and press the Shift and Escape Keys.
2. Select “C.Copy.”
3. Input the copy destination scene number.



4. Select “X.Execute.” The scene data is copied from the copy source scene number to the copy destination scene number.

Note Copying scene data can take a long time if many models are registered or if the model regions are large. However, do not 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.

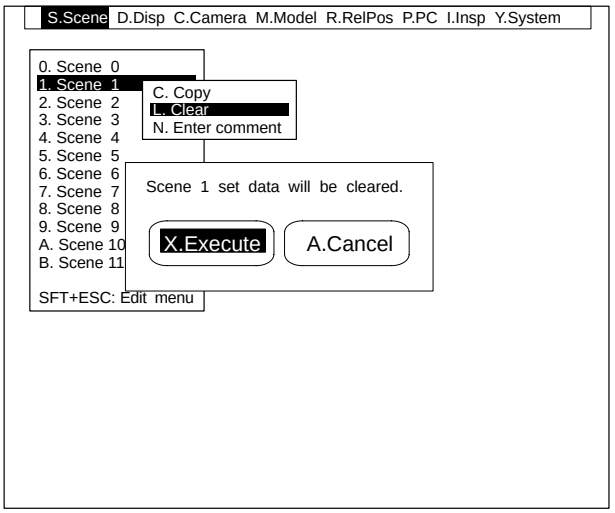
4-1-3 Clearing Scene Data: L.Clear

Set 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 is displayed.



3. Check that the correct scene number is highlighted and select “X.Execute.” All scene data for the selected scene number reverts to the initial data.

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

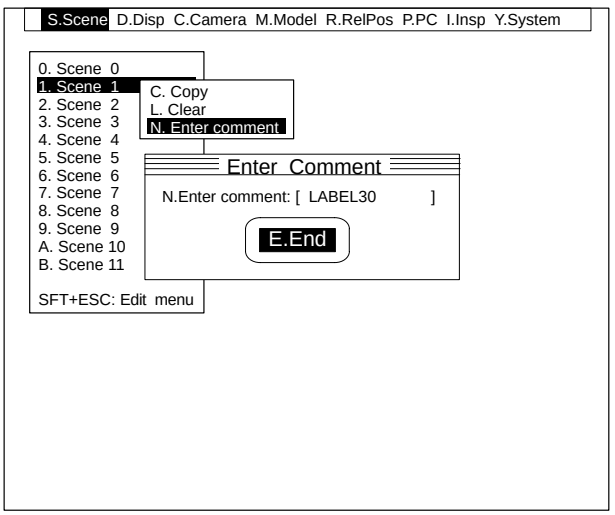
Add comments to scenes. Inspection details input as a comment can be used as a scene title.

The length of a comment must be a maximum of ten normal characters.

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.



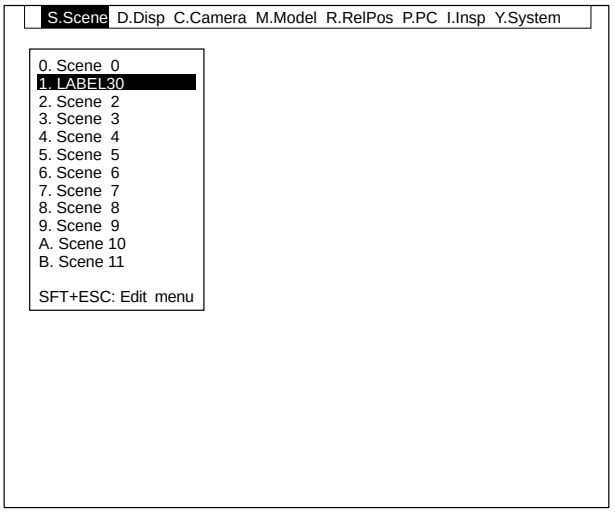
The following characters can be used in comments.

Least significant bits

Most significant bits	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
3	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
4	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
5	P	Q	R	S	T	U	V	W	X	Y	Z	[	¥	]	^	_
6	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
7	p	q	r	s	t	u	v	w	x	y	z	{	¦	}	~	

Character codes $30 to 7E.

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



4-2 D.Display

Use “D.Display” to set the image display method on the video monitor. Select the most convenient display method for setting the scene data or monitoring the inspection status.

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

Images can be displayed as static (freeze) or dynamic (unfreeze) images. If “U.Unfreeze” is selected, the image from the camera is displayed directly. Select the unfreeze display to adjust the camera focus or make other adjustments.

Select “F.Freeze” to display a static image. Select the freeze display to obtain static images for the inspection of fast moving objects or to set data while observing a static image.

Two methods of displaying a static image are available: displaying a frozen image direct from the camera, or displaying a frozen image after position compensation.

Refer to the following sections for information on reading images:
4-2-2 Inputting the Image: I.Input image
4-2-3 Reading Position Compensated Image: P.Input image after position compensation

Using a Strobe

The strobe flashes continuously if “U.Unfreeze” is selected. If “F.Freeze” is selected, the strobe flashes when the image is input.

Image Input Timing

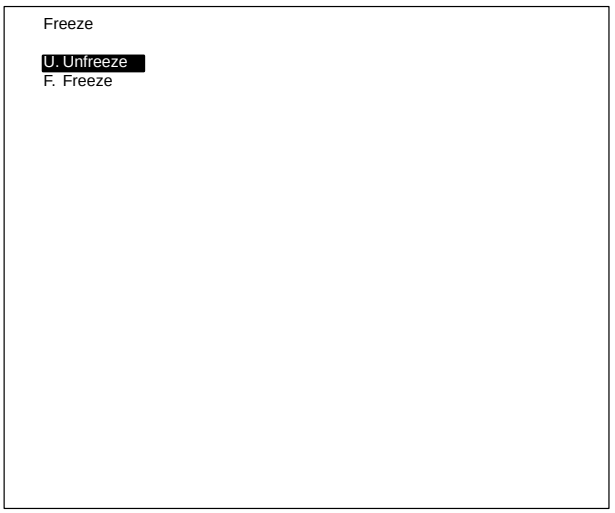
The static (freeze) image is updated when any of the following occurs:

- Start-up
- Different scene number is selected using “S.Scene”
- Image is input using “D.Display/I.Input image”
- Image is input using “D.Display/P.Input image after position compensation”
- Camera is selected using “C.Camera”
- Inspection is conducted using “I.Inspection/M.Inspection monitor”
- Inspection is conducted using “I.Inspection/I.Inspection”

Procedure

1, 2, 3...

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



4-2-2 Inputting the Image: I.Input image

If the static (freeze) image is selected, the image direct from the camera can be input by pressing the Enter Key or using the STEP signal.

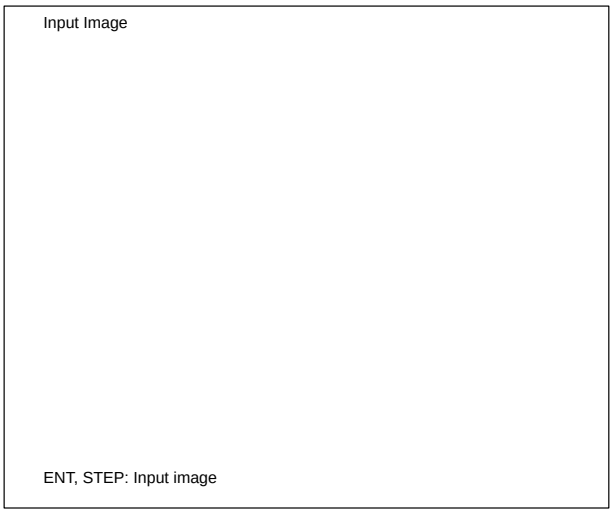
When the Enter Key is pressed or the STEP signal is input, the image is input and displayed as a static image. In addition, the “F.Freeze” display method is automatically selected.

To display a static image after position compensation. Refer to *4-2-3 Reading Position Compensated Image: P.Input image after position compensation*.

Procedure

1, 2, 3...

1. Select I.Input image." A dynamic (unfreeze) image is displayed.
2. Press the Enter Key or turn ON the STEP signal. The static image at the time the Enter Key is pressed or the STEP signal turns ON is displayed.



4-2-3 Inputting the Position-compensated Image: P.Input image after position compensation

If position compensation is set with "P.Position compensation," the position-compensated image can be input as a static (freeze) image. The image is read when the Enter Key is pressed of the STEP signal is input.

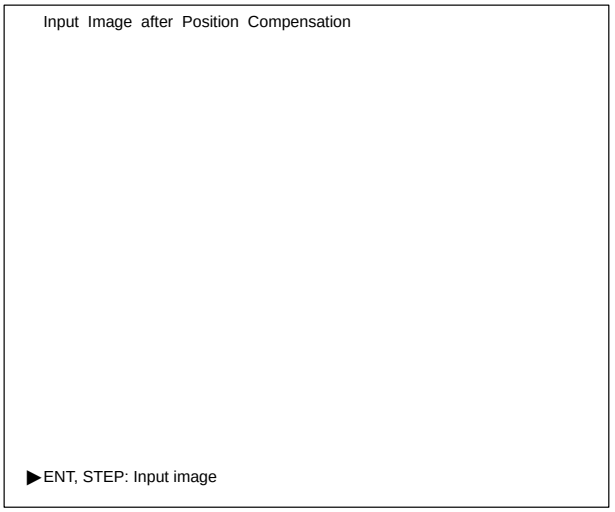
When the Enter Key is pressed or the STEP signal is input, the position-compensated image is input and displayed as a static image. In addition, the "F.Freeze" display method is automatically selected.

For inspected objects which are not fixed in position or angle of inclination, display the static (freeze) position-compensated image before drawing the inspection region.

Procedure

1, 2, 3...

1. Select "I.Input image." A dynamic (unfreeze) image is displayed.
2. Press the Enter Key or turn ON the STEP signal. The position-compensated static image at the time the Enter Key is pressed or the STEP signal turns ON is displayed.



4-3 C.Camera

Use “C.Camera” to select the camera number and set the data related to the image which is inspected.

4-3-1 Selecting the Camera Number: C.Camera

Data must be set for each camera number if multiple cameras are used. Note that the set data differs for each menu.

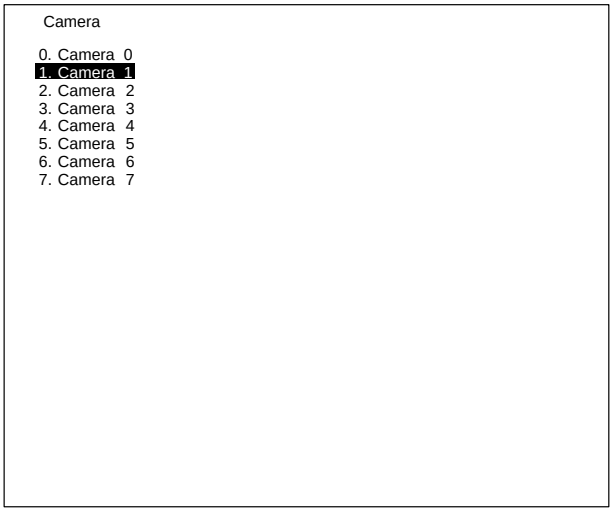
Menu	Data setting for each camera number
Surface Defect Inspection Program	C.Camera/F.Filtering, R.Registration, O.Conditions, P.Position compensation
Pattern Inspection Program	C.Camera/F.Filtering, M.Model, R.Relative position, P.Position compensation

The data can be set for the currently displayed camera number.

Procedure

1, 2, 3...

1. Select “C.Camera.”
2. Select the camera number. The image from the selected camera number is displayed.



4-3-2 Selecting the Filtering: F.Filtering

The F.Filtering functions process the camera image into an image more suitable for inspection. Select the filtering function to match the environment and inspection.

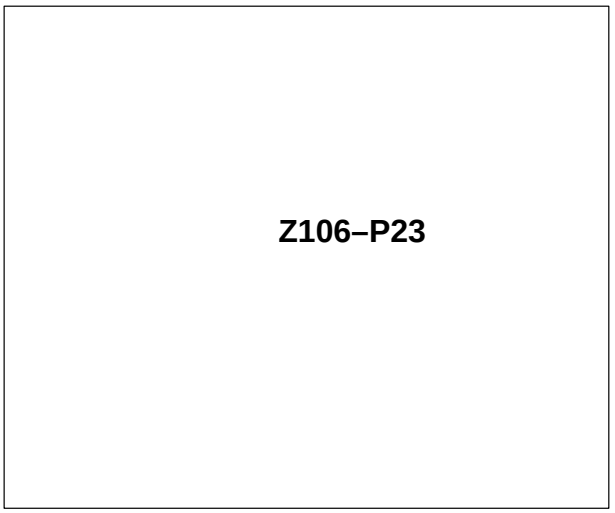
If filtering is specified for a particular camera number, the filtered image is always displayed for that camera number.

Note Correct inspection is not possible if different filtering is selected during inspection than at the time the model data was registered.
The inspection is conducted on the filtered image from the currently selected camera number. Do not change the filtering for any camera number after the model data is registered.
The menus used to register the model data are shown below.

Menu	Functions to register model data
Surface Defect Inspection Program	R.Registration, P.Position compensation
Pattern Inspection Program	M.Model, P.Position compensation

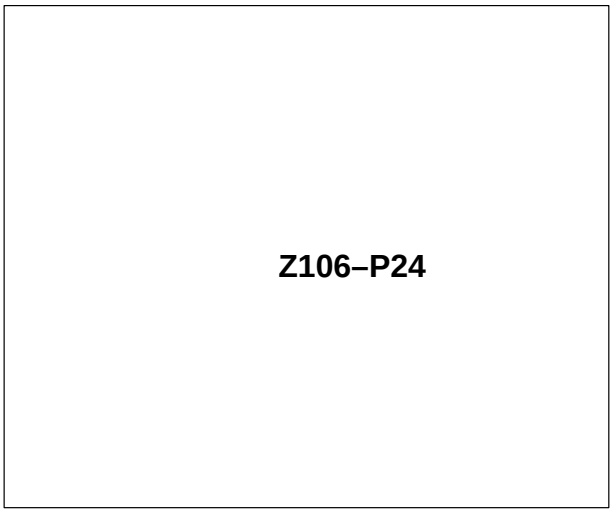
OFF

No filtering. The raw image is displayed.



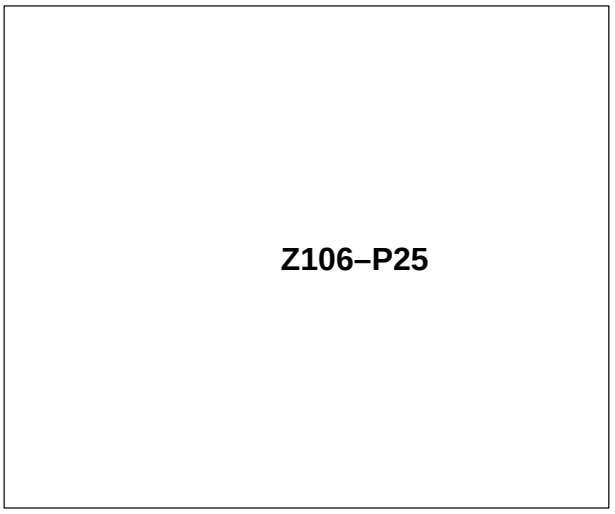
Smoothing

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.



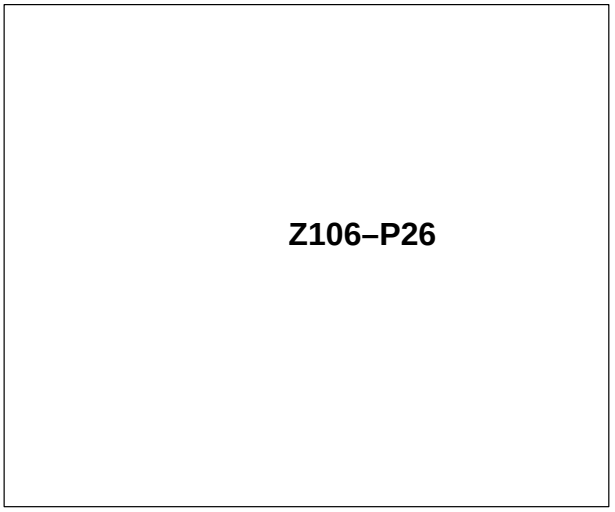
Edge Enhancement

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.



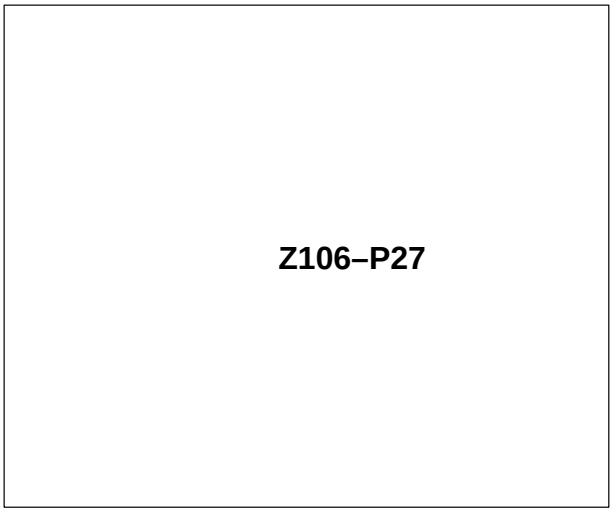
Vertical Edges

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



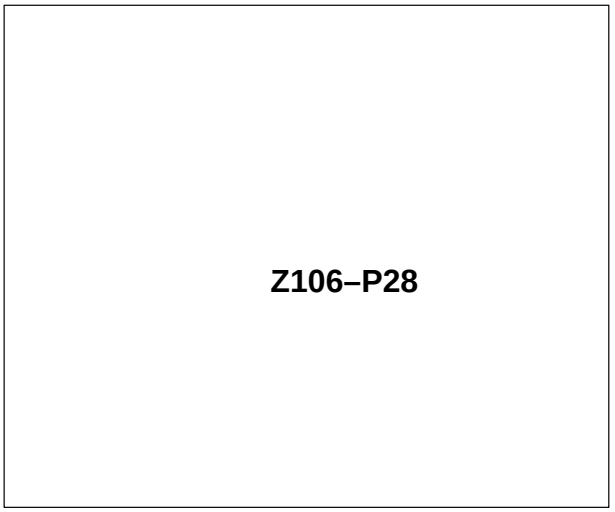
Horizontal Edges

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



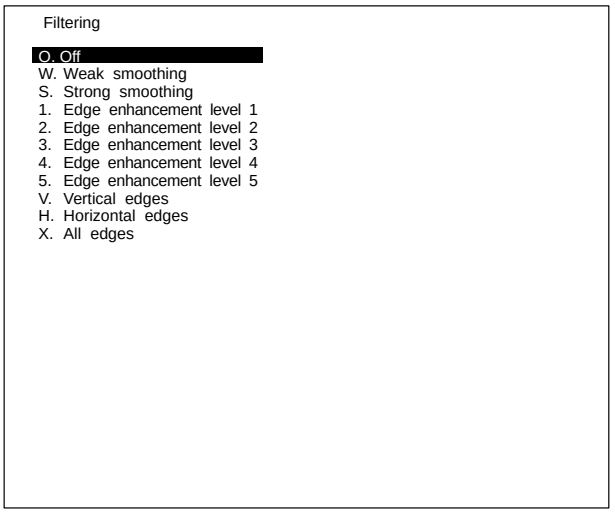
All Edges

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



Procedure

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



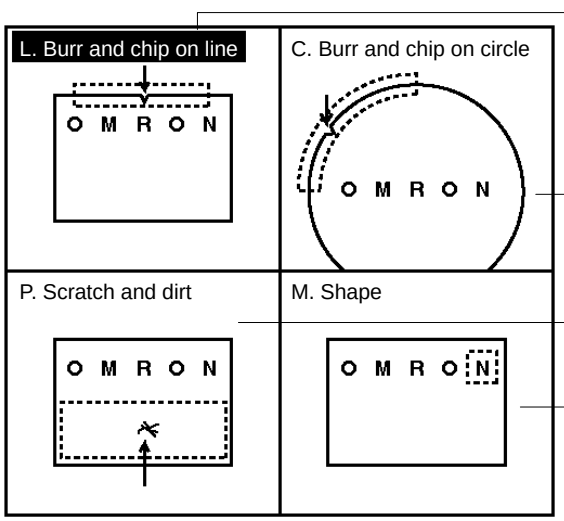
4-4 R.Registration

The Surface Defect Inspection Program offers four inspection modes. Use “R.Registration” to set the inspection mode and draw the inspection region.

Use position compensation to inspect objects which are not fixed in position or angle of inclination. Refer to *4-8 P.Position compensation*.

When position compensation is used, display the static (freeze) position-compensated image before drawing the inspection region. Refer to *4-2-3 Reading Position-compensated Image: P.Input image after position compensation*.

Up to 16 inspection regions can be set for each camera. If multiple cameras are used, select the image from the required camera number before setting the inspection regions. Refer to *4-3-1 Selecting the Camera Number: C.Camera*.



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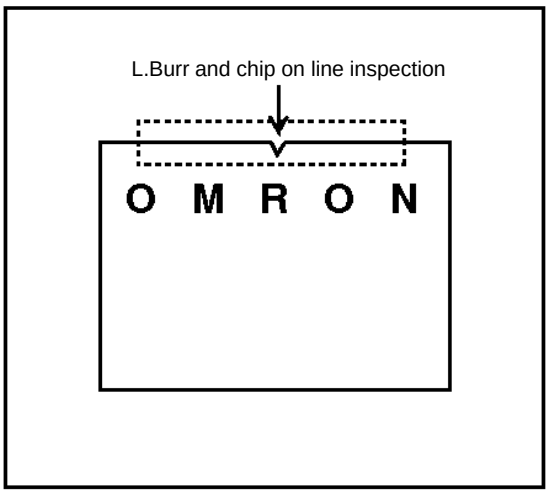
Drawing Burr and Chip On Circle Inspection Region Page 47
Drawing Scratch and Dirt Inspection Region Page 52
Drawing Shape Inspection Region and Registering Models Page 58

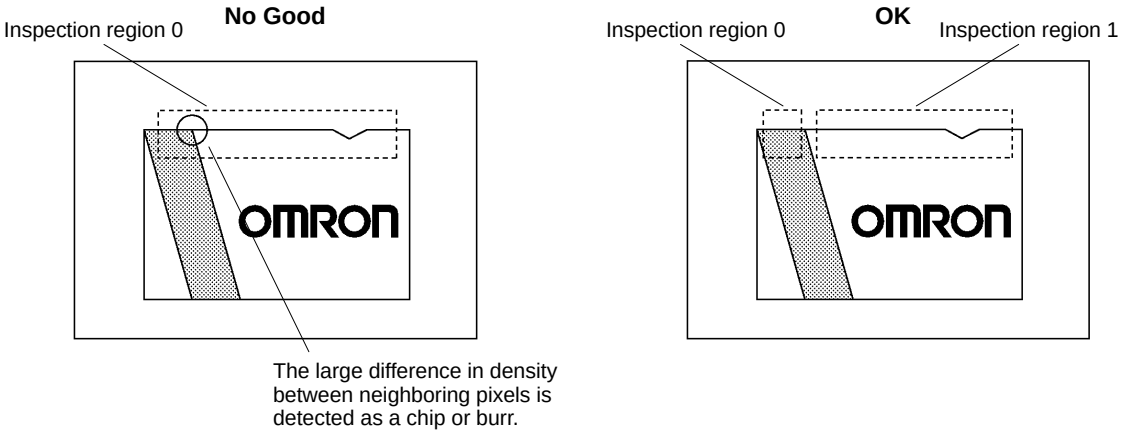
4-4-1 Drawing Burr and Chip on Line Inspection Region: L.Burr and chip on line inspection

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.



Note 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.

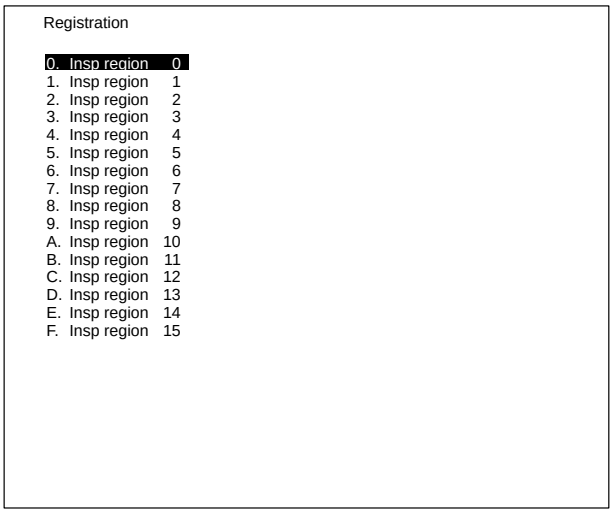


Drawing a New Region

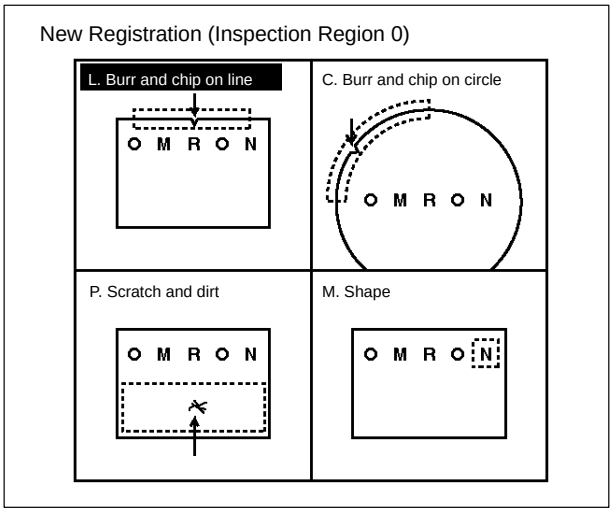
Follow the procedure below to draw a new inspection region.

Procedure

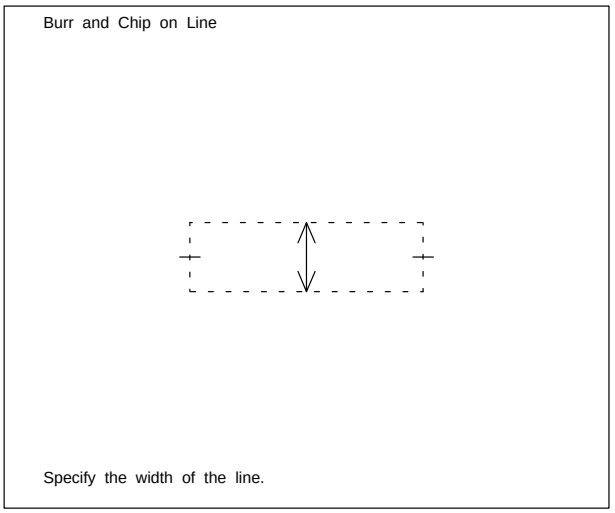
1, 2, 3... 1. Select the inspection region number. A table of inspection modes is displayed.



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



3. Draw the inspection region. The rectangle drawn is registered as the inspection region.

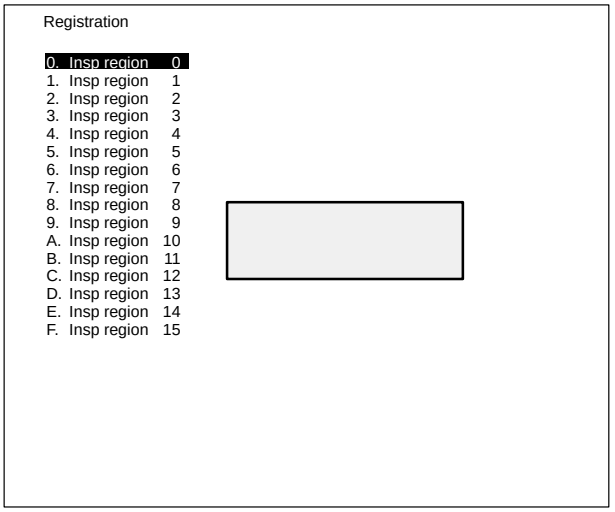


Modifying an Inspection Region

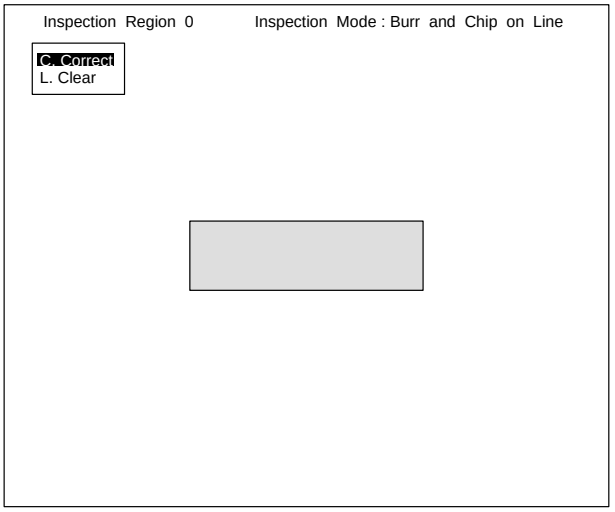
An existing inspection region can be modified. As the cursor is moved to select the inspection region number, the inspection region for each cursor position is displayed in solid lines.

Procedure

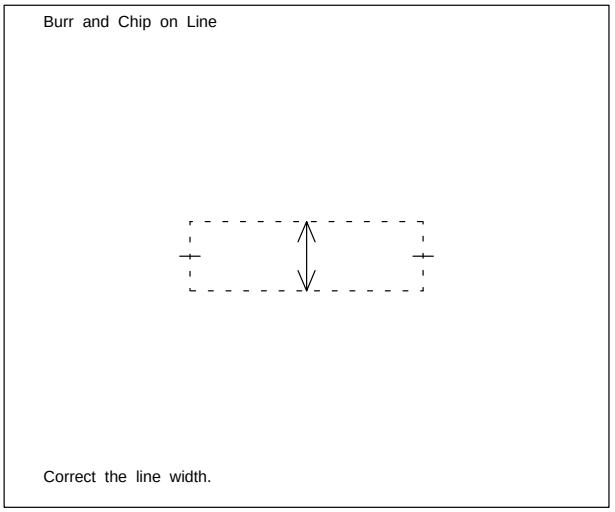
1, 2, 3... 1. Select the inspection region number.



2. Select “R.Correct.” The existing inspection region is displayed in broken lines.



3. Modify the inspection region. The rectangle drawn is registered as the inspection region.

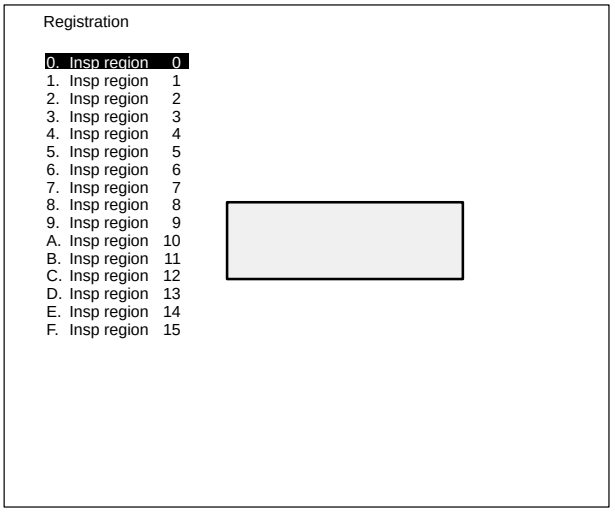


Clearing an Inspection Region

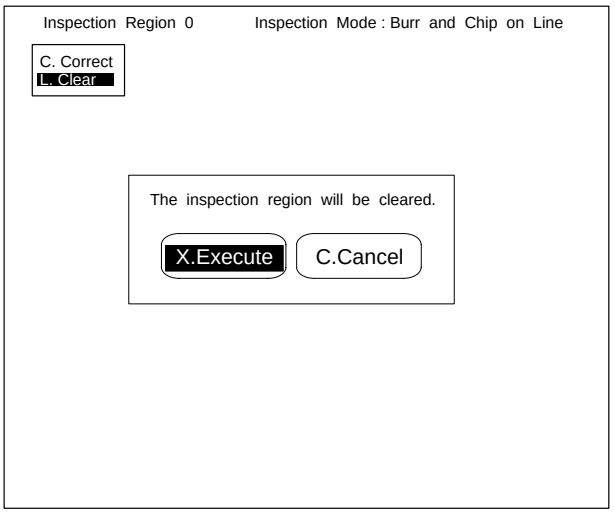
An existing inspection region can be cleared. Clear any inspection regions where no inspection is required.

Procedure

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



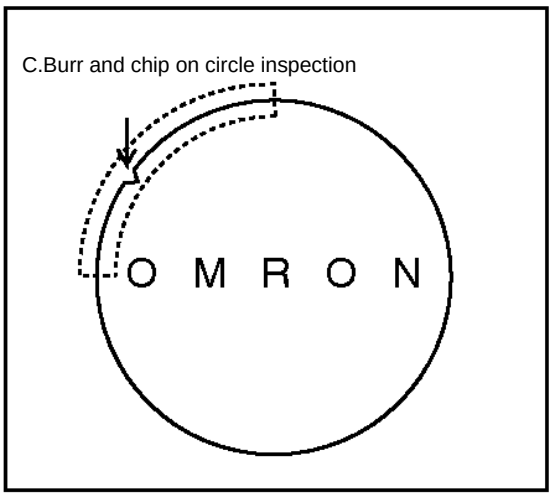
2. Select “L.Clear.” A confirmation message is displayed.



3. Check that the inspection region number to be deleted is selected and select “X.Execute.” The inspection region is cleared.

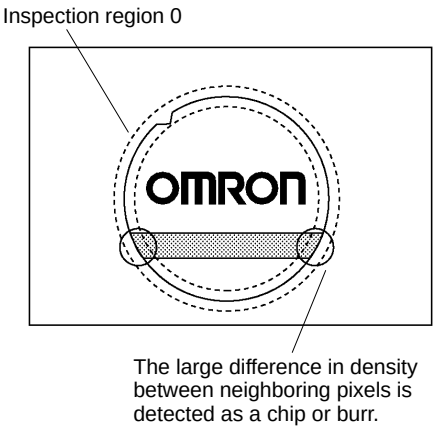
4-4-2 Drawing Burr and Chip on Circle Inspection Region: C.Burr and chip on circle inspection

Inspects for chips and burrs along the circular edge of a workpiece. Draw the inspection regions.

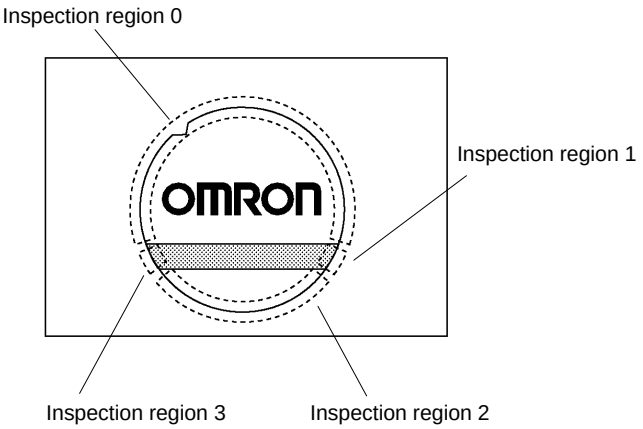


Note Do not draw the inspection region to include any mark or pattern, otherwise incorrect inspection will result because marks and patterns inside the inspection region cannot be differentiated from chips and burrs.

No Good



OK



The inspection region can be drawn as either of the following shapes:

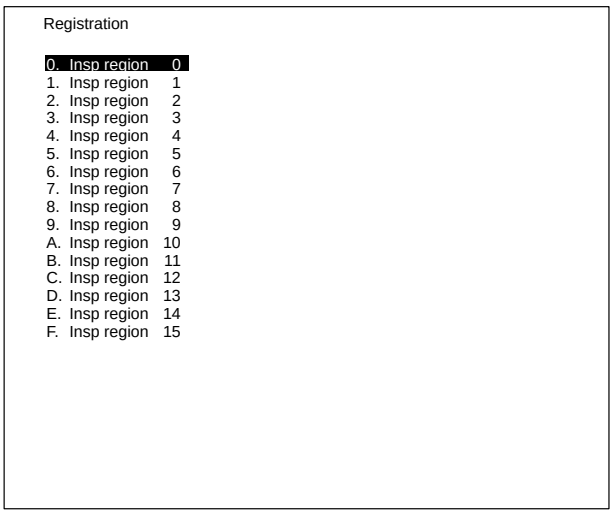
Shape	Drawing method
O.Circle	Set the circle center, a point on the circumference, and the width of the region.
P.Arc	Set the arc start point, a point on the arc, the arc end point, and the width of the region.

Drawing a New Region

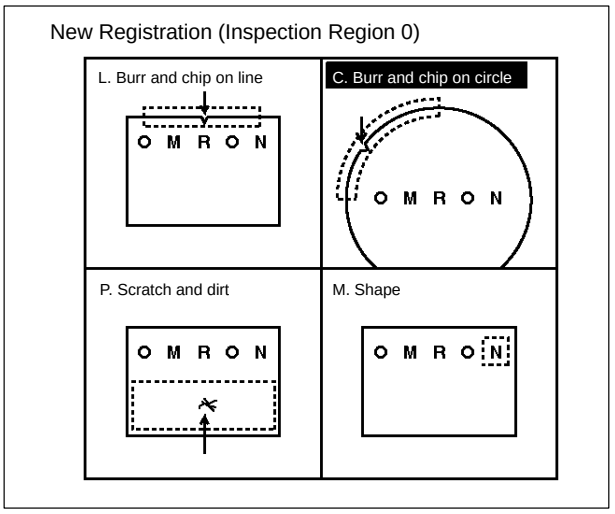
Follow the procedure below to draw a new inspection region.

Procedure

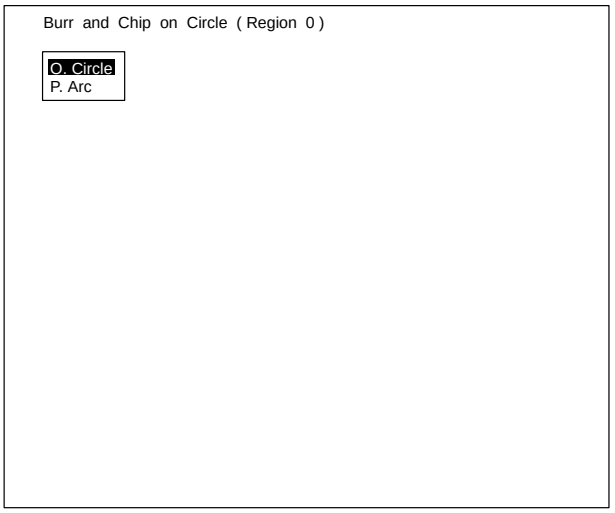
1, 2, 3... 1. Select the inspection region number. A table of inspection modes is displayed.



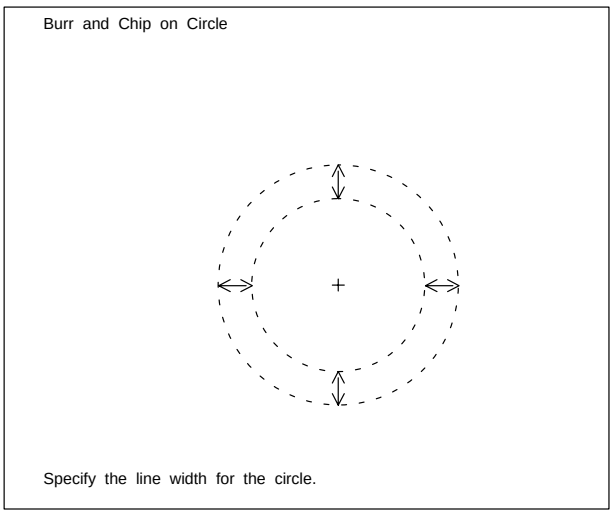
2. Select “C.Burr and chip on circle inspection.”



3. Select “O.Circle” or “P.Arc.” An arrow cursor is displayed in the center of the screen.



4. Draw the inspection region. The region drawn is registered as the inspection region.

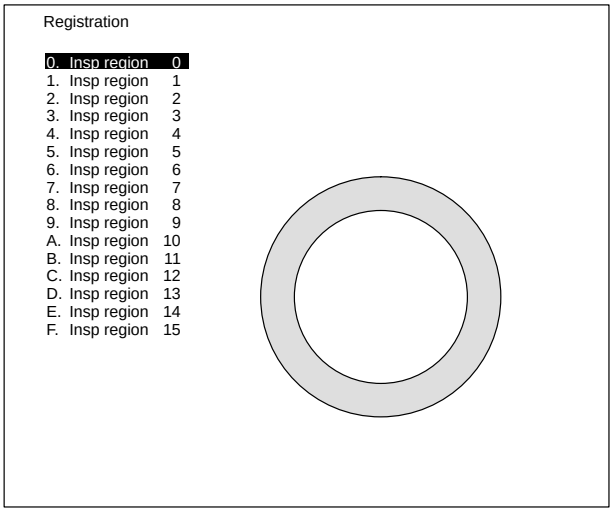


Modifying an Inspection Region

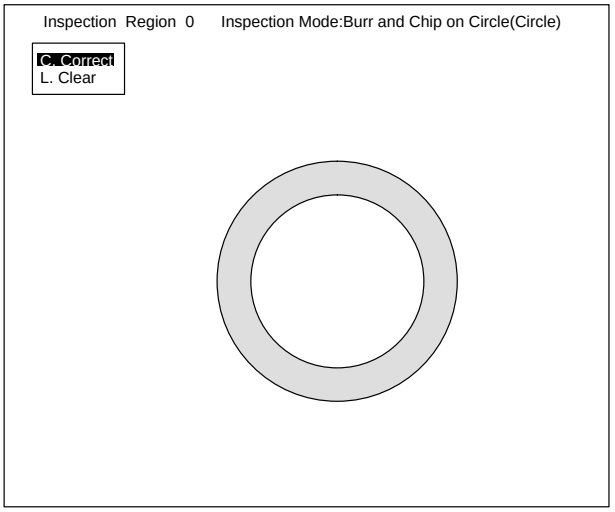
An existing inspection region can be modified. As the cursor is moved to select the inspection region number, the inspection region for each cursor position is displayed in solid lines.

Procedure

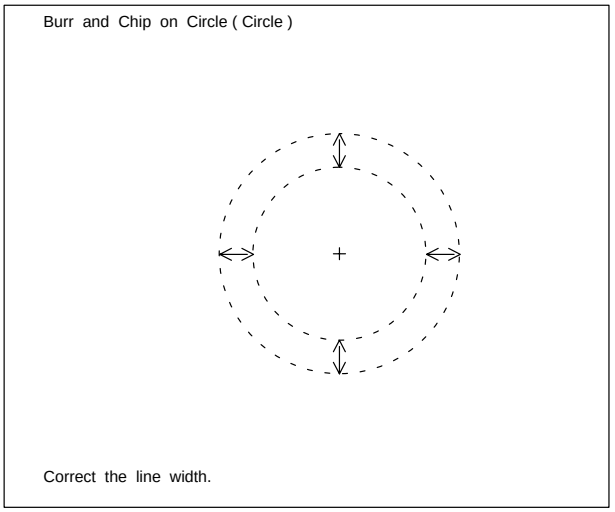
1, 2, 3... 1. Select the inspection region number.



2. Select “R.Correct.” The existing inspection region is displayed in broken lines.



3. Modify the inspection region. The region drawn is registered as the inspection region.



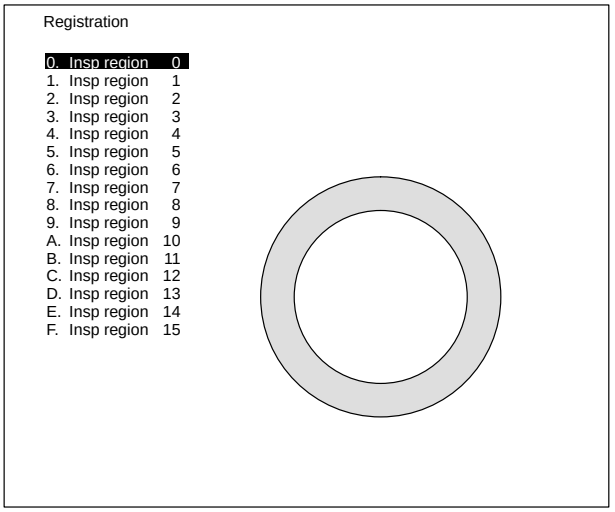
Clearing an Inspection Region

An existing inspection region can be cleared. Clear any inspection regions where no inspection is required.

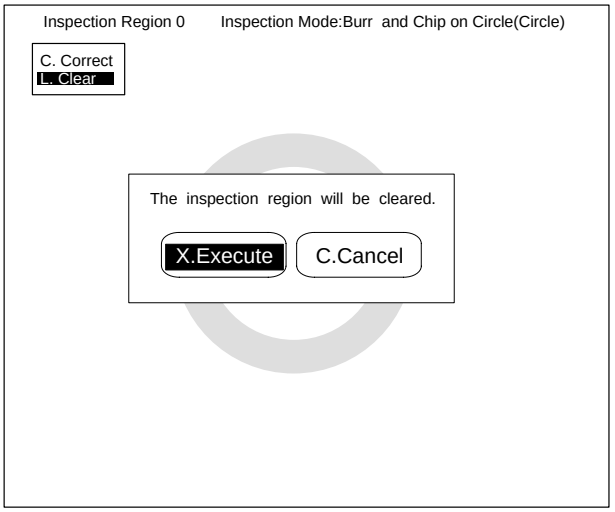
Procedure

1, 2, 3...

1. Select the inspection region number.



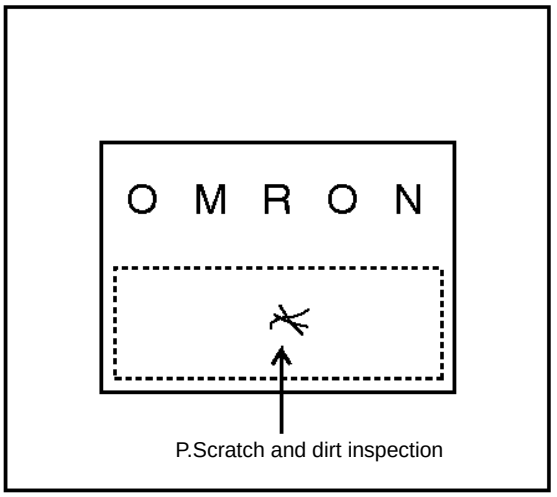
2. Select “L.Clear.” A confirmation message is displayed.



3. Check that the inspection region number to be deleted is selected and select “X.Execute.” The inspection region is cleared.

4-4-3 Drawing Scratch and Dirt Inspection Region: P.Scratch and dirt inspection

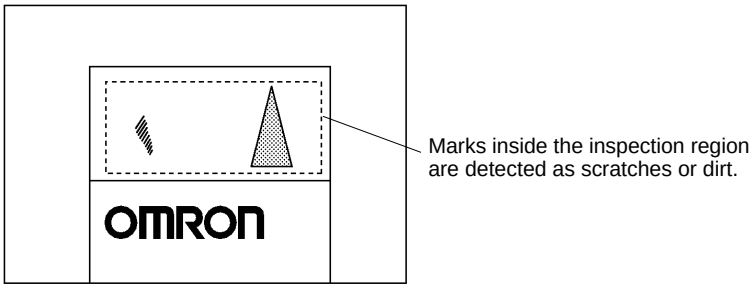
Inspects for scratches and dirt on a workpiece. Draw the inspection regions.



Note 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 scratches and dirt. Use the shape inspection to inspect for scratches and dirt in a region containing marks or patterns.

Regions drawn smaller than 30 x 30 pixels cannot be registered as an inspection region.

No Good



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

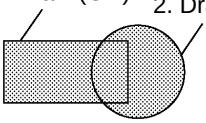
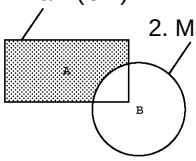
Shape	Drawing method
B.Box	Set two opposing corners.
C.Circle	Set the circle center and any point on the circumference.
A.Ellipse	Set the ellipse center and any corner of the rectangle enclosing the ellipse.
P.Polygon	Specify up to 254 adjacent points in sequence. When all points have been entered, press the Enter Key twice to join the start point and end point.

A shape can be moved around after it is drawn.

Menu	Action
M.Move all	Parallel movement of all drawn shapes.

Select the drawing mode for drawing the shapes in the inspection region. A combination of drawing modes and drawing sequences allows the drawing of complex shapes.

The following two drawing modes are available.

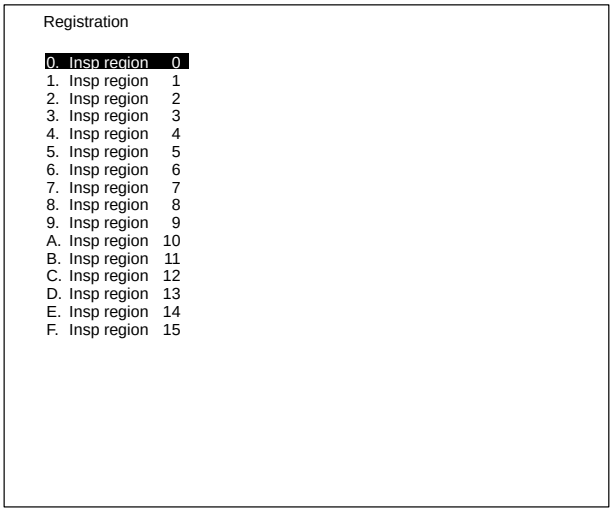
Drawing mode	Action	
O.Draw (OR)	1. Draw (OR) 2. Draw (OR) 	Use this mode to draw regions which are registered as inspection regions. Multiple shapes can be drawn in the same inspection region number and used as a single inspection region.
M.Mask (NOT)	1. Draw (OR) 2. Mask (NOT) 	Use this mode to delete parts of the inspection region. If shape B is drawn in mask mode over a previously-drawn shape A, the area inside shape B is deleted. However, the area inside shape B is not deleted if shape A is drawn after shape B is drawn in mask mode.

Drawing a New Region

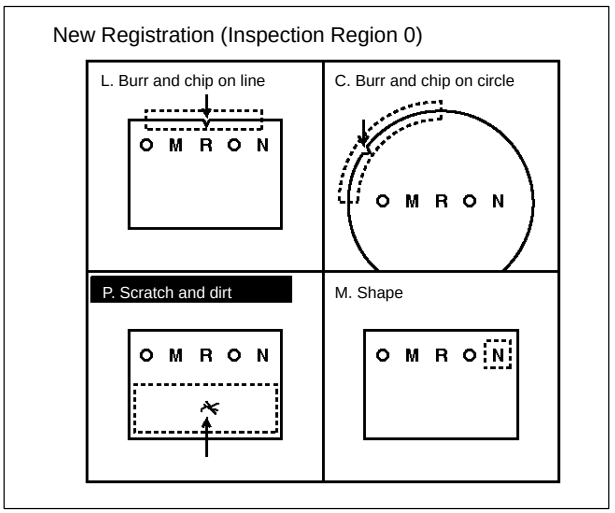
Follow the procedure below to draw a new inspection region.

Procedure

1, 2, 3... 1. Select the inspection region number. A table of inspection modes is displayed.

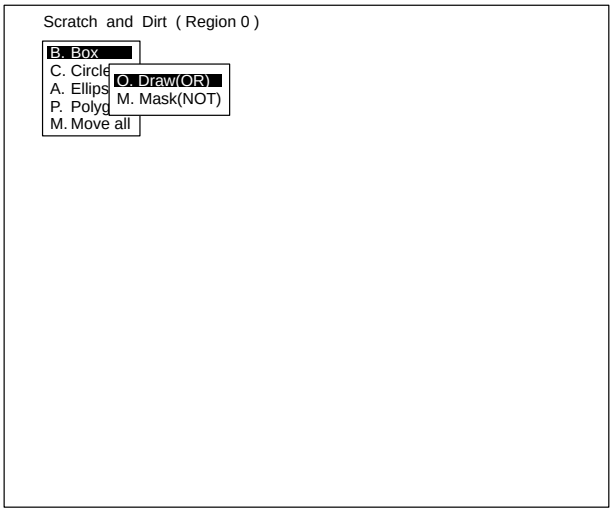


2. Select “P.Scratch and dirt inspection.”

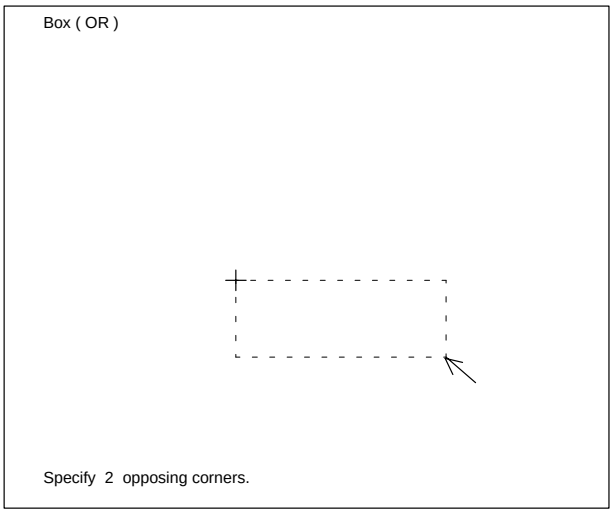


3. Select the shape.

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



5. Draw the inspection region. The region drawn is registered as the inspection region. Multiple shapes can be drawn in a single inspection region.



Modifying an Inspection Region

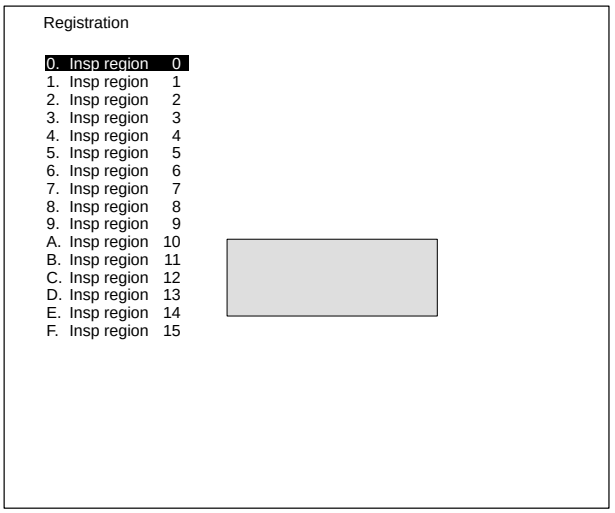
An existing inspection region can be modified by moving shapes drawn in the region or adding more shapes to the region.

As the cursor is moved to select the inspection region number, the inspection region for each cursor position is displayed in solid lines.

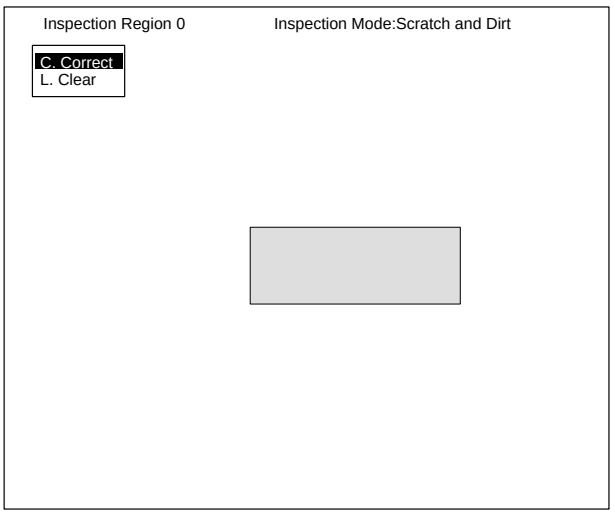
Use “L.Clear” to delete all shapes drawn in an inspection region. Select the mask mode (NOT) to delete parts of the shapes.

Procedure

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

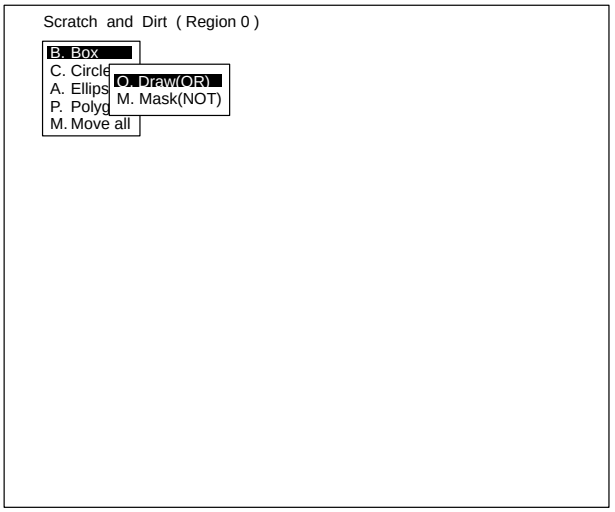


2. Select “R.Correct.” The existing inspection region is displayed.

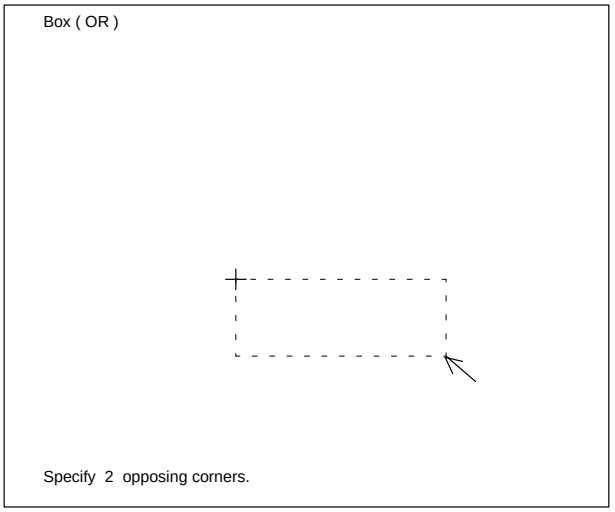


3. Select the shape.

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



5. Draw the inspection region. The region drawn is registered as the inspection region. Multiple shapes can be drawn in a single inspection region.

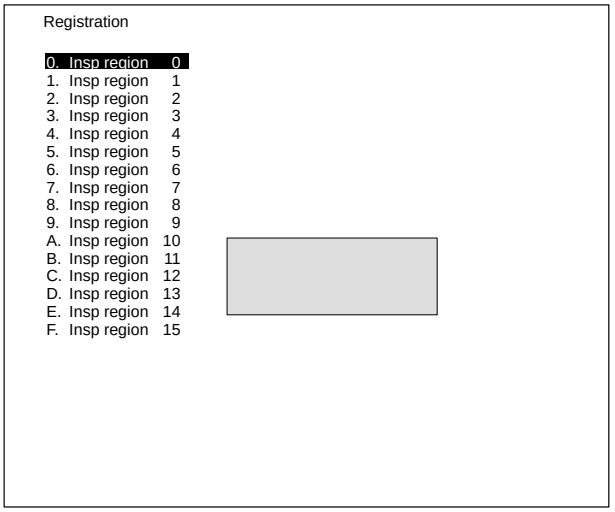


Clearing an Inspection Region

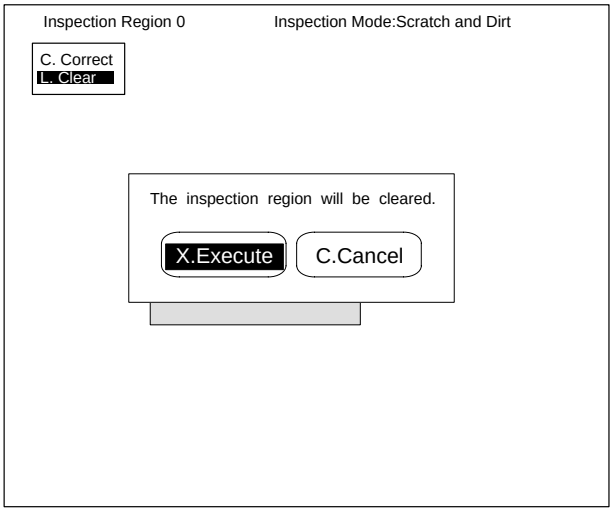
All shapes drawn in an inspection region are cleared. Clear any inspection regions where no inspection is required.

Procedure

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



2. Select “L.Clear.” A confirmation message is displayed.



3. Check that the inspection region number to be deleted is selected and select “X.Execute.” The inspection region is cleared.

4-4-4 Drawing Shape Inspection Region and Registering Models: M.Shape inspection

Inspects shapes by evaluating as OK or NG the correlation between the inspection model and the input image.

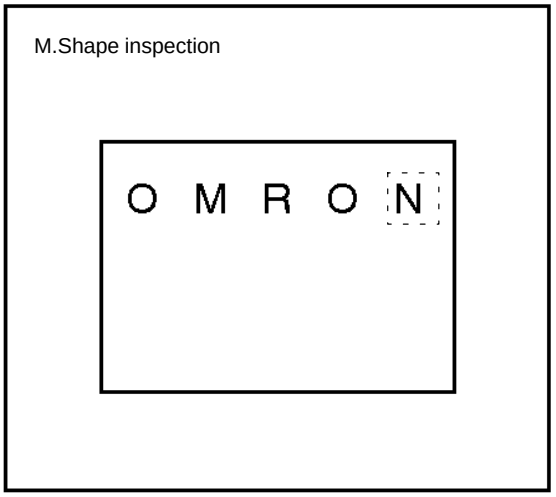
Draw the inspection region.

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.

Note Correct inspection is not possible if different filtering is selected during inspection than at the time the model was registered.
If filtering is to be used for the inspection image, select this filtering for each camera number before registering the model data. Refer to *4-3-2 Selecting Filtering: F.Filtering*.



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

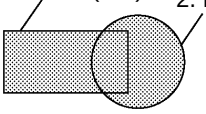
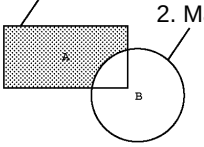
Shape	Drawing method
B.Box	Set two opposing corners.
C.Circle	Set the circle center and any point on the circumference.
A.Ellipse	Set the ellipse center and any corner of the rectangle enclosing the ellipse.
P.Polygon	Specify up to 254 adjacent points in sequence. When all points have been entered, press the Enter Key twice to join the start point and end point.

A shape can be moved around after it is drawn.

Menu	Action
M.Move all	Parallel movement of all drawn shapes.

Select the drawing mode for drawing the shapes in the inspection region. A combination of drawing modes and drawing sequences allows the drawing of complex shapes.

The following two drawing modes are available.

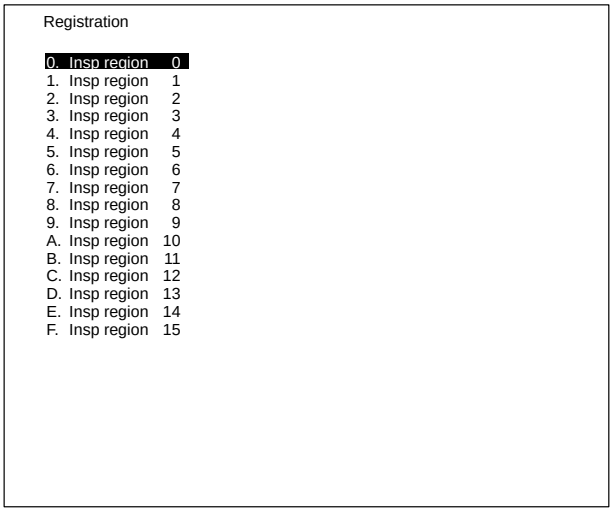
Drawing mode	Action	
O.Draw (OR)	1. Draw (OR) 2. Draw (OR) 	Use this mode to draw regions which are registered as inspection regions. Multiple shapes can be drawn in the same inspection region number and used as a single inspection region.
M.Mask (NOT)	1. Draw (OR) 2. Mask (NOT) 	Use this mode to delete parts of the inspection region. If shape B is drawn in mask mode over a previously-drawn shape A, the area inside shape B is deleted. However, the area inside shape B is not deleted if shape A is drawn after shape B is drawn in mask mode.

Drawing a New Region

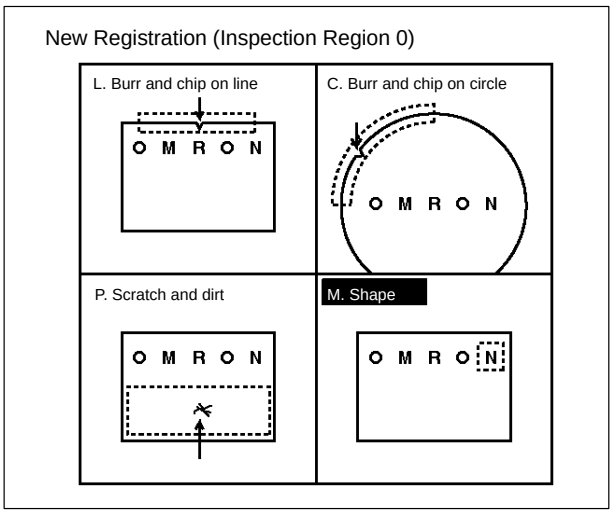
Follow the procedure below to draw a new inspection region.

Procedure

1, 2, 3... 1. Select the inspection region number. A table of inspection modes is displayed.

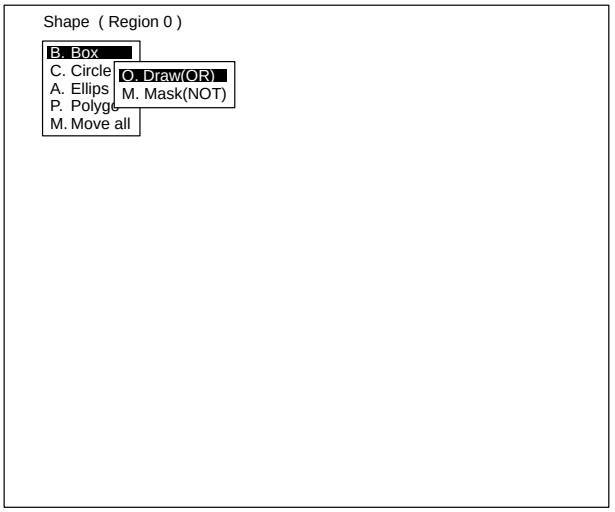


2. Select “M.Shape inspection.”

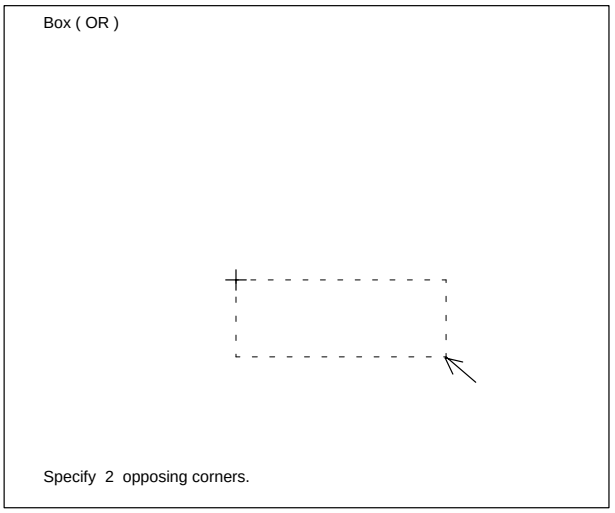


3. Select the shape.

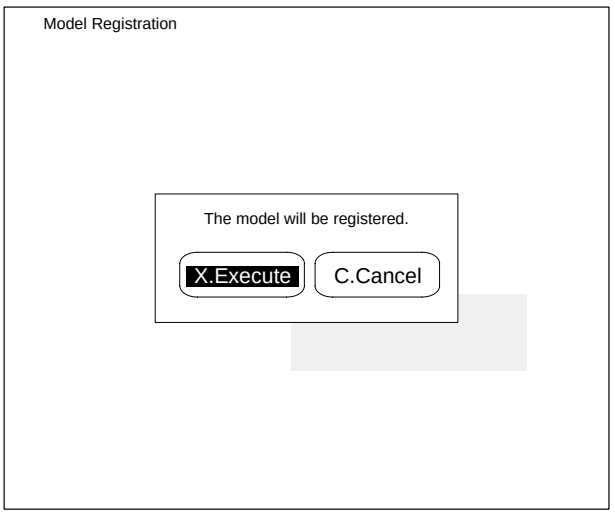
4. Select the drawing mode. An arrow cursor is displayed in the center of the screen.



5. Draw the inspection region. The region drawn is registered as the inspection region. Multiple shapes can be drawn in a single inspection region.



6. Press the Escape Key. A confirmation message is displayed.



7. Select “X.Execute.” The image inside the inspection region is registered as the model.

Modifying an Inspection Region

An existing inspection region can be modified by moving shapes drawn in the region or adding more shapes to the region.

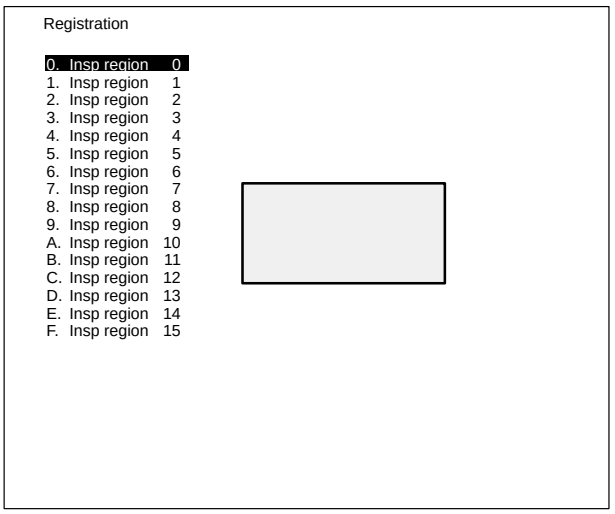
As the cursor is moved to select the inspection region number, the inspection region for each cursor position is displayed in solid lines. When an inspection region number is selected, the model registered for the region is displayed in it.

Use “L.Clear” to delete all shapes drawn in an inspection region. Select the mask mode (NOT) to delete parts of the shapes.

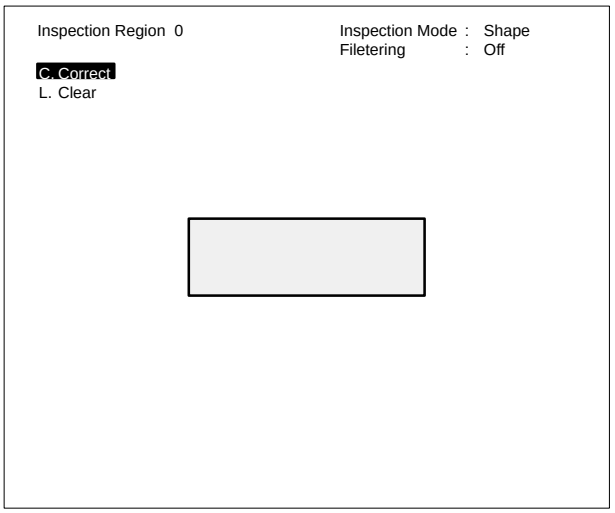
Procedure

1, 2, 3...

1. Select the inspection region number. The registered model is displayed inside the inspection region.

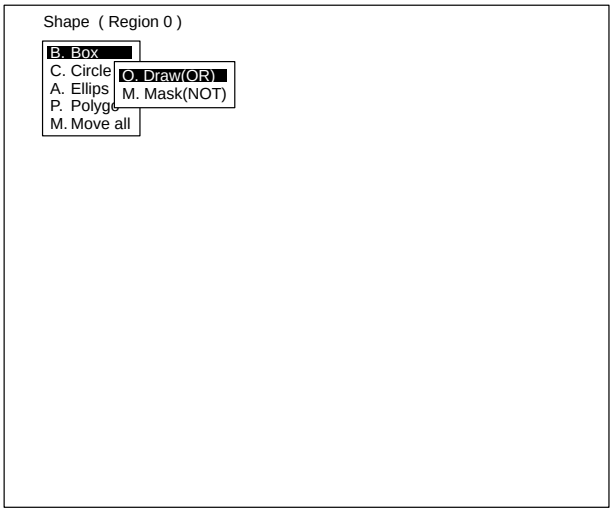


2. Select “R.Correct.” The existing inspection region is displayed.

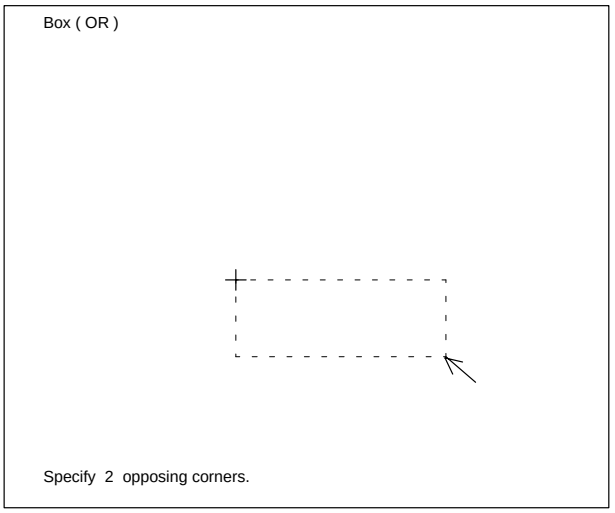


3. Select the shape.

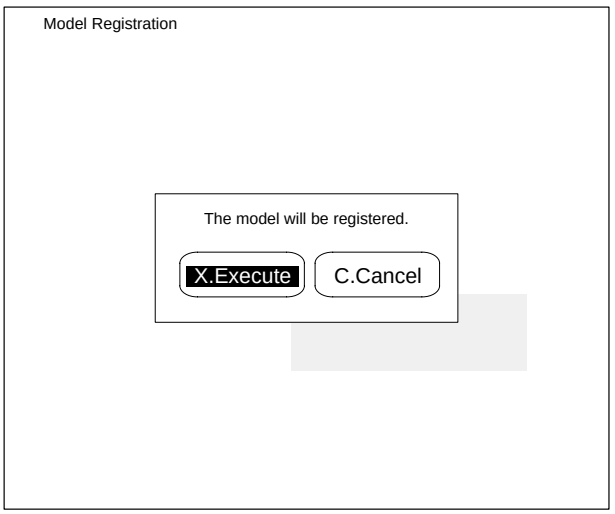
4. Select the drawing mode. An arrow cursor is displayed in the center of the screen.



5. Draw the inspection region. The region drawn is registered as the inspection region. Multiple shapes can be drawn in a single inspection region.



6. Press the Escape Key. A confirmation message is displayed.



7. Select “X.Execute.” The images inside all the shapes drawn in the inspection region registered as the model.

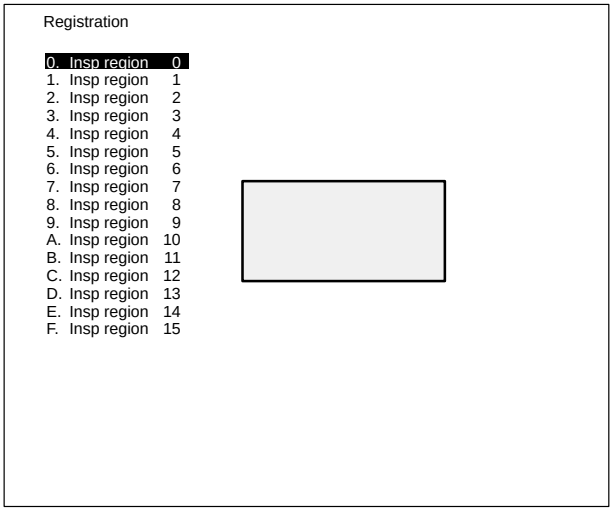
Clearing an Inspection Region

All shapes drawn in an inspection region and all registered models are cleared.

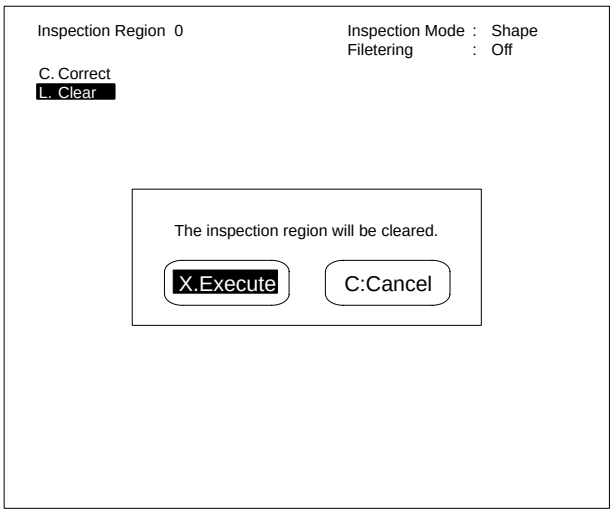
Clear any inspection regions where no inspection is required.

Procedure

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



2. Select “L.Clear.” A confirmation message is displayed.

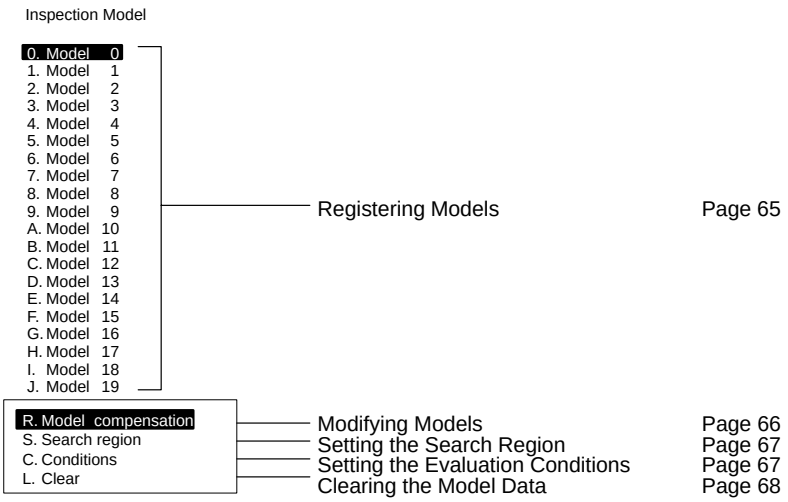


3. Check that the inspection region number to be deleted is selected and select “X.Execute.” The inspection region and all models are cleared.

4-5 M.Model

Searches for a pattern in the input image which is the same as the pattern registered with the Pattern Inspection Program, and uses correlation with the model to evaluate as OK or NG the pattern found.

Set the evaluation criterion and the model used as the inspection reference for "M.Model."



4-5-1 Registering Models: M.Model

Register the models used as the inspection reference.

The pattern in the input image which is the same as the registered model is searched and the correlation measured. Models are registered in rectangular regions.

As the cursor is moved to select the model number, the model for each cursor position and its search region are displayed in solid lines. The filtering selected at the time the model was registered is displayed at the bottom-left of the screen.

The registered model can be displayed over the input image by pressing the Shift + Escape Keys and turning ON "S.Reference model."

Note Correct inspection is not possible if different filtering is selected during inspection than at the time the model was registered. If filtering is to be used for the inspection image, select this filtering for each camera number before registering the model data. Refer to *4-3-2 Selecting Filtering: F.Filtering*.

Up to 60 Models Can be Registered for Each Camera.
If multiple cameras are used, select the camera number before registering the models. Refer to *4-3-1 Selecting the Camera Number: C.Camera*.

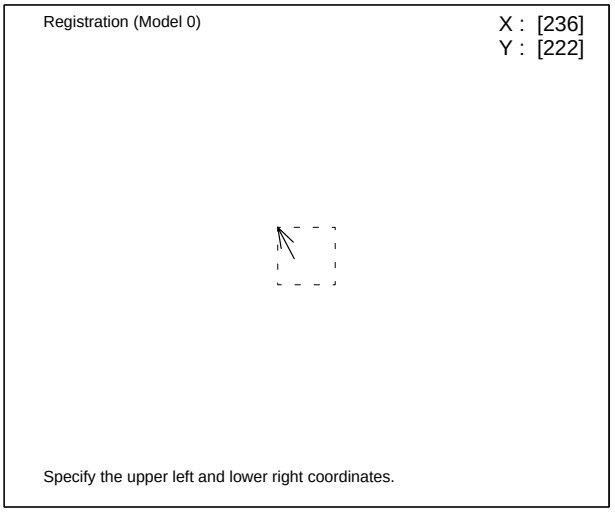
An Inspection Can be Run Using the Set Data to Measure the Inspection Time
Refer to *4-9-2 Checking Measured Values and Inspection Times (Pattern Inspection Program): M.Inspection monitor*.

Procedure

1, 2, 3...

1. Select the model number. A rectangle is displayed in the center of the screen.
2. Set the top-left corner coordinates of the region to be registered as the model. Move the arrow cursor to the required point and press the Enter Key.

3. Set the bottom-right corner coordinates of the region to be registered as the model. Move the arrow cursor to the required point and press the Enter Key. The image in the set rectangle is registered as the model.



4-5-2 Modifying Models: R.Model compensation

An existing model can be modified.

A model is registered in a rectangular region.

As the cursor is moved to select the model number, the model for each cursor position and its search region are displayed in solid lines. The filtering selected at the time the model was registered is displayed at the bottom-left of the screen. The registered model can be displayed over the input image by pressing the Shift + Escape Keys and turning ON “S.Reference model.”

Note Correct inspection is not possible if different filtering is selected during inspection than at the time the model was registered.
If filtering is to be used for the inspection image, select this filtering for each camera number before registering the model data. Refer to *4-3-2 Selecting Filtering*.

Up to 60 models can be registered for each camera.
If multiple cameras are used, select the camera number before registering the models. Refer to *4-3-1 Selecting the Camera Number*.

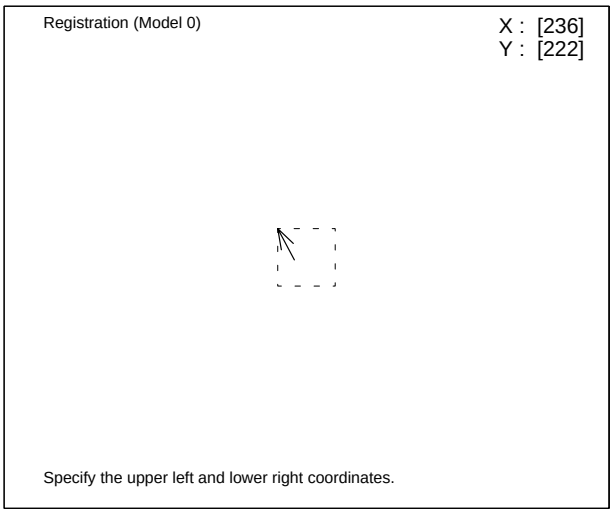
An inspection can be run using the set data to measure the inspection time.
Refer to *4-9-2 Checking Measured Values and Inspection Times (Pattern Inspection Program)*.

Procedure

1, 2, 3...

1. Select “R.Model compensation.” A rectangle is displayed in the registered region.
2. Set the top-left corner coordinates of the region to be registered as the model. Move the arrow cursor to the required point and press the Enter Key.

3. Set the bottom-right corner coordinates of the region to be registered as the model. Move the arrow cursor to the required point and press the Enter Key. The image in the set rectangle is registered as the model.



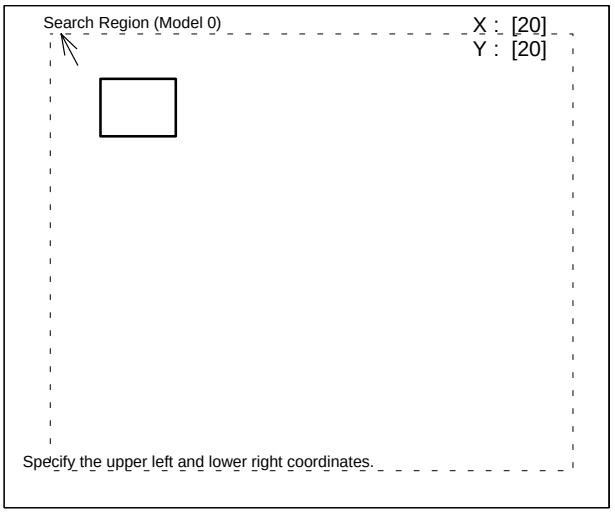
4-5-3 Setting the Search Region: S.Search region

Set the search region for each model.

Procedure

1, 2, 3...

1. Select “S.Search region.” The search region is displayed in broken lines and the region registered as the model is displayed in solid lines.
2. Set the top-left corner coordinates of the search region. Move the arrow cursor to the required point and press the Enter Key.
3. Set the bottom-right corner coordinates of the search region. Move the arrow cursor to the required point and press the Enter Key. The set rectangle is registered as the search region.



4-5-4 Setting the Evaluation Conditions: C.Conditions

The correlation of the searched image is used to evaluate it as OK or NG.

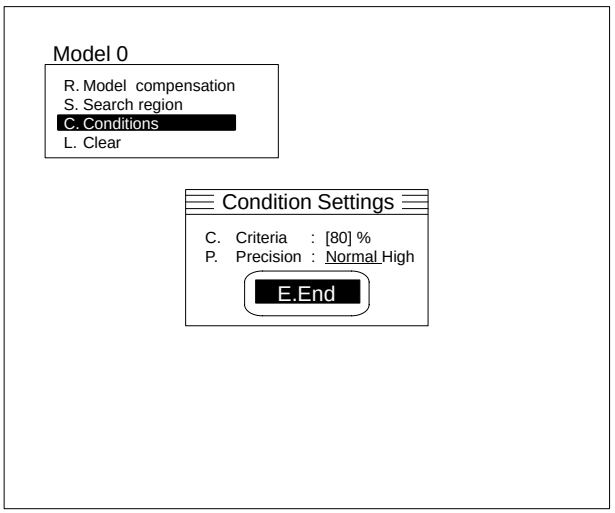
Accuracy	Units
Standard	Pixels
High	Sub-pixels

The evaluation criterion can be set by referring to the correlation measured for each model. Refer to *4-9-2 Checking Measured Values and Inspection Times (Pattern Inspection Program): M.Inspection monitor*.

Procedure

1, 2, 3...

1. Select “C.Conditions,”
2. Input the evaluation criterion.
3. Select the accuracy.



4. Select “E.End.” The evaluation conditions are now set.

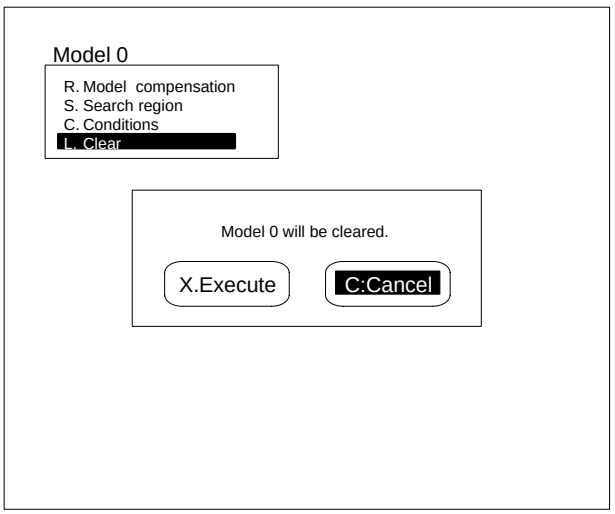
4-5-5 Clearing the Model Data: L.Clear

Clears the model search region and reverts the evaluation criterion and accuracy settings to the initial values. You are recommended to use “L.Clear” to clear existing model data before registering a new model.

Procedure

1, 2, 3...

1. Select “L.Clear.” A confirmation message is displayed.

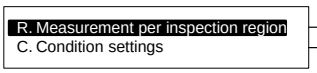


2. Check that the model number to be cleared is selected and select “X.Execute.” All data for the selected model number is cleared.

4-6 O.Conditions

The Surface Defect Inspection Program can be used to detect chips, burrs, scratches, and dirt as surface defects.

Use “O.Conditions” to set inspection items and evaluation criterion for each inspection region.



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Setting Inspection Conditions Page 74

4-6-1 Checking Measured Values: R.Measurement per inspection region

Conduct inspections to check the measured values for the inspection items.

Conduct inspections on satisfactory and defective products to to get a feel for the measured values. Set the evaluation criterion at the borderline between a satisfactory product and a defect.

The inspection items differ according to the inspection mode set using “R.Registration.”

Large Defects

Large defects can be determined in the burr and chip on line inspection, burr and chip on circle inspection, and scratch and dirt inspection modes by detecting large chips, burrs, scratches, and areas of dirt.

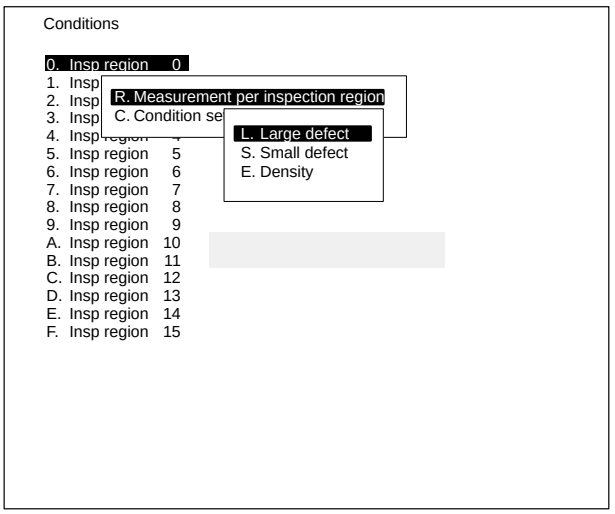
A cross cursor is displayed at the position in the inspection region where the defect is maximum and the degree of defectiveness is displayed as a value between 0 and 255. The move clearly defined the defect, the higher the displayed value.

Use small defect (SD) inspection to achieve stable inspection of small chips, burrs, scratches, and areas of dirt, not exceeding approximately 30 x 30 pixels.

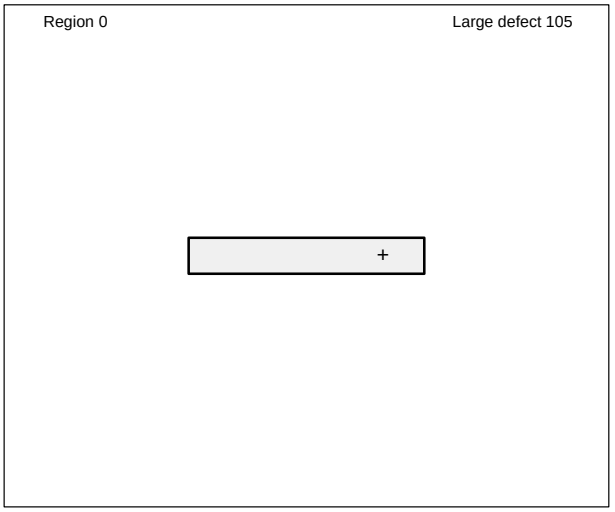
Procedure

1, 2, 3...

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



3. Select “L.Large defect.” The measurement runs continually and the degree of large defect is displayed.



Small Defects

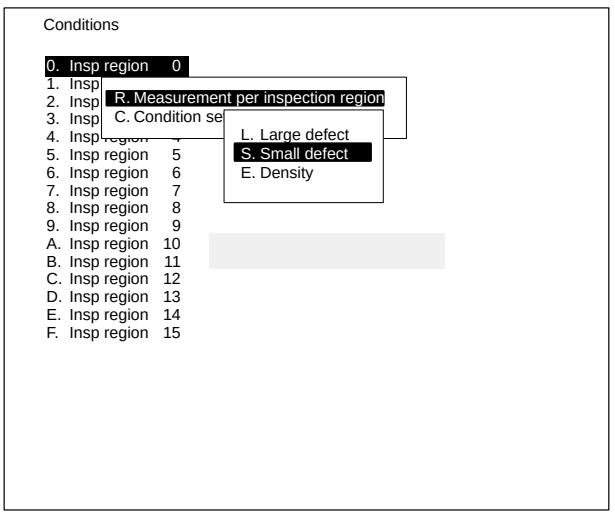
Small defects can be determined in the burr and chip on line inspection, burr and chip on circle inspection, and scratch and dirt inspection modes by detecting chips, burrs, scratches, and areas of dirt not exceeding approximately 30 x 30 pixels, which are comparatively small compared to large defects.

A cross cursor is displayed at the position in the inspection region where the defect is maximum and the degree of defectiveness is displayed as a value between 0 and 255. The move clearly defined the defect, the higher the displayed value.

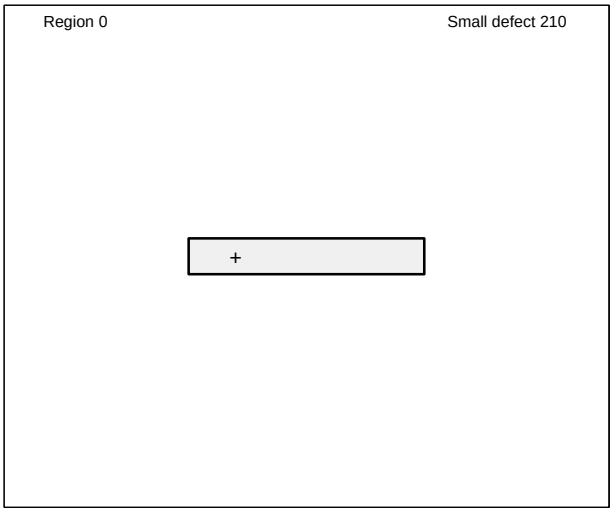
Procedure

1, 2, 3...

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



3. Select “S.Small defect.” The measurement runs continually and the degree of small defect is displayed.



Density

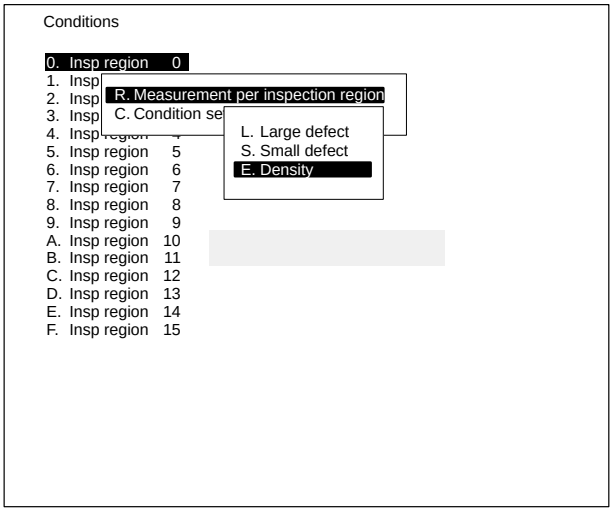
The density in an inspection region can be determined in the burr and chip on line inspection and burr and chip on circle inspection modes.

This inspection is used to determine whether an object is present.

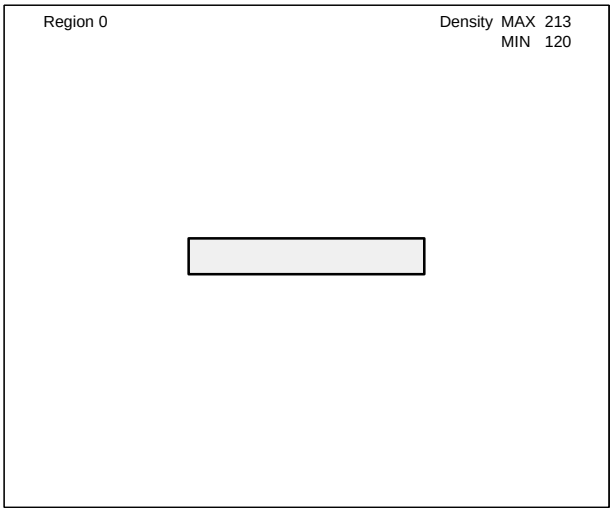
Procedure

1, 2, 3...

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



3. Select “E.Density.” The measurement runs continually and the maximum and minimum densities are displayed.



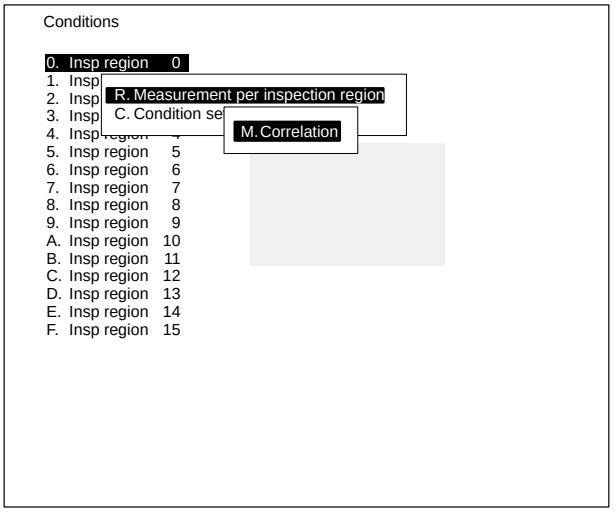
Correlation

The correlation can be checked in the shape inspection mode. The correlation with the registered model is determined and displayed as a value between 0 and 100.

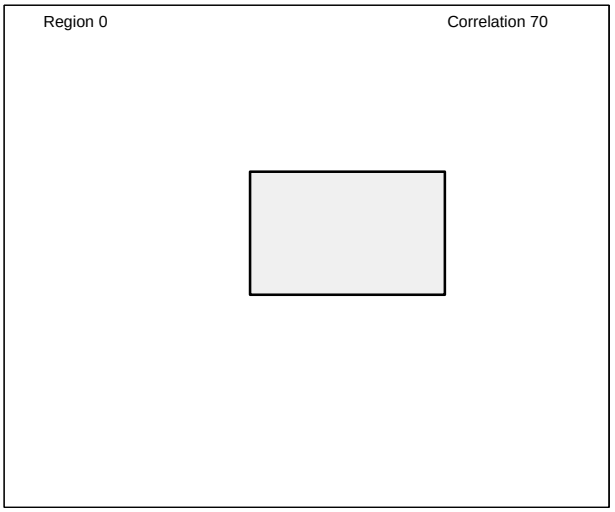
Procedure

1, 2, 3...

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



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



4-6-2 Setting Inspection Conditions: C.Condition settings

Set the inspection items and the OK and NG evaluation criterion.

The settable inspection items differ according to the inspection mode set using “R.Registration.”

Refer to the values determined using “R.Measurement per inspection region” when setting the conditions.

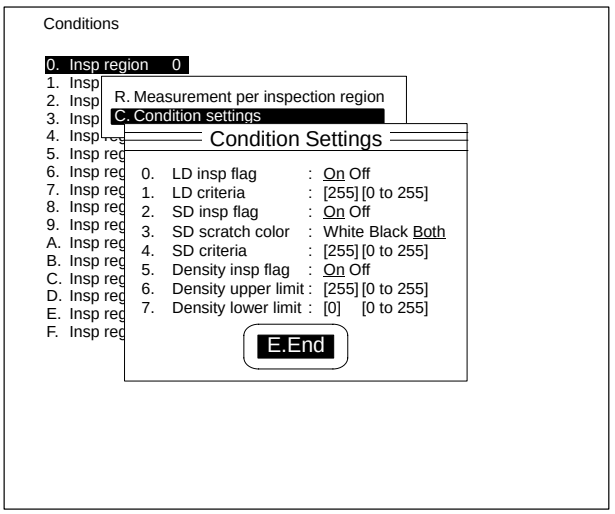
Inspection items		Description
LD	Inspection flag	Detect large chips, burrs, scratches, and areas of dirt. Large defect detection is possible in the burr and chip on line inspection, burr and chip on circle inspection, and scratch and dirt inspection modes. Set the LD insp flag ON to detect large defects. Use small defect (SD) inspection to achieve stable inspection of small chips, burrs, scratches, and areas of dirt, not exceeding approximately 30 x 30 pixels.
	Criteria	Set the evaluation criterion between 0 and 255. The product is evaluated as OK if the degrees of the detected defects are all below the evaluation criterion. The product is evaluated as NG if the degree of any one detected defect exceeds the evaluation criterion.
SD	Inspection flag	Detect small chips, burrs, scratches, and areas of dirt, not exceeding approximately 30 x 30 pixels. Detects chips, burrs, scratches, and areas of dirt which are comparatively small compared to large defects. Small defect detection is possible in the burr and chip on line inspection, burr and chip on circle inspection, and scratch and dirt inspection modes. Set the SD insp flag ON to detect small defects.
	Scratch color	Select the color of scratches to be detected. Select the color the scratch appears on the correlation image.
	Criteria	Set the evaluation criterion between 0 and 255. The product is evaluated as OK if the degrees of the detected defects are all below the evaluation criterion. The product is evaluated as NG if the degree of any one detected defect exceeds the evaluation criterion.
Density	Inspection flag	The maximum and minimum densities are measured inside the inspection region to determine whether an object is present. Object detection by density measurement is possible in the burr and chip on line inspection, burr and chip on circle inspection, and scratch and dirt inspection modes. Set the Density Insp Flag ON to measure the densities.
	Upper limit/Lower limit	Set the upper and lower limits between 0 and 255. The inspection is OK if both the maximum and minimum densities lie between the upper and lower limits or NG if either density lies outside the limits.
Correlation		The correlation with the registered model is determined for the shape inspection. The correlation can be measured in the shape inspection mode. Set the correlation value between 0 and 100. The inspection is OK if the correlation value exceeds the evaluation criterion or NG if it is less than the evaluation criterion.

An inspection can be run using the set data to measure the inspection time. Refer to *4-9-1 Checking Measured Values and Inspection Times (Surface Defect Inspection Program): M.Inspection monitor*.

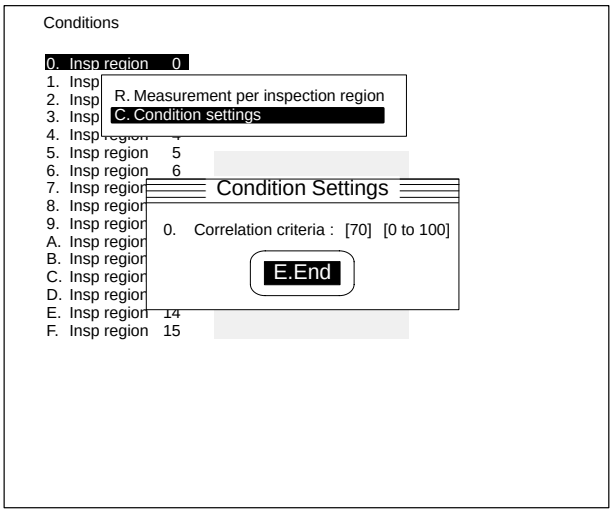
Procedure

1, 2, 3...

1. Select the inspection region number.
2. Select “C.Conditions.”
3. Set the inspection items and conditions. When setting the density evaluation conditions, make sure that the upper limit is set to a higher value than the lower limit.



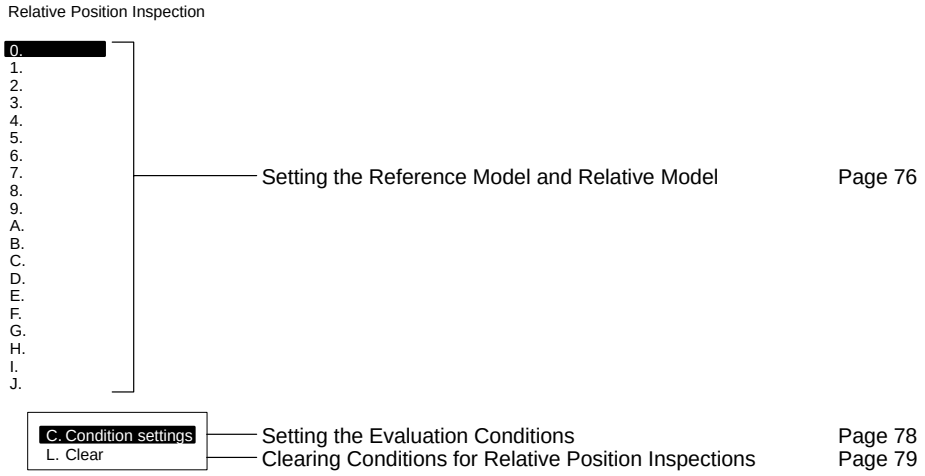
4. Select “E.End.” The inspection conditions are set.



4-7 R.Relative Position

The Pattern Inspection Program allows inspection of the relative position between two models. This inspection is called the relative position inspection and 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). It is used for inspections, such as checking that labels are stuck on correctly.

Set the inspection conditions for the relative position inspection using “R.Relative position.”



4-7-1 Setting the Reference Model and Relative Model: R.Relative position

Select the reference model and relative model numbers.

The position of the relative model can be determined from the origin position on the reference model. The position of a model is the center of gravity of the rectangle used to register the model.

As the cursor is moved to select the model number, the model for each cursor position is displayed in broken lines (or in solid lines if the model is set as a reference model). The filtering selected at the time the model was registered is displayed at the bottom-left of the screen.

The registered model can be displayed over the input image by pressing the Shift + Escape Keys and turning ON “S.Reference model.”

Twenty relative position inspections can be set for each camera.

Note A model number cannot be selected if no model is registered for it. Register a model before selecting the model number. Refer to *4-5-1 Registering Models*.

It is not possible to conduct relative position inspections with a model registered for a different camera if multiple cameras are used. Select the camera number before setting up the relative position inspection. Refer to *4-3-1 Selecting the Camera Number*.

Any model can be set as the reference model for only one relative position inspection. However, a model can be set as the relative model for multiple relative position inspections.

Example Label Displacement Inspection:

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

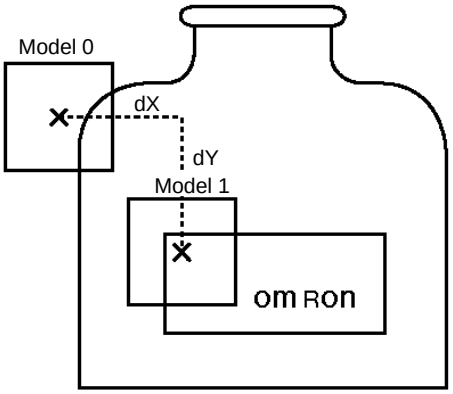
Model cannot be set as the reference model for more than one inspection.

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

Model can be set as the relative model for more than one inspection.

Inspection Example

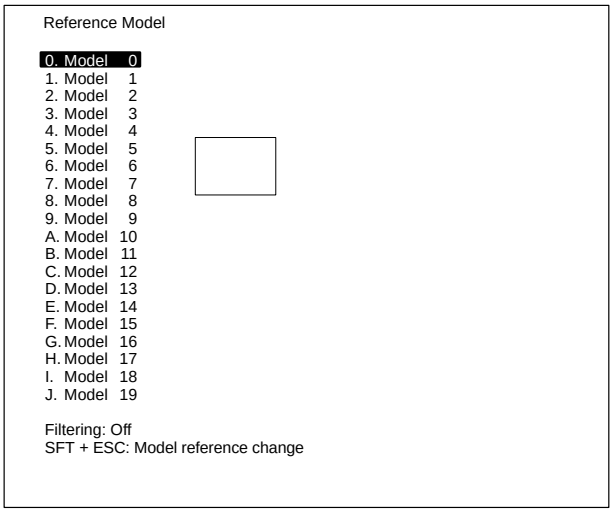
Reference Model: Model 0
Relative Model Model 1



Procedure

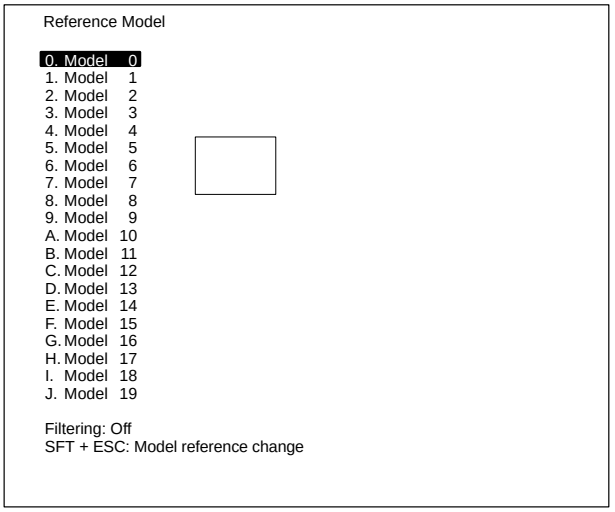
1, 2, 3...

1. Select the number of the relative position inspection. A table of model numbers is displayed.



2. Select model number of the reference model. A table of model numbers is displayed.

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



4-7-2 Setting the Evaluation Conditions: C.Condition settings

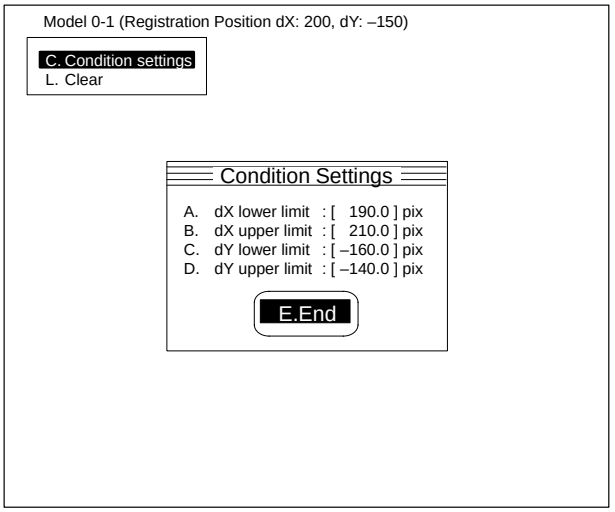
OK/NG evaluation of the position of the relative model with respect to the reference model is possible because the position of the reference model is fixed. In the example below, the upper and lower limits of the permitted range are fixed in units of sub-pixels.

The evaluation conditions can be set by referring to measured relative position data. Refer to *4-9-2 Checking Measured Values and Inspection Times (Pattern Inspection Program): M.Inspection monitor.*

Procedure

1, 2, 3...

1. Select “C.Condition settings.” The screen to set the upper and lower limits is displayed.
2. Input the upper and lower limits. Make sure that the dX upper limit ≥ the dX lower limit. Make sure that the dY upper limit ≥ the dY lower limit.



What are dX and dY?
Refer to the label displacement inspection diagram in *4-7-1 Setting the Reference Model and Relative Model: R.Relative position*.

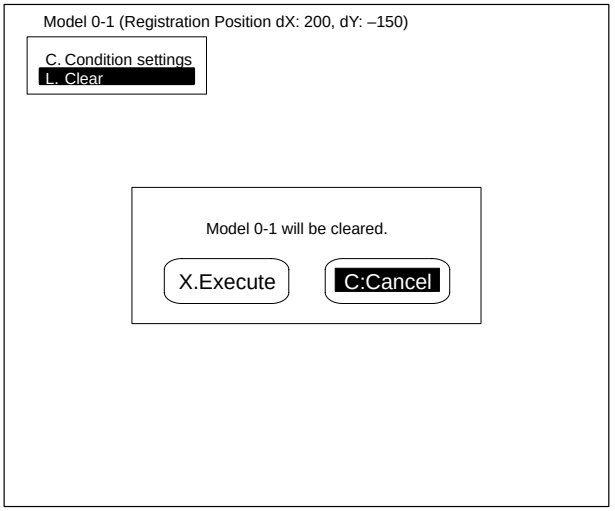
3. Select “E.End.”

4-7-3 Clearing Conditions for Relative Position Inspections: L.Clear

Clears the reference and relative models and reverts the evaluation conditions to the initial values. “L.Clear” is recommended to clear existing settings before setting new relative position inspection data.

Procedure

1, 2, 3... 1. Select “L.Clear.” A confirmation message is displayed.



2. Check that the model number to be cleared is selected and select “X.Execute.” All relative position inspection data is cleared.

4-8 P.Position Compensation

Set the position compensation data.

Use the position compensation functions for inspected objects which are not fixed in position or angle of inclination.

The position compensation function calculates the displacement between the inspection object position and the reference position and automatically scrolls the image by the detected amount of displacement before the inspection is started. This ensures that the inspection position lies within the inspection region.

R. PC registration	Selecting the Position Compensation Mode	Page 80
T. Rotation angle	Setting Rotation Compensation Range	Page 88
A. PC region	Setting the Position Compensation Region	Page 89
S. Reference	Checking Data Set with “P.Position compensation”	Page 91

4-8-1 Selecting the Position Compensation Mode: R.Position compensation registration

Select the position compensation mode and register the reference model used to determine the displacement.

Three different methods of position compensation can be used.

1-model Position Compensation:
One feature (corner or mark) on the inspected object is used to determine the position and rotation of the object.

2-model Position Compensation:
The angle of the line joining two features on the inspected object is used to determine the rotation of the object.

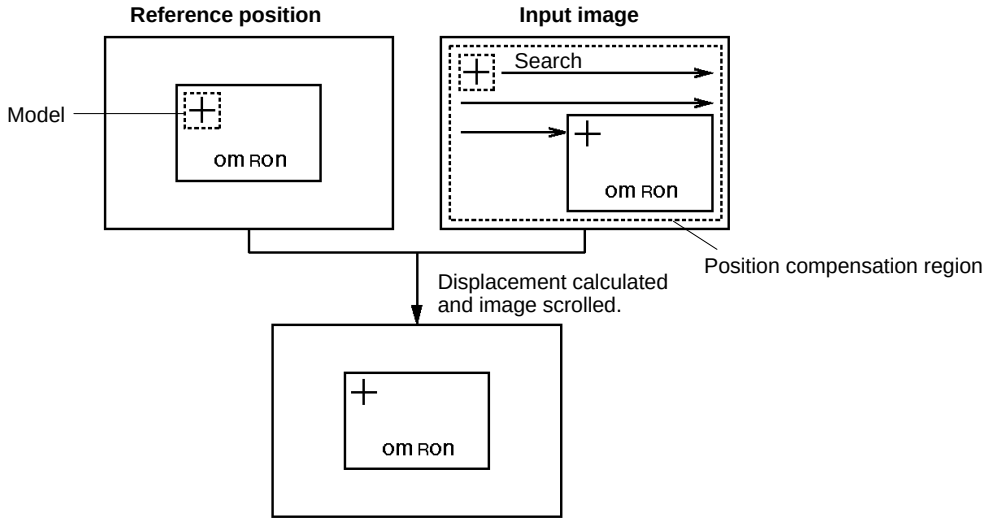
Circle Positioning:
Use to detect the position of circular workpieces.

Conduct inspections using the set data to check the inspection time. Refer to *4-9-1 Checking Measured Values and Inspection Times (Surface Defect Inspection Program): M.Inspection monitor*. Refer to *4-9-2 Checking Measured Values and Inspection Times (Pattern Inspection Program): M.Inspection monitor*.

To increase the accuracy of the registered reference position, set the display to static (freeze) before setting the position compensation data. Refer to *4-2-1 Selecting the Image Display: F.Freeze*.

1-Model Position Compensation

One feature (corner or mark) on the workpiece is registered as the model. The position of the registered model is the reference position. A search detects the displacement (X, Y, θ) between the reference position coordinates and the coordinates of the position with the highest correlation to the model, and the image then scrolls by the detected amount of displacement.



Note Correct inspection is not possible if different filtering is selected during inspection than at the time the model was registered. If filtering is to be used for the inspection image, select this filtering for each camera number before registering the model data. Refer to *4-3-2 Selecting Filtering: F.Filtering*.

The position compensation can be set for each camera. If multiple cameras are used, select the required camera number before setting the position compensation. Refer to *4-3-1 Selecting the Camera Number: C.Camera*.

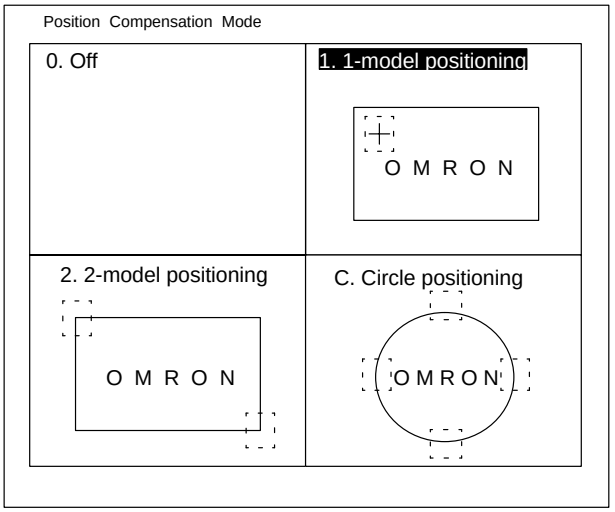
Procedure

1, 2, 3... 1. Select “R.Position compensation registration.”

2. Select “1.1-model positioning.” A rectangle is displayed.

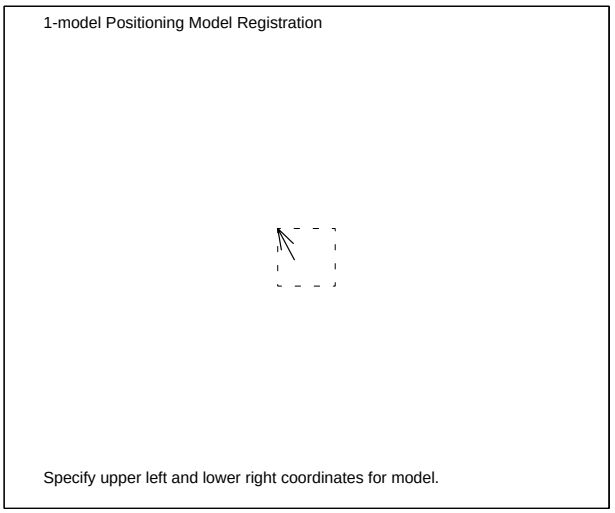
   The rectangle is displayed in the center of the screen if a new model is being registered.

   If a model is already registered, the rectangle is displayed in the region where the model is registered.

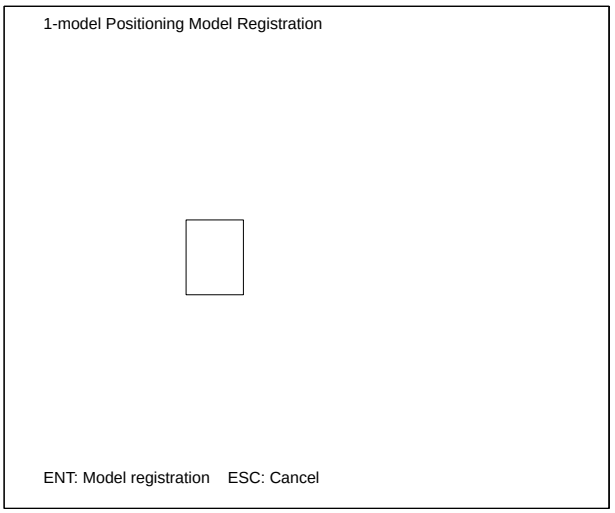


3. Set the top-left corner coordinates of the region to be registered as the model. Move the arrow cursor to the required point and press the Enter Key.

4. Set the bottom-right corner coordinates of the region to be registered as the model. Move the arrow cursor to the required point and press the Enter Key.

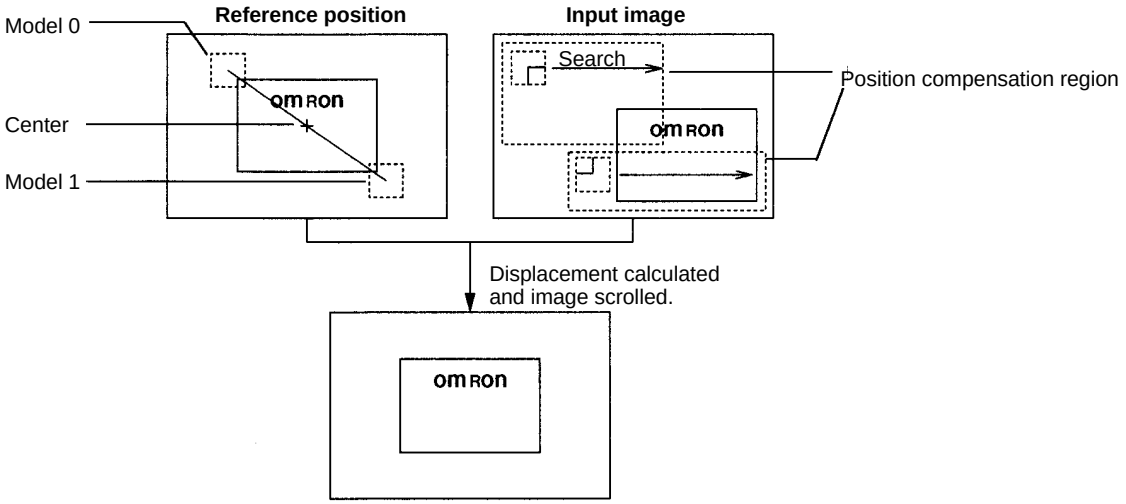


5. Press the Enter Key. The image in the set rectangle is registered as the model.



2-Model Position Compensation

Two features on the workpiece are registered as the models. The positions of the registered models are the reference positions. A search detects the position with the highest correlation for each model (model center coordinates). The center coordinates (X, Y) and rotation (θ) of the line joining the two model centers are detected and the image scrolls by the detected amount of displacement.



Note Correct inspection is not possible if different filtering is selected during inspection than at the time the model was registered. If filtering is to be used for the inspection image, select this filtering for each camera number before registering the model data. Refer to *4-3-2 Selecting Filtering: F.Filtering*.

The position compensation can be set for each camera. If multiple cameras are used, select the required camera number before setting the position compensation. Refer to *4-3-1 Selecting the Camera Number: C.Camera*.

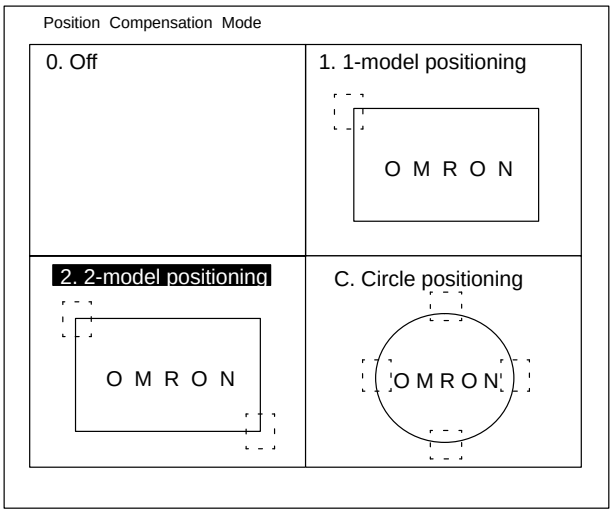
Procedure

1, 2, 3... 1. Select “R.Position compensation registration.”

2. Select “2.2-model positioning.” Two rectangles are displayed.

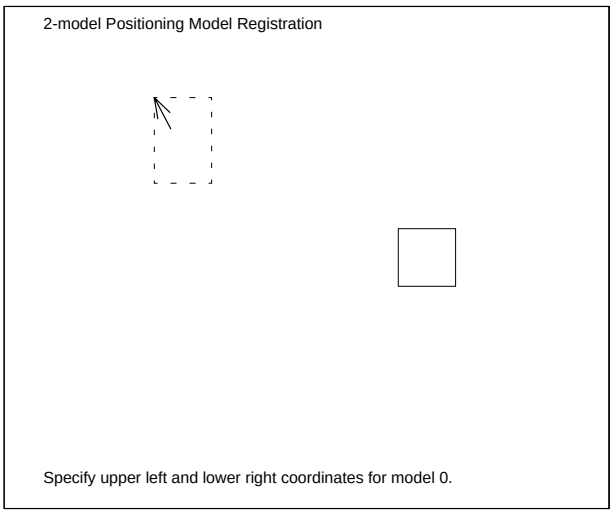
   The rectangles are displayed in the center of the screen if a new model is being registered.

   If a model is already registered, the rectangles are displayed in the region where the models are registered.



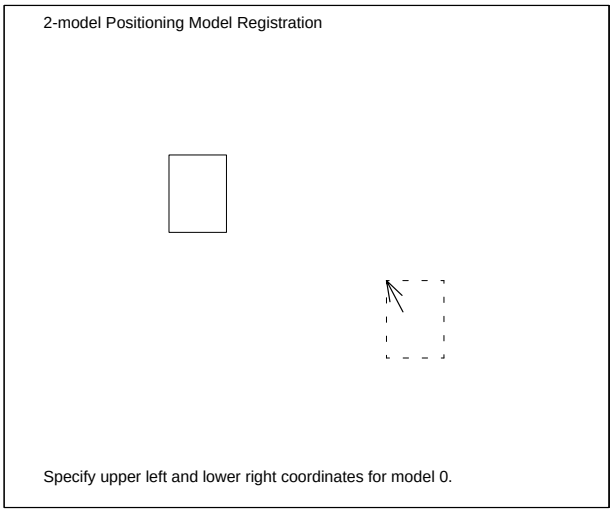
3. Set the top-left corner coordinates of the region to be registered as model 0. Move the arrow cursor to the required point and press the Enter Key.

4. Set the bottom-right corner coordinates of the region to be registered as model 0. Move the arrow cursor to the required point and press the Enter Key.

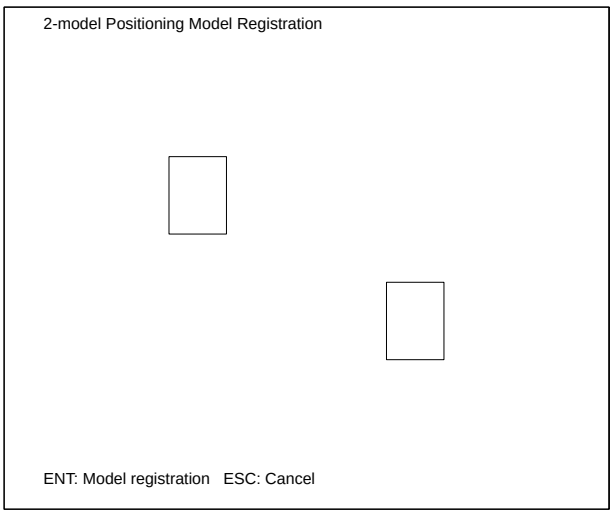


5. Set the top-left corner coordinates of the region to be registered as model 1. Move the arrow cursor to the required point and press the Enter Key.

6. Set the bottom-right corner coordinates of the region to be registered as model 1. Move the arrow cursor to the required point and press the Enter Key.



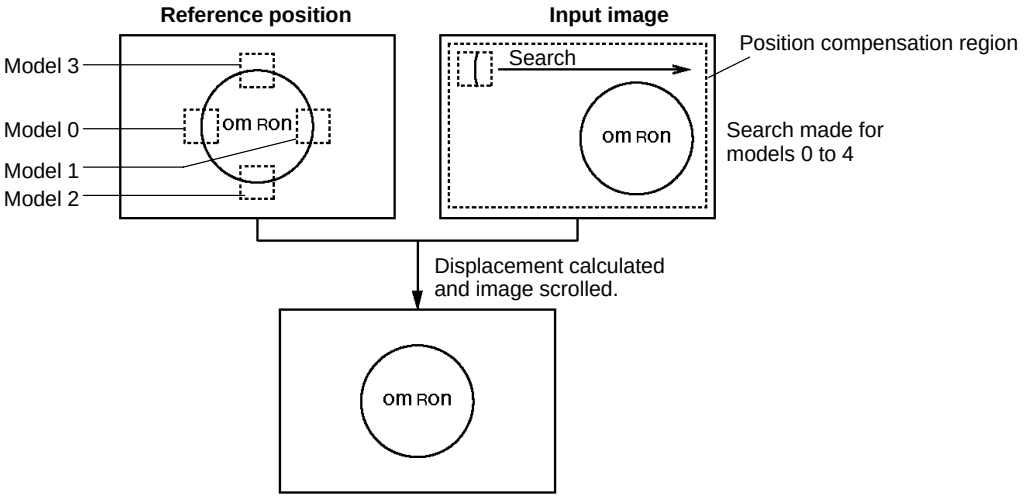
7. Press the Enter Key. The images in the two set rectangles are registered as model 0 and model 1.



Circle Positioning

Four positions on the workpiece are registered as the models. The positions of the registered models are the reference positions. A search detects the position with the highest correlation for each model (model center coordinates). The positions of the four model centers are used to detect the center coordinates (X, Y) of the circle and the image scrolls by the detected amount of displacement.

No compensation is made for rotational displacement. Use 1-model positioning or 2-model positioning for workpieces requiring compensation for angular displacement.



Note Correct inspection is not possible if different filtering is selected during inspection than at the time the model was registered. If filtering is to be used for the inspection image, select this filtering for each camera number before registering the model data. Refer to *4-3-2 Selecting Filtering: F.Filtering*.

The position compensation can be set for each camera. If multiple cameras are used, select the required camera number before setting the position compensation. Refer to *4-3-1 Selecting the Camera Number: C.Camera*.

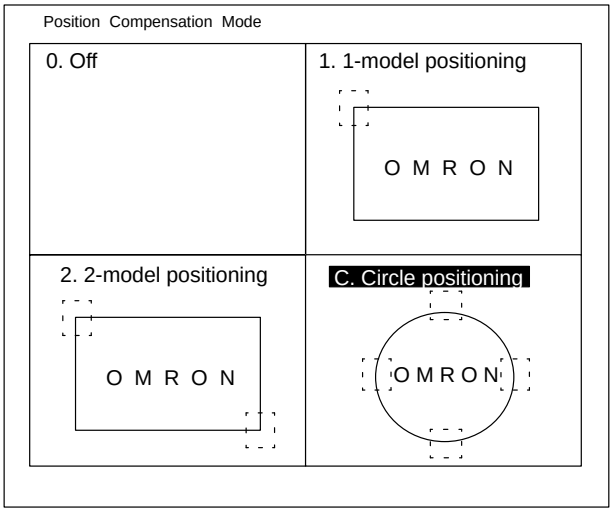
Procedure

1, 2, 3...

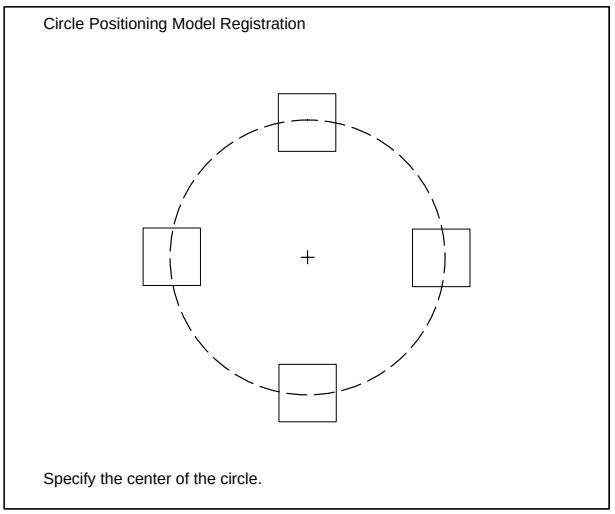
1. Select “R.Position compensation registration.”
2. Select “C.Circle positioning.” A circle is displayed with four rectangles on the circumference.

   The circle and four rectangles are displayed in the center of the screen if a new model is being registered.

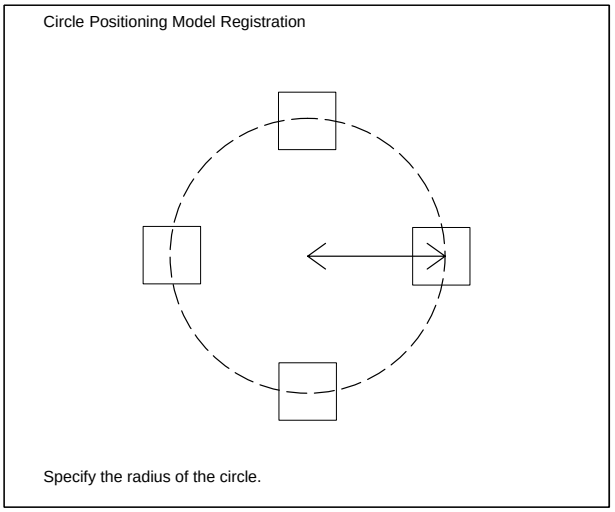
   If a model is already registered, the circle and four rectangles are displayed in the region where the models are registered.



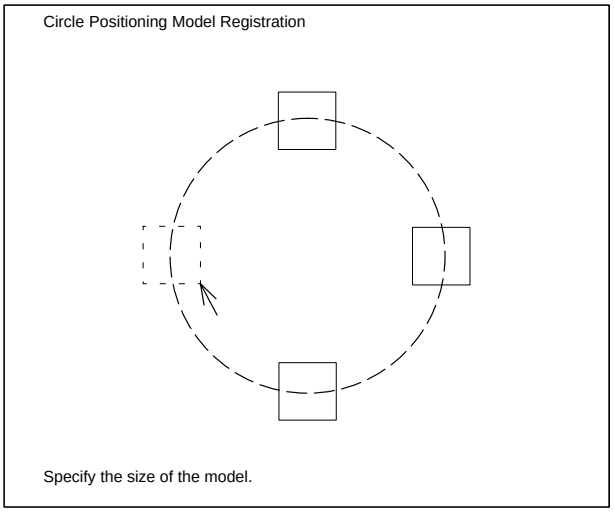
3. Set the circle center coordinates. Move the arrow cursor to the required point and press the Enter Key.



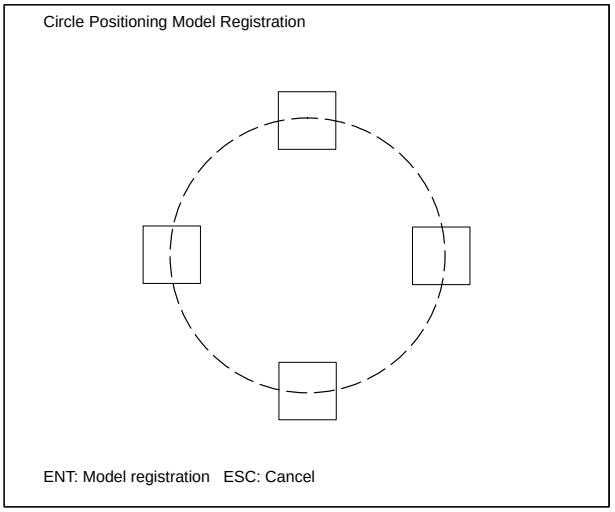
4. Set the circle radius. Move the arrow cursor to the required point and press the Enter Key.



5. Set the size of the models. Only model 0 is displayed in broken lines. The size of all models changes when the arrow cursor is moved. Set the models to the required size and press the Enter Key.



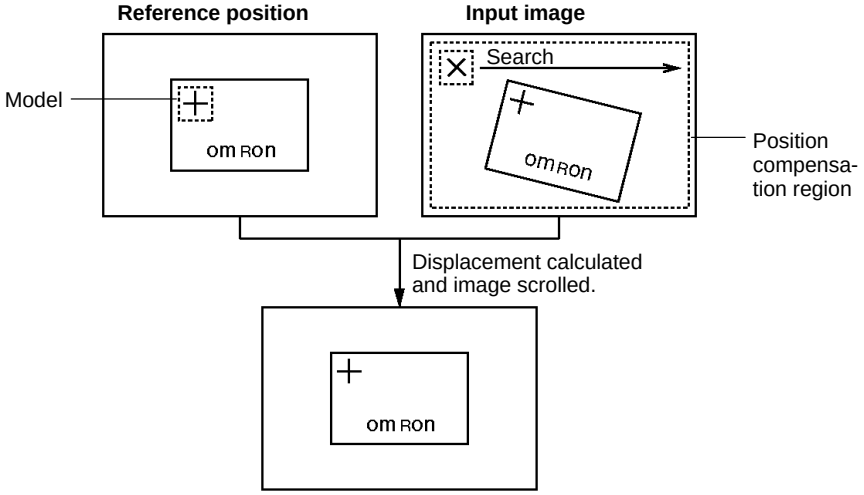
6. Press the Enter Key. The images in the four set rectangles are registered as the models.



4-8-2 Setting Rotation Compensation Range: T.Rotation angle

Set “T.Rotation angle” according to the angle of rotation if the inspected image is rotated. The model is registered as the same model which was registered using “P.Position compensation/R.Position compensation registration” rotated in 5° increments within the set range.

Incorrect position compensation results if the angle of rotation of the inspected object exceeds the set range.



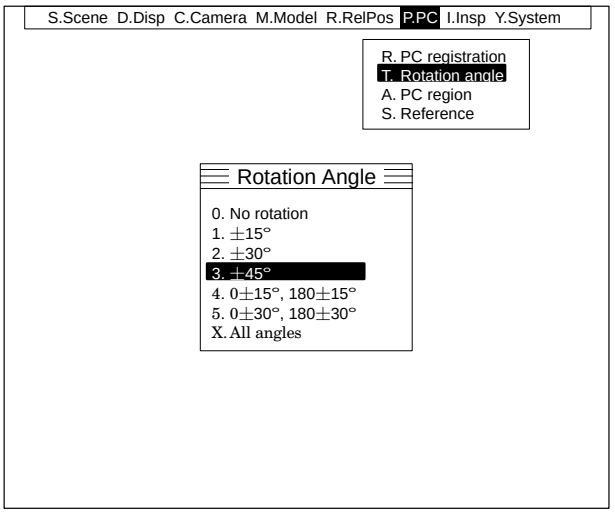
Conduct inspections using the set data to check the inspection time. Refer to *4-9-1 Checking Measured Values and Inspection Times (Surface Defect Inspection Program): M.Inspection monitor*. Refer to *4-9-2 Checking Measured Values and Inspection Times (Pattern Inspection Program): M.Inspection monitor*.

The position compensation can be set for each camera. If multiple cameras are used, select the required camera number before setting the rotation compensation range. Refer to *4-3-1 Selecting the Camera Number: C.Camera*.

Procedure

1, 2, 3...

1. Select “T.Rotation angle.”
2. Select the rotation compensation range. The rotation compensation range is set.



4-8-3 Setting the Position Compensation Region: A.Position compensation region

Sets the region to search for each position compensation model.

If either “2.2-model positioning” or “C.Circle positioning” is selected under “P.Position compensation/R.Position compensation registration,” sequentially set the position compensation regions to search, starting from model 0.

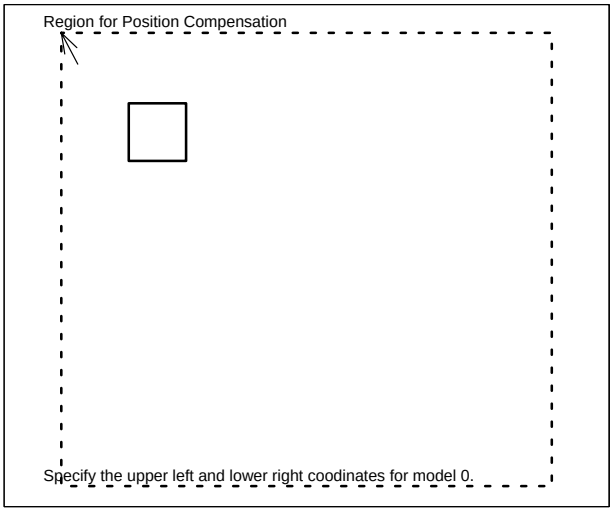
Set the position compensation region large enough to include any movement of the inspected object. Correct position compensation is not possible if the position compensation model cannot be found inside the position compensation region.

The position compensation regions can be set for each camera. If multiple cameras are used, select the required camera number before setting the position compensation regions. Refer to *4-3-1 Selecting the Camera Number: C.Camera*.

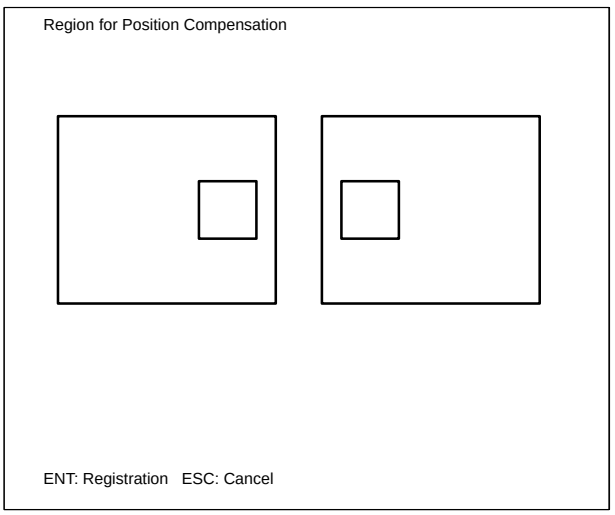
Procedure

1, 2, 3...

1. Select “A.Position compensation region.” The position compensation region is displayed in broken lines and the region registered as the position compensation model is displayed in solid lines.
2. Set the top-left corner coordinates of the position compensation region. Move the arrow cursor to the required point and press the Enter Key.

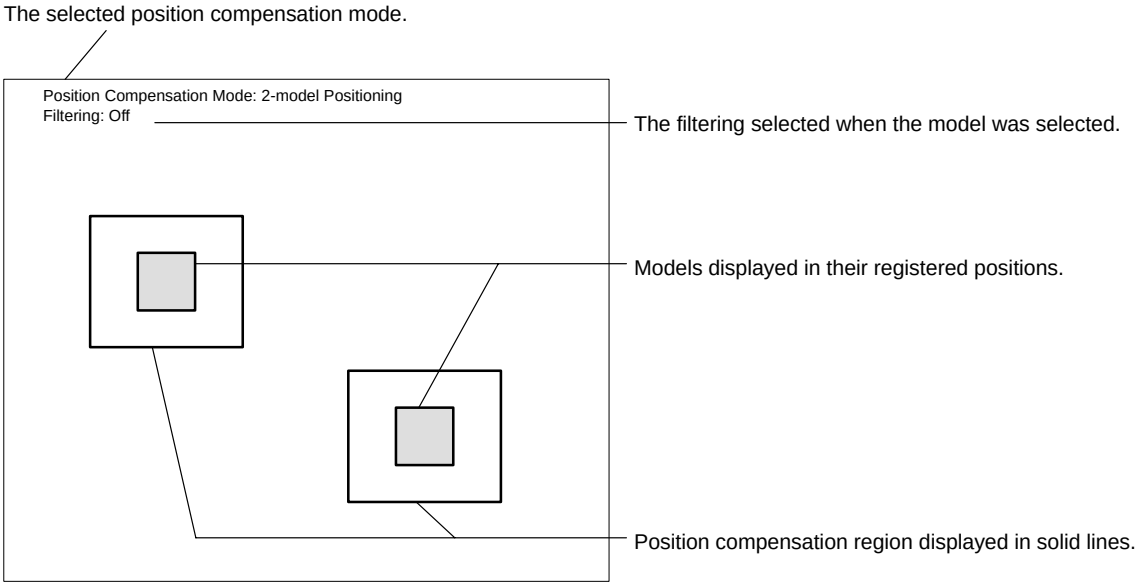


3. Set the bottom-right corner coordinates of the position compensation region. Move the arrow cursor to the required point and press the Enter Key. Repeat steps 2 and 3 to register the position compensation regions for multiple position compensation models.
4. Press the Enter Key. The specified regions are registered as the position compensation regions.



4-8-4 Checking Data Set with “P.Position compensation”: S.Reference

Displays the data set using “P.Position compensation” to allow checking of all data related to position compensation. However, modification of the data is not possible.



After the image is input using “D.Display/P.Input image after position compensation,” select “P.Position compensation/S.Reference” to display the models in their registered positions. Refer to *4-2-3 Reading Position-compensated Image: P.Input image after position compensation*.

Procedure Select “S.Reference.” The data is displayed.

4-9 I.Inspection

Runs the inspection based on the set data. The inspection monitor is used to check measured values and inspection times.

The inspection monitor of the Pattern Inspection Program allows adjustment of the evaluation criterion while referring to the measured values.

M.Inspection Monitor
I. Inspection
Checking Measured Values and Inspection Times Page 91
Checking Measured Values and Inspection Times Page 94
Running the Inspection: I.Inspection Page 101

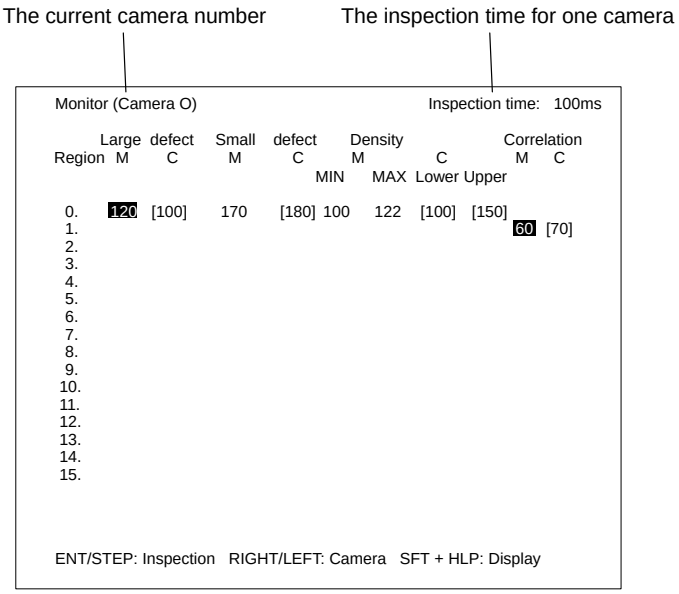
4-9-1 Checking Measured Values and Inspection Times (Surface Defect Inspection Program): M.Inspection monitor

This function allows the measured values and inspection times based on the set data to be checked before the actual inspection is started.

The inspection results are output to the video monitor only, and not to any Terminal Block Unit or Parallel I/O Unit which is mounted.

The inspection time is displayed on the video monitor for the one camera from which the image is currently displayed. If multiple cameras are used, switch from one camera to the next and use this function to check the inspection time for each camera. The overall inspection time for the scene is the sum of the inspection times for each camera.

Use the inspection times as a reference to adjust the input timing of the Inspect instructions.



Item	Description
Large defect	If the LD inspection flag is ON, the measured value is displayed between 0 and 255. If the degree of defectiveness exceeds the evaluation criterion, the result is evaluated as NG and the measured value is highlighted.
Small defect	If the SD inspection flag is ON, the measured value is displayed between 0 and 255. If the degree of defectiveness exceeds the evaluation criterion, the result is evaluated as NG and the measured value is highlighted.
Density	If the density inspection flag is ON, the measured value is displayed between 0 and 255. If the degree of defectiveness exceeds the evaluation criteria range, the result is evaluated as NG and the measured value is highlighted.
Correlation	If the density inspection flag is ON, the measured value is displayed between 0 and 100. If the degree of defectiveness is less than the evaluation criteria range, the result is evaluated as NG and the measured value is highlighted.

Note Instruction Input Timing:
Do not input the next instruction until the previous instruction execution is complete, or incorrect execution of both the current instruction and the next instruction may result.
If a Terminal Block Unit or Parallel I/O Unit is mounted, the Busy signal remains ON during instruction execution. Check that the Busy signal has turned OFF before inputting the next instruction.

Console

The following instructions can be input from the Console.

Instruction	Keys	Action
Inspect	ENT	Runs the inspection once.
Select camera	◀ / ▶	Selects the displayed camera. The inspection is run for the selected camera number.
Character display/No display	SHIFT + HELP	Sets whether characters are displayed or not. If a NG result is produced by a burr and chip on line inspection, burr and chip on circle inspection, or scratch and dirt inspection, a cross cursor is displayed at the position in the inspection region where the defect is maximum. If a NG result is produced by a shape inspection, a cross cursor is displayed at the center of gravity of the rectangle enclosing the NG inspection region. In order to check the position of the cross cursor, do not display characters on the screen.

When the camera for the inspection is switched, the inspected image differs according to the type of camera.

Camera	Inspected image
F300-A20/A20R	The image is read immediately the camera is selected and the inspection is conduced on the input image.
F300-A20S/A20RS/A21RS	Each time the Inspect instruction is input, the images are simultaneously input to the memory of each camera. When a camera is selected, the inspection is conducted on the image stored in the camera memory.

Note The F300-A21RS Shutter Simultaneously Camera I/F Unit is still under development and is not yet available as of October 1, 1995.

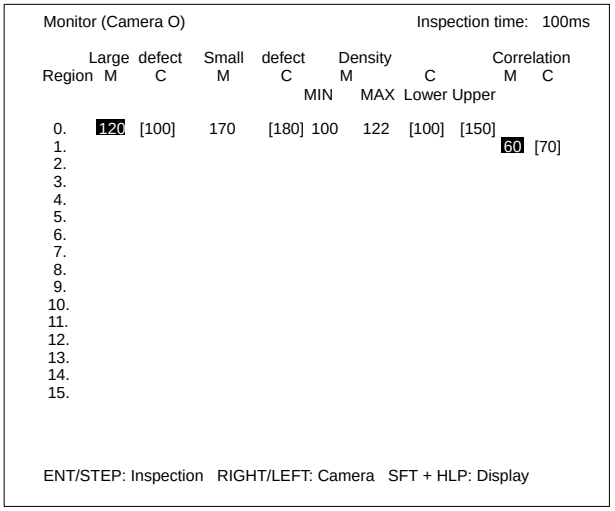
STEP Signal Input

The inspection runs once each time the STEP signal turns from OFF to ON.

Procedure

1, 2, 3...

1. Select “M.Inspection monitor.” Shows the inspection monitor screen.
2. Press the Enter Key or input the STEP signal. The inspection monitor results are displayed.



4-9-2 Checking Measured Values and Inspection Times (Pattern Inspection Program): M.Inspection monitor

This function allows the measured values and inspection times based on the set data to be checked before the actual inspection is started.

The inspection results are output to the video monitor only, and not to any Terminal Block Unit or Parallel I/O Unit which is mounted.

Use this function for the fine adjustment of evaluation criteria or to determine the inspection time.

The inspection monitor offers the following three modes:

- Search monitor
- Correlation value monitor
- Relative position monitor

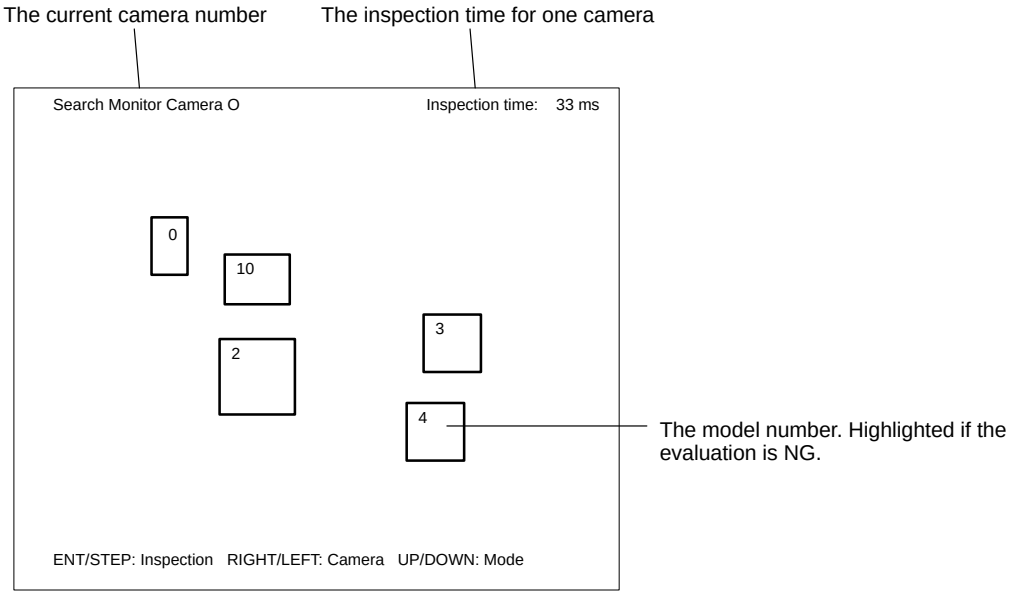
Search Monitor

Searches for registered models.

A rectangular frame and the model number are displayed where each model is found.

The inspection time is displayed for the camera from which the image is currently displayed. If multiple cameras are used, switch from one camera to the next and use this function to check the inspection time for each camera. The overall inspection time for the scene is the sum of the inspection times for each camera.

Use the inspection times as a reference to adjust the input timing of the Inspect instructions.



Note Instruction Input Timing:
Do not input the next instruction until the previous instruction execution is complete, or incorrect execution of both the current instruction and the next instruction may result.
If a Terminal Block Unit or Parallel I/O Unit is mounted, the Busy signal remains ON during instruction execution. Check that the Busy signal has turned OFF before inputting the next instruction.

Console The following instructions can be input from the Console.

Instruction	Keys	Action
Inspect	ENT	Runs the inspection once.
Select camera	◀ / ▶	Selects the displayed camera. The inspection is run for the selected camera number.
Switch modes	▲ / ▼	Select the search monitor, correlation value monitor, or relative position monitor.

When the camera for the inspection is switched, the inspected image differs according to the type of camera.

Camera	Inspected image
F300-A20/A20R	The image is read immediately the camera is selected and the inspection is conduced on the input image.
F300-A20S/A20RS/A21RS	Each time the Inspect instruction is input, the images are simultaneously input to the memory of each camera. When a camera is selected, the inspection is conducted on the image stored in the camera memory.

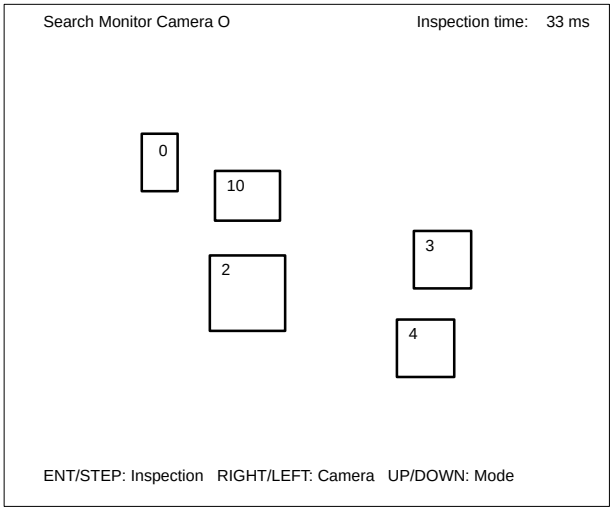
Note The F300-A21RS Shutter Simultaneously Camera I/F Unit is still under development and is not yet available as of October 1, 1995.

STEP Signal Input The inspection runs once each time the STEP signal turns from OFF to ON.

Procedure

1, 2, 3...

1. Select “M.Inspection monitor.” Shows the search monitor screen.
2. Press the Enter Key or input the STEP signal. The inspection runs and the searched positions are displayed.



Correlation Value Monitor

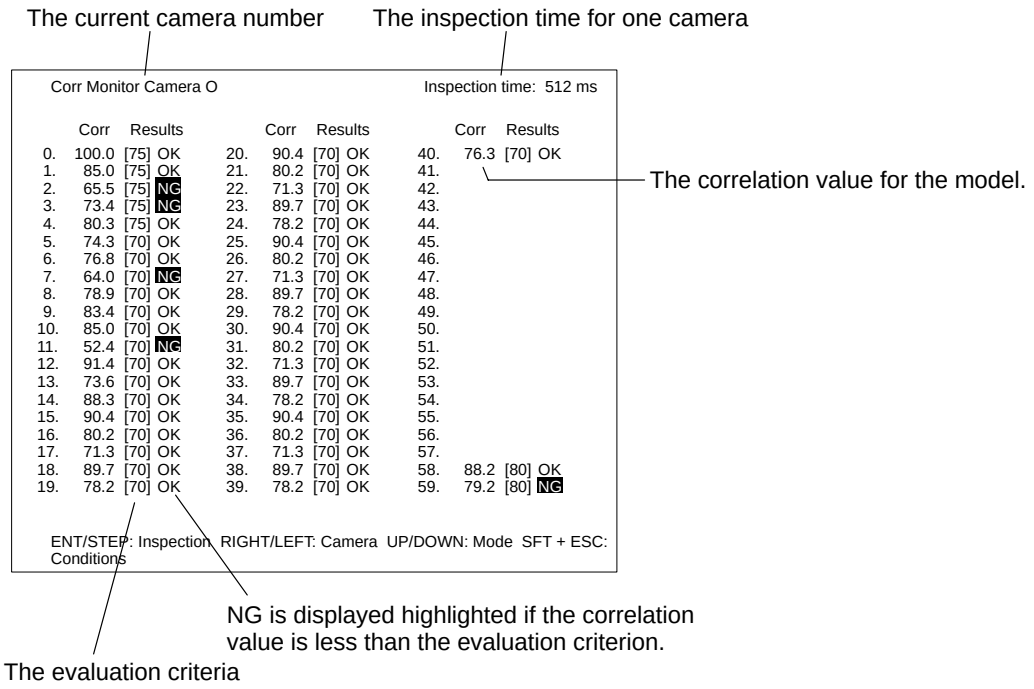
Measures the correlation value for each model.

The correlation values and evaluation results are displayed.

The inspection time is displayed for the camera from which the image is currently displayed. If multiple cameras are used, switch from one camera to the next and use this function to check the inspection time for each camera. The overall inspection time for the scene is the sum of the inspection times for each camera.

Use the inspection times as a reference to adjust the input timing of the Inspect instructions.

Refer to the correlation values when changing the evaluation conditions.



Note Instruction Input Timing:
Do not input the next instruction until the previous instruction execution is complete, or incorrect execution of both the current instruction and the next instruction may result.
If a Terminal Block Unit or Parallel I/O Unit is mounted, the Busy signal remains ON during instruction execution. Check that the Busy signal has turned OFF before inputting the next instruction.

Console The following instructions can be input from the Console.

Instruction	Keys	Action
Inspect	ENT	Runs the inspection once.
Select camera	◀ / ▶	Selects the displayed camera. The inspection is run for the selected camera number.
Switch modes	▲ / ▼	Select the search monitor, correlation value monitor, or relative position monitor.
Change criteria	SHIFT + ESC	Displays the menu to change the evaluation criteria.

When the camera for the inspection is switched, the inspected image differs according to the type of camera.

Camera	Inspected image
F300-A20/A20R	The image is read immediately the camera is selected and the inspection is conduced on the input image.
F300-A20S/A20RS/A21RS	Each time the Inspect instruction is input, the images are simultaneously input to the memory of each camera. When a camera is selected, the inspection is conducted on the image stored in the camera memory.

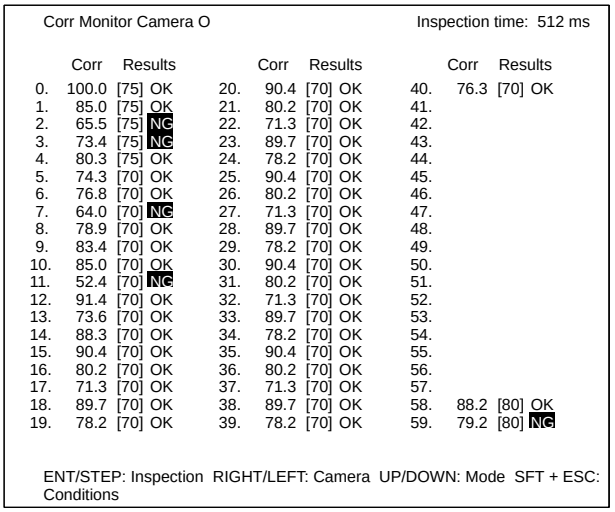
Note The F300-A21RS Shutter Simultaneously Camera I/F Unit is still under development and is not yet available as of October 1, 1995.

STEP Signal Input The inspection runs once each time the STEP signal turns from OFF to ON.

Procedure

1, 2, 3...

1. Select “M.Inspection monitor.” Shows the search monitor screen.
2. Press the Up/Down Keys to select the mode. Select the correlation value monitor.
3. Press the Enter Key or input the STEP signal. The inspection runs and the inspection results are displayed.



Corr Monitor Camera O — Inspection time: 512 ms

	Corr	Results		Corr	Results		Corr	Results
0.	100.0	[75] OK	20.	90.4	[70] OK	40.	76.3	[70] OK
1.	85.0	[75] OK	21.	80.2	[70] OK	41.		
2.	65.5	[75] NG	22.	71.3	[70] OK	42.		
3.	73.4	[75] NG	23.	89.7	[70] OK	43.		
4.	80.3	[75] OK	24.	78.2	[70] OK	44.		
5.	74.3	[70] OK	25.	90.4	[70] OK	45.		
6.	76.8	[70] OK	26.	80.2	[70] OK	46.		
7.	64.0	[70] NG	27.	71.3	[70] OK	47.		
8.	78.9	[70] OK	28.	89.7	[70] OK	48.		
9.	83.4	[70] OK	29.	78.2	[70] OK	49.		
10.	85.0	[70] OK	30.	90.4	[70] OK	50.		
11.	52.4	[70] NG	31.	80.2	[70] OK	51.		
12.	91.4	[70] OK	32.	71.3	[70] OK	52.		
13.	73.6	[70] OK	33.	89.7	[70] OK	53.		
14.	88.3	[70] OK	34.	78.2	[70] OK	54.		
15.	90.4	[70] OK	35.	90.4	[70] OK	55.		
16.	80.2	[70] OK	36.	80.2	[70] OK	56.		
17.	71.3	[70] OK	37.	71.3	[70] OK	57.		
18.	89.7	[70] OK	38.	89.7	[70] OK	58.	88.2	[80] OK
19.	78.2	[70] OK	39.	78.2	[70] OK	59.	79.2	[80] NG

ENT/STEP: Inspection RIGHT/LEFT: Camera UP/DOWN: Mode SFT + ESC: Conditions

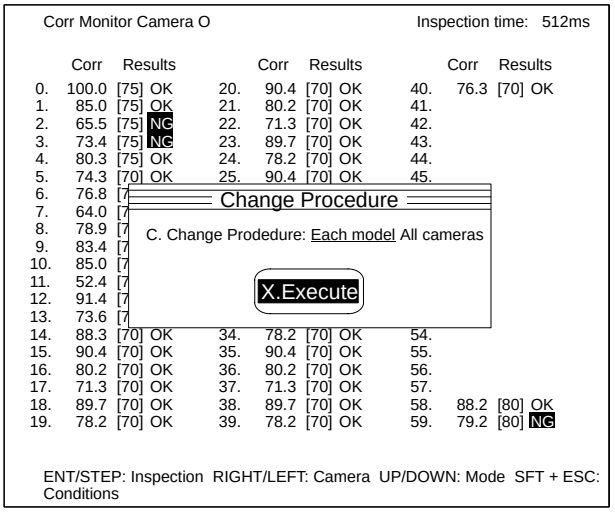
Changing the Evaluation Conditions for Each Model

Refer to the correlation values and follow the procedure described below to change the evaluation conditions for each model. Refer to *4-5-4 Setting the Evaluation Conditions: C.Conditions*.

Procedure

1, 2, 3...

1. Press the Shift+Escape Keys. A choice of methods is displayed for changing the evaluation conditions.
2. Select “Each model.”



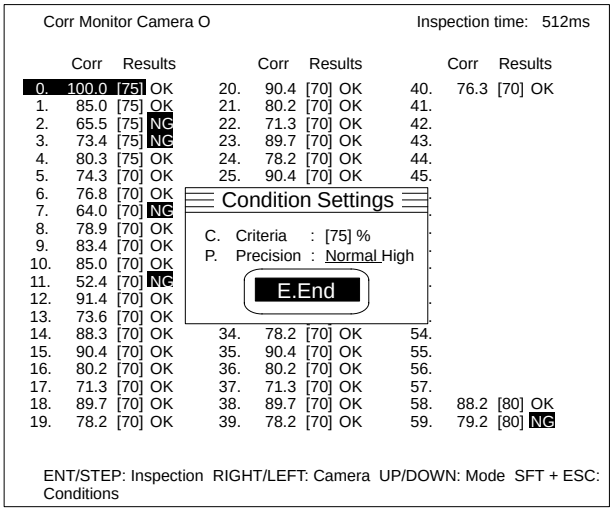
Corr Monitor Camera O — Inspection time: 512ms

	Corr	Results		Corr	Results		Corr	Results
0.	100.0	[75] OK	20.	90.4	[70] OK	40.	76.3	[70] OK
1.	85.0	[75] OK	21.	80.2	[70] OK	41.		
2.	65.5	[75] NG	22.	71.3	[70] OK	42.		
3.	73.4	[75] NG	23.	89.7	[70] OK	43.		
4.	80.3	[75] OK	24.	78.2	[70] OK	44.		
5.	74.3	[70] OK	25.	90.4	[70] OK	45.		
14.	88.3	[70] OK	34.	78.2	[70] OK	54.		
15.	90.4	[70] OK	35.	90.4	[70] OK	55.		
16.	80.2	[70] OK	36.	80.2	[70] OK	56.		
17.	71.3	[70] OK	37.	71.3	[70] OK	57.		
18.	89.7	[70] OK	38.	89.7	[70] OK	58.	88.2	[80] OK
19.	78.2	[70] OK	39.	78.2	[70] OK	59.	79.2	[80] NG

ENT/STEP: Inspection RIGHT/LEFT: Camera UP/DOWN: Mode SFT + ESC: Conditions

3. Select “X.Execute.”
4. Select the model number to change. Move the cursor to the model number to be changed and press the Enter Key.
5. Enter the evaluation criterion.

6. Select the precision.



7. Select “E.End.” The evaluation conditions are selected. Repeat steps 4 to 7 to change the evaluation conditions for multiple models.
8. Press the Escape Key. The correlation value monitor screen is displayed again.

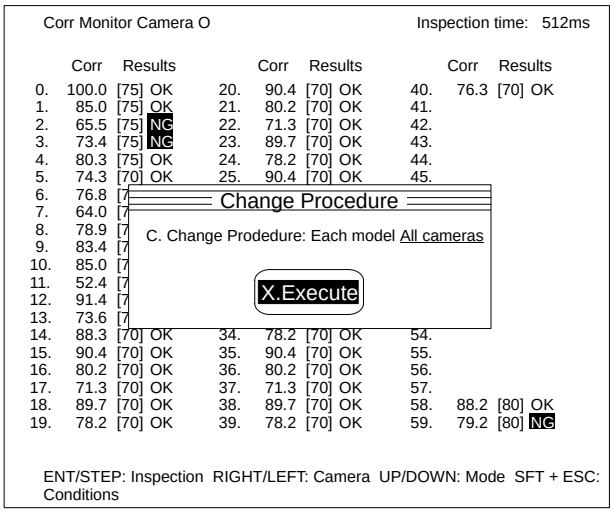
Changing the Evaluation Conditions for All Models

Refer to the correlation values and follow the procedure described below to simultaneously change the evaluation conditions for all models registered for the currently displayed camera. This function does not change the precision settings. Refer to *4-5-4 Setting the Evaluation Conditions: C.Conditions*.

Procedure

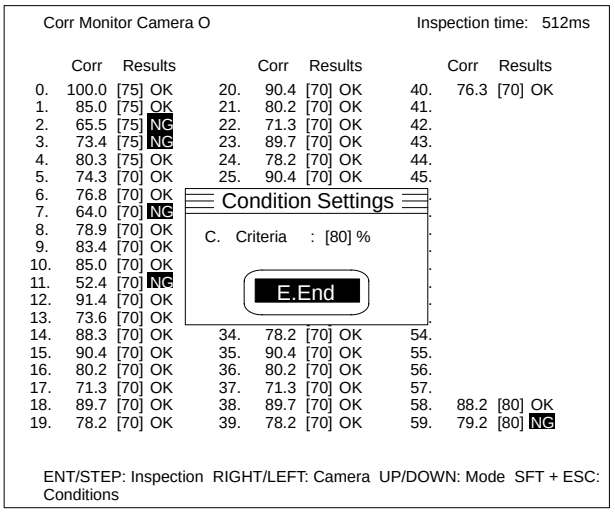
1, 2, 3...

1. Press the Shift+Escape Keys. A choice of methods is displayed for changing the evaluation conditions.
2. Select “All models.”



3. Select “X.Execute.”

4. Enter the evaluation criterion.



5. Select “E.End.” The evaluation criterion is changed and the correlation value monitor screen is displayed again.

Relative Position Monitor

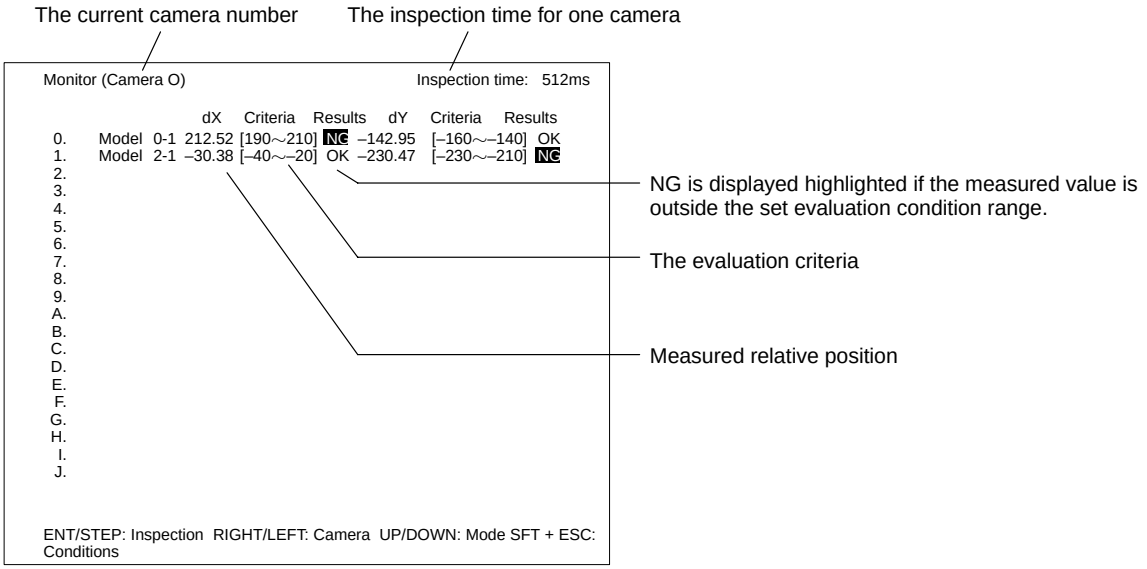
Measures the relative position between two models.

The measured values and evaluation results are displayed.

The inspection time is displayed for the camera from which the image is currently displayed. If multiple cameras are used, switch from one camera to the next and use this function to check the inspection time for each camera. The overall inspection time for the scene is the sum of the inspection times for each camera.

Use the inspection times as a reference to adjust the input timing of the Inspect instructions.

Refer to the correlation values when changing the evaluation conditions.



Note Instruction Input Timing:
Do not input the next instruction until the previous instruction execution is complete, or incorrect execution of both the current instruction and the next instruction may result.
If a Terminal Block Unit or Parallel I/O Unit is mounted, the Busy signal remains ON during instruction execution. Check that the Busy signal has turned OFF before inputting the next instruction.

Console

The following instructions can be input from the Console.

Instruction	Keys	Action
Inspect	ENT	Runs the inspection once.
Select camera	◀ / ▶	Selects the displayed camera. The inspection is run for the selected camera number.
Switch modes	▲ / ▼	Select the search monitor, correlation value monitor, or relative position monitor.
Change criteria	SHIFT + ESC	Displays the menu to change the evaluation criteria.

When the camera for the inspection is switched, the inspected image differs according to the type of camera.

Camera	Inspected image
F300-A20/A20R	The image is read immediately the camera is selected and the inspection is conduced on the input image.
F300-A20S/A20RS/A21RS	Each time the Inspect instruction is input (Enter Key is pressed), the images are simultaneously input to the memory of each camera. When a camera is selected, the inspection is conducted on the image stored in the camera memory.

Note The F300-A21RS Shutter Simultaneously Camera I/F Unit is still under development and is not yet available as of October 1, 1995.

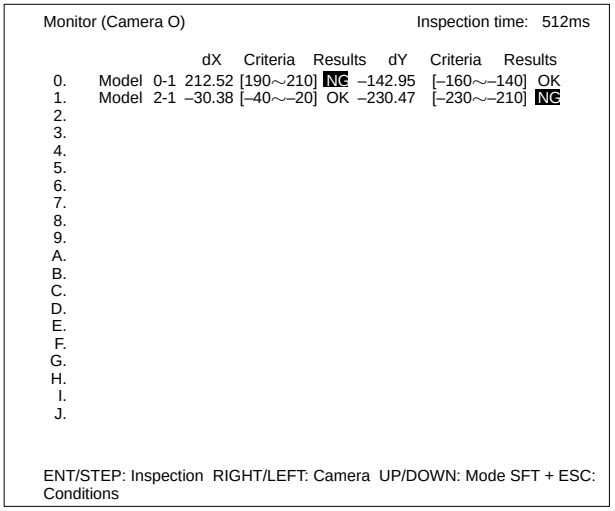
STEP Signal Input

The inspection runs once each time the STEP signal turns from OFF to ON.

Procedure

1, 2, 3...

1. Select “M.Inspection monitor.” Shows the search monitor screen.
2. Press the Up/Down Keys to select the mode. Select the relative position monitor.
3. Press the Enter Key or input the STEP signal. The inspection runs and the inspection results are displayed.



Changing the Evaluation Conditions

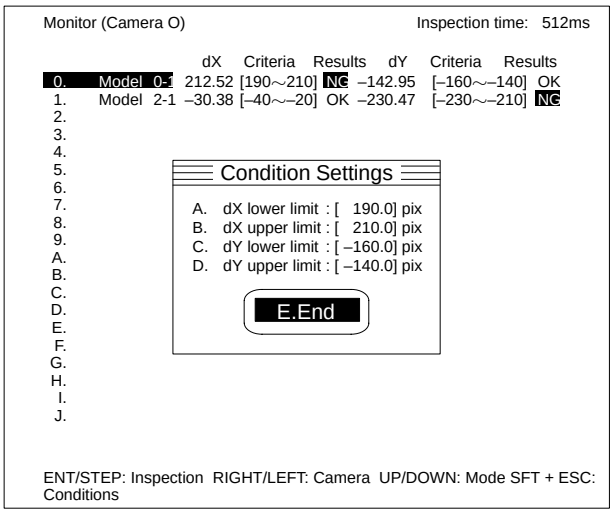
Refer to the measured values and follow the procedure described below to change the relative position evaluation conditions. Refer to *4-7-2 Setting the Evaluation Conditions*.

Procedure

1, 2, 3...

1. Press the Shift+Escape Keys.
2. Select the relative position inspection number to be changed. Move the cursor to the relative position inspection number to be changed and press the Enter Key.

3. Input the upper and lower limits. Make sure that the dX upper limit ≥ the dX lower limit. Make sure that the dY upper limit ≥ the dY lower limit.



4. Select “E.End.” The evaluation conditions are changed. Repeat steps 2 to 4 to change the evaluation conditions for multiple relative position inspections.
5. Press the Escape Key. The correlation value monitor screen is displayed again.

4-9-3 Running the Inspection: I.Inspection

Runs the inspection based on the set inspection conditions.

The inspection screen is displayed after the power supply is turned on and the system waits for an instruction to be input. Refer to *4-10-1 Automatic Inspection: M.Initial mode*.

Inputting Instructions from the Inspection Screen

Follow the instructions on the inspection screen to run the inspection. The instructions that can be input and the devices from which they can be input are described below.

Make all connections with the input devices if a Terminal Block Unit or Parallel I/O Unit is used. Refer to *2.4 Connecting Peripheral Devices* in the *F350 Setup Menu Operation Manual*.

Note Instruction Input Timing:
Do not input the next instruction until the previous instruction execution is complete, or incorrect execution of both the current instruction and the next instruction may result.
If a Terminal Block Unit or Parallel I/O Unit is mounted, the Busy signal remains ON during instruction execution. Check that the Busy signal has turned OFF before inputting the next instruction.

Console

The following instructions can be input from the Console.

Instruction	Keys	Action
Inspect	ENT	Runs the inspection once.
Switch Scene	SHIFT+▲	Decreases the scene number by 1.
	SHIFT+▼	Increases the scene number by 1.
End Inspection	ESC	Cancels the inspection screen.

Parallel I/O

The following instructions can be input from a Parallel I/O Unit or a Terminal Block Unit. In the table below, 1 indicates a bit is ON and 0 indicates a bit is OFF. An asterisk (*) indicates the bit may be either ON or OFF.

Instruction	Input data DI: 7 6 5 4 3 2 1 0 .	Action
Inspect	***1****	Continuous inspection while this instruction is input.
Switch Scene	**10 (Scene #) Example: 0010010	Switches the inspected screen. Set the scene number from 0 or 1 specified with the bits DI0 to 3 and turn DI5 ON within 1 ms. The example switches to scene 2.

STEP Signal Input

The inspection runs once each time the STEP signal turns from OFF to ON.

Outputting the Inspection Results

The inspection result is output to the video monitor and the Parallel I/O Unit or Terminal Block Unit.

The inspection result for the scene is OK if the evaluation result is OK for each inspection item. The inspection result for the scene is NG if the evaluation result is NG for any inspection item.

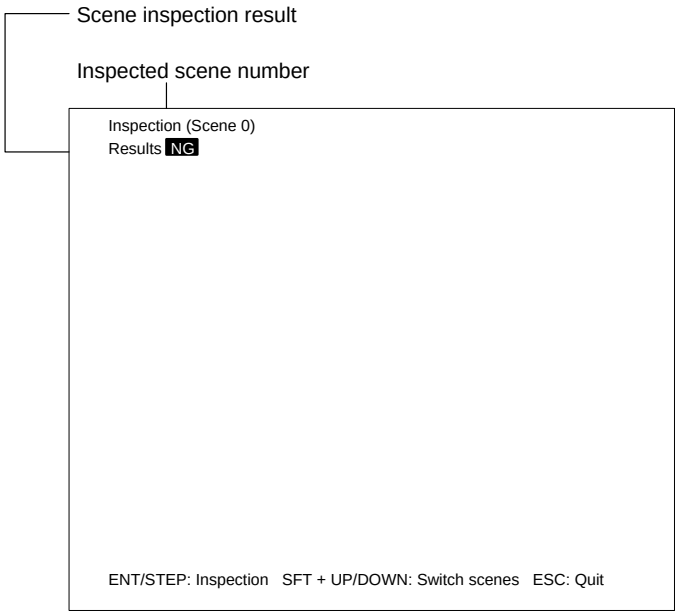
If multiple cameras are used, the camera required for the inspection is automatically selected and the inspection run.

Outputting the Inspection Results to a Parallel I/O Unit or Terminal Block Unit

Make all connections with the output devices. Refer to *2.4 Connecting Peripheral Devices* in the *F350 Setup Menu Operation Manual*.
Set the output specifications in the setup menu. Refer to *5.2.4 Setting the Output Specifications for Parallel Data: P.I/O Unit* in the *F350 Setup Menu Operation Manual*.

Video Monitor

The inspection result is displayed on the video monitor in the format shown below.



Parallel I/O

The inspection result is output in bit D0 of the Parallel I/O Unit or a Terminal Block Unit, as shown below.

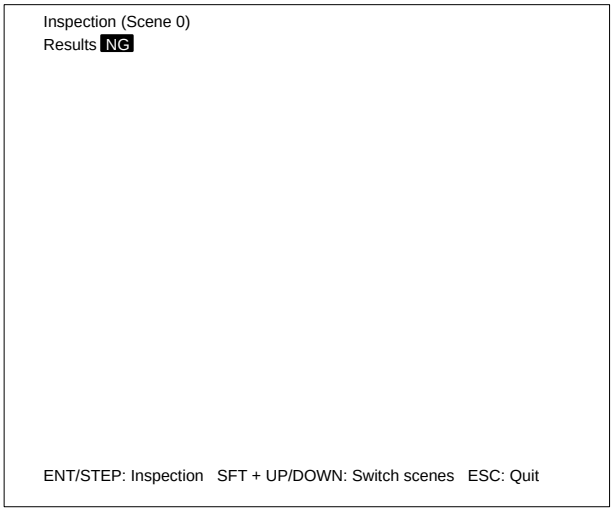
Inspection result	Output
OK	0 (OFF)
NG	1 (ON)

Running the Inspection

Runs the inspection. The F350 operates according to the input instructions.

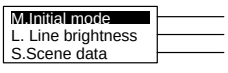
Procedure

1, 2, 3... 1. Select “I.Inspect.” The inspection screen is shown for the displayed scene number. Inspection operates according to the input instructions.



4-10 Y.System

Store the set scene data and set the environment data. The data set using “Y.System” does not directly affect the inspection conditions.



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4-10-1 Automatic Inspection: M.Initial mode

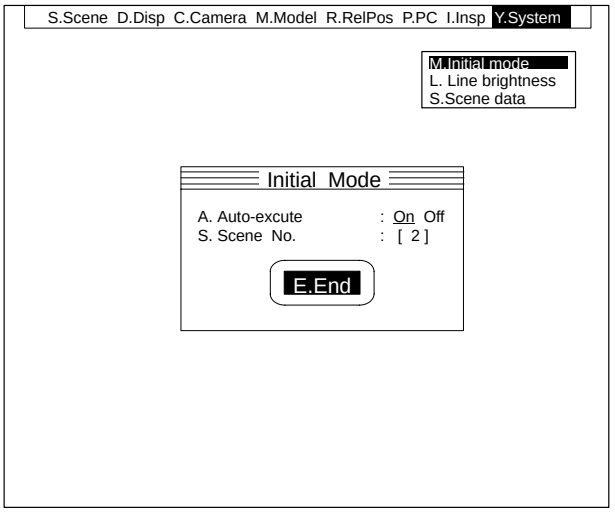
The automatic inspection function displays the inspection screen and inputs the inspection instruction to start the inspection when the Application Program is started. Use this function to start inspection after all the inspection conditions are set as scene data.

Procedure

1, 2, 3... 1. Select “M.Initial mode.”

2. Set “A.Automatic execution” ON.

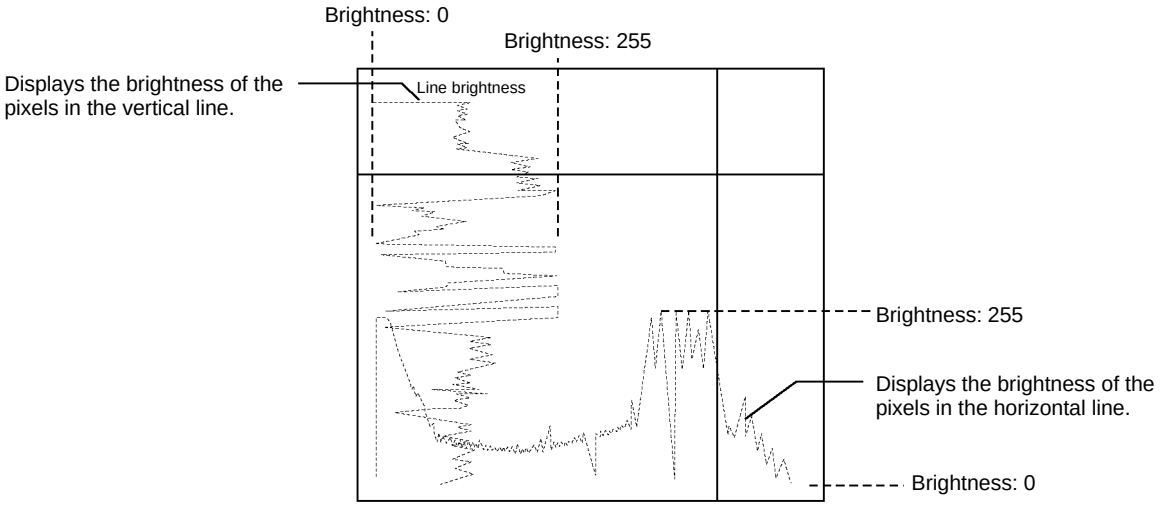
3. Set the scene number in “S.Scene.” The inspection screen for the specified screen number is automatically displayed the next time the system is started.



4. Select “E.End.”

4-10-2 Displaying the Line Brightness: L.Line brightness

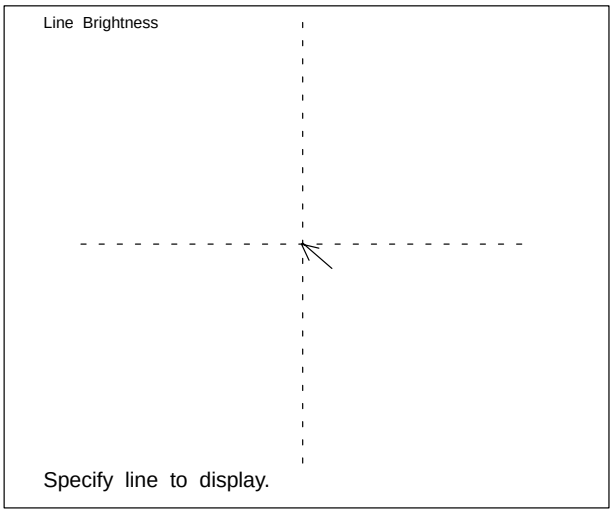
Line brightness is the name given to a graph which indicates the brightness distribution along a line through the image. The line brightness can be displayed for any arbitrary vertical or horizontal lines through the image.



Procedure

1, 2, 3... 1. Select “L.Line brightness.” Dotted lines are displayed vertically and horizontally through the cursor.

Note 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 is displayed for the selected vertical and horizontal lines.
3. Press the Enter Key or the Escape Key. Returns to the menu.

4-10-3 Saving and Loading Scene Data: S.Scene data

Loads and saves data to and from the memory card. The contents of the scene data differs for each menu.

Menu	Scene data contents
Surface Defect Inspection Program	Data set using: S.Scene, D.Display, C.Camera, R.Registration, O.Conditions, P.Position compensation
Pattern Inspection Program	Data set using: S.Scene, D.Display, C.Camera, M.Model, R.Relative position, P.Position compensation

Saving Scene Data

Saves scene data to a memory card. The extension “.SCN” is automatically appended to the saved file name.

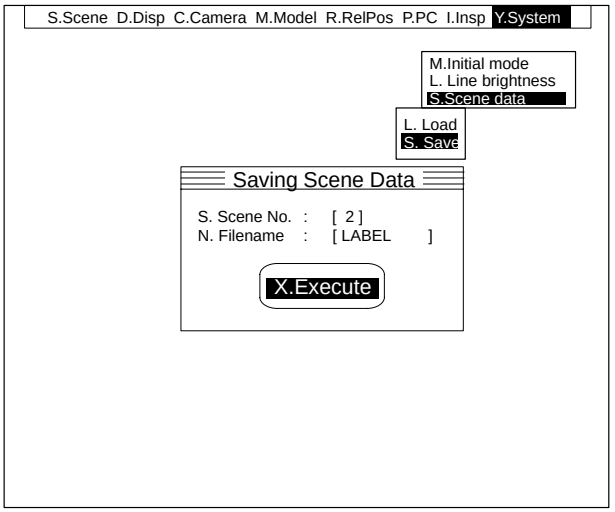
When using a new memory card for the first time, initialize it using the setup menu. Refer to *5.4.1 Initializing Memory Cards: F.Format* in the *F350 Setup Menu Operation Manual*.

Procedure

1, 2, 3... 1. Select “S.Scene data.”
2. Select “S.Save.”
3. Input the save source scene number for “S.Scene No.”

4. Input the save destination file name “N.Filename.”

   Only the upper-case characters A to Z can be input (character codes: $41 to $5A).



5. Select “X.Execute.”

   The data from the specified scene number is saved in the memory card under the specified file name.

Loading Scene Data

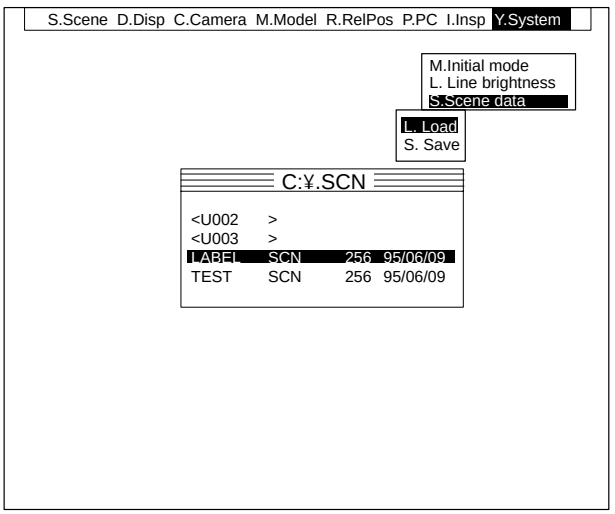
Loads saved scene data from a memory card. Insert a memory card containing saved scene data. When the scene data is loaded, it overwrites the scene data for the currently displayed scene number. Display the load destination scene number before loading.

Note Compatibility of Scene Data Between Menus:
Scene data for the Surface Defect Inspection Program is not compatible with the scene data for the Pattern Inspection Program, or vice-versa. Only load scene data to the menu from which it was saved.

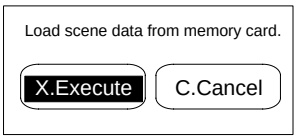
Procedure

1, 2, 3...

1. Select “S.Scene data.”
2. Select “L.Load.” A directory is displayed of the scene data file names in the root directory. The names of any existing sub-directories are also displayed.



3. Select the file name. A confirmation message is displayed.



4. Select “X.Execute.” The selected scene data is loaded to the currently displayed scene number.

SECTION 5
Troubleshooting

This section provides a list of error messages, and the causes and remedies of them.

5-1 Troubleshooting

The error messages and corresponding remedies for the surface defect inspection program and pattern inspection program are displayed in alphabetical order.

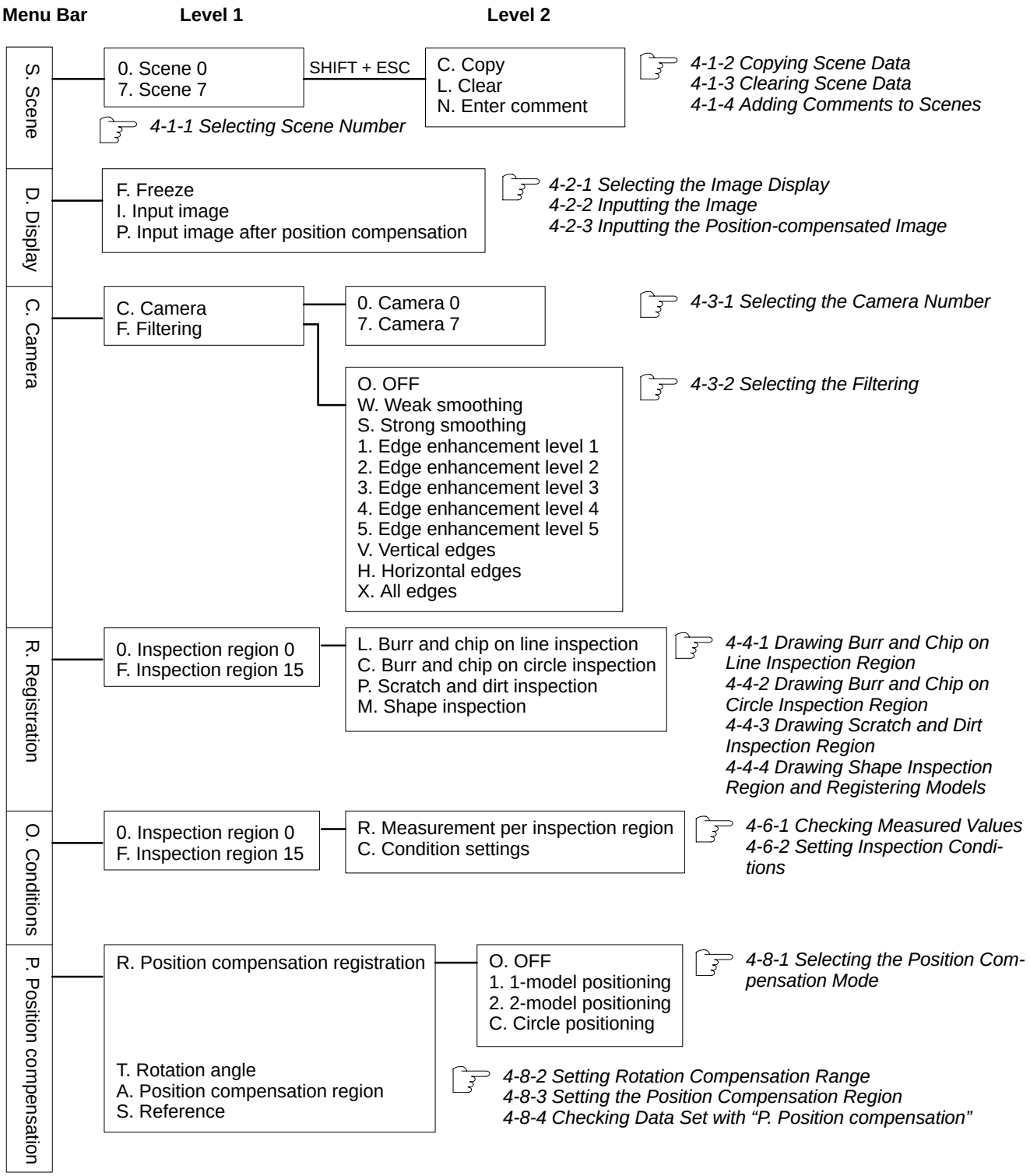
Note "○" means that the error is applicable to the program.

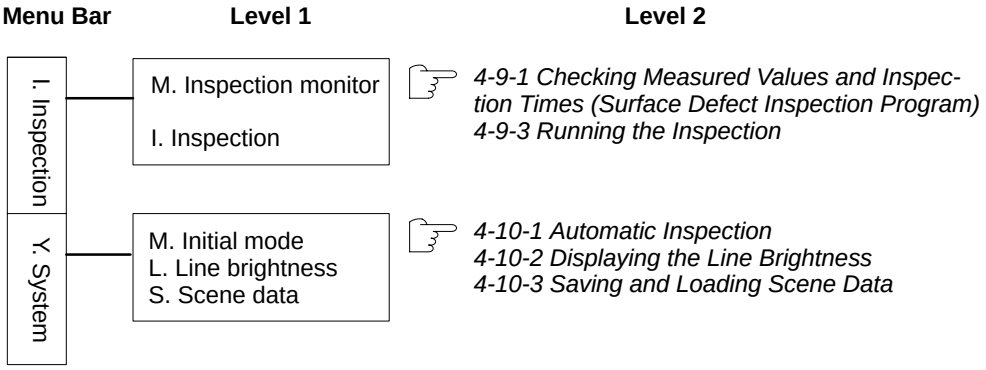
<table>
<tr><th>Error message</th><th>Cause and remedy</th><th>Surface defect</th><th>Pattern</th></tr>
<tr><td>All inspection flags cannot be OFF.</td><td>Inspection is not possible if all of the inspection flags are set OFF. Turn ON one of the inspection flags.</td><td>○</td><td></td></tr>
<tr><td>Already registered as reference model.</td><td>Model is already registered as the reference model for the relative position inspection. A model can be registered as the reference model for only one relative position inspection. Register an unregistered model as the reference model.</td><td></td><td>○</td></tr>
<tr><td>Cannot copy to the same scene number.</td><td>The copy source and copy destination are the same scene number. Select different scene numbers.</td><td>○</td><td>○</td></tr>
<tr><td>Cannot be registered. No space in model registration region.</td><td>No more space exists in the model registration region.
No more models can be registered or loaded.</td><td>○</td><td>○</td></tr>
<tr><td>Cannot save to memory card. Not sufficient space.</td><td>The memory card does not have enough free space to save to.
Insert a memory card with sufficient free space and try again.</td><td>○</td><td>○</td></tr>
<tr><td>Circle positioning set for position compensation mode.
Cannot rotate.</td><td>Compensation for rotational displacement is not possible when circle positioning is set.
If compensation for rotational displacement is required, select 1-model or 2-model position compensation.</td><td>○</td><td>○</td></tr>
<tr><td>File does not exist.</td><td>No file exists in the inserted memory card.
Insert a memory card containing files and try again.</td><td>○</td><td>○</td></tr>
<tr><td>No inspection conditions are set.</td><td>No inspection conditions are set for the relative position inspection.
Select a relative position inspection number which has inspection conditions set.</td><td></td><td>○</td></tr>
<tr><td>No memory card inserted.</td><td>The operation is not possible because not memory card is inserted.
Insert a memory card and try again.</td><td>○</td><td>○</td></tr>
<tr><td>No model is registered.</td><td>The inspection cannot be run because no model is registered as the reference. Register a model.</td><td></td><td>○</td></tr>
<tr><td>No registration. Too many models.
Reduce rotation compensation range.</td><td>The large rotation compensation range requires many models so that no more models can be registered.
Reduce the rotation compensation range to reduce the number of models.
<table>
<tr><th rowspan="2">Rotation compensation range</th><th colspan="2">Number of models</th></tr>
<tr><th>1-model position compensation</th><th>2-model position compensation</th></tr>
<tr><td>±15°</td><td>6</td><td>12</td></tr>
<tr><td>±30°</td><td>12</td><td>24</td></tr>
<tr><td>±45°</td><td>18</td><td>36</td></tr>
<tr><td>0±15°, 180±15°</td><td>12</td><td>24</td></tr>
<tr><td>0±30°, 180±30°</td><td>24</td><td>48</td></tr>
<tr><td>Any angle</td><td>72</td><td>144</td></tr>
</table></td><td>○</td><td>○</td></tr>
<tr><td>No registration. Too small region. Inspection region will be cleared.</td><td>The inspection region is too small to register and will be cleared. Draw a slightly larger region.</td><td>○</td><td></td></tr>
<tr><td>Not scene data for the Pattern Inspection Program.</td><td>Scene data saved with the surface defect inspection program cannot be used with the pattern inspection program. Load scene data saved with the pattern inspection program.</td><td></td><td>○</td></tr>
<tr><td>Not scene data for the Surface Defect Inspection Program.</td><td>Scene data saved with the pattern inspection program cannot be used with the surface defect inspection program. Load scene data saved with the surface defect inspection program.</td><td>○</td><td></td></tr>
</table>

Error message	Cause and remedy	Surface defect	Pattern
Part of the region will be outside the screen.	The region cannot be drawn because part of it would be outside the screen. Set the region at a position where it will entirely fit inside the screen.	○	
Scene data initializing.	Initializing the scene data to start the installed Application Program. All scene data will revert to the initial values.	○	○
	Initializing the scene data because exiting scene data is destroyed. All scene data will revert to the initial values.		
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 loaded scene data has the wrong format. The data is destroyed, or an attempt was made to load incorrect data. Load scene data with the correct format.		
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.		
	Saving not possible because the memory card is write-protected. Cancel the write protection and save the scene data again.		
Set criteria so that the upper limit ≥ the lower limit.	Incorrect values set. Set the dX (dY) upper limit ≥ the dX (dY) lower limit.		○
Set density criteria so that the upper limit ≥ the lower limit.	Incorrect values set. Set the density evaluation upper limit ≥ the lower limit.	○	
The inspection region is not drawn.	The inspection conditions cannot be set because the inspection region is not drawn. Draw the inspection region.	○	
	The inspection cannot run because the inspection region is not drawn. Draw the inspection region.		
The position compensation mode is turned OFF.	The position compensation mode is turned off. First turn on the position compensation mode, then select the position compensation model.	○	○
The reference model and relative model are the same.	The same model number was set as the reference model and relative model. Set different model numbers.		○
Too many models. No more can be registered.	No more models can be loaded. Reducing the rotation compensation range reduces the number of models allowing new models to be registered.	○	○
Wrong model image.	The image is completely white or completely black and is unsuitable for registration as a model.	○	○

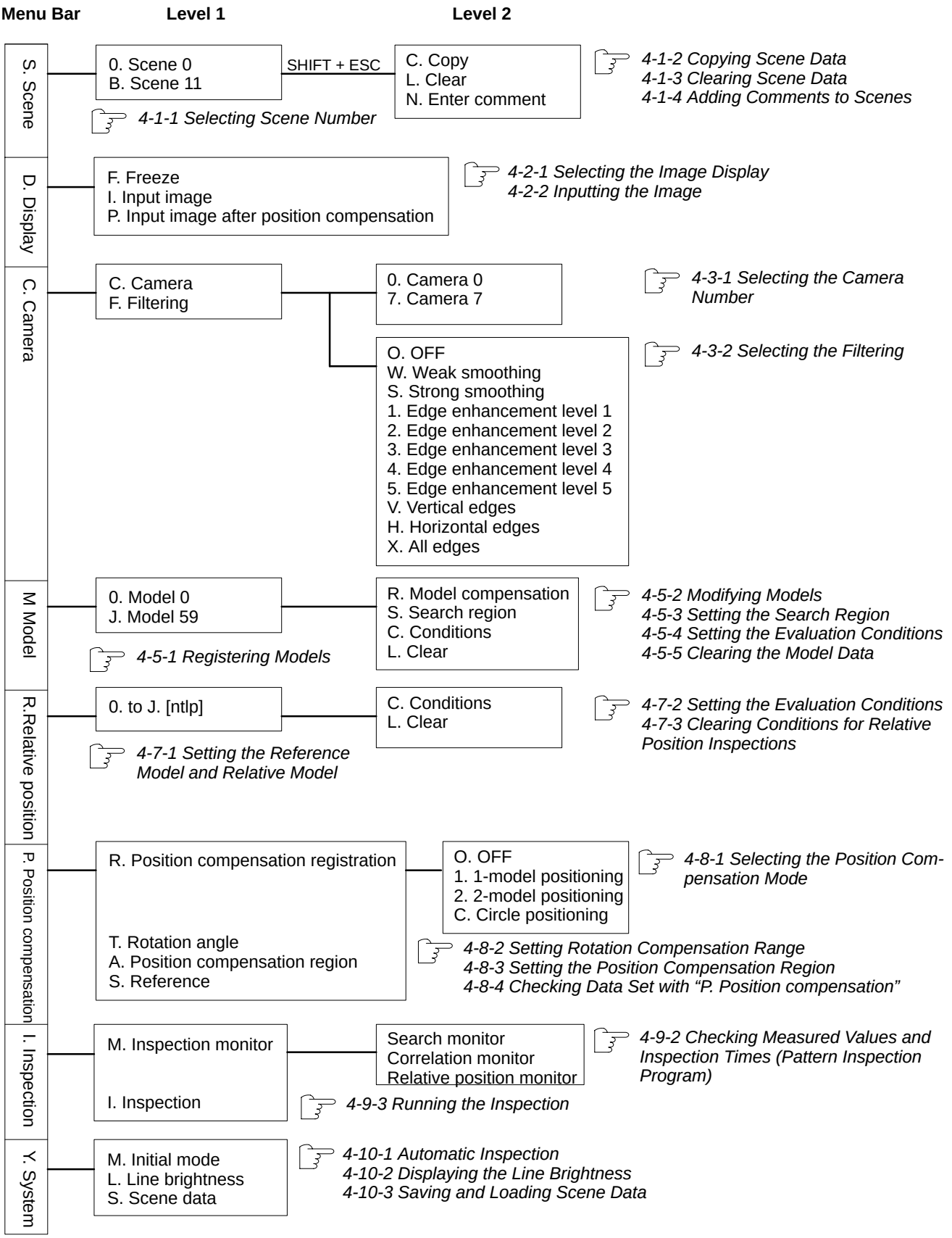
Appendix A
Menu Hierarchy Diagrams

Surface Defect Inspection Program




Menu Bar
Level 1
Level 2
I. Inspection
M. Inspection monitor
I. Inspection
4-9-1 Checking Measured Values and Inspection Times (Surface Defect Inspection Program)
4-9-3 Running the Inspection
Y. System
M. Initial mode
L. Line brightness
S. Scene data
4-10-1 Automatic Inspection
4-10-2 Displaying the Line Brightness
4-10-3 Saving and Loading Scene Data

Pattern Inspection Program



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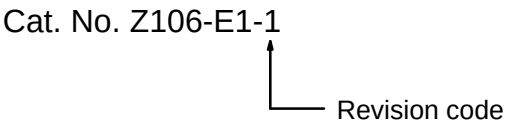
Revision History

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	August 1995	Original production