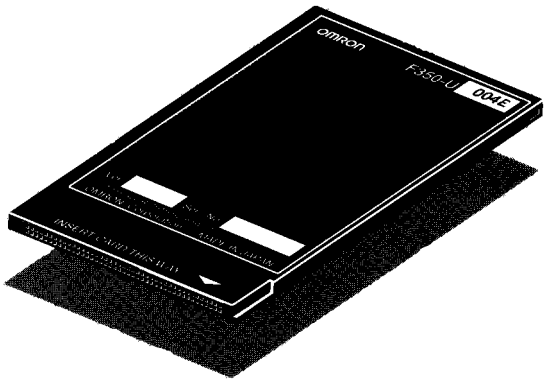
F350-U004E
Character Reading Software 1

Operation Manual

Produced March 1997



OMRON Product References

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

Visual Aids

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

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

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

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

Symbols

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

Standard Reading	Indicates information for using standard character reading.
Steady Reading	Indicates information for using steady character reading.
Position Compensation	Indicates information for using position compensation.

Menu Item Notation

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

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

TABLE OF CONTENTS

About this Manual:

This manual describes the operation of the F350-U004E Character Reading Software 1 and includes the sections described below. The F350-U004E Character Reading Software 1 is a software package used with the F350 Visual Inspection System.

Please read this manual carefully and be sure you understand the information provided before attempting to operate the F350-U004E Character Reading Software 1.

Section 1 provides a general introduction to the F350 Character Reading Software 1.

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

Section 3 explains the functions and operations in order of the F350-U004E Character Reading Software 1, using typical inspections as examples.

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

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

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

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

SECTION 1
Introduction

This section provides a general introduction to the F350 Character Reading Software 1.

1-1 Before Using this Manual

Copyright

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

Copying and Modifications

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

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

Handling the System Memory Card

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

1-2 Applicable Manuals

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

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

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

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

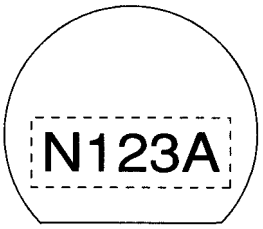
1-3 Features

The Character Reading Software can make two types of measurement: standard character reading and steady character reading. Select one of them according to the characters to be measured. It is also possible to use both types simultaneously.

Standard Character Reading

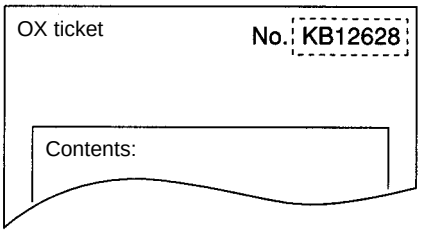
Use standard character reading to read characters within an area when the character status is stable. Characters can be read more quickly by this method than by steady character reading.

Characters etched on a wafer



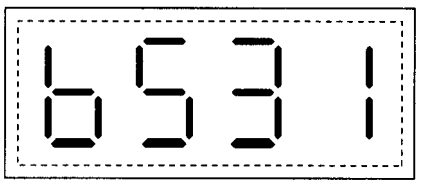
Reading result: N123A

Characters printed on a ticket



Reading result: KB12628

Liquid crystal or LED displays



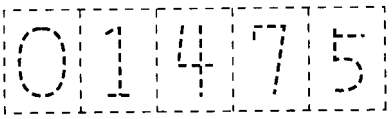
Reading result: 6531

Steady Character Reading

Use steady character reading to read characters within an area when the character status is unstable (e.g., blurred or smudged), or when adjacent characters overlap. Steady character reading detects characters more reliably than standard character reading.

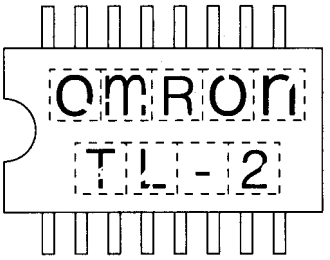
Ink jet printer characters

Production number



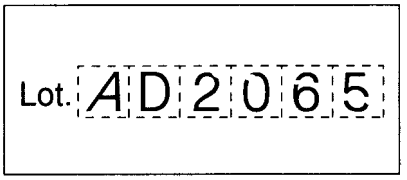
Reading result: 01475

Seal characters on ICs (Blurred or smudged)



Reading result: OMRON TL-2

Seal characters (Deformed or chipped)



Reading result: AD2065

SECTION 2
Preparation for Operation

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

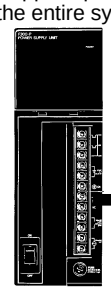
2-1 System Configuration

The numbers of cameras and the types of I/O devices that can be used depends on the application software. Check that the system is correctly configured for the application software. Some of the products listed may not be available overseas.

Basic System Configuration (Must be used.)

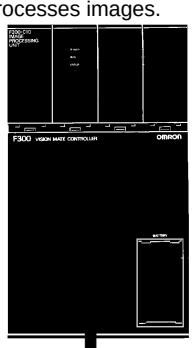
F300-P2

⋆ F300-P2E Power Supply Unit
Supplies power to the entire system.



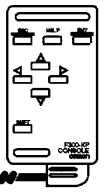
(Important: The F200-P Power Supply Unit cannot be mounted because its capacity is too small.)

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

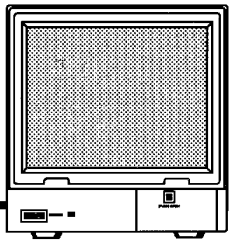


⋆ F300-FM2 MMI Unit
Provides Memory Card functions and menu operations via a Video Monitor and Console.

⋆ F300-KP Console

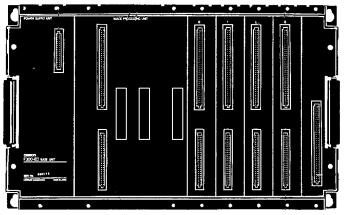


F300-M09 Video Monitor (100 VAC)



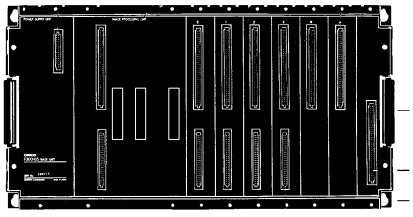
⋆ F309-VM Monitor Cable

⋆ F300-B32 (3 slots)

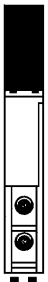


or

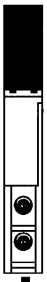
⋆ F300-B52 (5 slots)



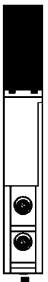
Camera I/F Units (use four maximum)



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



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



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

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

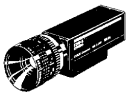
F300-A23RS Frame Shutter Camera I/F Unit
This I/F Unit is used exclusively with the F300-S4R.
For measuring objects moving at high speed, and for measuring two places simultaneously using two cameras.

⋆ F309-VSR2 Camera Cable

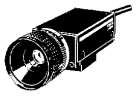
⋆ F309-VSR2 Camera Cable

⋆ F309-VSR2 Camera Cable

F200-S Camera



*** F300-S Camera**



⋆ F300-S2R Shutter Camera

F300-S3DR Shutter Camera

F300-S4R Frame Shutter Camera

· Lens

· Light

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

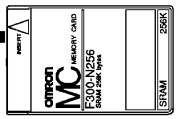
Important
1. An incorrect image may be read if different types of cameras and I/F Units are used together. Do not mix different types of cameras and I/F Units.
2. Strobes cannot be used when an F200-S Camera is used for inspection.

Please contact your nearest OMRON sales office by referring to the addresses provided at the back of this manual.

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

F350-U004E Character Reading Software 1
Character reading programs

Peripheral Devices



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

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

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

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

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

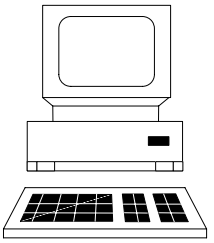
F300-FS Strobe I/F Unit
Use to take images while using a strobe light.

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

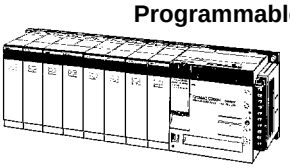
★ **F300-G Dummy Unit**
Use to insert into empty slots to protect and connectors and maintain external strength and appearance.

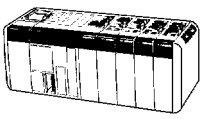
★ F309-VR
RS-232C Cable

IBM PC/AT or compatible

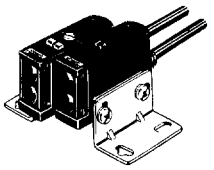


C200H or CQM1 Programmable Controller

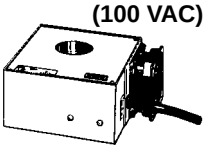




Synchronization Sensor



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



F309-VFS
Strobe Cable

2-2 Starting and Quitting an Application Program

2-2-1 Starting

The application program contains three different measurement items: position compensation, standard character reading, and steady character reading. The application and reading procedures differ depending on the measurement item being used. Install the ones necessary for your application.

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

Not all measurement items can be installed at the same time for the F350-C12E. The following table shows the possible combinations of measurement items that can be installed. The four possible combinations shown for the F350-C12E are based on the following conditions: 1) both standard character reading and steady character reading cannot be installed at the same time and 2) it is necessary to install position compensation only when it is required.

IMP Unit	Position compensation	Standard character reading	Steady character reading
	The position of the measured object can be compensated so that the measurement location does not fall outside of the read area.	Reads alphanumeric characters. Use when character status is stable, i.e., when there is little deformation. Standard character reading reads characters faster than steady character reading.	Reads alphanumeric characters. Use when character status is unstable, e.g., blurred or smudged, or when characters overlap. Steady character reading detects characters more reliably than standard character reading.
F350-C12E		◯	
			◯
	◯	◯	
	◯		◯
F350-C41E	All three measurement items can be installed at the same time. Install only the measurement items that you will be using.		

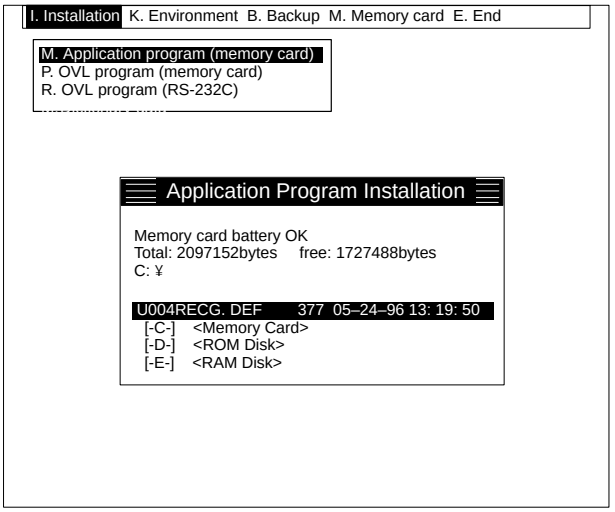
The Setup Menu is used to install and run an Application Program. Operate the Setup Menu by referring to *3-1 Starting the Setup Menu* in the *F350 Setup Menu Operation Manual*.

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

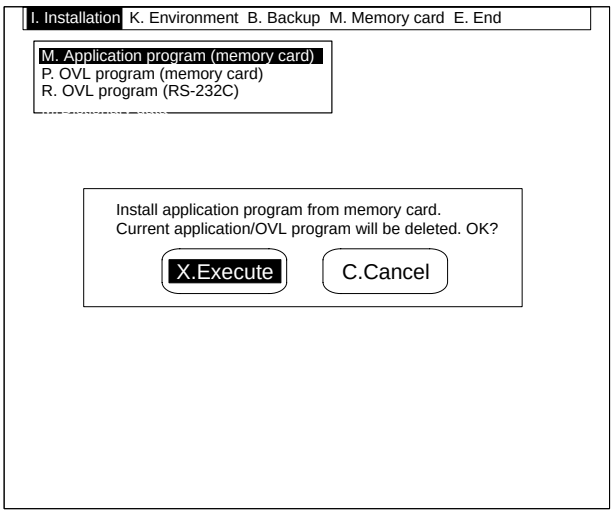
Procedure

1, 2, 3...

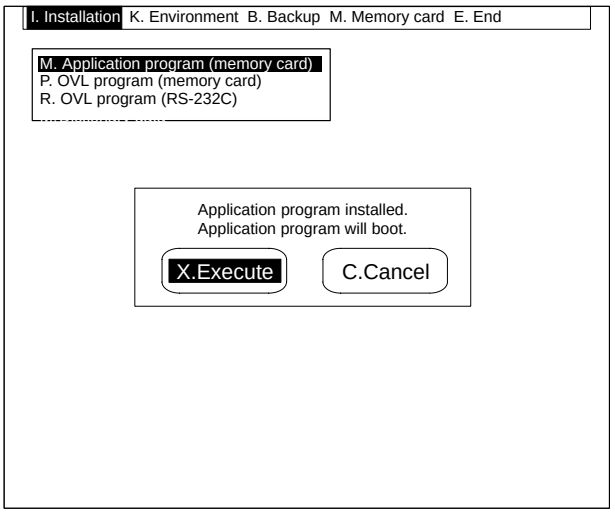
1. Select “I.Installation.”
2. Select “M.Application program (memory card).” The Application Program directory will be displayed.



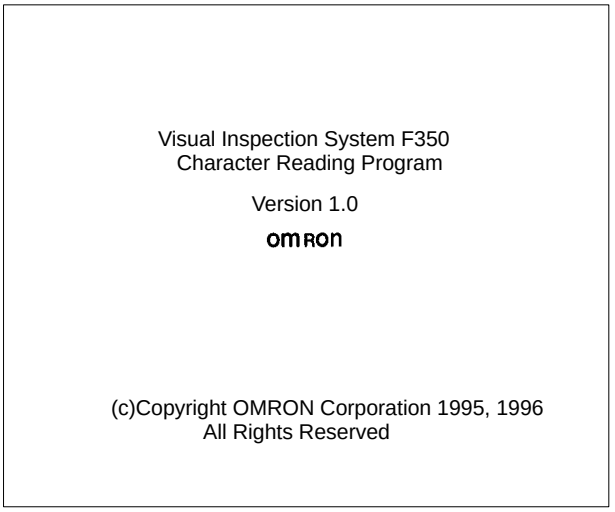
3. Select the filename. A confirmation message will be displayed.



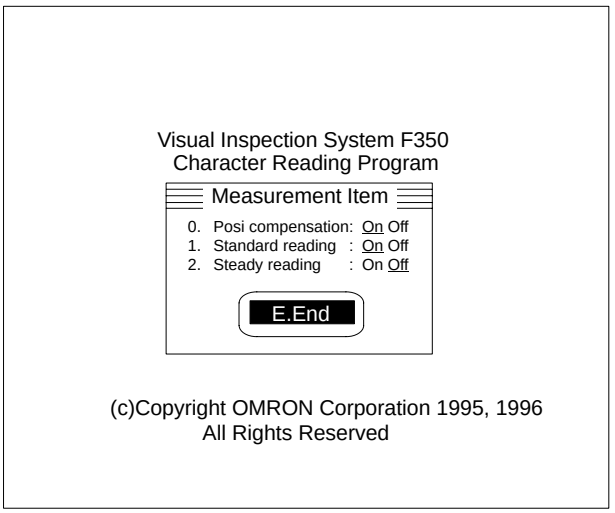
4. Select “X.Execute.” The Application Program will be installed. A confirmation message will be displayed when installation is complete.



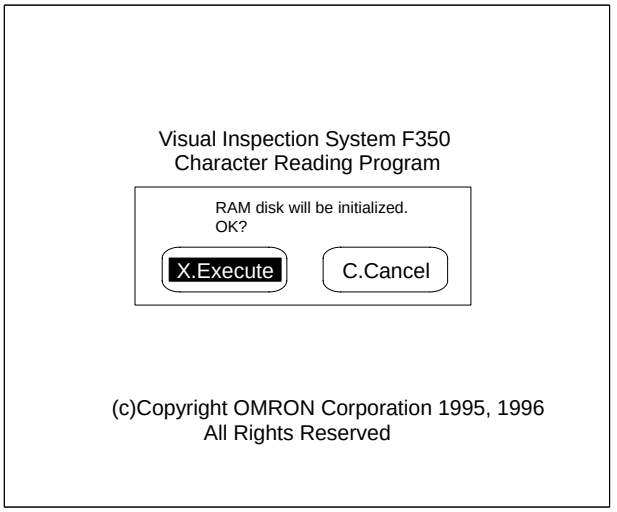
5. Select “X.Execute.” The Application Program will be started. The Initial Screen is shown below.



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



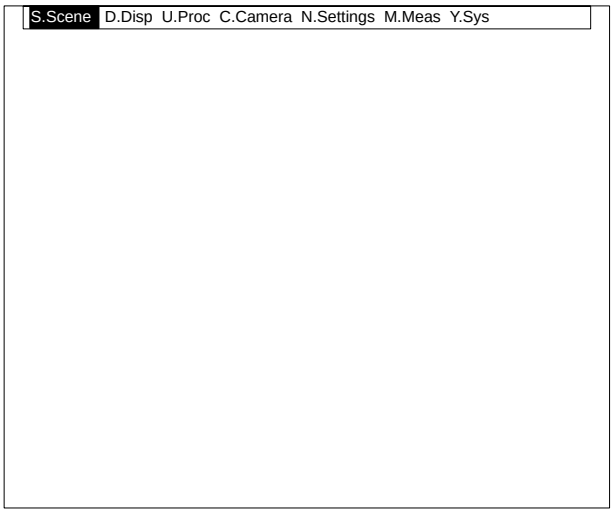
If the F350-C41E is being used, a message will be displayed to confirm whether the RAM disk is to be initialized. Select “X.Execute.”



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

   Adjust the image focus.

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



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

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

2-2-2 Quitting

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

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

Procedure

1, 2, 3...

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

   Data settings are stored when the F350 is turned off.

Note

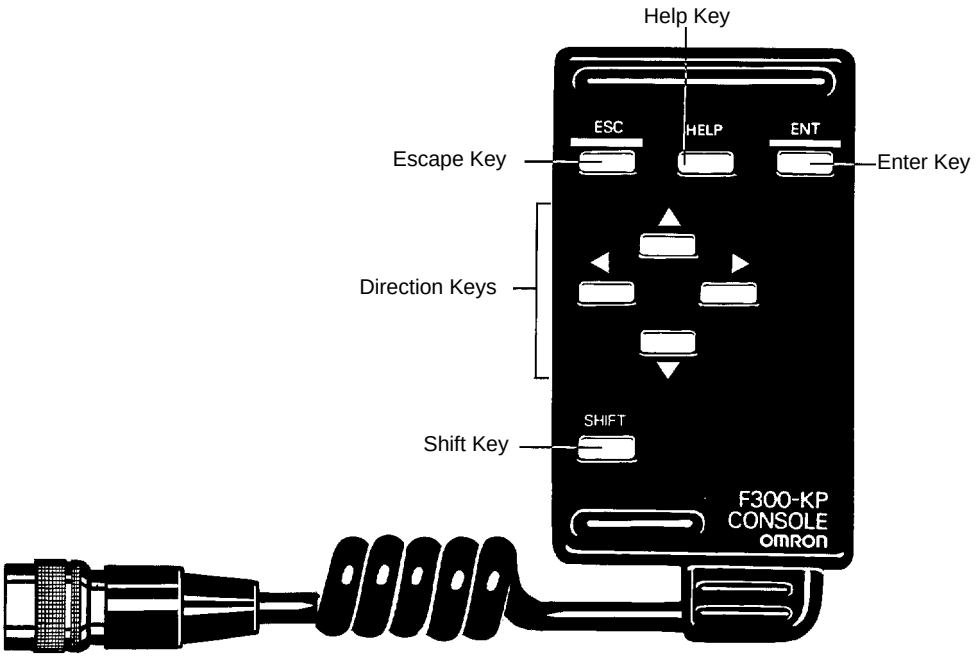
1) The Setup Menu and OVL system cannot be started from the Application Program. Quit the Application Program before starting the Setup Menu or OVL system.
2) To run the Setup Menu, turn on the power while holding down the Enter Key. Refer to *3-1 Starting the Setup Menu* in the *F350 Setup Menu Operation Manual*.
3) To start the OVL system, run the Setup Menu, change the “K.Environment/ M.Initial Mode” to “OVL prompt,” and restart the F350. Refer to *2-2-1 Starting Up* in the *F350 OVL Reference Manual*.

2-3 Basic Menu Operation

The Application Program is operated from the Console.

2-3-1 About the Console

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

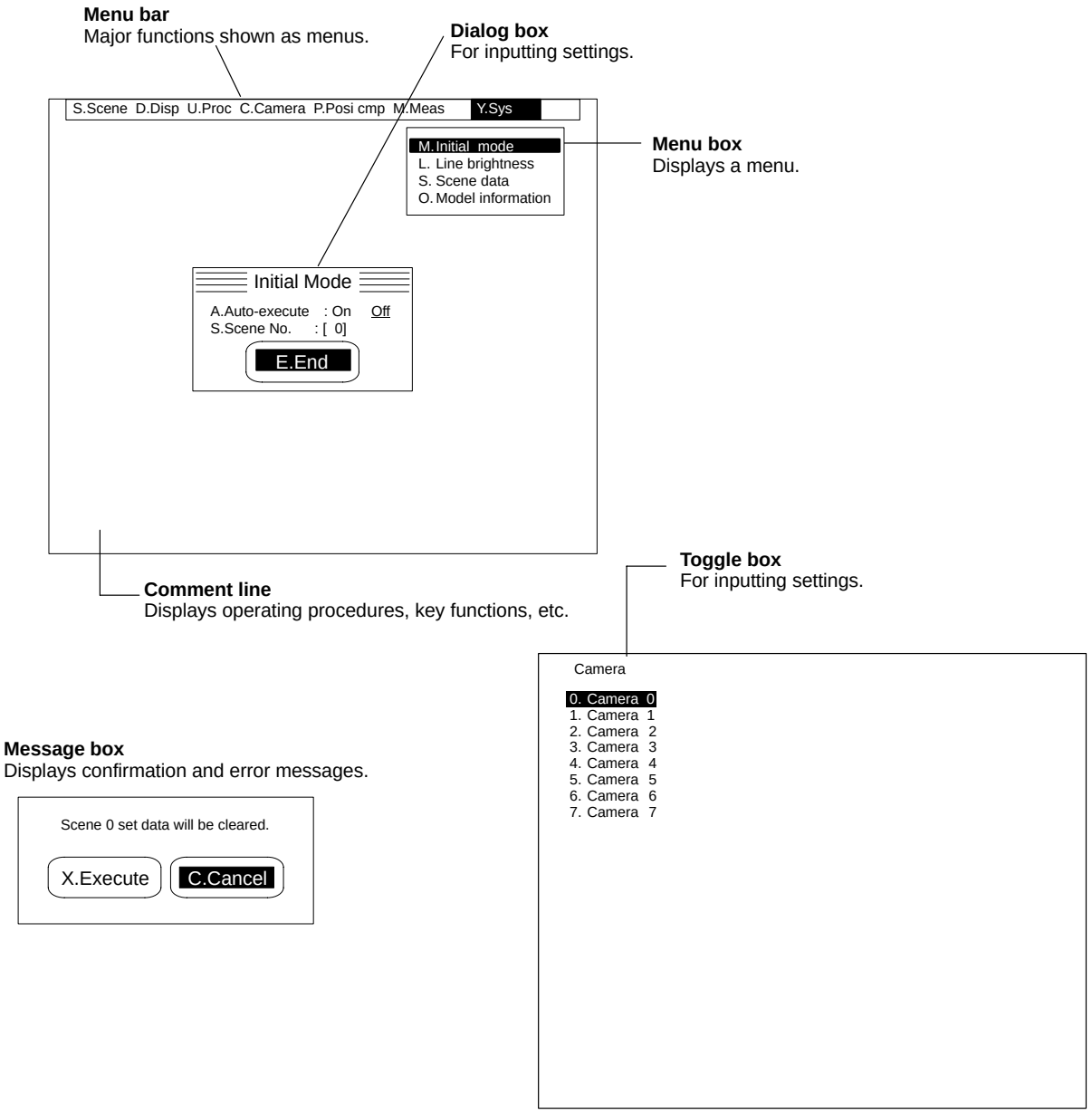


F300-KP Console

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

2-3-2 Key to the Screens

The menus and their functions are described below.



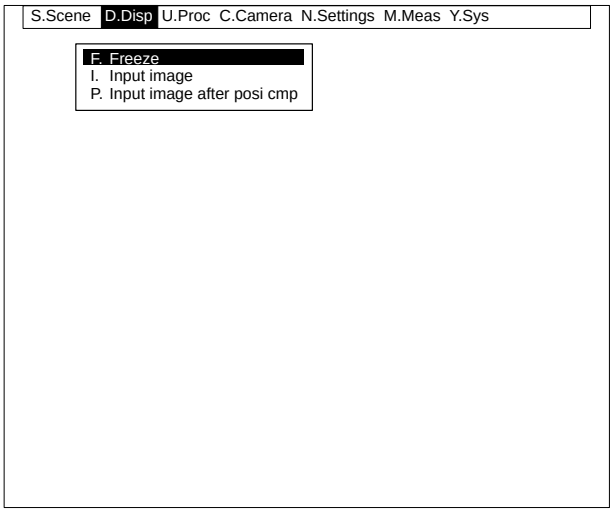
2-3-3 Selecting a Menu

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

Procedure

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

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



2-3-4 Inputting Settings

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

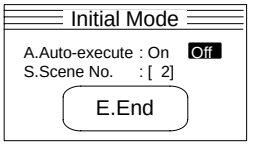
All settings are set to default values at the factory. Change the settings as required.

Settings in Dialog Boxes

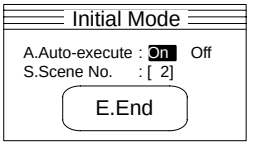
The current settings are underlined when a dialog box is displayed.

Procedure

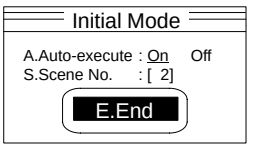
1, 2, 3... 1. Press the Up/Down Keys to move the cursor to the setting to be changed. The cursor will move to the current setting.



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



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



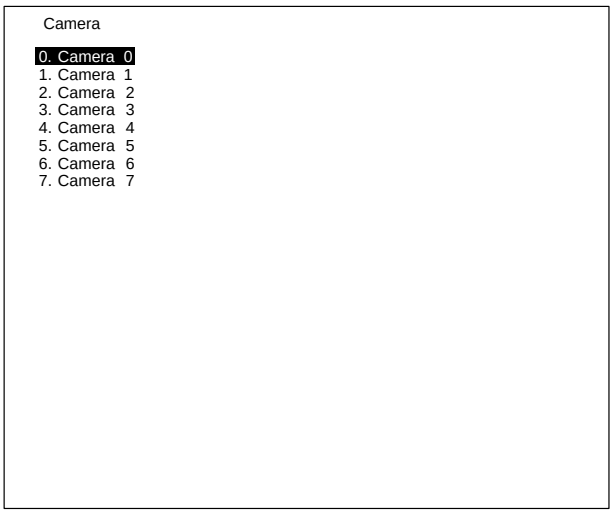
Settings in Toggle Boxes

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

Procedure

1, 2, 3...

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



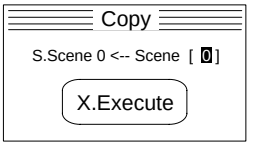
2-3-5 Inputting Numbers

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

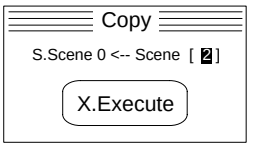
Procedure

1, 2, 3...

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



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

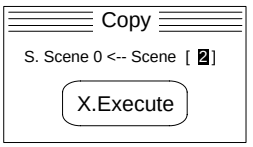


3. Press the Up/Down Keys to increase or decrease the number.

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

   Repeat steps 2 and 3 above to input multiple values.

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

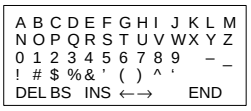


A convenient method exists for fine adjustment of a number. Move the cursor to the number to be changed and press the Direction Keys shown in the following table.

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

2-3-6 Inputting Characters

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

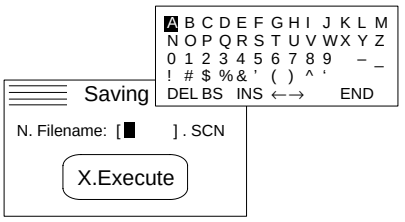


The displays other than characters have the functions described below.

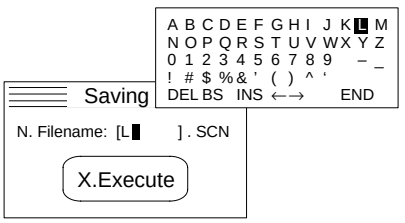
Display	Action
DEL	Deletes the character at the cursor position.
BS	Deletes the character immediately to the left of the cursor position.
INS	Toggles between insert and overwrite modes. The initial setting is overwrite.
←	Moves the cursor to the left.
→	Moves the cursor to the right.
END	Ends the character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

Procedure

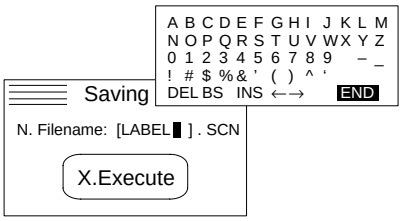
1, 2, 3... 1. Move the cursor to the item for which a character is to be input and press the Enter Key. The character input mode will be entered, and the characters that can be input will be displayed on the screen.



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



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



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

Clearing All Characters

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

Inserting Characters

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

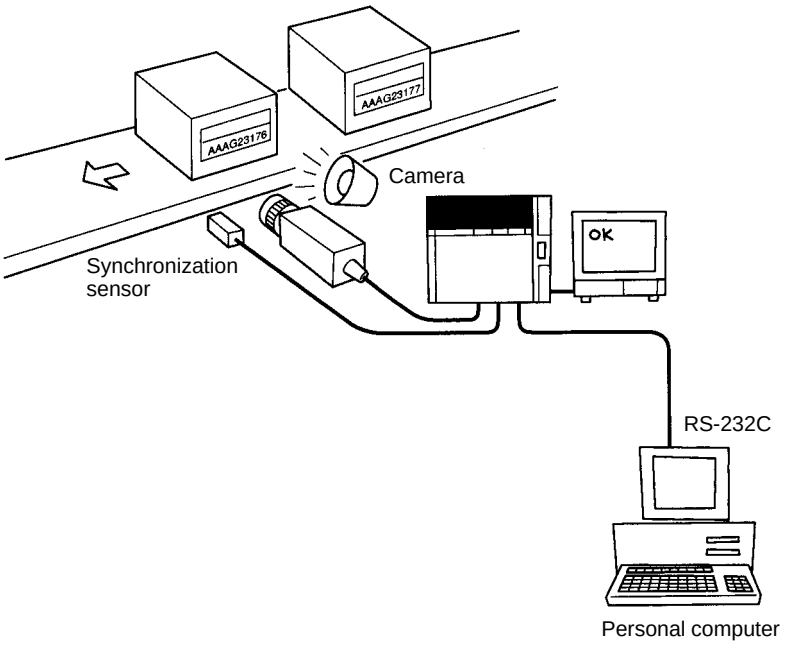
SECTION 3
Using the Menus

The character reading programs provide three measurement items. Select the measurement items to use according to the objects that are to be measured. This section explains the functions and operations in order, using typical measurements as examples.

3-1 Standard Character Reading

In this example, characters printed on labels are read and are output via RS-232C. When the objects reach the measurement position, a STEP signal is input from a synchronization sensor. The position compensation function is set to allow measurement when the position of the boxes is not consistent, i.e., deviates from the measurement position.

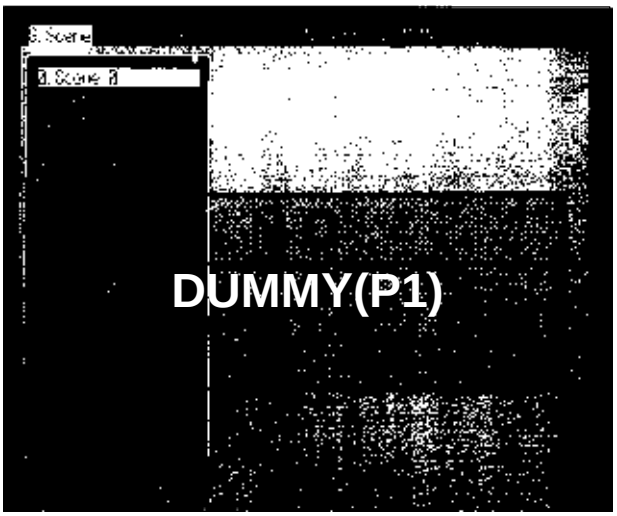
The F350 carries out measurements in sync with the STEP signal.



Procedure

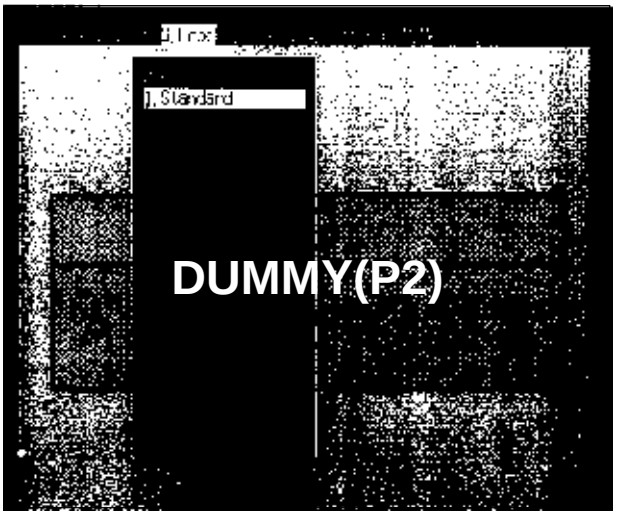
Selecting the Scene Number

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



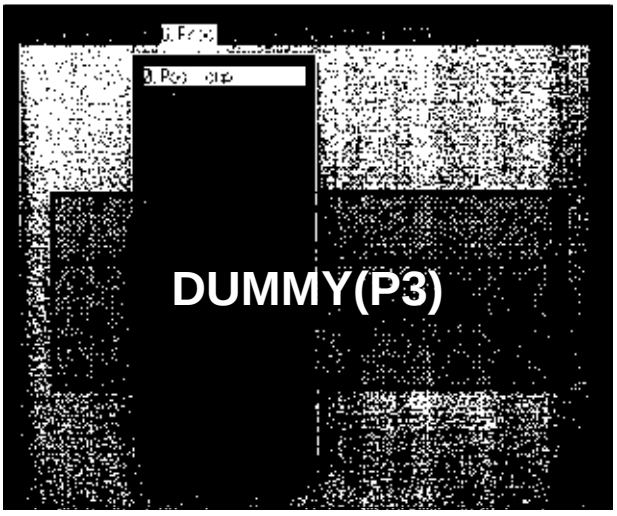
Setting Processes

2. Set position compensation for process number 0.
3. Set standard character reading for process number 1.
   Refer to *4-3-1 Setting Measurement Items*.

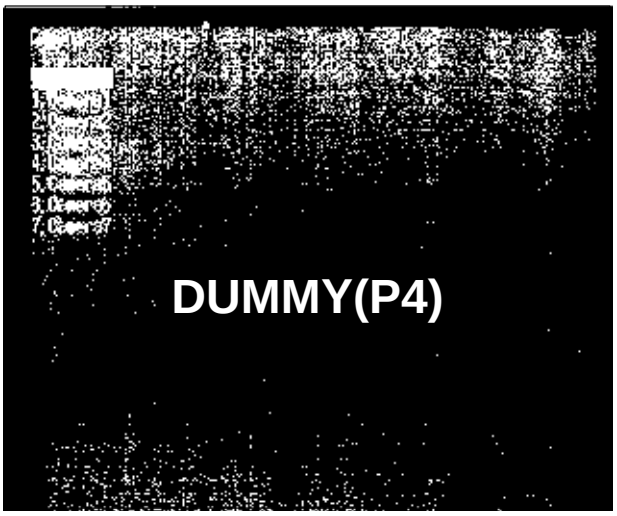


Setting Position Compensation

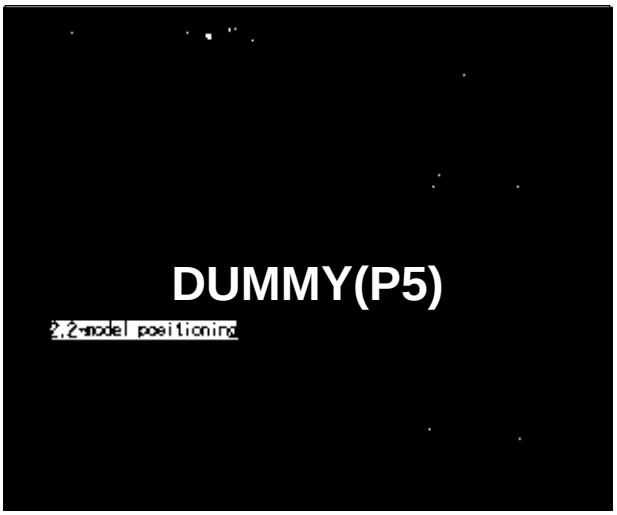
4. Select “0.Position compensation” under “U.Process.”
   “P.Position compensation” will be displayed on the menu bar. Refer to *4-3-2 Switching Processes*.



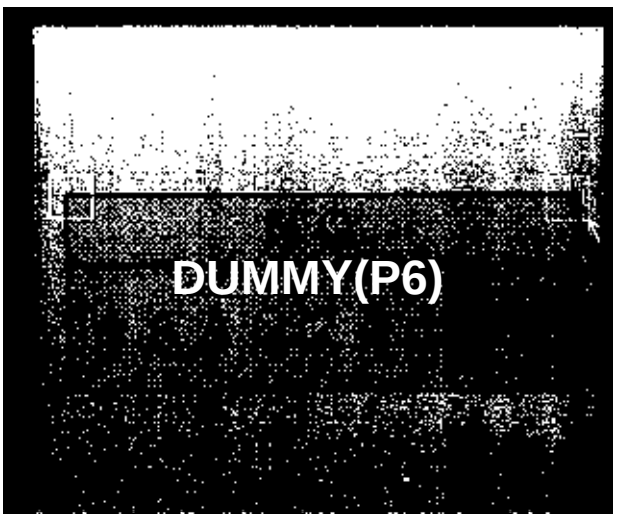
5. Select camera 0. Refer to *4-4-1 Selecting the Camera Number*.



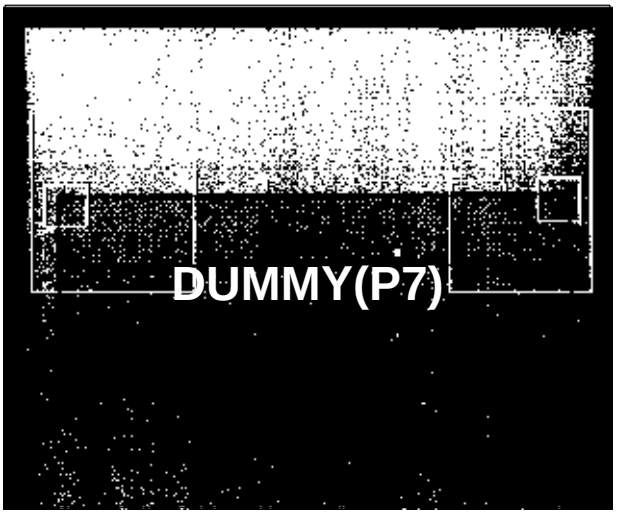
6. Select the position compensation method. In this case, select 2-model positioning. Refer to *4-11-1 Selecting the Position Compensation Mode*.



7. Register the position compensation model. Refer to *4-11-1 Selecting the Position Compensation Mode*.

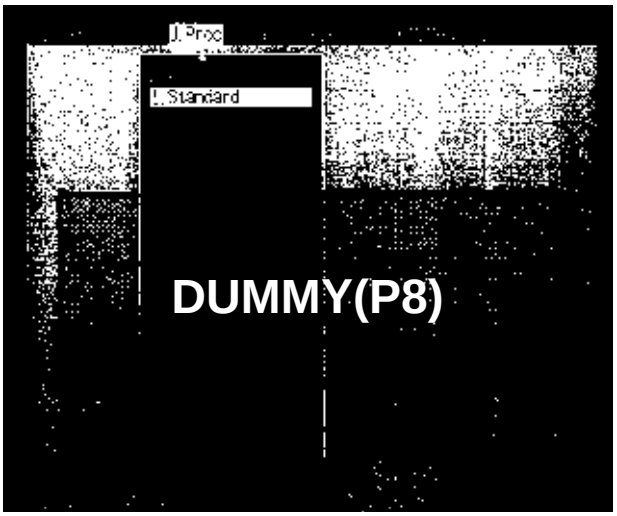


8. Draw the position compensation region. Refer to *4-11-3 Setting the Position Compensation Region*.

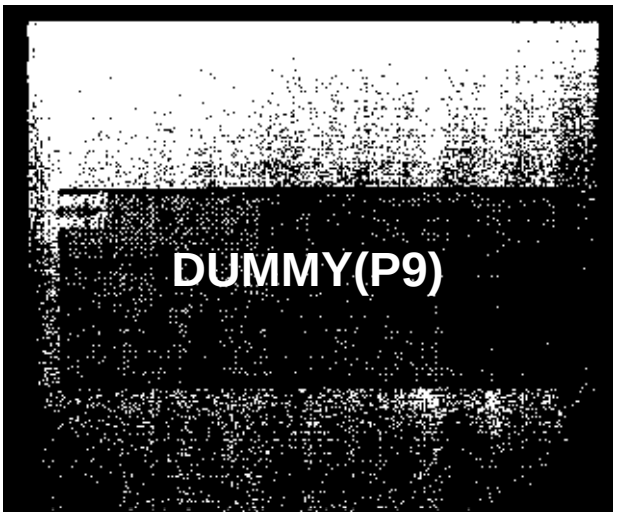


Setting Standard Character Reading

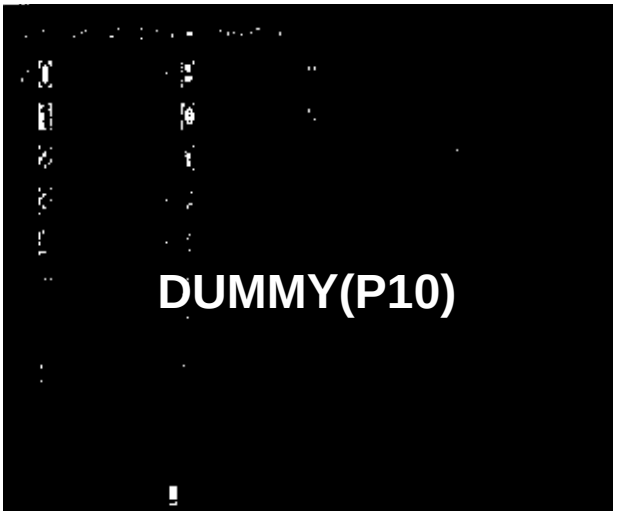
9. Select “1.Standard” under “U.Process.”
   “G.Standard” will be displayed on the menu bar. Refer to *4-3-2 Switching Processes*.



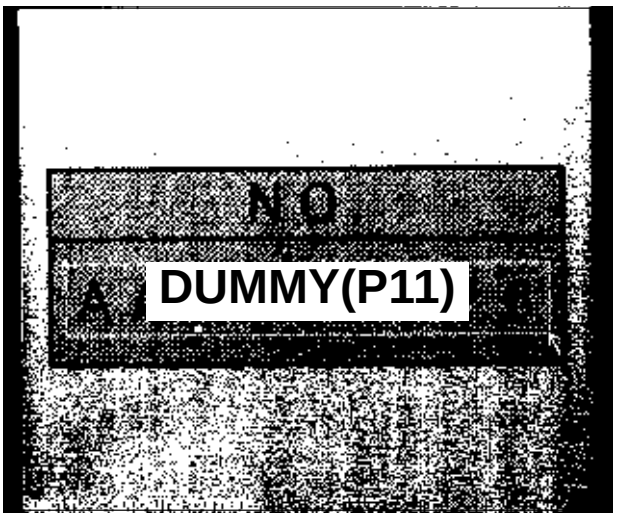
10. Select camera 0. Refer to *4-4-1 Selecting the Camera Number*.



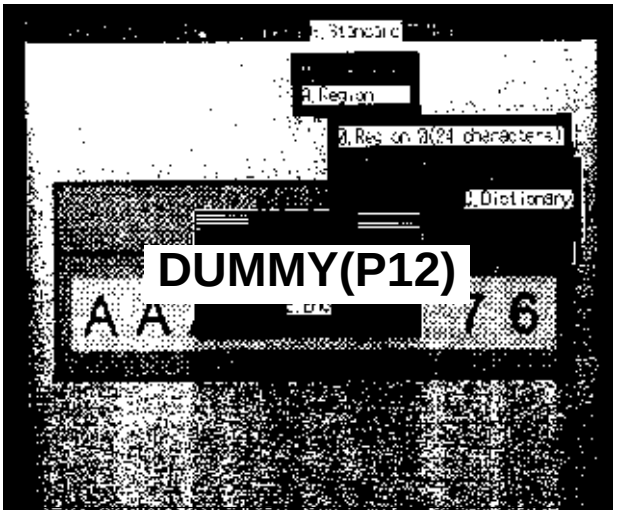
11. Register characters in the dictionary. In this case, register to the dictionary the alphanumeric patterns that are to be read. Refer to *4-5-1 Registering a Character Model*.



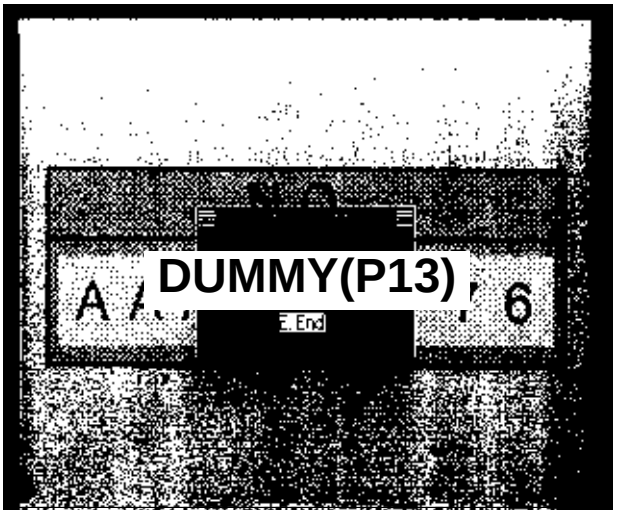
12. Set the read region. In this case, set the region containing the number to be read. Refer to *4-6-1 Drawing the Read Region*.



13. Select the dictionary. In this case, select dictionary 0, in which the patterns of the alphanumeric character patterns were registered. Refer to *4-6-2 Selecting the Dictionary*.



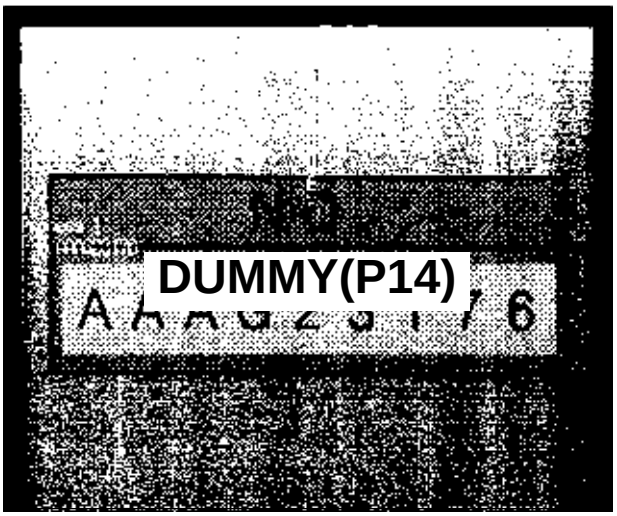
14. Set the evaluation criteria and search level. In this case, set the minimum limit of the correlation value as the evaluation criteria. Refer to *4-5-4 Setting the Criteria* and *4-7-2 Setting the Read Conditions*.



Reading

15. Execute the measurement using the measurement command. The character string that is read will be output to both the video monitor and the RS-232C I/F Unit.

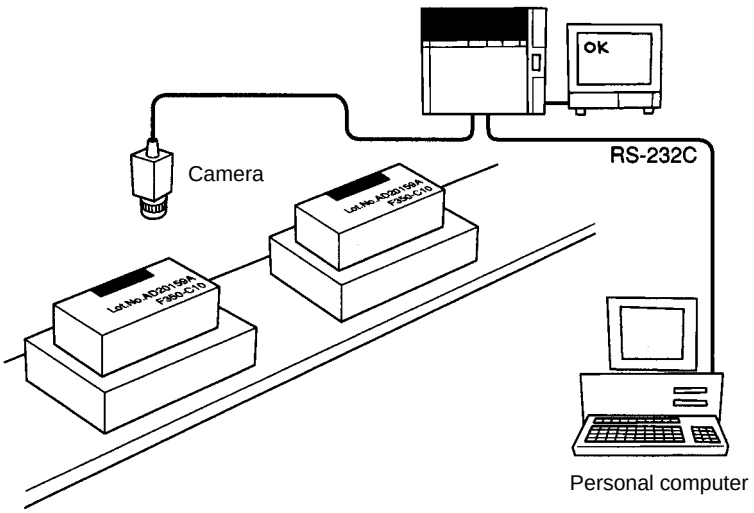
    Refer to *4-13-1 Entering Measurement Screens*.



3-2 Steady Character Reading

In this example, the lot numbers and model numbers of products are read from their packages, and are output via RS-232C. When the objects reach the measurement position, a STEP signal is input from a synchronization sensor. The position compensation function is set to allow measurement when the position of the boxes is not consistent, i.e., deviates from the measurement position.

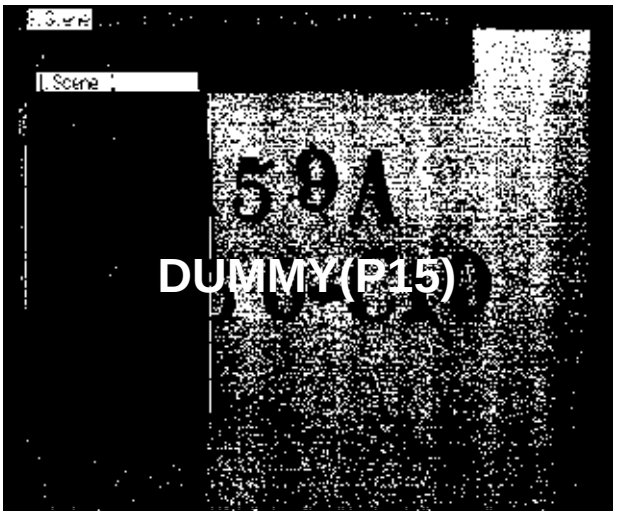
The F350 carries out measurements in sync with the STEP signal.



Procedure

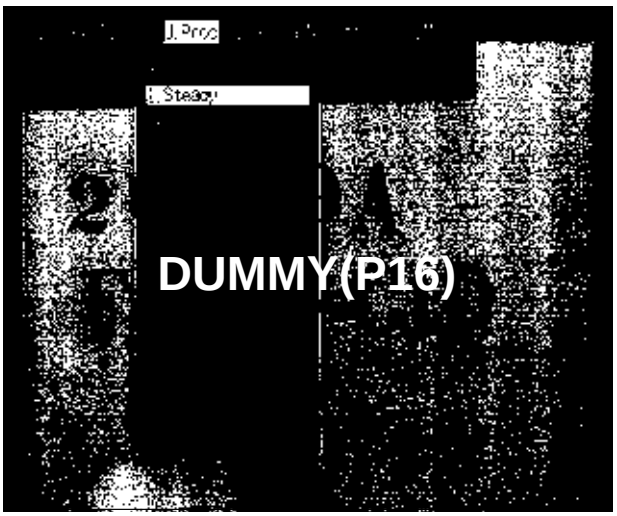
Selecting the Scene Number

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



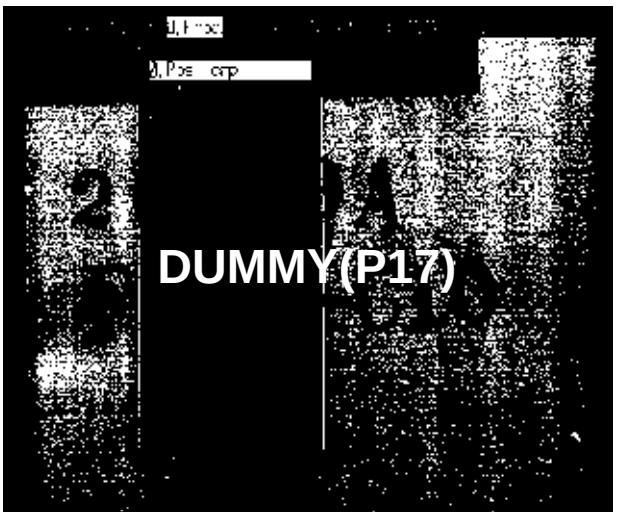
Setting Processes

2. Set position compensation for process number 0.
3. Set steady character reading for process number 1.
   Refer to *4-3-1 Setting Measurement Items*.

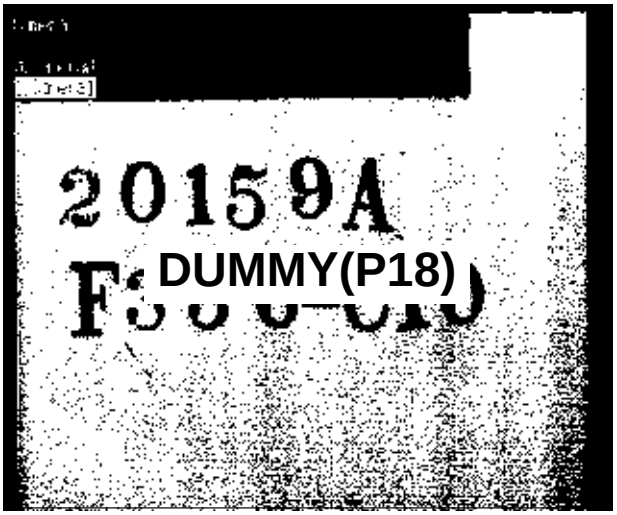


Setting Position Compensation

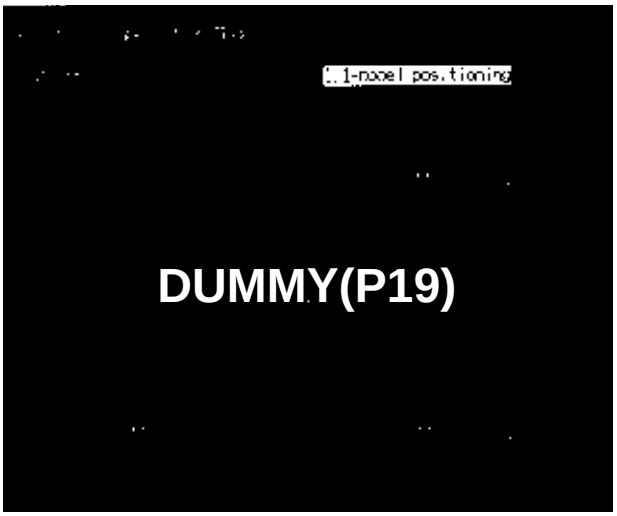
4. Select “0.Position compensation” under “U.Process.”
   “P.Position compensation” will be displayed on the menu bar. Refer to *4-3-2 Switching Processes*.



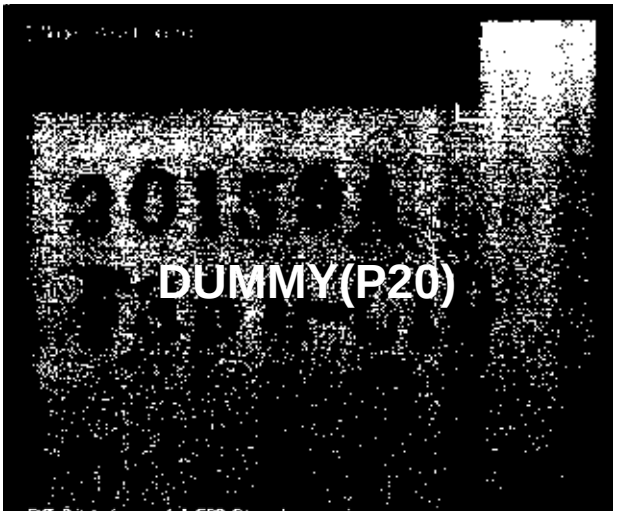
5. Select camera 1. Refer to *4-4-1 Selecting the Camera Number*.



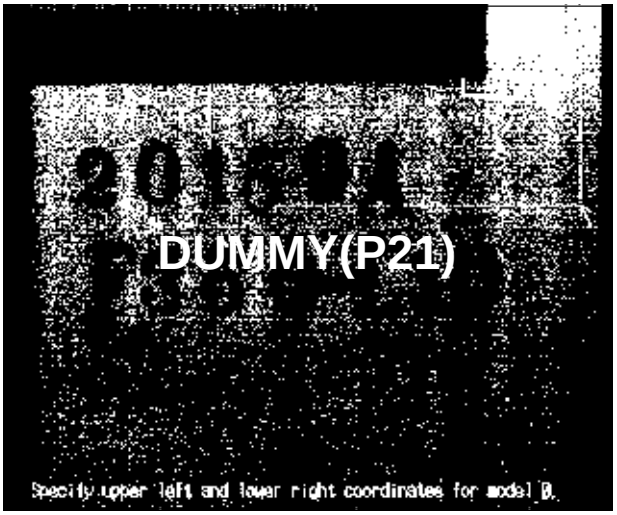
6. Select the position compensation method. In this case, select 1-model positioning. Refer to *4-11-1 Selecting the Position Compensation Mode*.



7. Register the position compensation model. Refer to *4-11-1 Selecting the Position Compensation Mode*.

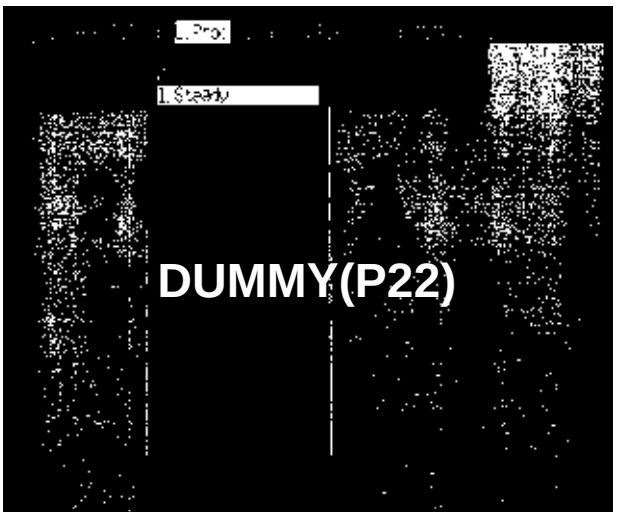


8. Draw the position compensation region. Refer to *4-11-3 Setting the Position Compensation Region*.



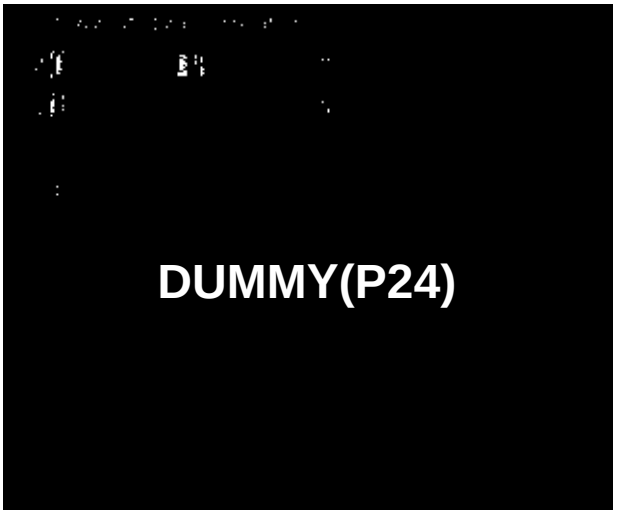
Setting Steady Character Reading

9. Select “1.Steady” under “U.Process.”
   “R.Steady” will be displayed on the menu bar. Refer to *4-3-2 Switching Processes*.

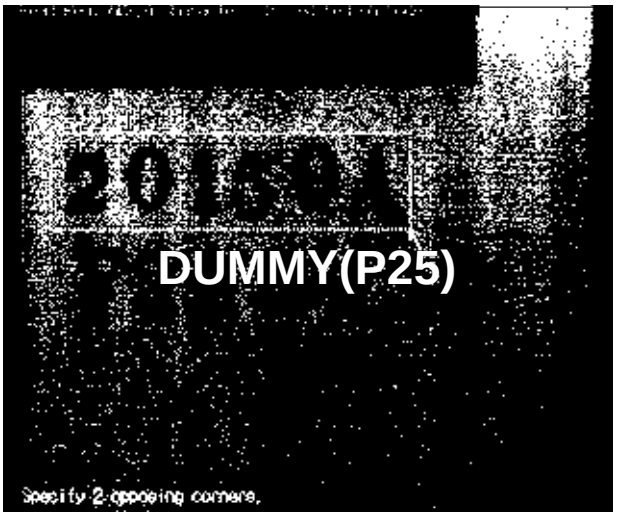


10. Select camera 1. Refer to *4-4-1 Selecting the Camera Number*.

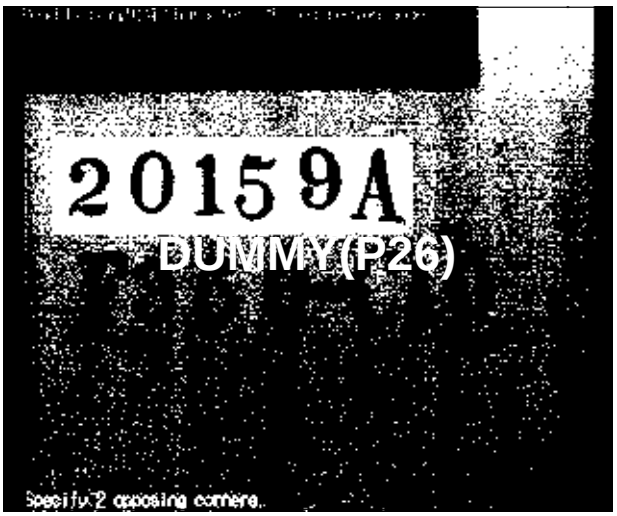
11. Register the characters in the dictionary. In this case, register in the dictionary the alphanumeric patterns that are to be read. Refer to *4-5-1 Registering a Character Model*.



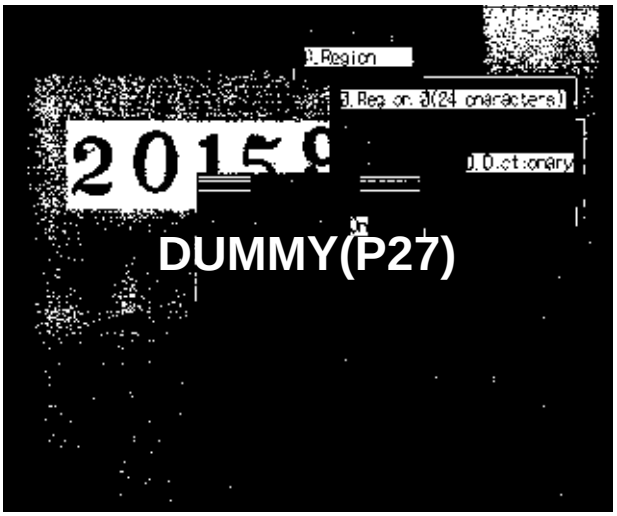
12. Set read region 0. In this case, set the region containing the number to be read. Refer to *4-6-1 Drawing the Read Region*.



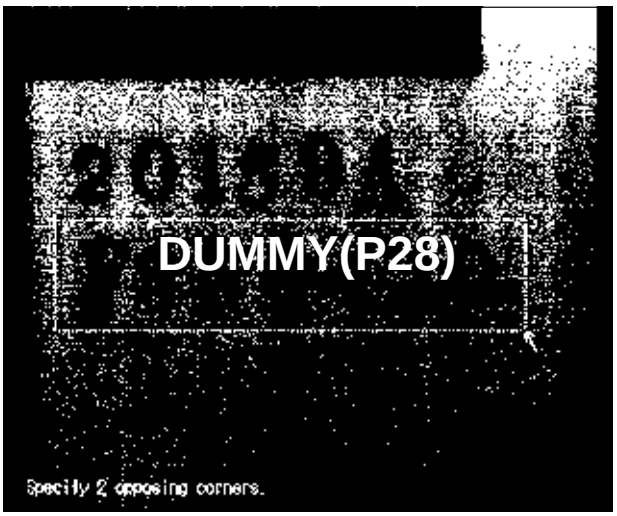
13. Set the number of characters in the region and set the read region for each character. Refer to *4-9-1 Drawing the Read Region*.



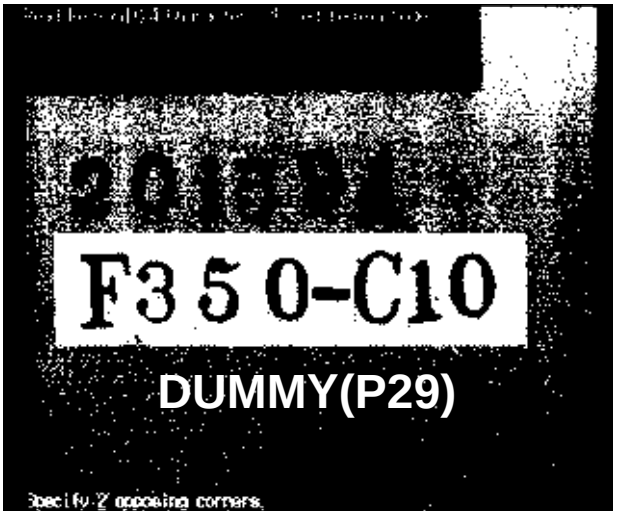
14. Select the dictionary. In this case, select dictionary 0, in which the patterns of the alphanumeric characters to be read were registered. Refer to *4-9-2 Selecting the Dictionary*.



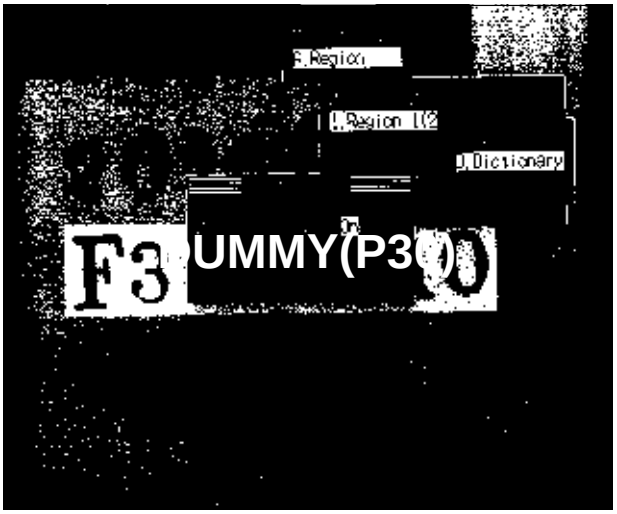
15. Select read region 1. In this case, set the region for reading the model number. Refer to *4-9-1 Drawing the Read Region*.



16. Just as for read region 0, set the read region for each character. Refer to *4-9-1 Drawing the Read Region*.

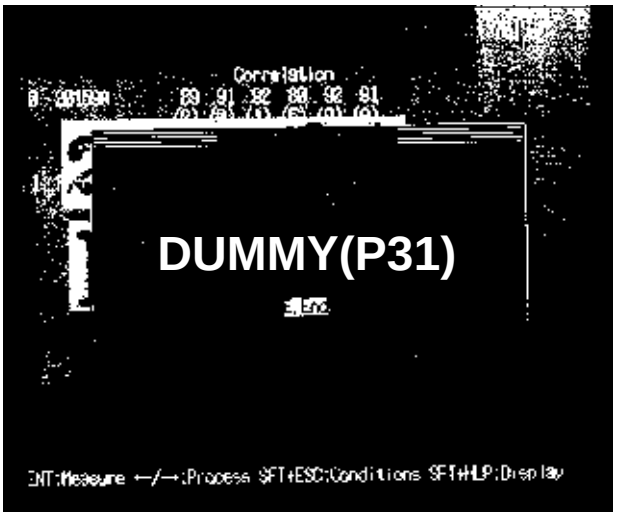


17. Select the dictionary. In this case, select dictionary 0, in which the patterns of the alphanumeric character patterns were registered. Refer to *4-9-2 Selecting the Dictionary*.



18. Set the evaluation criteria. In this case, set the minimum limit of the correlation value as the evaluation criteria.

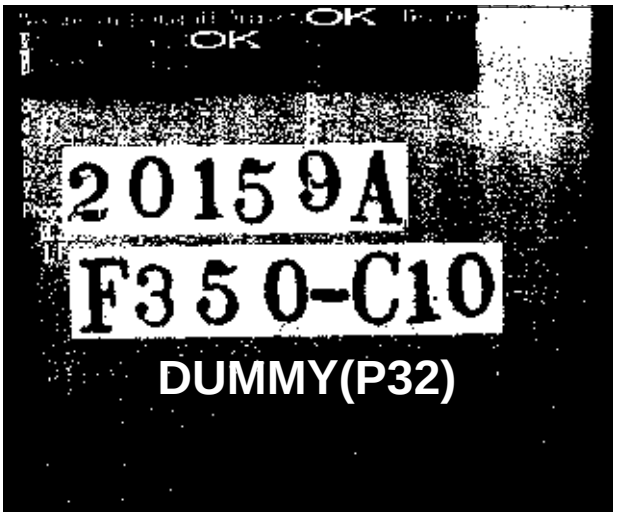
    Refer to *4-5-4 Setting the Criteria* and *4-10-2 Setting the Read Conditions*.



Reading

19. Execute the measurement using the measurement command. The character string that is read will be output to both the video monitor and the RS-232C I/F Unit.

    Refer to *4-13-1 Entering Measurement Screens*.



SECTION 4
Functions and their Operation

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

■ Setting Conditions

■ Standard Character Reading

■ Steady Character Reading

■ Position Compensation

■ Measurements

■ System

■ Setting Conditions

4-1 S.Scenes

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

Measurement conditions that have been set can be stored as scene data for each scene number. Refer to *4-14-3 Saving and Loading Scene Data*.

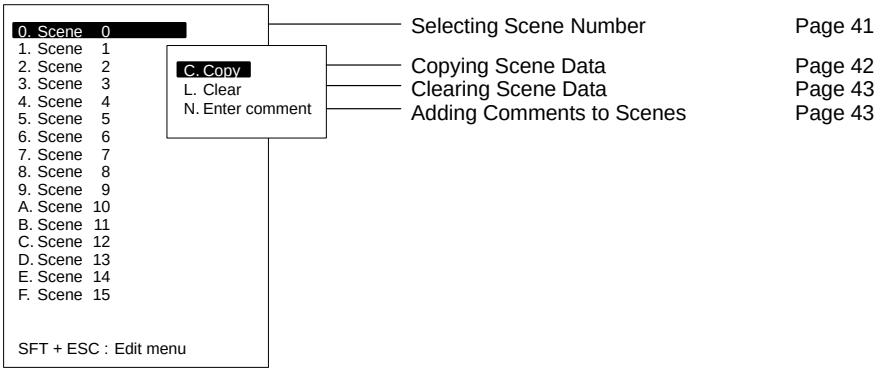
Use memory cards with enough available space for the data that is set. Standard sizes for scene data are provided in *Appendix B*.

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

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

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

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



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

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

Initial Scene Number

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

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

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

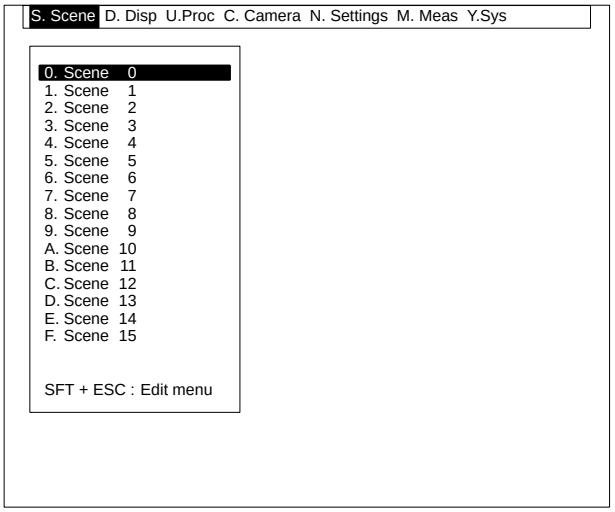
Refer to *4-14-1 Automatic Measurement*.

Displaying Scene Comments

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

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

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



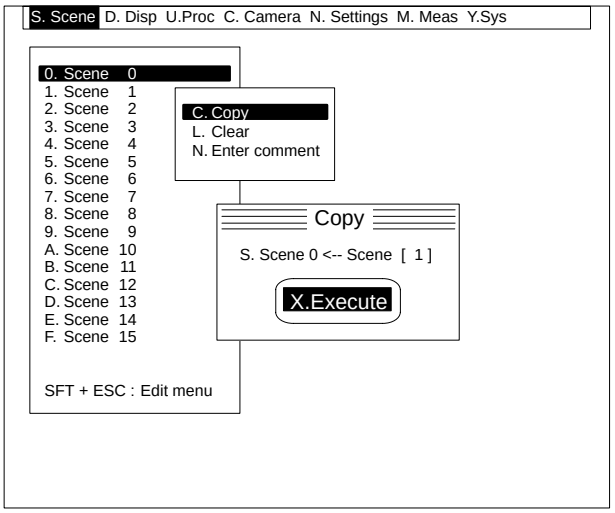
4-1-2 Copying Scene Data: C.Copy

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

Procedure

1, 2, 3...

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



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

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

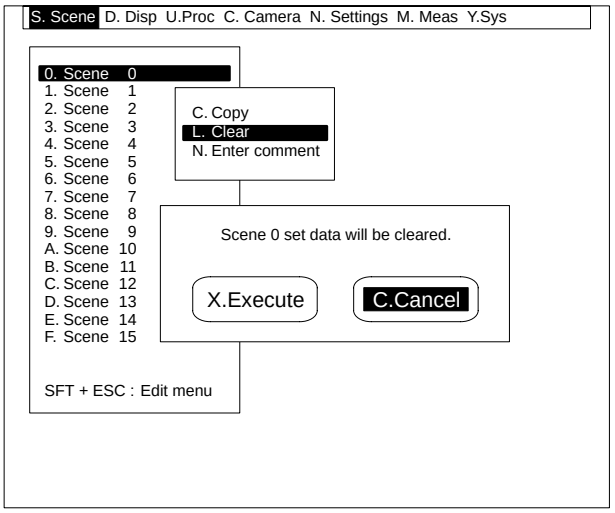
4-1-3 Clearing Scene Data: L.Clear

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

Procedure

1, 2, 3...

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



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

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

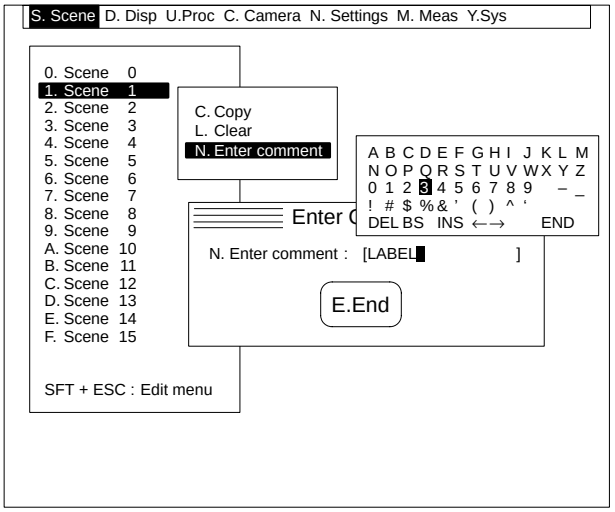
"N.Enter comment" is used to add comments to scenes. Comments, such as the item being measured, is used as a scene title.

The comment can be up to ten characters long.

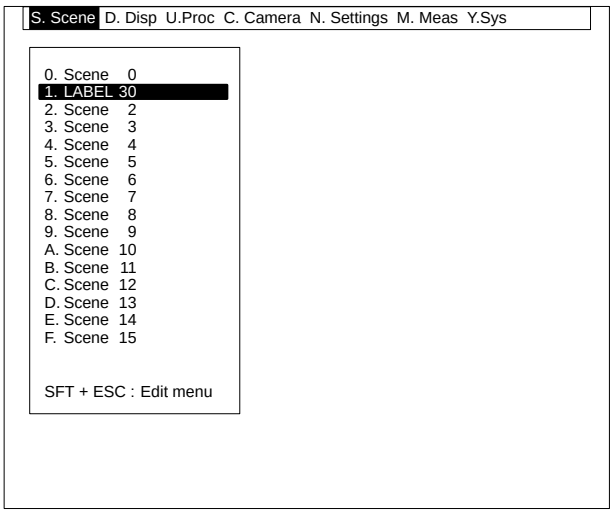
Procedure

1, 2, 3...

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



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



4-2 D.Display

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

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

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

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

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

Using Strobes

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

Timing of Inputting Images

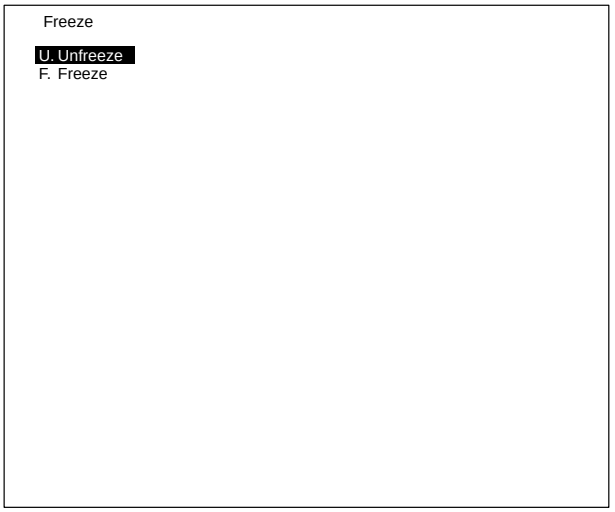
Static (freeze) images are updated when the following functions are executed:

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

Procedure

1, 2, 3...

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



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

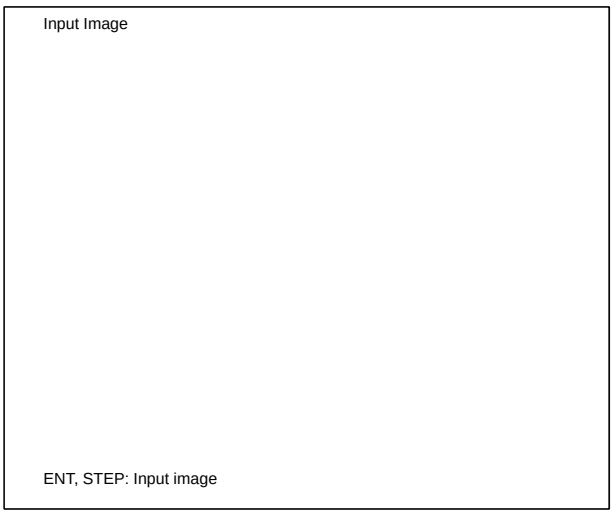
“I.Input image” displays camera images as static just as they are (i.e., without position compensation). The timing for inputting images can be specified by pressing the Enter Key or using the STEP signal. Images are input simultaneously with the pressing of the Enter Key or inputting of the STEP signal,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

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

Procedure

1, 2, 3...

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



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

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

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

The timing for inputting images can be specified by pressing the Enter Key or using the STEP signal. Set the position compensation function in advance. For details, refer to *4-11 P.Position Compensation*.

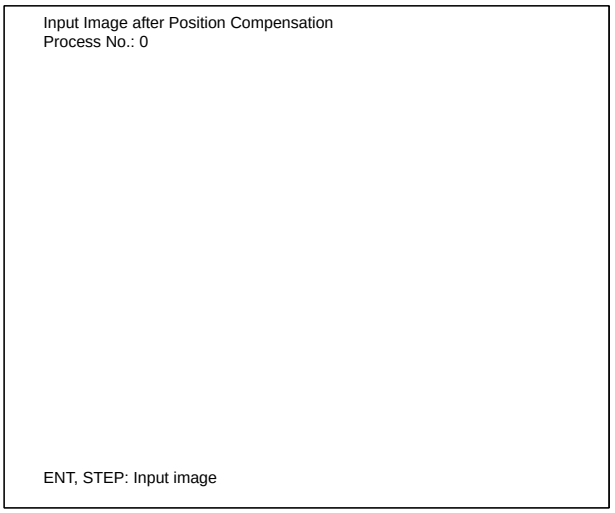
Images are input simultaneously with the pressing of the Enter Key or the inputting of a STEP signal, and the static (freeze) images are displayed. The display method is automatically set to"F.Freeze."

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

Procedure

1, 2, 3...

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



4-3 U.Process

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

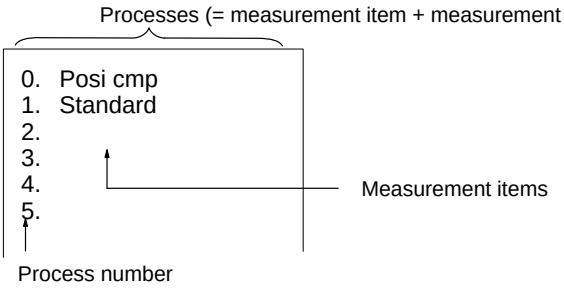
- Set the order in which measurement items are to be executed by assigning them to process numbers.
- Switch the measurement item displayed on the menu bar.

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

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

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

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



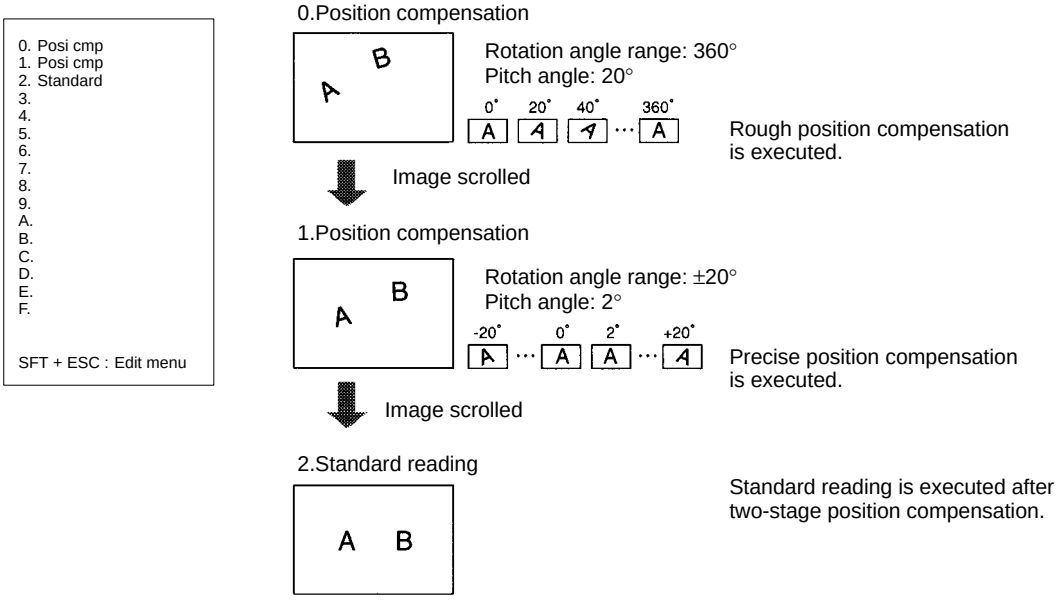
In the above example, standard character reading is executed after position compensation.

Up to 16 processes can be set per screen.

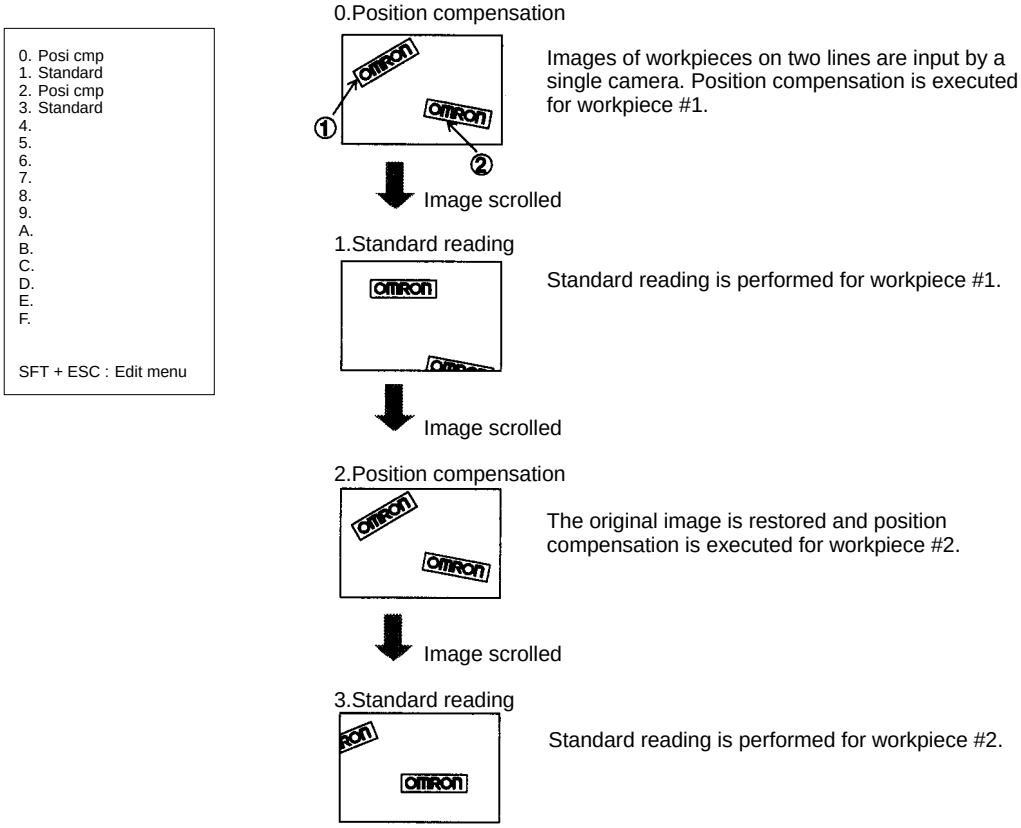
Important With standard character reading and steady character reading, the same dictionary cannot be used for different processes set for the same scene number. No more than five processes can be set per scene for standard reading and steady reading combined.

Example:

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



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



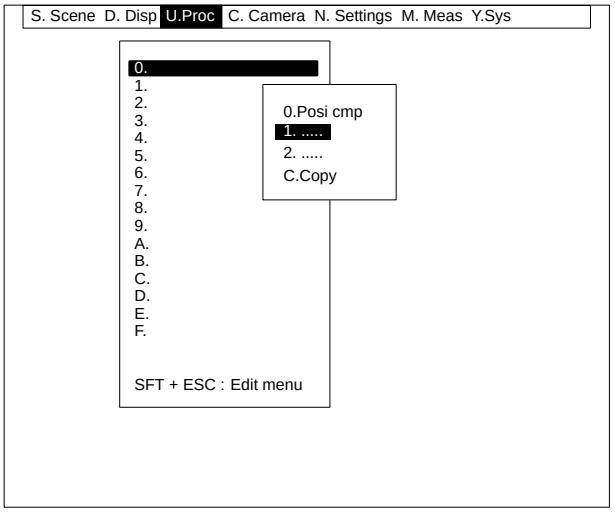
Procedure

1, 2, 3...

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

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

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

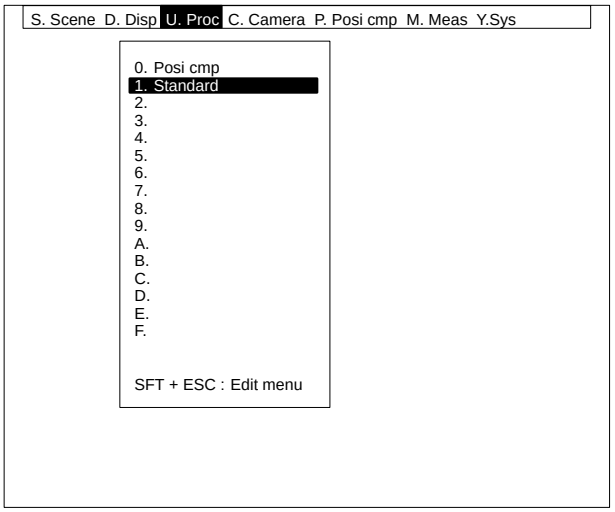


4-3-2 Switching Processes: U.Process

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

Procedure

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



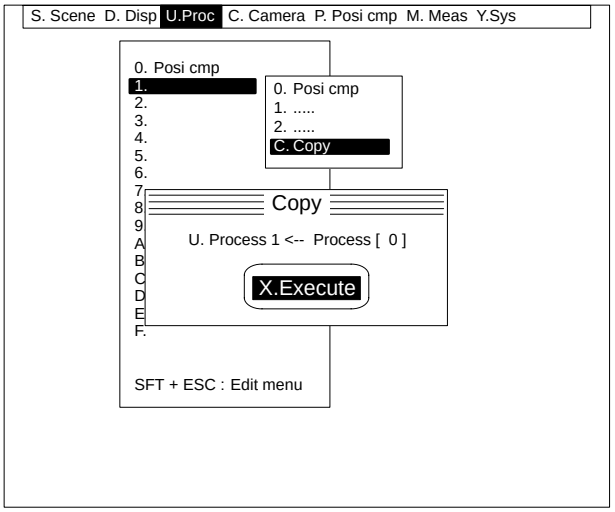
4-3-3 Copying Measurement Item Settings: C.Copy

"C.Copy" copies the setting of a specified process number to another process number. In cases where there are a lot of conditions in common between processes, it is convenient to copy process data that has already been created. Settings for processes set for standard character reading or steady character reading cannot be copied, because the same dictionary cannot be used for different process numbers.

Procedure

1, 2, 3...

1. Move the cursor to the process number of the copy destination and press the Shift+Escape Keys.
2. Select "C.Copy."
3. Enter the process number of the copy source.
4. Select "X.Execute." The data will be copied from the copy source to the copy destination.



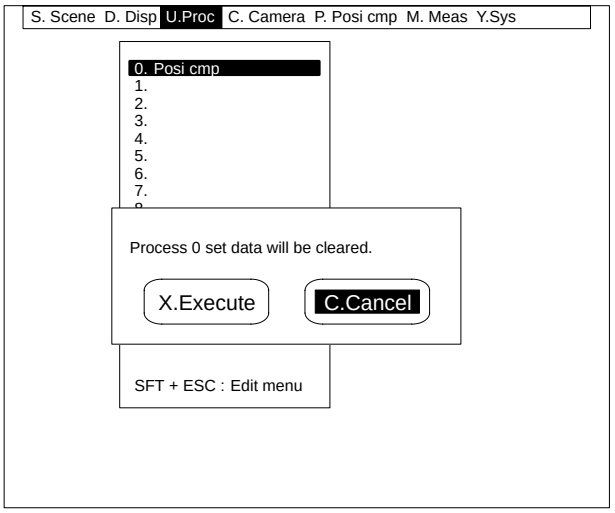
4-3-4 Clearing Measurement Item Settings: U.Process

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

Procedure

1, 2, 3...

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



4-4 C.Camera

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

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

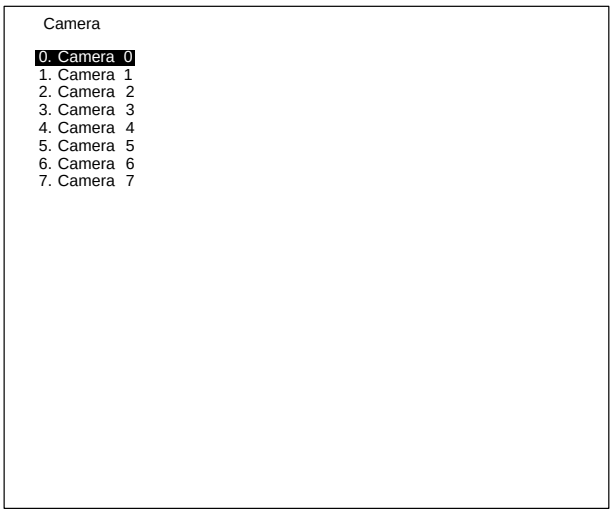
"C.Camera" is used to select the camera number for the currently displayed process. A camera number can be selected for each process number.

Procedure

1, 2, 3...

1. Select "C.Camera."

2. Select the camera number. The image from the selected camera number will be displayed.



4-4-2 Selecting Filtering: F.Filtering

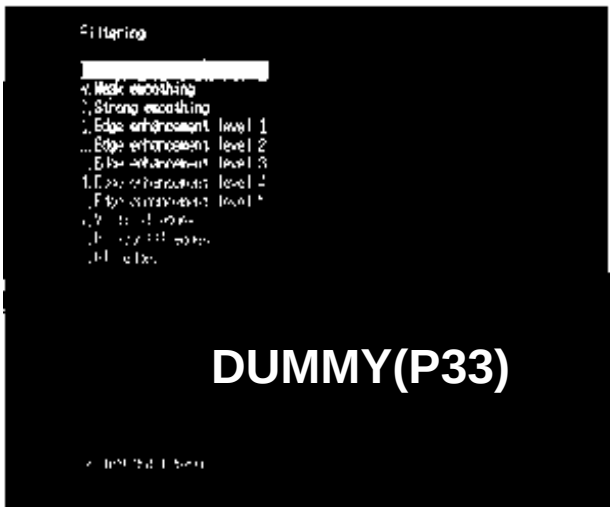
"F.Filtering" is used to process the camera image into an image more suitable for measurement. Select a filtering function that matches the environment and required measurement.

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

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

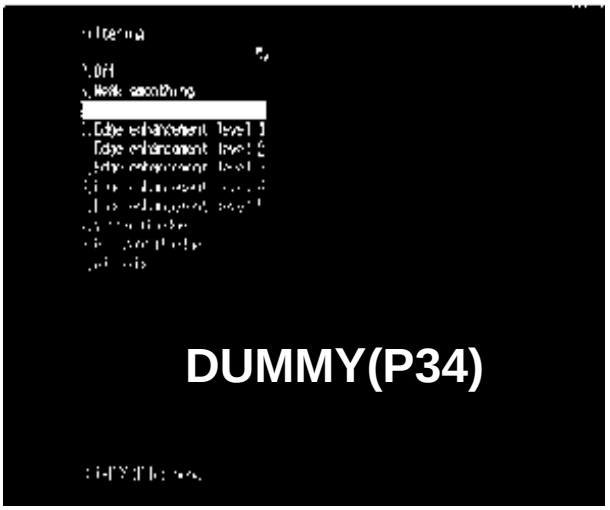
Important Correct measurement is not possible if the filtering and background suppression levels used during measurement are different from those used that were used when the model was registered. When setting the filtering and background suppression levels for the measurement object, set the filter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

OFF No filtering. The raw image is displayed.



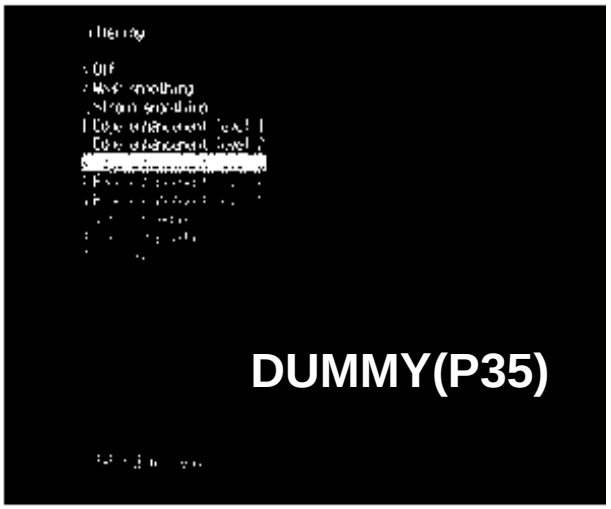
Smoothing

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

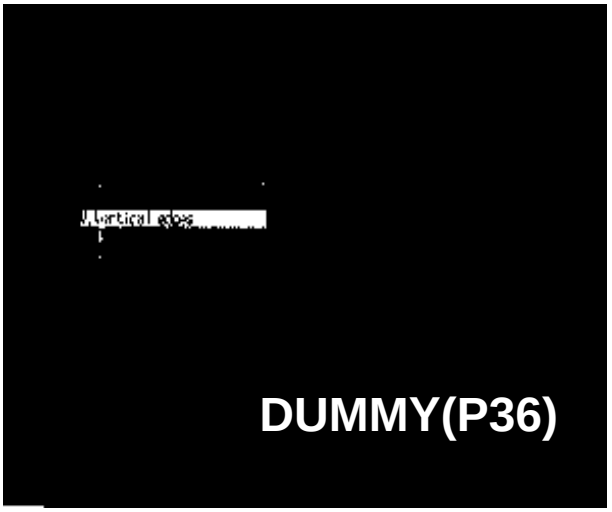


Edge Enhancement

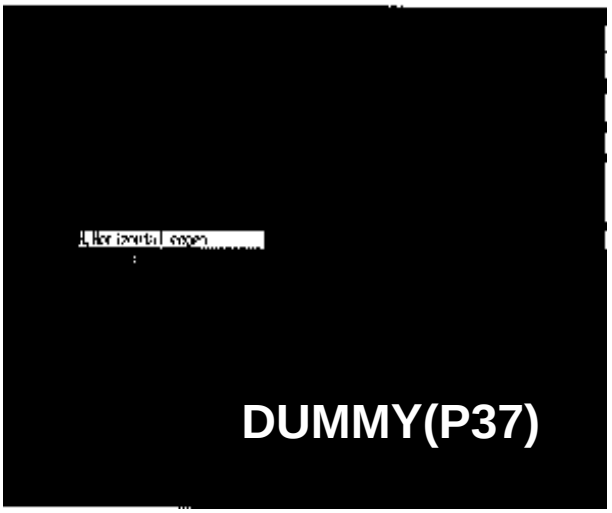
Displays an image with enhanced edges between bright and dark regions. Select the degree of edge enhancement from 1 to 5. Edge enhancement 5 is stronger than edge enhancement 1.



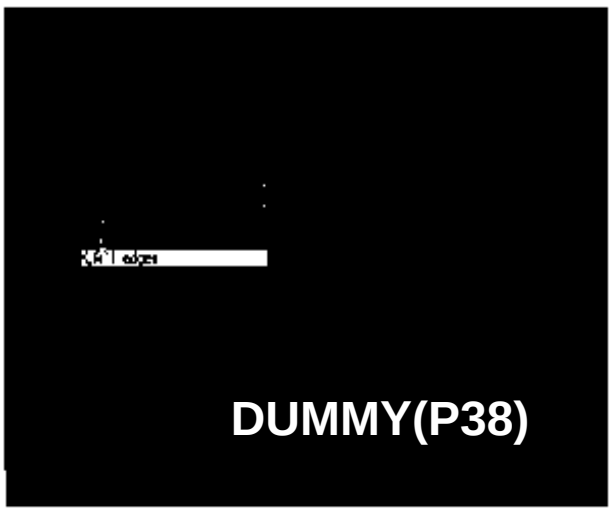
Vertical Edges Displays an image of only the vertical edges between bright and dark regions.



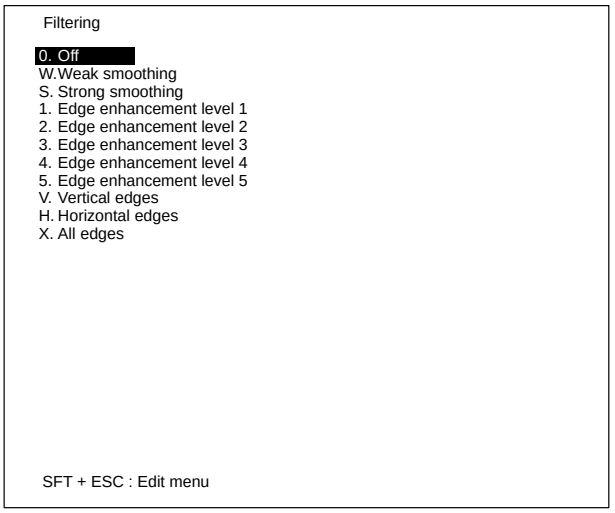
Horizontal Edges Displays an image of only the horizontal edges between bright and dark regions.



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



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



Copying Filter Settings

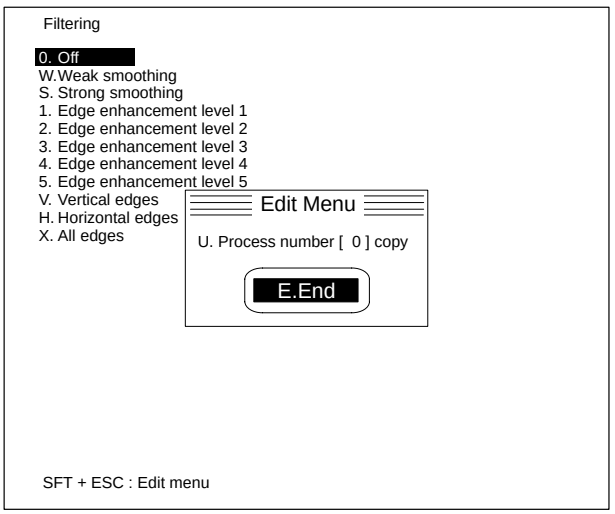
The filter settings for a specified process number can be copied to the process number that is currently displayed.

Note The measurement time per scene can be shortened if processes with the same camera number, filtering, and background suppression level are set consecutively. For details, refer to *4-13-1 Entering Measurement Screens*.

Procedure

1, 2, 3...

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



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

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

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

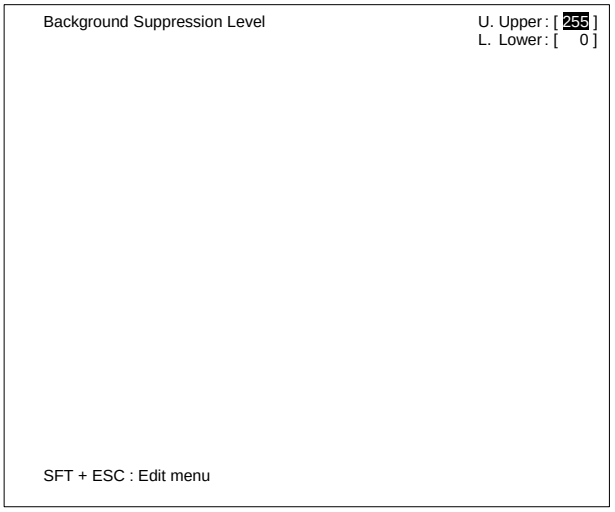
Important Correct measurement is not possible if different background suppression levels are used during measurement than those used when the model data was registered. Do not change the background suppression level after registering the models.

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

Procedure

1, 2, 3...

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



Copying the Background Suppression Level

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

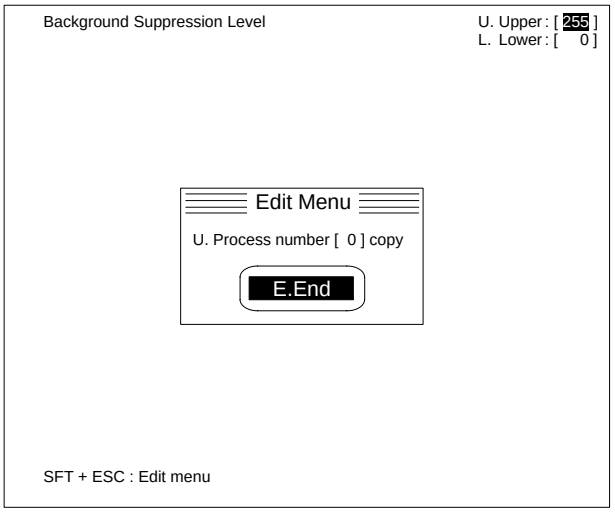
Note The measurement time per scene can be shortened if processes with the same camera number, filtering, and background suppression level are set consecutively. For details, refer to *4-13-1 Entering Measurement Screens*.

Procedure

1, 2, 3...

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

4. Select “E.End.” The copy source background suppression level setting will be copied.



■ Standard Character Reading

Standard character reading appears on the menus as simply “G.Standard” and is abbreviated in text as “standard reading.”

“G.Standard reading” reads alphanumeric characters using character patterns called character models registered in a dictionary. The character models are compared to characters in the read region and the character model with the highest correlation value is output as the result for each character. Use standard reading when character status is stable, i.e., when there is little variation in character quality. Characters can be read more quickly with standard reading than with steady reading.

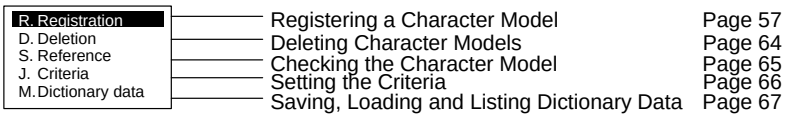
Standard character reading must be set for a process number before it can be used. Refer to *4-3 U.Process*.

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

4-5 G.Standard/M.Dictionary

“M.Dictionary” registers and deletes character models in a dictionary.

“M.Dictionary” is used both for “G.Standard reading” and “R.Steady reading.”



Display the static (freeze) image after position compensation and then register the character model. Refer to *4-2-3 Inputting Images After Position Compensation*.

4-5-1 Registering a Character Model: R.Registration

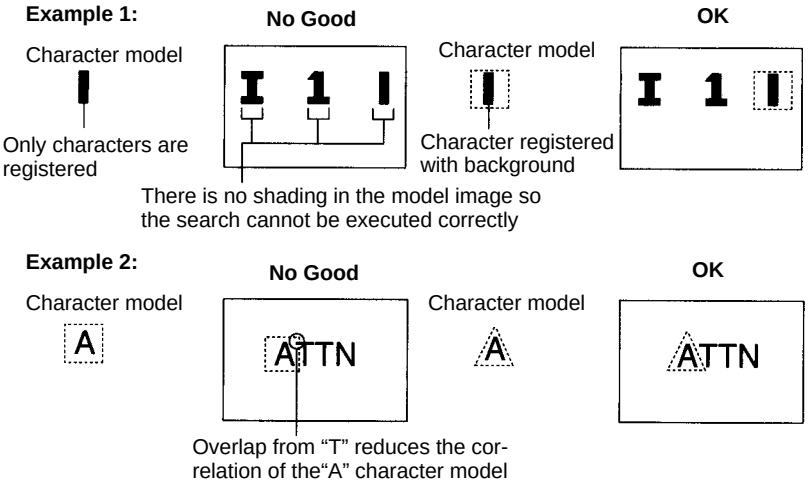
“R.Registration” registers character models to be used as reading references in a dictionary. A dictionary already contains a list of characters (hereafter referred to as dictionary characters). Up to six character models can be registered for each dictionary character, enabling the measurement of a mix of character patterns and varied character quality. Dictionary characters are the same for all scenes and cannot be created individually for each scene.

When registering a character model, there are two methods for extracting the character model region, automatic and manual cutting. When automatic cutting is selected, the region which fits the character model is automatically extracted from the specified region and registered. In manual cutting, character model regions are specified and registered one by one.

No. of dictionaries	Dictionary character	Remarks
5 (Dictionaries 0 to 4)	Dictionaries 0 to 3 44 characters: 0 to 9, A to Z and symbols (– / : . , % * +). There are no dictionary characters for a dot (·) or an apostrophe (’) but they can be registered to the period (.) and comma (,) if required. Dictionary 4 Ten arbitrary marks can be displayed using the dictionary characters a to j. These characters can be used to register any mark, symbol, or character.	Max. number of character models: 308 Six character models can be registered for a single dictionary character. Max. character model size: A total of about 3 screens (768 Kbytes) Individual character model size: Refer to *Appendix C: Dictionary Data Size*.

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

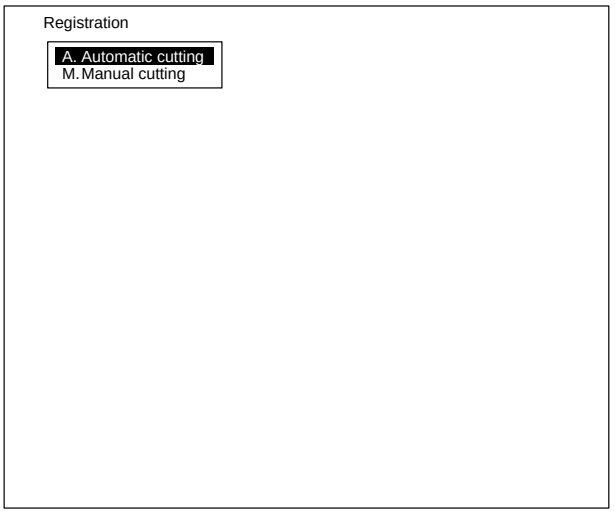
Important Do not turn off the power during character model registration or the memory data will be destroyed and the F350 will malfunction when it is turned on again.



Automatic Cutting

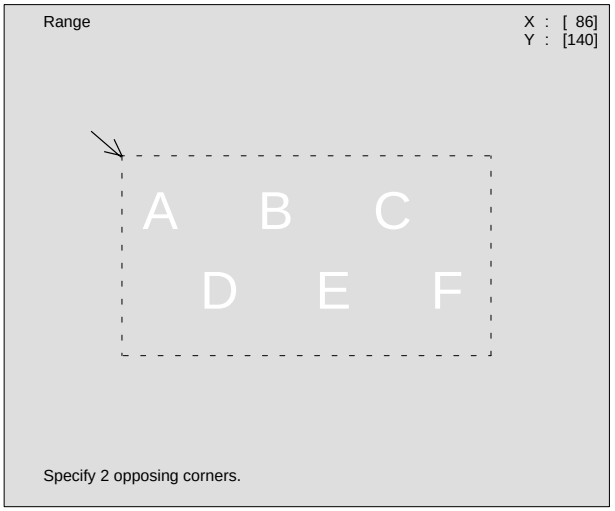
Procedure

1, 2, 3... 1. Select "R.Registration." The cutting method will be displayed.

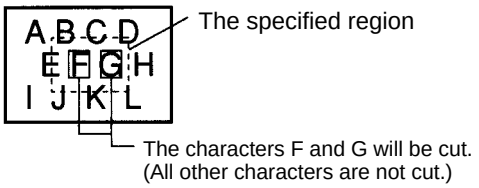


2. Select "A.Automatic cutting." The screen for setting the cutting parameters will be displayed.
3. Set the top-left coordinates of the rectangle for automatic cutting.

4. Set the bottom-right coordinates of the rectangle for automatic cutting.

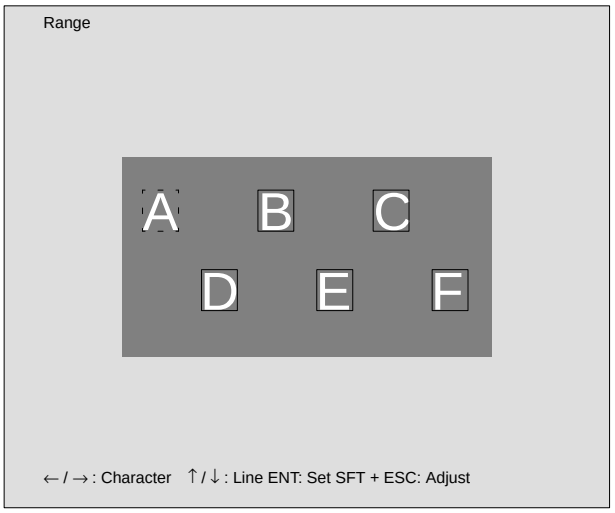


Set the region so that it contains all characters to be cut. If any part of a character is outside the region, it will not be cut.



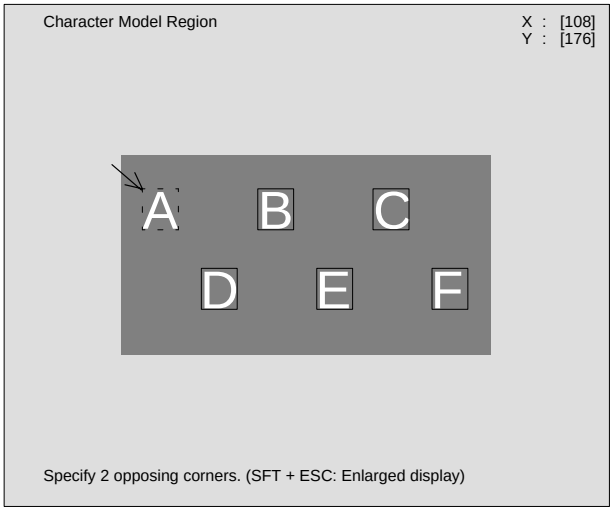
The maximum size for one cutting region is 10 lines × 24 characters. Be sure to set the rectangular region within these limits.

5. Press the Enter Key. The character model region is automatically extracted. When there are no changes to the region size, go to step 6. To change the size of the region, go to step 7.
6. Move the cursor to the character model region and press the Enter Key. Go to step 9.
7. Move the cursor to the character model region and press the Shift+Escape Keys.



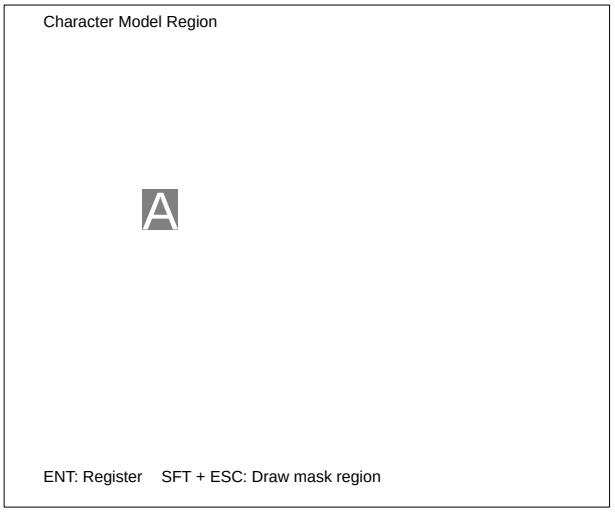
8. Adjust the character model region.

   The display can be enlarged when adjusting the character model region. Select the character model region for enlargement and then press the Shift + Escape Keys.



9. Check the character model.

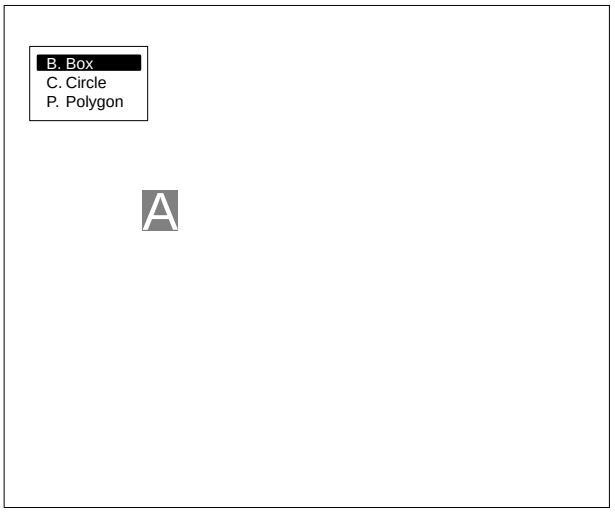
   To mask one section of the character model (to remove it from the character model), set the mask region in steps 10 to 12. If the character region setting is complete, go to step 13.



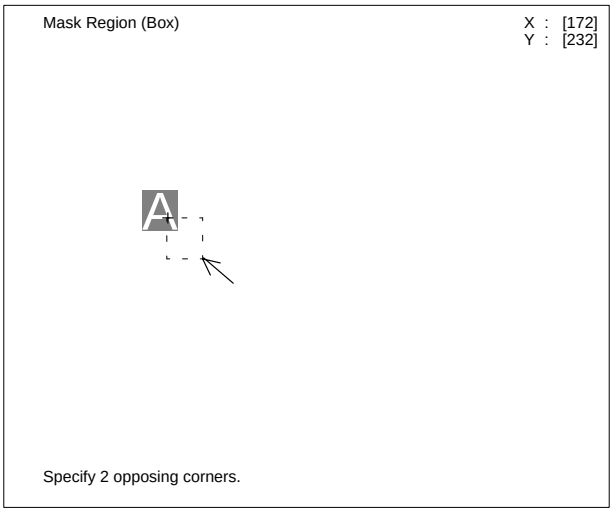
10. Press the Shift+Escape Keys. The mask region drawing menu will be displayed.
11. Select a mask region drawing method.

To Draw a Polygon

Specify a polygon with 64 vertices or less. If the polygon has more than 65 vertices, it cannot be drawn.

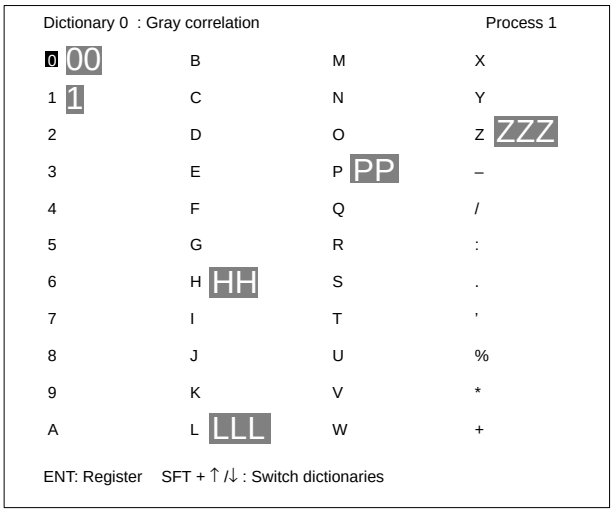


12. Specify the region to be masked. Move the arrow cursor and, using a drawing method, set the appropriate coordinates. When the region has been specified, press the Escape Key. The screen from step 9 will be displayed.

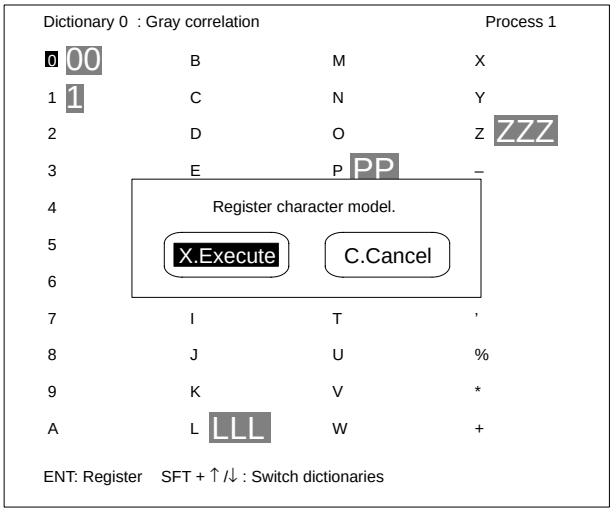


13. Press the Enter Key. A list of registered character models will be displayed.

    The dictionary can be switched by holding down the Shift Key and using the Up and Down Keys. You cannot, however, register models to a dictionary being used for a measurement item set for another process number or to one with a different measurement feature.



14. Select a dictionary character. Move the cursor to the position of the dictionary character to be registered as a character model. Press the Enter Key. A confirmation message will be displayed.



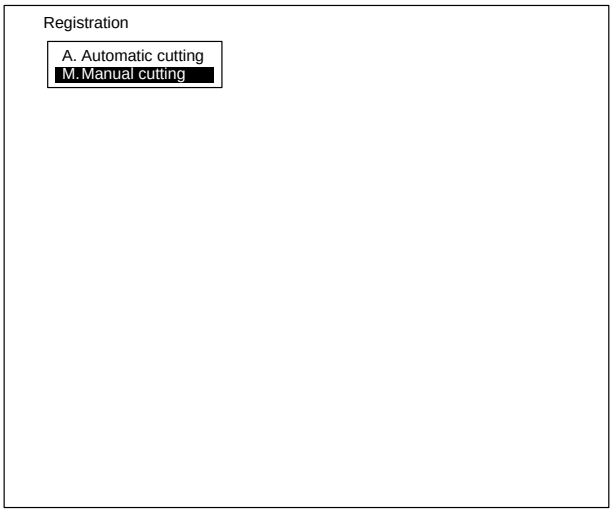
15. Select “X.Execute.” A character model is registered to the dictionary character. A reduced form of the character model image will be displayed. Press the Escape Key to return to the screen in step 5. For automatic cutting, when several character models are being registered, repeat steps 6 to 15.

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

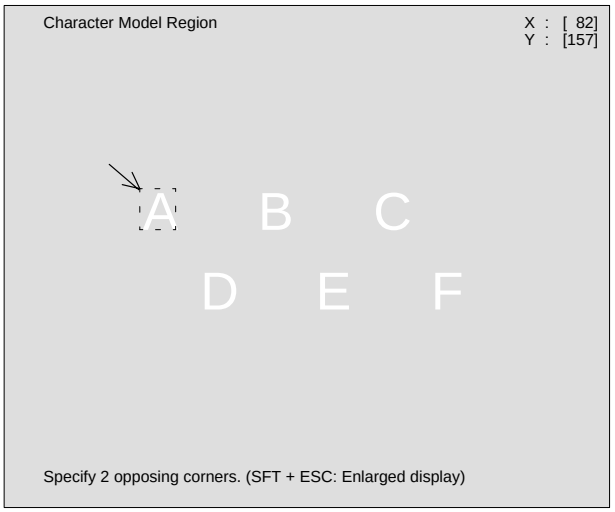
Manual Cutting

Procedure

1, 2, 3... 1. Select “R.Registration.” The cutting method will be displayed.



2. Select “M.Manual cutting.” A dotted line frame and an arrow cursor will be displayed.
3. Set the top-left coordinates of the character model region.
4. Set the bottom-right coordinates of the character model region.



Note To view an enlargement of the character model, move the dotted frame and adjust it so that the model for enlargement is enclosed completely. Then press the Shift + Escape Keys. If the model is not completely enclosed, it will not be displayed in the center of the screen.

5. The remaining steps are the same as for “A.Automatic cutting” so refer to steps 9 to 15 for details. When registering several character models in succession, repeat from step 3.

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

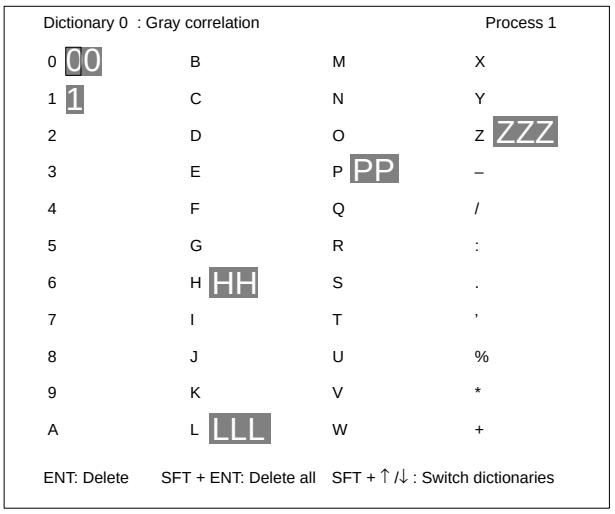
4-5-2 Deleting Character Models: D.Deletion

Deletes registered character models.

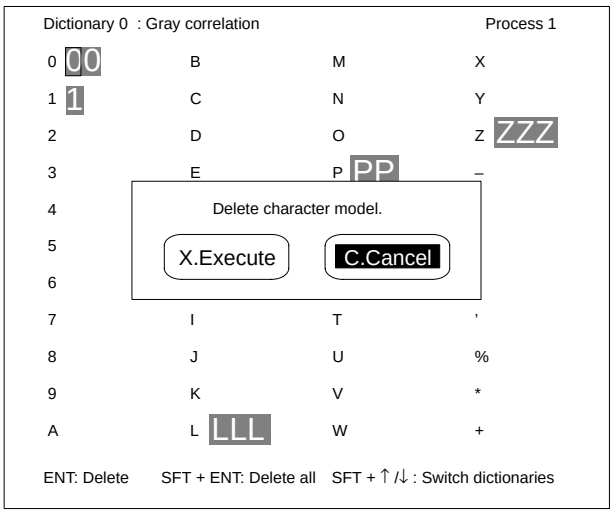
Procedure

1, 2, 3... 1. Select “D.Deletion.” A list of registered character models will be displayed.

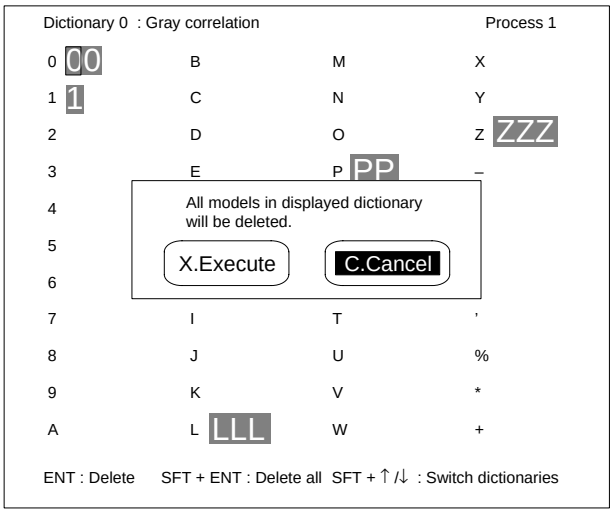
The dictionary can be switched by holding down the Shift Key and using the Up and Down Keys. You cannot, however, delete models from a dictionary being used for a measurement item set for another process number or to one with a different measurement feature.



2. Select the character model to be deleted. Move the cursor to the position of the character model. Press the Enter Key. A confirmation message will be displayed.
3. Select “X.Execute.”



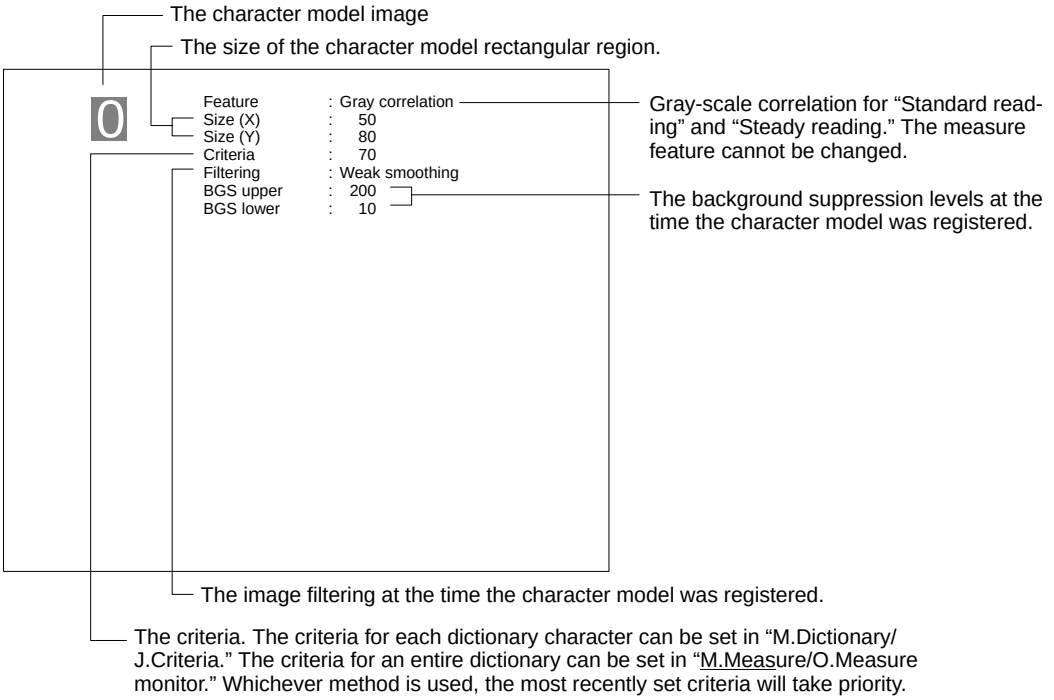
All character models in the displayed dictionary can be deleted at one time. Press the Shift + Enter Keys and a confirmation message will be displayed. Select “X.Execute.”



4-5-3 Checking the Character Model: S.Reference

The character model data registered in the dictionary will be displayed. The images, criteria, filtering, etc., of the set character models can be confirmed. Confirm that the set data is correct before executing measurements. Data cannot be changed using this menu item.

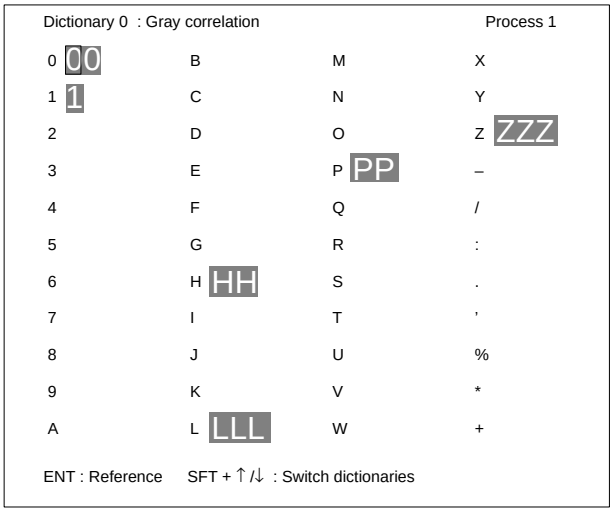
Important Correct measurement is not possible if the filtering and background suppression levels used during measurement are different from those that were used when the model was registered. Do not change the filtering and background suppression levels after registering the models.



Procedure

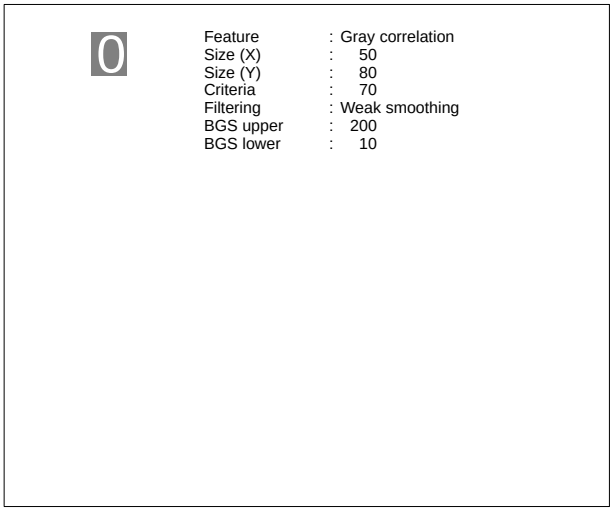
1, 2, 3... 1. Select “S.Reference.” A list of registered character models will be displayed.

The dictionary can be switched by holding down the Shift Key and using the Up and Down Keys.



2. Select the character model. The specified character model data will be displayed.

Items other than criteria are set at the time of character model registration and cannot be changed after that. If they must be changed, first change the conditions and then register the character models again.



4-5-4 Setting the Criteria: J.Criteria

The criteria to make judgements OK or NG are set for each dictionary character model. Set a number from 0 to 100. Images which fit the character model exactly are set at 100. Set the evaluation criteria to the minimum limit of the correlation value for a non-defective part (OK result). A correlation value less than the set evaluation criteria is evaluated as a defect (NG result).

Two Methods for Setting the Criteria

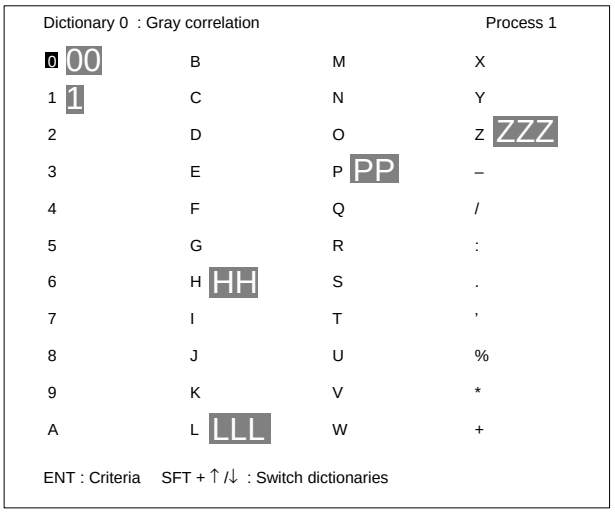
The criteria for each dictionary character can be set with “M.Dictionary/J.Criteria.” The criteria for the entire dictionary can be set with “M.Measure/O.Measure Monitor.” Regardless of which method is used, the most recently set criteria will take priority.

For example, if the criteria for the entire dictionary is set to 75 using "M.Measure/O.Measure Monitor," after the criteria for the character "C" had been set to 80 using "M.Dictionary/J.Criteria," then the criteria for the character "C" will be 75. Refer to *4-7-2 Setting the Read Conditions* and *4-10-2 Setting the Read Conditions.*

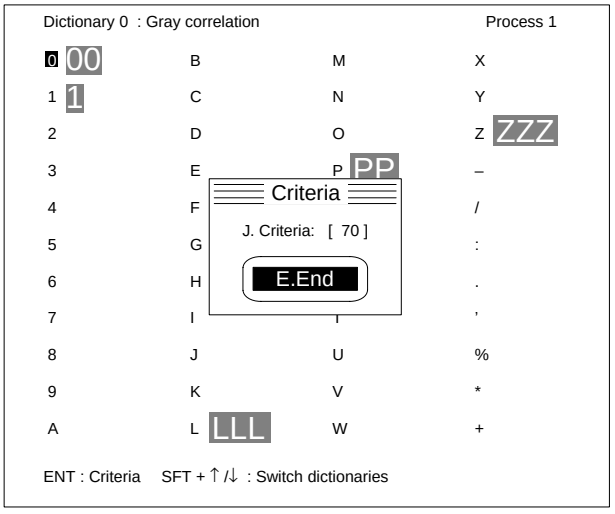
Procedure

1, 2, 3... 1. Select "J.Criteria." A list of all registered character models will be displayed.

The dictionary can be switched by holding down the Shift Key and using the Up and Down Keys. You cannot, however, change the criteria by switching to a dictionary being used for a measurement item set for another process number or to one with a different measurement feature.



2. Select a dictionary character. The criteria of the specified dictionary character will be displayed.
3. Input the criteria
4. Select "E.End."



4-5-5 Saving, Loading and Listing Dictionary Data: M.Dictionary Data

"M.Dictionary data" loads and saves dictionary data from/to a Memory Card. "M.Dictionary data" can also be used to display a list of dictionaries to confirm which dictionaries are being used by which processes.

Loading Dictionary Data

"M.Dictionary data" loads dictionary data saved on a Memory Card. Insert a Memory Card which contains previously saved dictionary data.

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

When the current scene is set "Position Compensation" use the following procedure to load data.

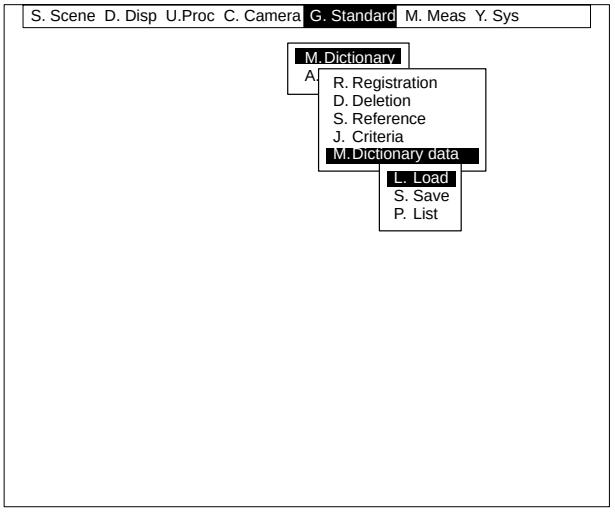
1, 2, 3...

1. Switch to a scene that is not set to "position compensation."
2. Load the dictionary data.
3. Switch back to the original scene.

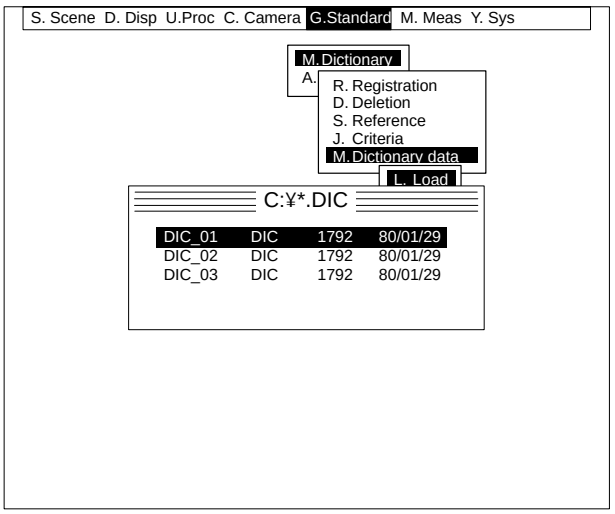
Procedure

1, 2, 3...

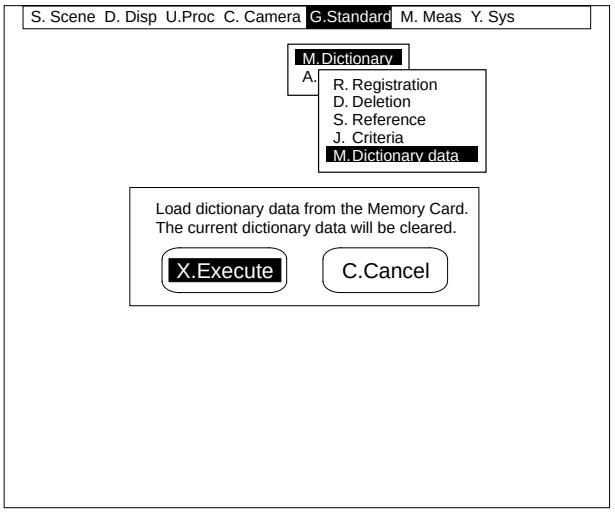
1. Select "M.Dictionary data."
2. Select "L.Load." A list of file names of dictionary data saved on the Memory Card will be displayed.



3. Select a file name. A confirmation message will be displayed.



4. Select “X.Execute.” The dictionary data is loaded.



Saving Dictionary Data

“M.Dictionary data” saves dictionary data to a Memory Card. An extension is automatically attached to the file names (.DIC). Search model data (.SMD) and ROI model data (.RMD) are also saved. When using the Memory Card for the first time after purchasing, format the Memory Card using the Setup menu. Refer to *5.4 1. Initializing Memory Cards* in the *Setup Manual*.

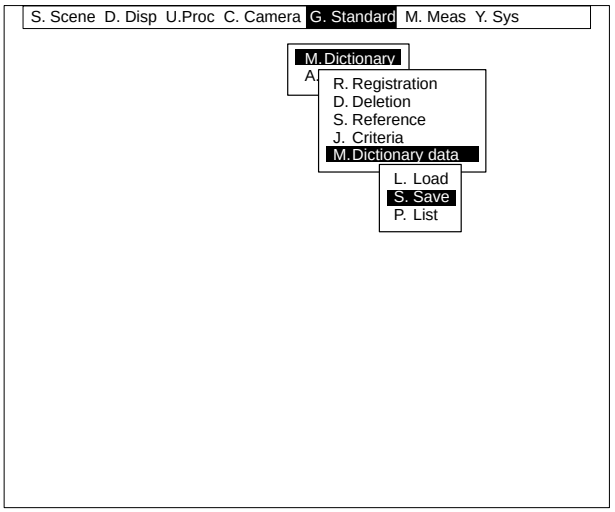
Important With the **F350-C12E IMP Unit**, it is necessary to insert a scene data back-up Memory Card in order to use several scenes. Use a separate Memory Card for saving dictionary data, and be sure to re-insert this Memory Card before saving the dictionary data.

The appendices contain information on dictionary data sizes. Use a Memory Card of the appropriate size for the set data. Refer to *Appendix C: Dictionary Data Sizes*

Procedure

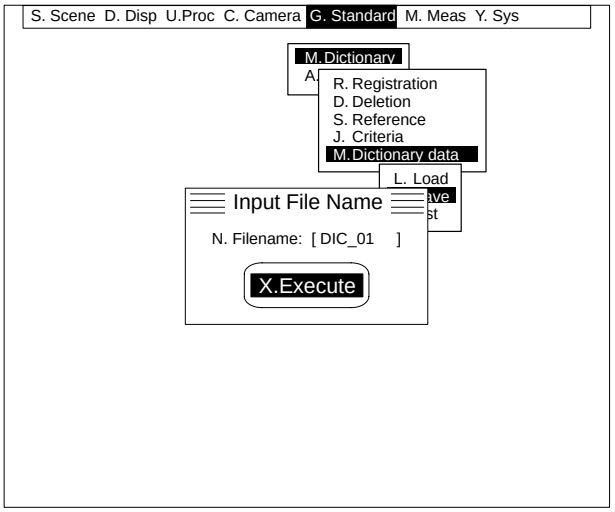
1, 2, 3... 1. Select “M.Dictionary data.”

2. Select “S.Save.”



3. Input the file name.

4. Select “X.Execute.” Dictionary data will be saved to the Memory Card under the specified file name.



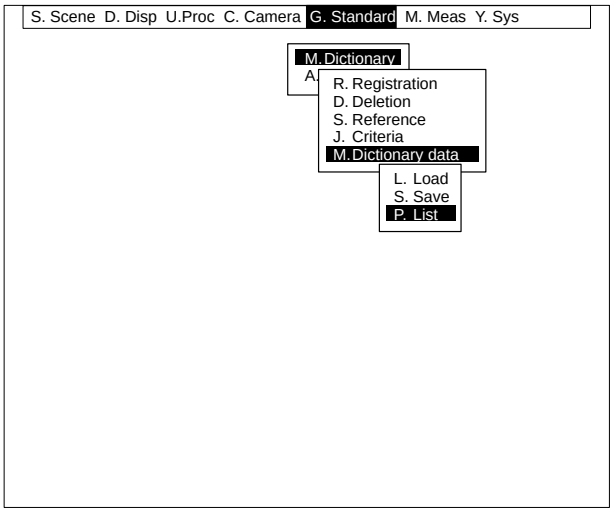
Important Do not turn the power off while the data is being saved, or the data will not be saved correctly.

Displaying the Dictionary List

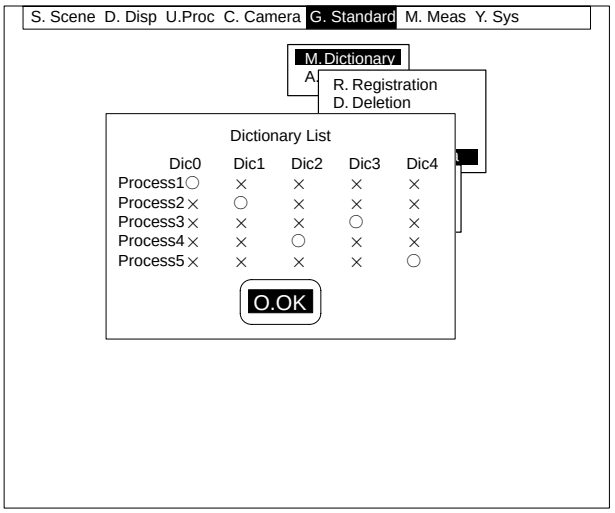
"P.List" confirms which dictionaries are being used by which processes.

Procedure

1, 2, 3... 1. Select "M.Dictionary data."

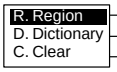


2. Select "P.List." The dictionary list will be displayed.



4-6 G.Standard/A.Region

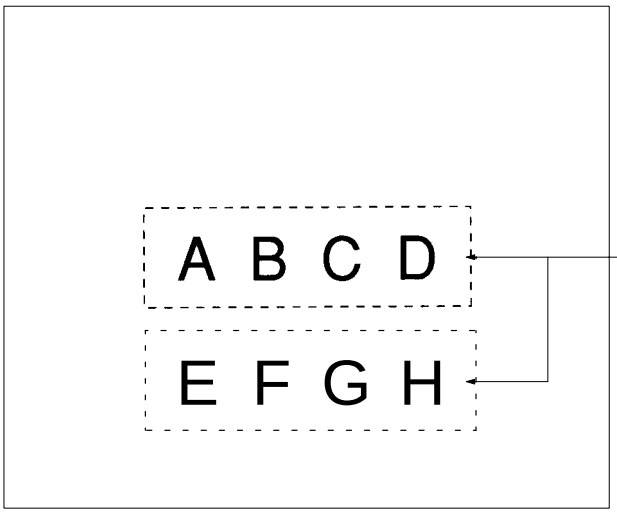
"A.Region" sets the read region and the dictionary for use in the read region. The region is searched for the registered character models and the model with the highest correlation value at the positions containing characters is output as the read results.



4-6-1 Drawing the Read Region: R.Region

"R.Region" sets a rectangular region as the read region. Images within the specified region are read. The position and orientation of the measurement objects may not be fixed, so when a measurement area deviates from the specified region, use the position compensation function. Refer to *4-11 P.Position Compensation*.

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



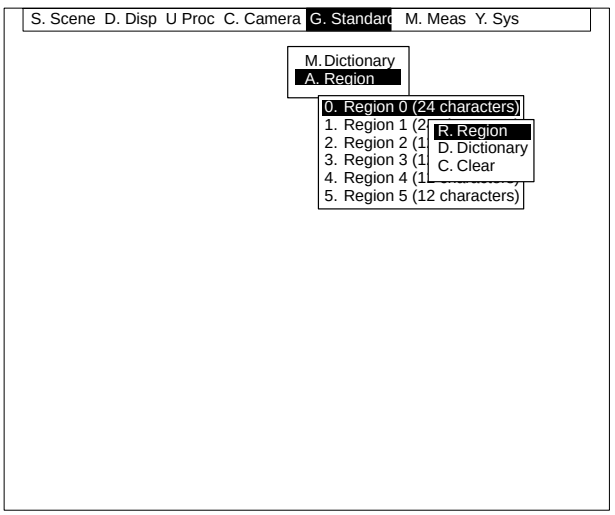
The read region
Characters within the region are read. A separate read region is set for each line.

There are two types of read regions. They are as follows:
Read regions 0 and 1: 24 characters per region
Read regions 2, 3, 4, 5: 12 characters per region

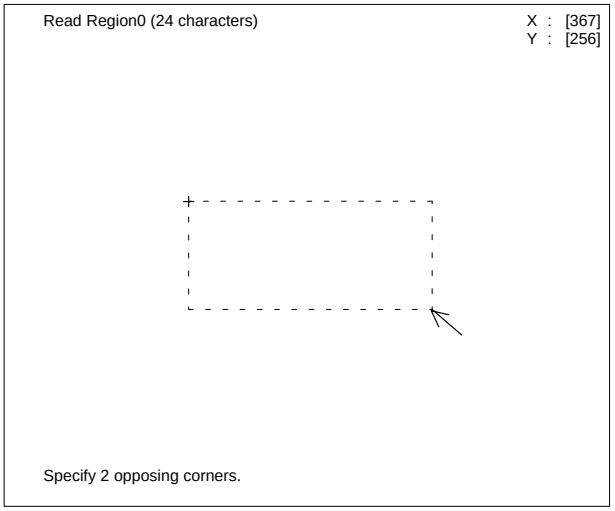
Drawing a New Region

Procedure

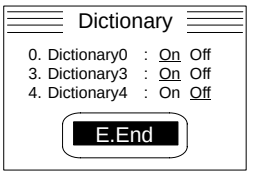
1, 2, 3... 1. Select the region to be drawn.



2. Select “R.Region.”
3. Move the arrow cursor and set the two opposing corners of the read region. When the dictionary to be used has not be selected, carry out step 4.



4. Set the dictionary number to be used to ON. Only the dictionary number to be used will be displayed. When a dictionary has already been set to ON, this screen is not displayed. Refer to *4-6-2 Selecting the Dictionary*.

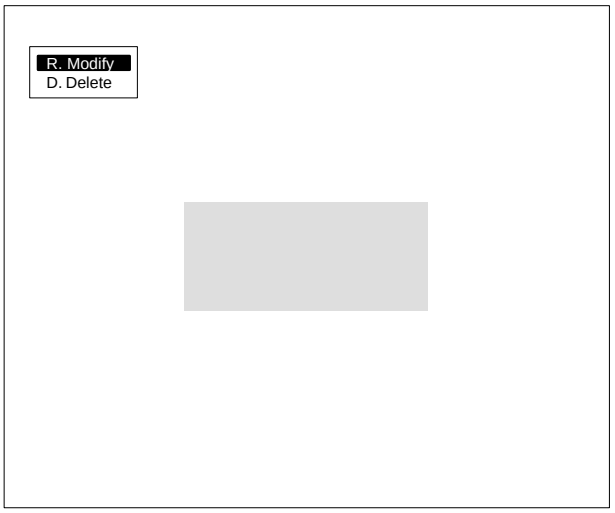


Modifying a Region

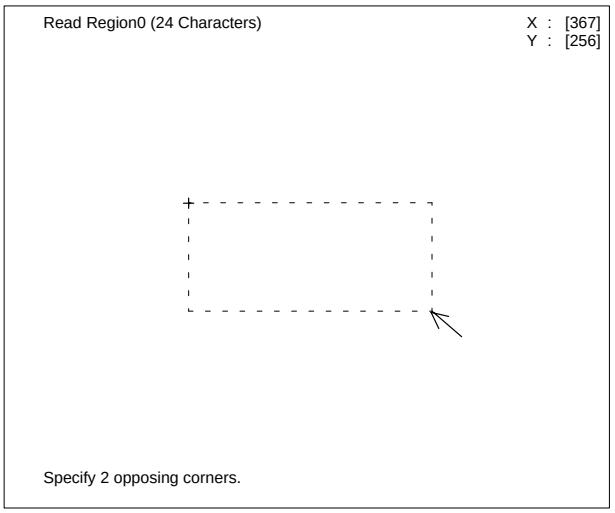
Procedure

1, 2, 3...

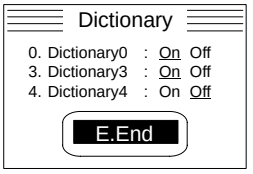
1. Select the region for modification.
2. Select “R.Region.”
3. Select “R.Modify.”



4. Modify the region. When the dictionary to be used has not be selected, carry out step 5.



5. Set the dictionary number to be used to ON. Only the dictionary number to be used will be displayed. When a dictionary has already been set to ON, this screen will not be displayed. Refer to *4-6-2 Selecting the Dictionary.*

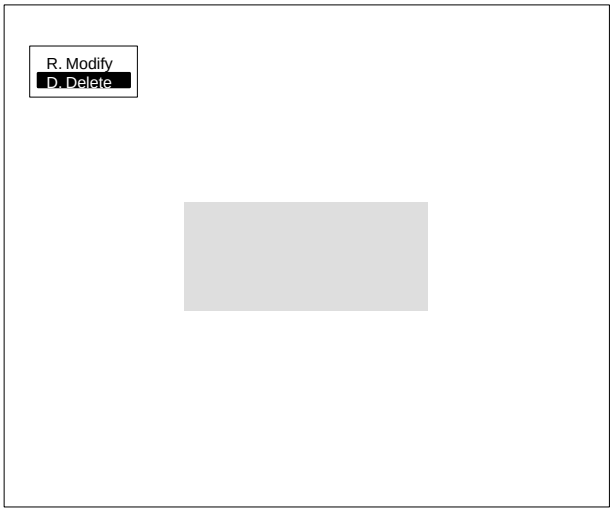


Deleting a Region

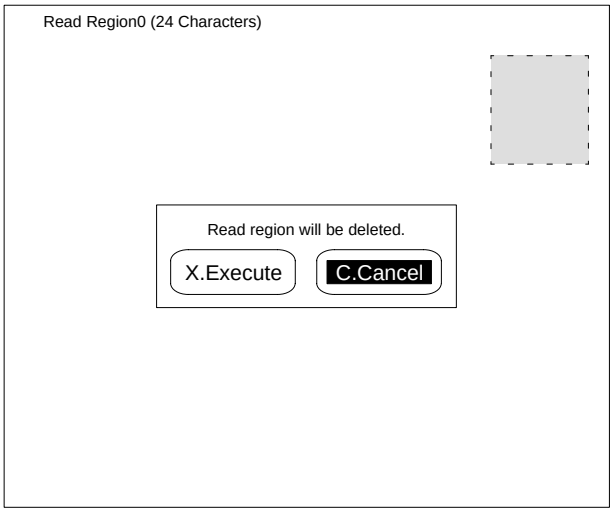
Procedure

1, 2, 3...

1. Select the region to be deleted.
2. Select “R.Region.”
3. Select “D.Delete.” A confirmation message will be displayed.



4. Select “X.Execute.”



4-6-2 Selecting the Dictionary: D.Dictionary

“D.Dictionary” is used to set the dictionaries to be used for the read regions. This setting is required for each preset read region. Multiple dictionaries can be set for a single read region.

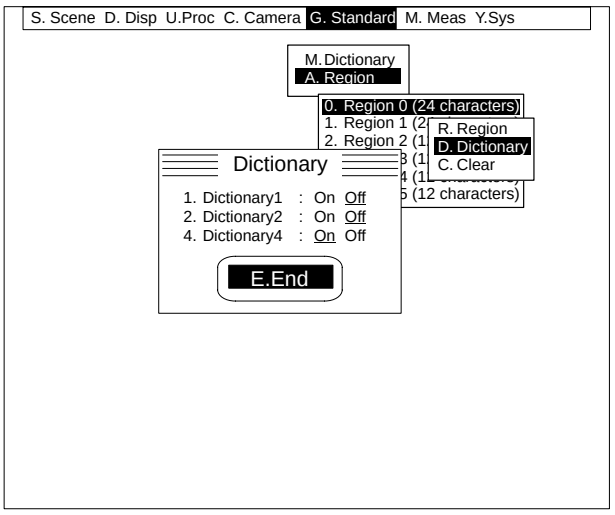
The same dictionary cannot be used for different processes that are set for the same scene. The same dictionary can be used, however, for different processes set for different scenes.

At least one dictionary must be set for each region, or no reading will be performed.

Procedure

1, 2, 3...

1. Select the region for which a dictionary will be set.
2. Select “D.Dictionary.” Only dictionary numbers which meet all the following criteria will be displayed.
   - There is at least one registered character model.
   - The dictionary is not being used by other processs for the same scene.
   - The measurement feature is the same as the gray-scale correlation.



3. Set the dictionary number to be used to “ON.”
4. Select “E.End.”

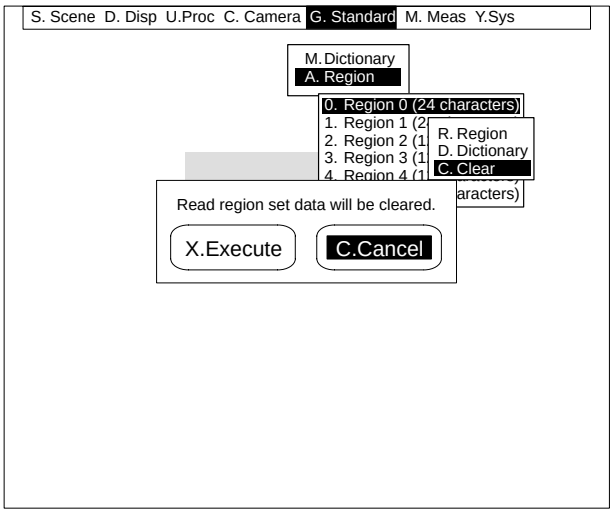
4-6-3 Clearing the Read Region Data: C.Clear

"C.Clear" clears the read region and sets all dictionary numbers in use (those set to ON) to OFF.

Procedure

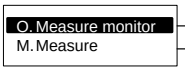
1, 2, 3...

1. Select the region to be cleared.
2. Select "C.Clear." A confirmation message will be displayed.
3. Select "X.Execute."



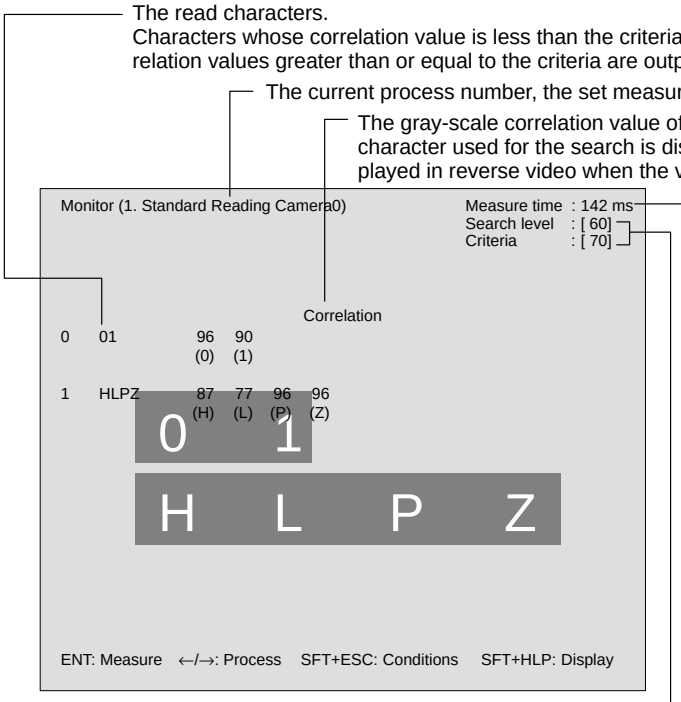
4-7 M.Measure/O.Measure Monitor

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



4-7-1 Checking Measurement Values and Measurement Times: O.Measure Monitor

"O.Measure monitor" is used to monitor measurement values based on the set data. Measured results are output to the Video Monitor only, even when a Parallel I/O Unit, Terminal Block Unit, or RS-232C Unit is mounted. The measurement time for each process is also displayed on the Video Monitor. When several processes are set, the measurement time for each can be monitored by switching between them.



The measurement time for the current process.

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

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

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

Refer to *4-13-1 Entering Measurement Screens*.

Important

Instruction Input Timing

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

Finding Multiple Characters

The number of characters that can be found for the same character model will be reduced when there is a large number of registered character models.

Example

Conditions:

Position compensation: 2-model positioning; Rotation angle: 360°; Pitch angle: 5°; Standard reading using 292 character models in the dictionary.

Character model

- **F350-C12E IMP Units**

  When measurement is conducted under the above conditions, up to seven oc-

currences of the same character model can be found. All other occurrences of the same character will be disregarded.

AAAAAAA AA...

The first 7 occurrences are found. All other occurrences are disregarded.

- **F350-C41E IMP Units**

  When measurement is conducted under the above conditions, up to 17 occurrences of the same character model can be found. All other occurrences of the same character will be disregarded.

AA.....A AA...

The first 17 occurrences are found. All other occurrences are disregarded.

If reading is not possible because not enough of the same character can be found, increase the number of occurrences that can be found by deleting models which are not being used for measurement. When using position compensation, the number of models can also be reduced by decreasing the rotation angle or increasing the pitch angle.

Console

The following instructions can be input from the Console.

Instruction	Key	Action
Measure	ENT	Executes a measurement. When position compensation is set for the same camera number for the preceding process, the measurement is executed after position compensation.
Switch process	◀ / ▶	Switches the process and executes the measurement item as set. Processes which have no set data are skipped. When position compensation is set for the same camera number for the preceding process, the measurement is executed after the position compensation.
Set level	SHIFT+ESC	The criteria can be changed, while referring to the correlation values. Refer to *4-7-2 Setting the Read Conditions*.
Display mode	SHIFT+HELP	Sets whether or not to display on the screen the characters read on the measurement screen. Measurement time is reduced when the display is turned OFF.
Quit measurement	ESC	Quits the measure monitor screen.

RS-232C

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

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

Measure

M m	Delimiter

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

Quit measurement

Q q	Delimiter

Quits the measure monitor screen.

Parallel I/O

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

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

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

4-7-2 Setting the Read Conditions: O.Measure Monitor

"O.Measure monitor" is used to set the search level and criteria for reading.

Item	Read conditions
Search level	Sets the level to be used to search for characters that are similar to the character model. Searches for areas with a correlation value greater than or equal to the search level. Set to 1 to 100. Items which match the character model exactly are set at 100. The default value of the search level is 60. When searching with a stable character model is not possible, lower the search level.
Criteria	Sets the criteria for judging OK/NG. After finding positions similar to the character model, the one with the highest correlation value is found. The image is judged NG if it has a correlation value below the criteria. Set to 0 to 100. Items which match the character model exactly are set to 100.

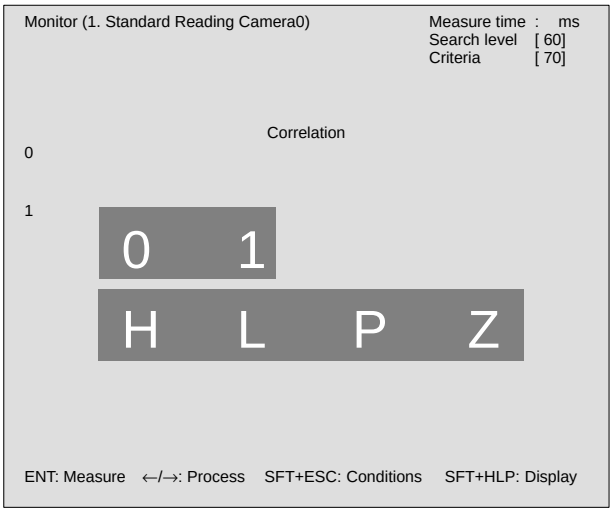
Two Methods for Setting the Criteria

The criteria for each dictionary character can be set with "M.Dictionary/J.Criteria." The criteria for the entire dictionary can be set with "M.Measure/O.Measure Monitor." Regardless of which method is used, the most recently set criteria will take priority.

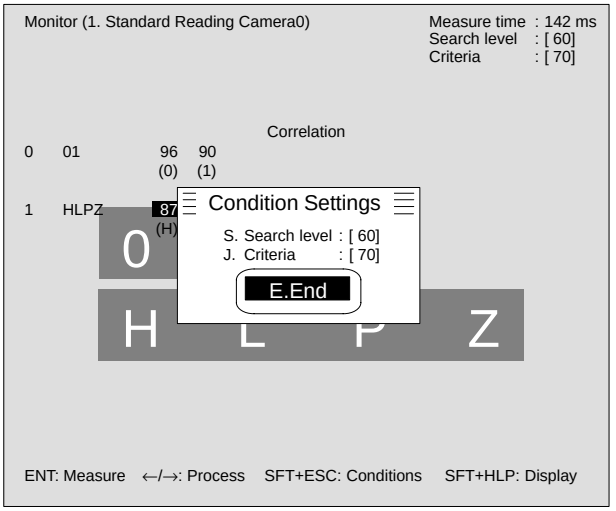
For example, if the criteria for the entire dictionary is set to 75 using "M.Measure/O.Measure Monitor," after the criteria for the dictionary character "C" had been set to 80 using "M.Dictionary/J.Criteria," then the criteria for the dictionary character "C" will be 75. Refer to *4-5-4 Setting the Criteria*.

Procedure

1, 2, 3... 1. Select “O.Measure monitor.”



2. Press the Shift+Escape Keys. The level setting screen will be displayed.
3. Set the search level or the criteria.
4. Select “E.End.”



■ Steady Character Reading

Steady character reading appears on the menus as simply “R.Steady” and is abbreviated in text as “steady reading.”

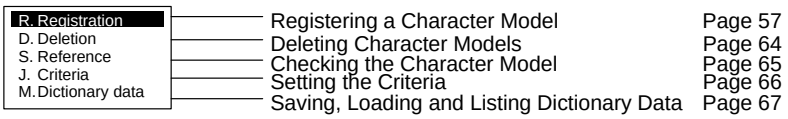
“R.Steady Reading” reads alphanumeric characters using character patterns called character models registered in a dictionary. The character models are compared to characters in the read region and the character model with the highest correlation value is output as the result for each character. Use steady reading to read characters which are unstable in some way (scratched or blurred) or are overlapping other characters. The ability to detect characters is much greater than when using standard reading.

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

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

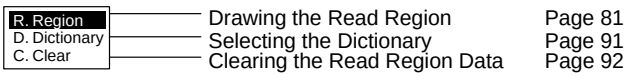
4-8 R.Steady/M.Dictionary

“M.Dictionary” registers and deletes character models in the dictionary. Refer to *4-5 G.Standard/M.Dictionary* for details on functions and operating procedures.



4-9 R.Steady/A.Region

“A.Region” sets the read region and the dictionary for use in the read region. Using the registered character models, the region is searched and the model with the highest correlation value at the positions containing characters is output as the read results.



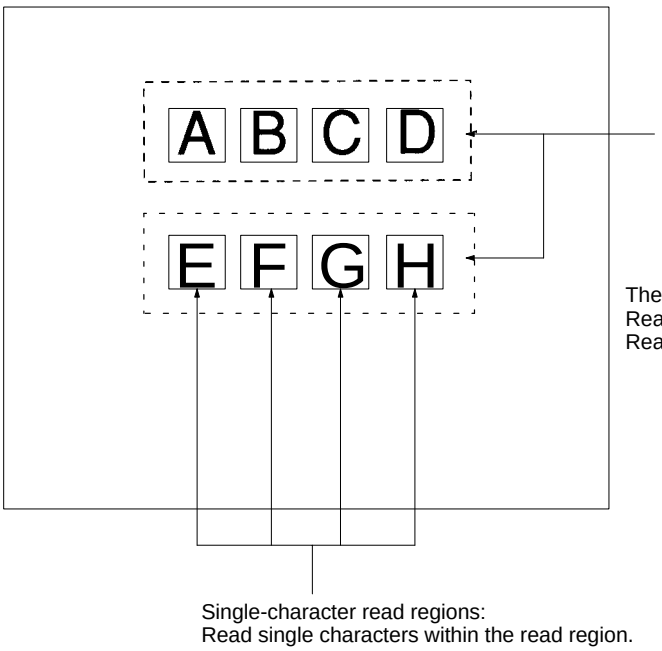
4-9-1 Drawing the Read Region: R.Region

“R.Region” sets a rectangular region as the read region. Images within the specified region are read. The position and orientation of the measurement objects may not be fixed, so when a measurement area deviates from the specified region, use the position compensation function. Refer to *4-11 P.Position Compensation*.

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

There are two reading modes, as follows:

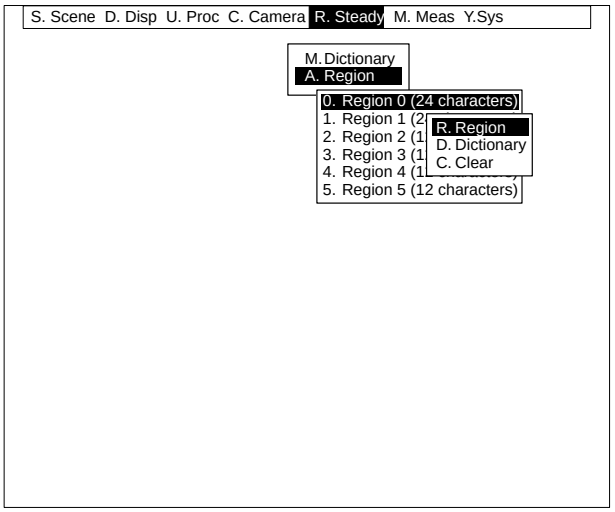
Reading mode	Details
Automatic cut mode	Automatically cuts characters inside the read region and reads them during measurement. Only draw the region that is to be read.
Fixed region mode	Reads one character in each read region during measurement. After drawing the read region, draw single-character read regions for the number of characters that exist.



Drawing a New Region: Automatic Cut Mode

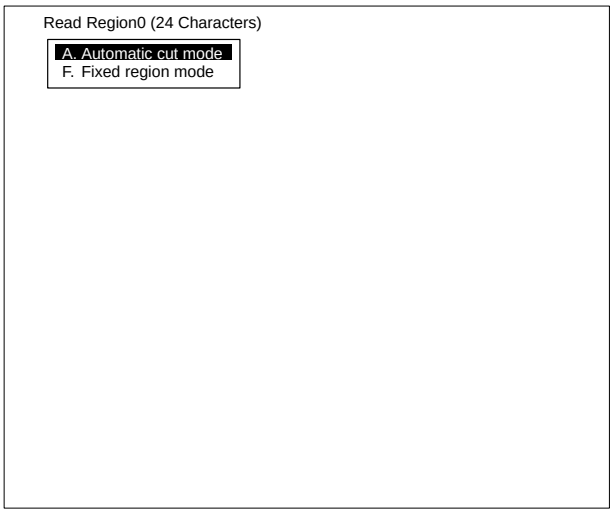
Procedure

1, 2, 3... 1. Select the region to be drawn.

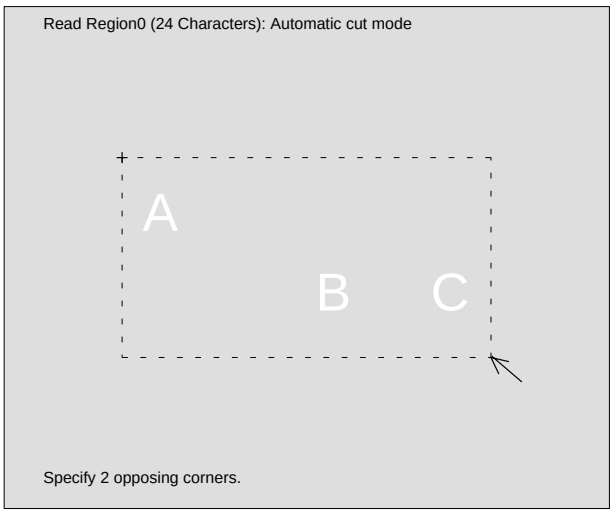


2. Select “R.Region.”

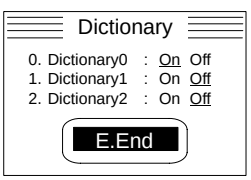
3. Select the reading mode. Select “A.Automatic cut mode.”



4. Move the arrow cursor and set the two opposite corners of the read region. When the dictionary to be used has not been selected, carry out step 5.



5. Set the dictionary number to be used to ON. Only the dictionary number to be used will be displayed. When a dictionary has already been set to ON, this screen is not displayed. Refer to *4-9-2 Selecting the Dictionary*.

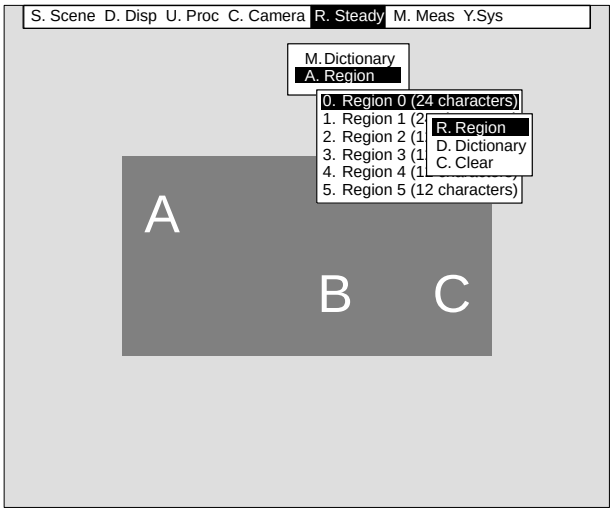


Drawing a New Region: Fixed Region Mode

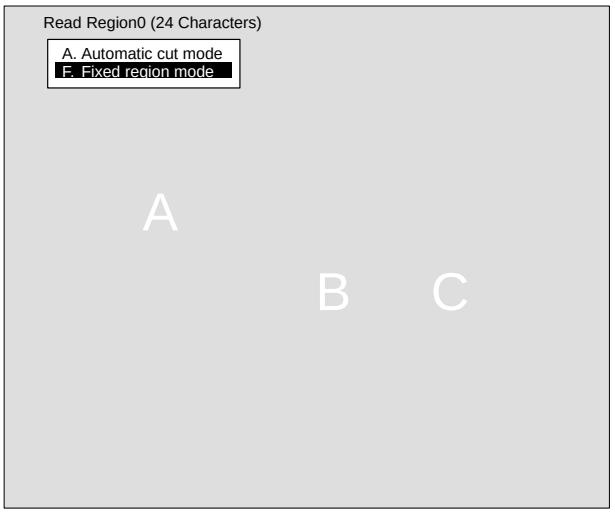
Procedure

1, 2, 3... 1. Select the region to be drawn.

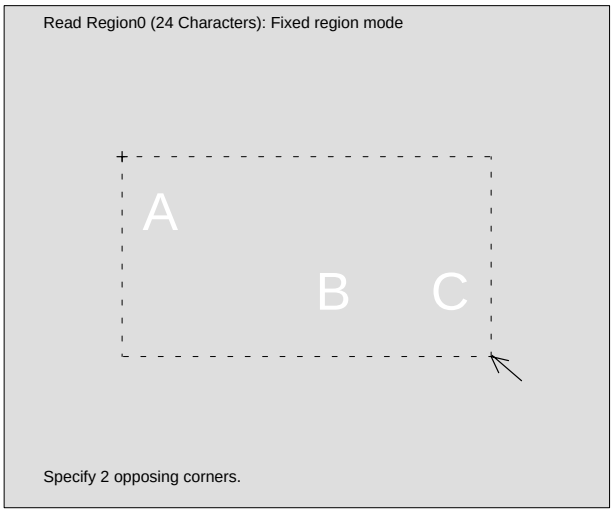
2. Select “R.Region.”



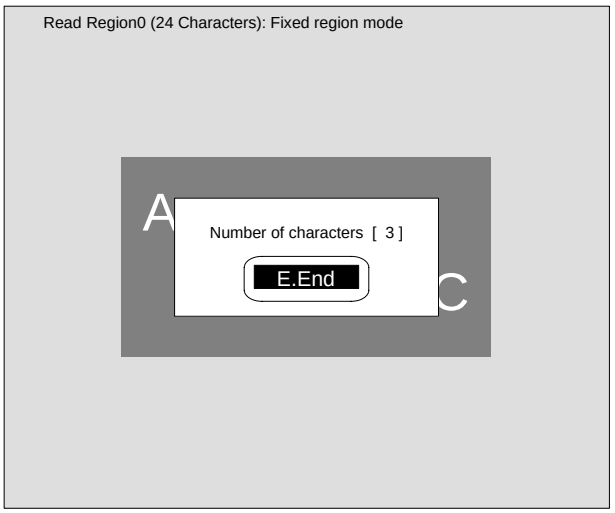
3. Select the reading mode. Select “F.Fixed region mode.”



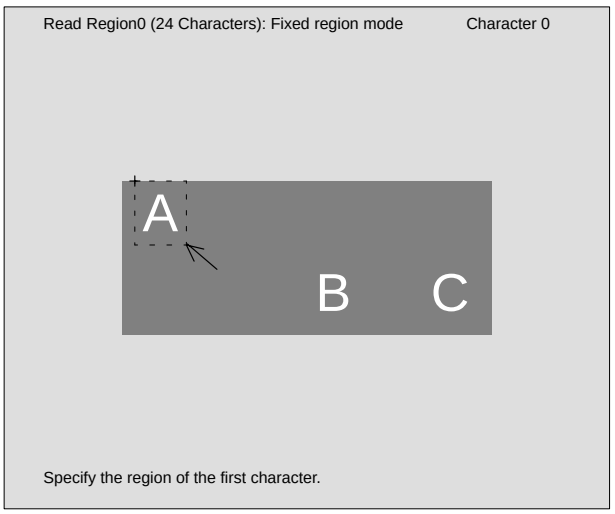
4. Move the arrow cursor and set the two opposite corners of the read region.



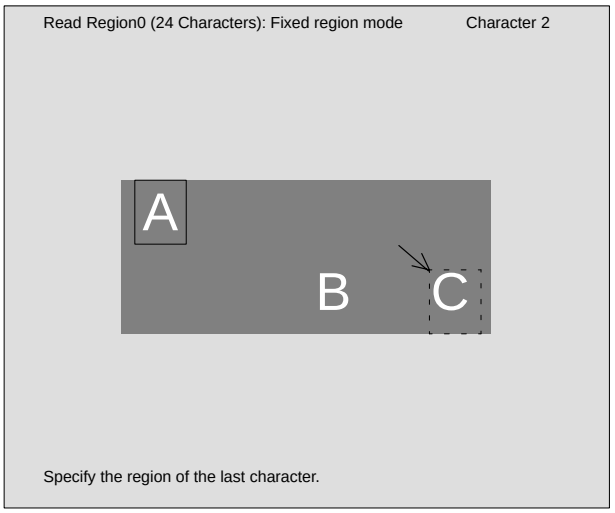
5. Input the number of characters in the region and select “E.End.”



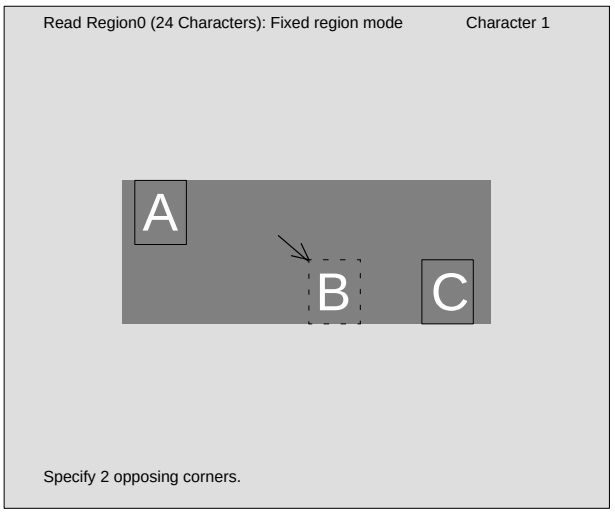
6. Set the first character. Align the dotted box around the first character.



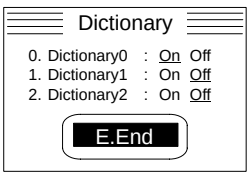
7. Set the last character. Align the dotted box around the last character.



8. Set the remaining characters. A dotted box will be displayed according to the number of characters in the region. Align the dotted boxes around the remaining characters. When the dictionary to be used has not be selected, carry out step 9.



9. Set the dictionary number to be used to ON. Only the dictionary number to be used will be displayed. When a dictionary has already been set to ON, this screen is not displayed. Refer to *4-9-2 Selecting the Dictionary*.



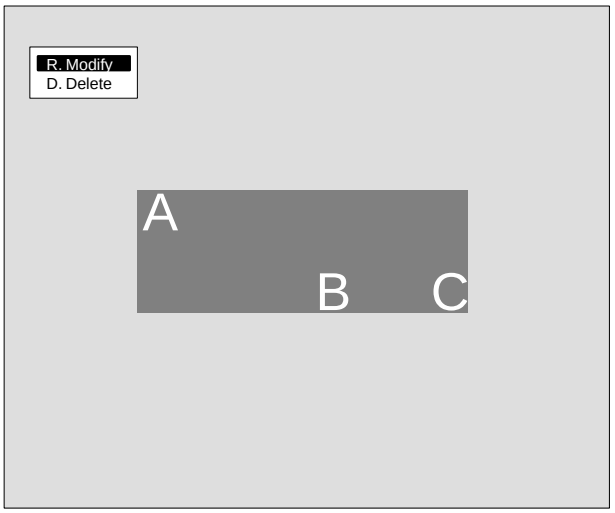
Modifying the Region: Automatic Cut Mode

The reading mode cannot be changed. To change the reading mode, clear the read region and draw again.

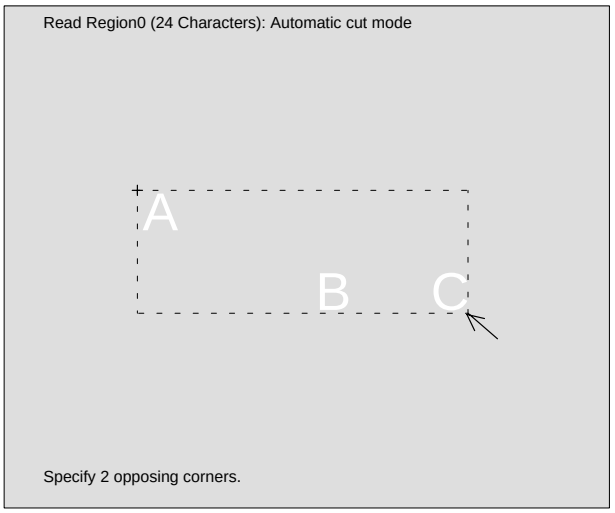
Procedure

1, 2, 3...

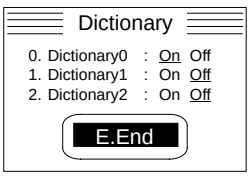
1. Select the region to be modified.
2. Select “R.Region.”
3. Select “R.Modify.”



4. Modify the region. When the dictionary to be used has not been selected, carry out step 5.



5. Set the dictionary number to be used to ON. Only the dictionary number to be used will be displayed. When a dictionary has already been set to ON, this screen is not displayed. Refer to *4-9-2 Selecting the Dictionary*.



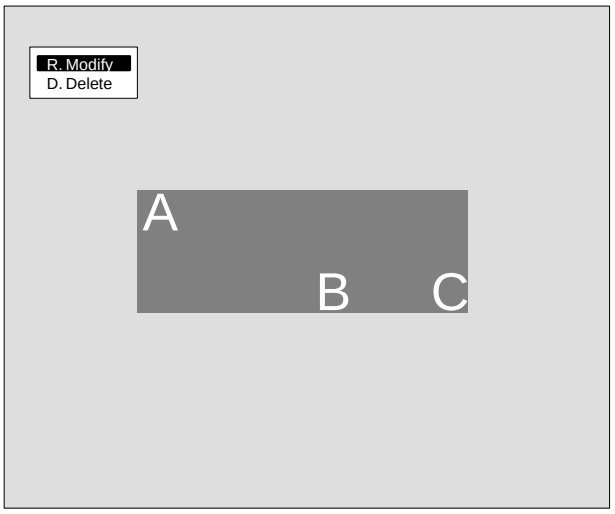
Modifying the Region: Fixed Region Mode

The reading mode cannot be changed. To change the reading mode, clear the read region and draw again.

Procedure

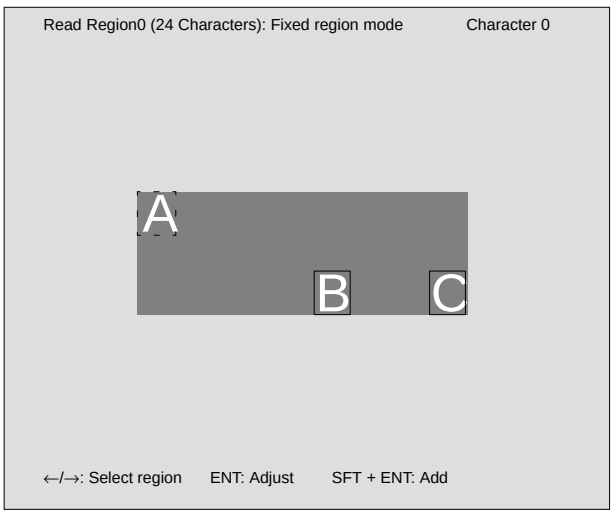
1, 2, 3...

1. Select the region to be modified.
2. Select “R.Region.”
3. Select “R.Modify.”

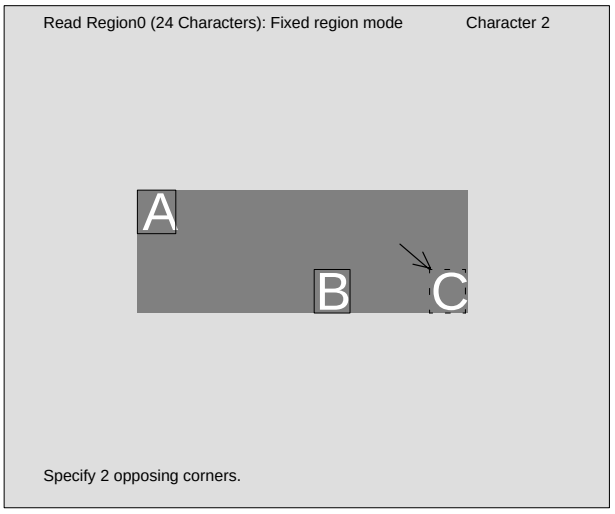


4. Select a single-character read region to be modified and press the Enter Key.

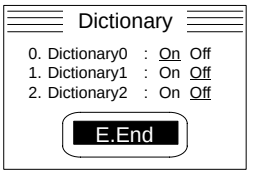
Note More single-character read regions can be added. Press the Shift + Enter Keys to add to character regions.



5. Modify the region. When several regions are being modified, repeat steps 4 and 5. When region modification is finished, press the Escape Key. When the dictionary to be used has not be selected, carry out step 6.



6. Set the dictionary number to be used to ON. Only the dictionary number to be used will be displayed. When a dictionary has already been set to ON, this screen is not displayed. Refer to *4-9-2 Selecting the Dictionary*.

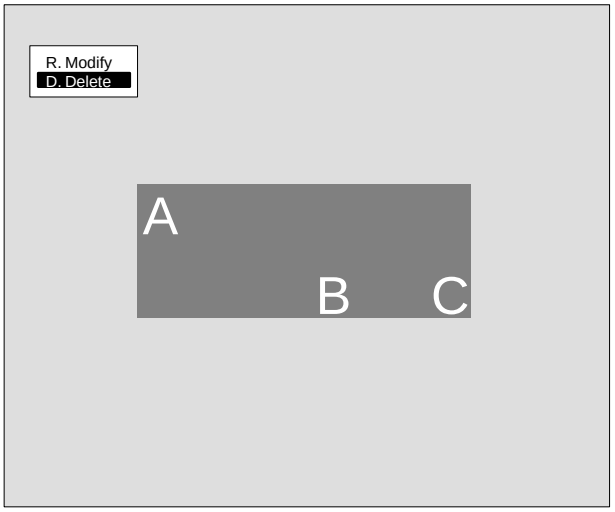


Deleting a Region: Automatic Cut Mode

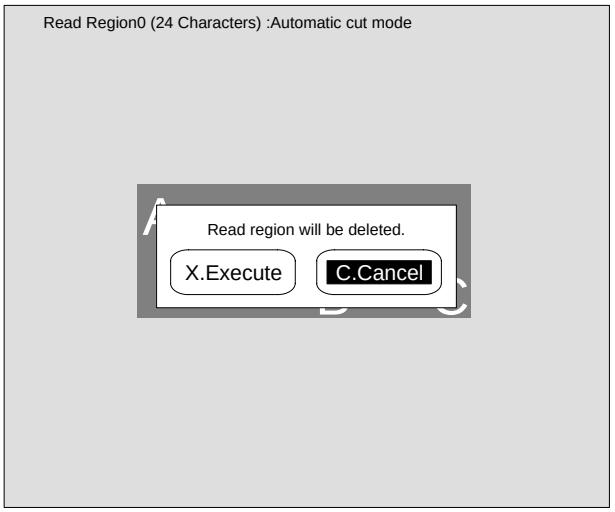
Procedure

1, 2, 3...

1. Select the region to be deleted.
2. Select “R.Region.”
3. Select “D.Delete.” A confirmation message will be displayed.



4. Select “X.Execute.”



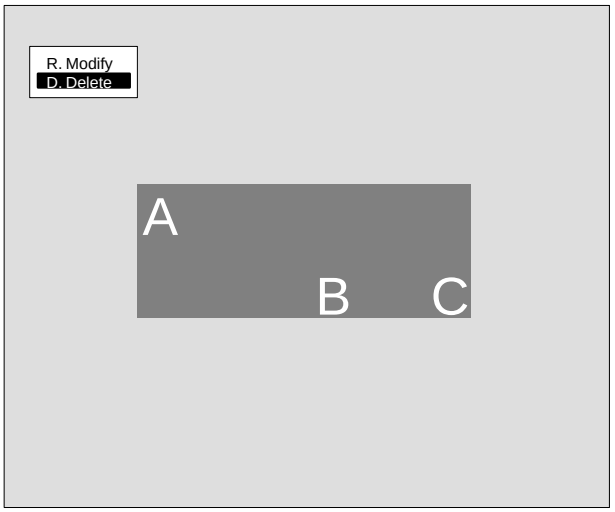
Deleting a Region: Fixed Region Mode

Procedure

1, 2, 3... 1. Select the region to be deleted.

2. Select “R.Region.”

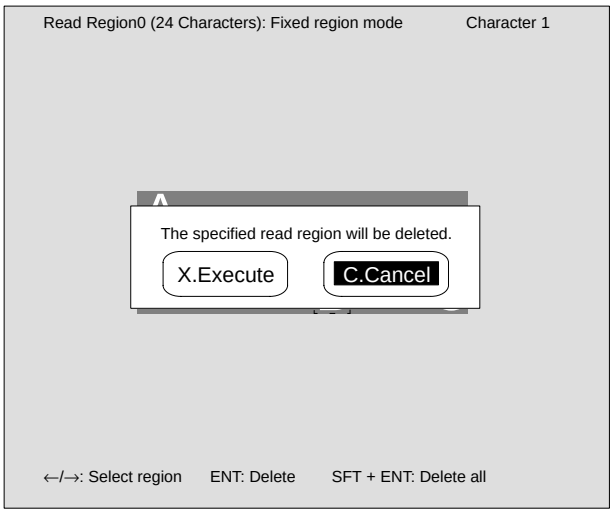
3. Select “D.Delete.”



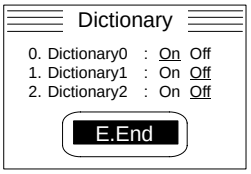
4. Select a single-character region to be deleted. A confirmation message will be displayed.

   To delete the entire region at once press the Shift + Enter Keys.

5. Select “X.Execute.” When deleting several regions, repeat steps 4 and 5. When the region has been deleted, press the Escape Key. When the dictionary to be used has not be selected, carry out step 6.



6. Set the dictionary number to be used to ON. Only the dictionary number to be used will be displayed. When a dictionary has already been set to ON, or all single-character regions have been deleted, this screen is not displayed. Refer to *4-9-2 Selecting the Dictionary*.



4-9-2 Selecting the Dictionary: D.Dictionary

“D.Dictionary” is used to set the dictionaries to be used for the read regions. This setting is required for each preset read region. Multiple dictionaries can be set for a single read region.

The same dictionary cannot be used for different processes that are set for the same scene. The same dictionary can be used, however, for different processes set for different scenes.

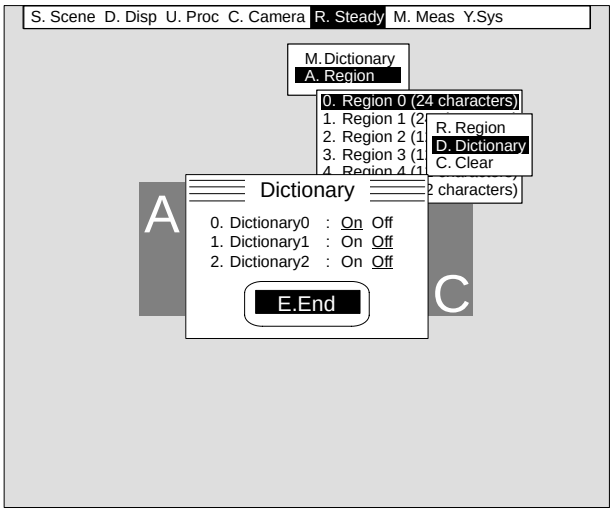
At least one dictionary must be set for each region, or no reading will be performed.

Procedure

1, 2, 3...

1. Select the region number for which a dictionary will be set.
2. Select “D.Dictionary.” Only dictionary numbers which meet all the following criteria will be displayed.
   - There is at least one registered character model.
   - The dictionary is not being used by other processes for the same scene.

- The measurement feature is the same as the gray-scale correlation.



3. Set the dictionary number to be used to ON.
4. Select “E.End.”

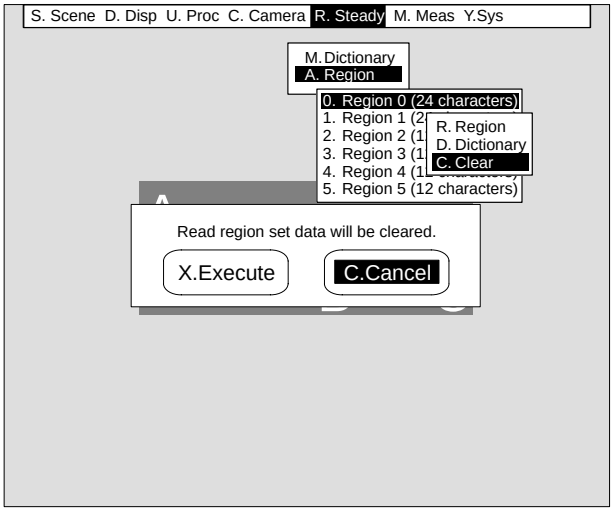
4-9-3 Clearing the Read Region Data: C.Clear

“C.Clear” clears the read region and sets all dictionary numbers in use (those set to ON) to OFF.

Procedure

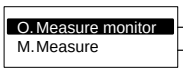
1, 2, 3...

1. Select the region to be cleared
2. Select “C.Clear.” A confirmation message will be displayed.
3. Select “X.Execute.”



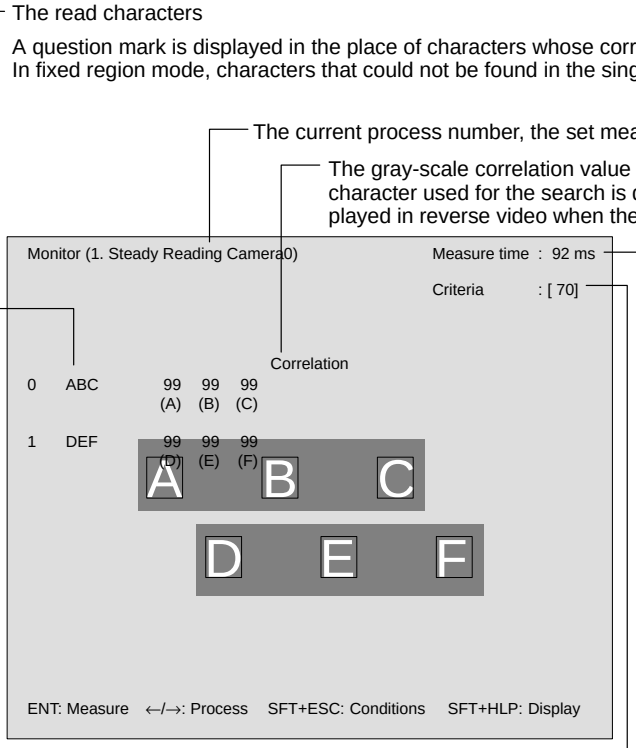
4-10 M.Measure/O.Measure Monitor

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



4-10-1 Checking Measurement Values and Measurement Times: O.Measure Monitor

"O.Measure monitor" monitors measurement values based on the set data. Measured results are output to the Video Monitor only, even when a Parallel I/O Unit, Terminal Block Unit, or RS-232C Unit is mounted. The measurement time for each process is also displayed on the Video Monitor. When several processes are set, the measurement time for each can be monitored by switching between them.



The read characters

A question mark is displayed in the place of characters whose correlation value is less than the criteria.
In fixed region mode, characters that could not be found in the single-character region, are underlined.

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

The gray-scale correlation value of each character between 0 and 100. The dictionary character used for the search is displayed below the correlation value. The value is displayed in reverse video when the value is less than the criteria.

The measurement time for the current process.

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

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

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

Refer to *4-13-1 Entering Measurement Screens*.

Currently set read conditions. The read conditions can be changed while referring to the correlation values.

Refer to *4-10-2 Setting the Read Conditions*.

Important

Instruction Input Timing

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

Console

The following instructions can be input from the Console.

Instruction	Key	Action
Measure	ENT	Executes measurement. When position compensation is set for the same camera number for the preceding process, the measurement is executed after the position compensation.
Switch process	◀ / ▶	Switches the process and executes measurement items as set. Processes which have no set data are skipped. When position compensation is set for the same camera number for the preceding process, the measurement is executed after the position compensation.
Set criteria	SHIFT+ESC	The criteria can be changed while referring to the correlation values. Refer to *4-10-2 Setting the Read Conditions*.
Display mode	SHIFT+HELP	Sets whether or not to display on the screen the characters read on the measurement screen. Measurement time is reduced when the display is turned OFF.
Quit measurement	ESC	Quits the measure monitor screen.

RS-232C

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

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

Measure

M m	Delimiter

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

Quit measurement

Q q	Delimiter

Quits the measure monitor screen

Parallel I/O

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

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

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

4-10-2 Setting the Read Conditions: O.Measure Monitor

"O.Measure Monitor" sets the criteria and the conditions for cutting characters during reading.

Item	Read conditions	Default value
J.Criteria	Sets the criteria for judging OK/NG. Set at 0 to 100. Items which match the character model exactly are set at 100.	70
M.Automatic cut mode (Only for automatic cut mode regions)	Selects the mode for cutting characters. Normal: Use when the contrast between the background and the characters is distinct and there are only characters in the read region. High Accuracy: Use when the contrast between the background and the characters is low and there are other marks or designs in the read region. Processing speed is slower.	Normal
X.Automatic cut noise size X Y.Automatic cut noise size Y (Only for automatic cut mode regions)	Any section smaller than or equal to the noise size will not be cut as characters. The noise size is set to 0 to 512 for X and 0 to 484 for Y. When there is noise that is not a character and that is smaller than the characters, adjust the value to cut it.	X: 3 Y: 3
D.Density deviation threshold (Only for automatic cut mode regions)	Cuts regions whose density deviation is larger than the density deviation threshold. Set to 0 to 100. When the contrast between the background and the characters is low or the character area is small relative to the read region, lower the density deviation threshold.	15

Note When the "M.Automatic cut mode" is set to "High accuracy" but still fails to read correctly, go to "A.Region/R.Region" and select "F.Fixed region mode" and set the region again.

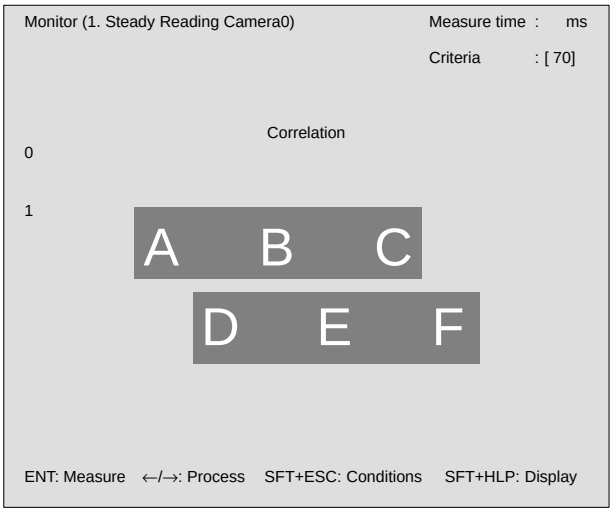
Two Methods for Setting the Criteria.

The criteria for each dictionary character can be set with "M.Dictionary/J.Criteria." The criteria for the entire dictionary can be set with "M.Measure/O.Measure Monitor." Regardless of which method is used, the most recently set criteria will take priority.

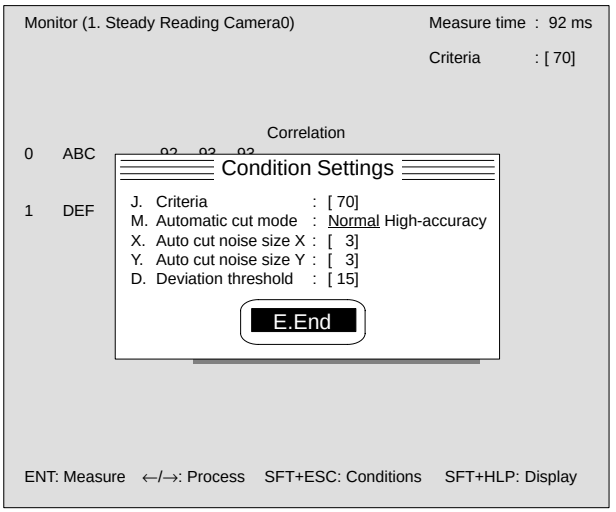
For example, if the criteria for the entire dictionary is set to 75 using "M.Measure/O.Measure Monitor," after the criteria for the dictionary character "C" had been set to 80 using "M.Dictionary/J.Criteria," then the criteria for the dictionary character "C" will be 75. Refer to *4-5-4 Setting the Criteria*.

Procedure

1, 2, 3... 1. Select “O.Measure monitor.”



2. Press the Shift+Escape Keys. The measurement conditions setting screen will be displayed.
3. Set the conditions.
4. Select “E.End.”



■ Position Compensation

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

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

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

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

The following procedure is used to execute position compensation.

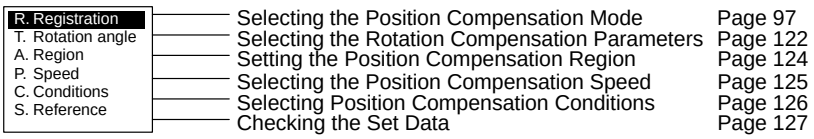
1, 2, 3...

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

4-11 P.Position Compensation

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

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



4-11-1 Selecting the Position Compensation Mode: R.Registration

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

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

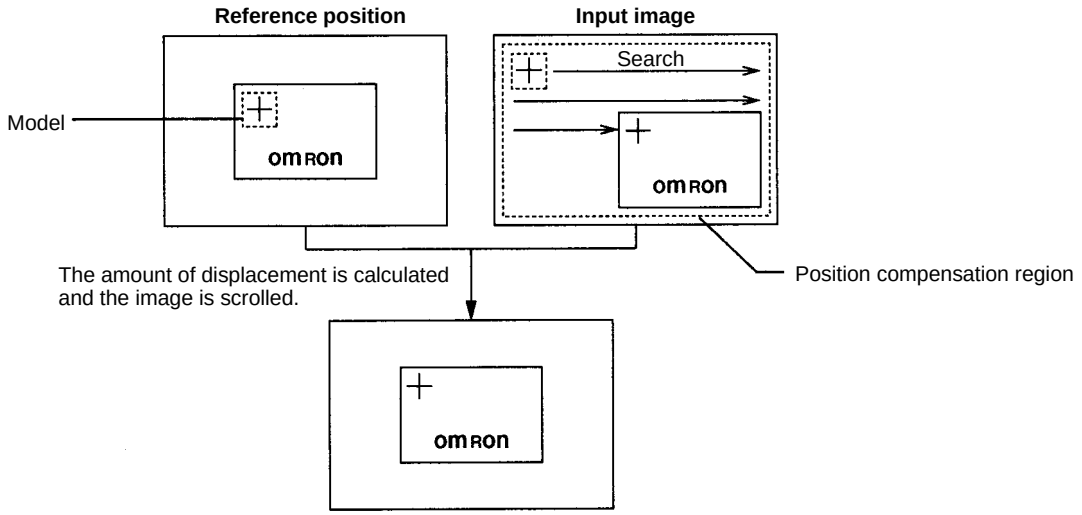
When selecting a new position compensation mode or to change a previously set position compensation mode, set the position compensation settings.

Item	Details
0.Search verification	Searches for position compensation models inside the search region for candidates. Verifies whether or not these candidates are correct. Required Register any size model. This is called the verification model. The rectangular region containing the features will be cut automatically from the region specified as the model. This is called the search model. 1. "0.Search Verification" searches for search models inside the search region and detects candidates. All candidates with correlation values greater than the criteria will be detected. Set the criteria for detecting candidates in "P.Position compensation/ C.Conditions." Refer to *Section 4-11-5 Setting Position Compensation Conditions*. 2. For each candidate, verification is executed using the verification model and positions with the highest correlation values are found. Although high-accuracy position compensation can be executed, the processing speed will become slower depending on the verification model used. Refer to *4-12 M.Measure/O.Measure Monitor*. Not required Register any size model. This is called the search model. Search models are searched for in the search region and positions with the highest correlation values will be found.
1.Auto-registration	Automatically cuts the region most suitable for position compensation and registers it as a position compensation model. If circle positioning is selected as the position compensation mode, however, automatic registration cannot be performed. Set to "No."

One-model Positioning

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

The rotation model must be registered to execute rotational position compensation (θ). Refer to *4-11-2 Selecting the Rotation Compensation Parameters*.



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

Automatic Model Registration

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

Important Set the search correlation values before registering the models. Refer to *4-11-5 Setting Position Compensation Conditions*.

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

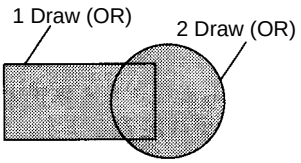
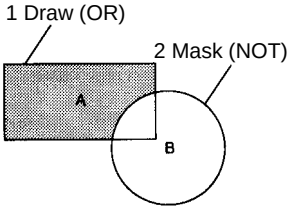
1, 2, 3...

1. Register the provisional model. Either automatic or manual registration can be used.
2. Set the rotation angle and the pitch angle of the rotation model. Refer to *4-11-2 Setting the Rotation Compensation Parameters*.
3. Execute automatic model registration once the model is in the correct position. If the rotation angle or the pitch angle are changed after auto-registration, measurement will be incorrect.

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

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

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

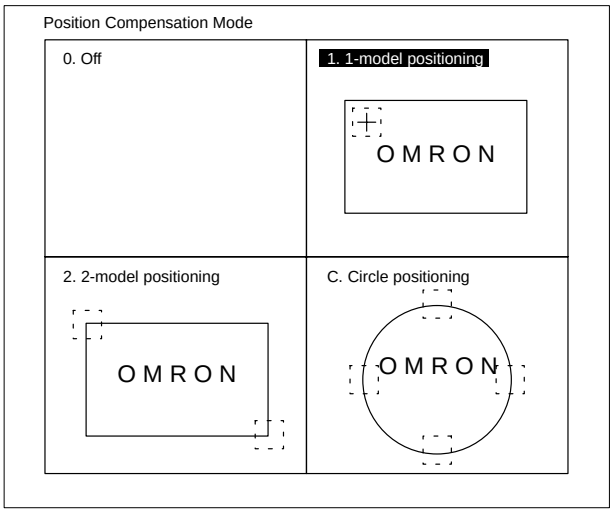
Drawing mode	Action	
O.Draw (OR)		Use this mode when drawing the automatic registration region. The region drawn will be set as the automatic registration region. When several figures are drawn, a model can be cut which incorporates all the figures as one automatic registration region.
M. Mask (NOT)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

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

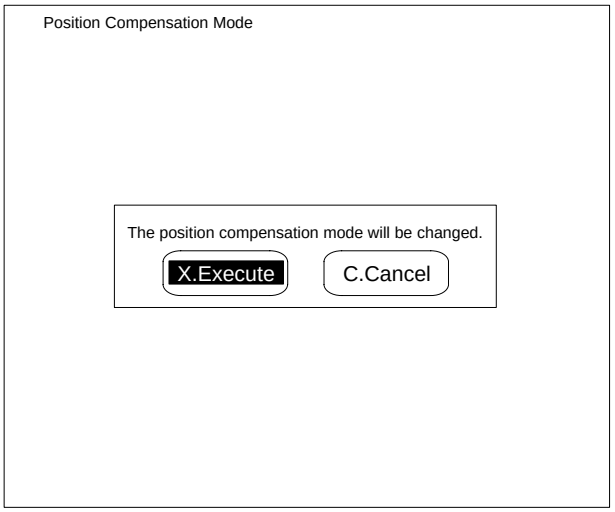
Procedure

1, 2, 3...

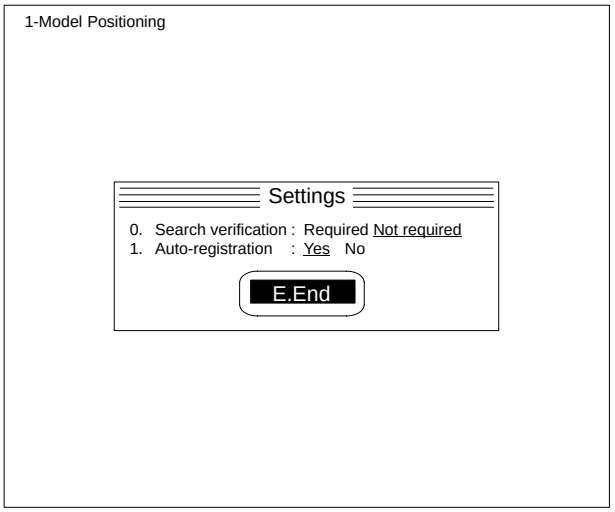
1. Select “R.Registration.” Position compensation mode will be displayed.
2. Select “1.1-model positioning.” When the position compensation mode needs to be changed, carry out steps 3 and 4. When the mode is already set to “1.1-model positioning,” go to step 5.



3. Select “X.Execute.”

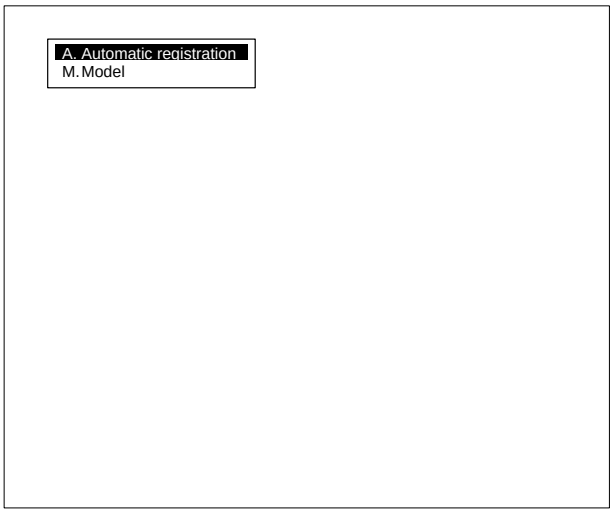


4. Set the position compensation settings. Set “1.Auto-registration” to “Yes.” Set “0.Search verification” to “Required” or “Not required.”



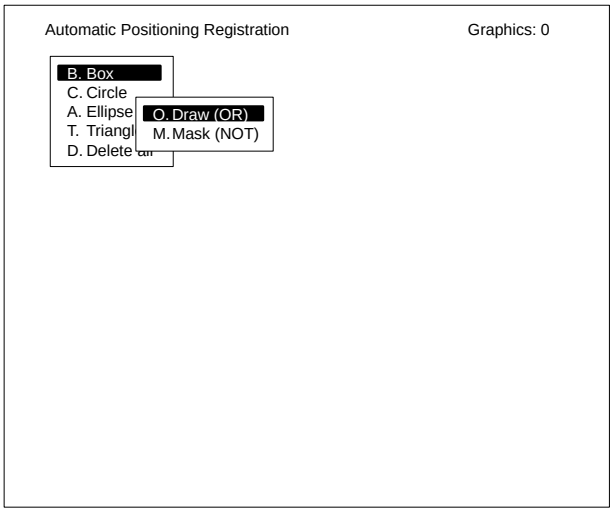
5. Select “A.Automatic registration.”

   When modifying an automatically registered model, select “M.Model.” Refer to page 103 “Manual Model Registration” for operating procedures.

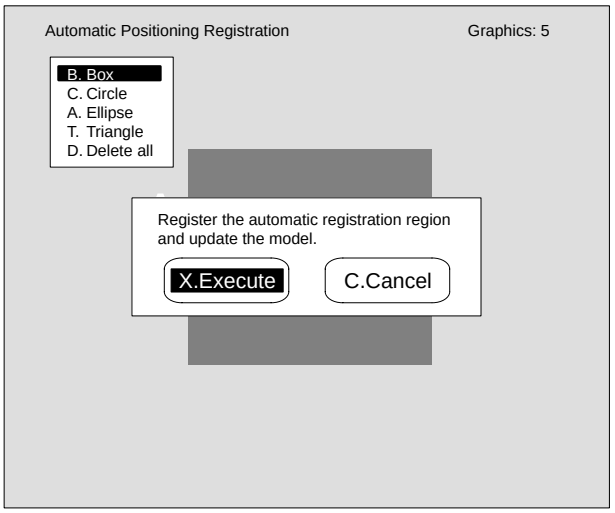


6. Select a figure.
7. Select a drawing mode.

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



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

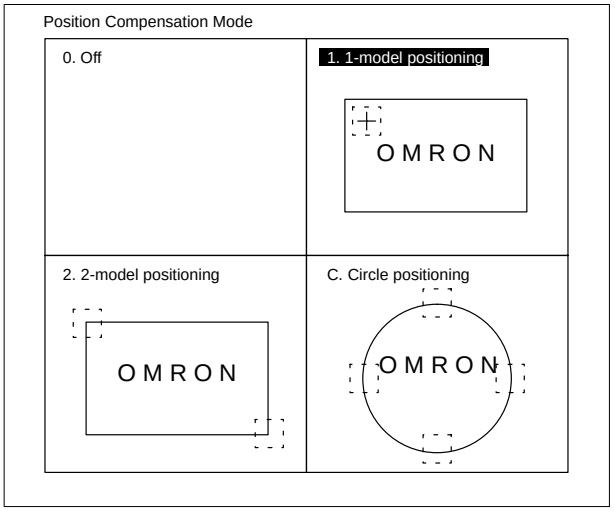


Manual Model Registration Set the region to be registered as the model.

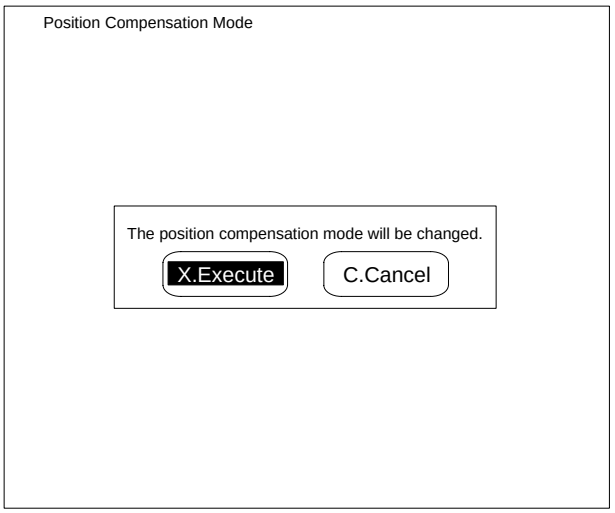
Procedure

1, 2, 3...

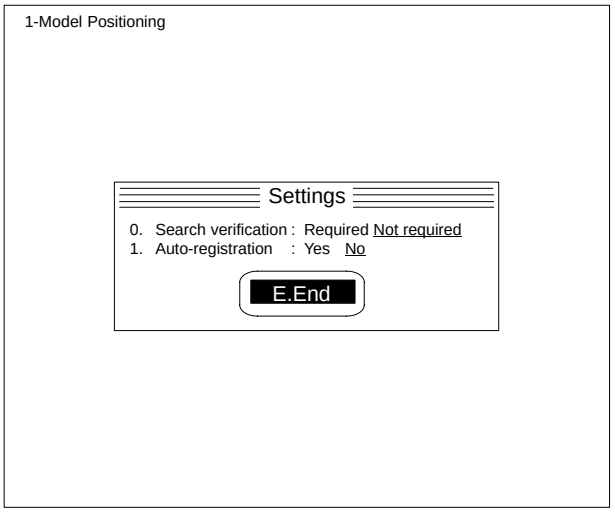
1. Select “R.Registration.”
2. Select “1.1-model positioning.” When the position compensation mode needs to be changed, carry out steps 3 and 4. When the mode is already set to “1.1-model positioning” go to step 5.



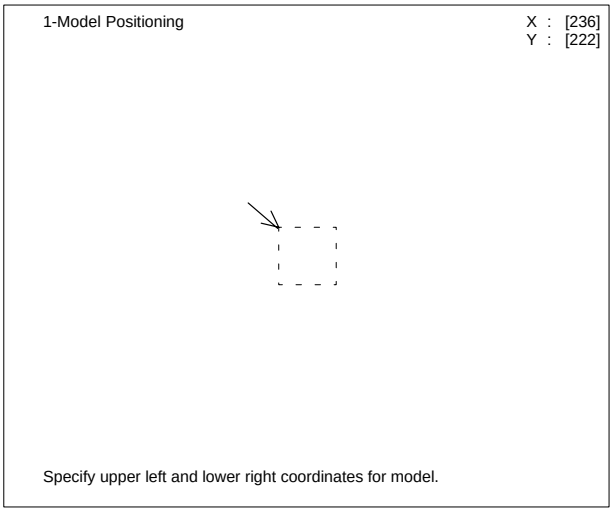
3. Select “X.Execute.”



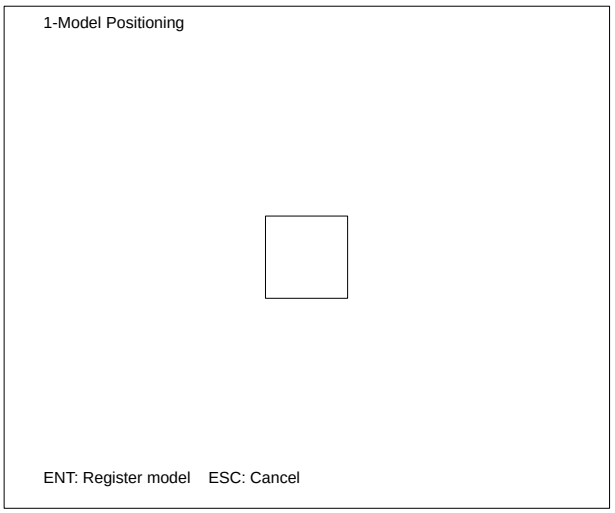
4. Set the position compensation settings. Set “1.Automatic registration” to “No.” Set “0.Search verification” to “Required” or “Not required.”



5. Set the top-left coordinates of the region to be registered as the model by moving the arrow cursor and pressing the Enter Key.
6. Set the bottom-right coordinates of the region to be registered as the model by moving the arrow cursor and pressing the Enter Key.



7. Before registering the model, confirm that the measurement object is in the correct position. Press the Enter Key. The image in the specified region will be registered as the model.

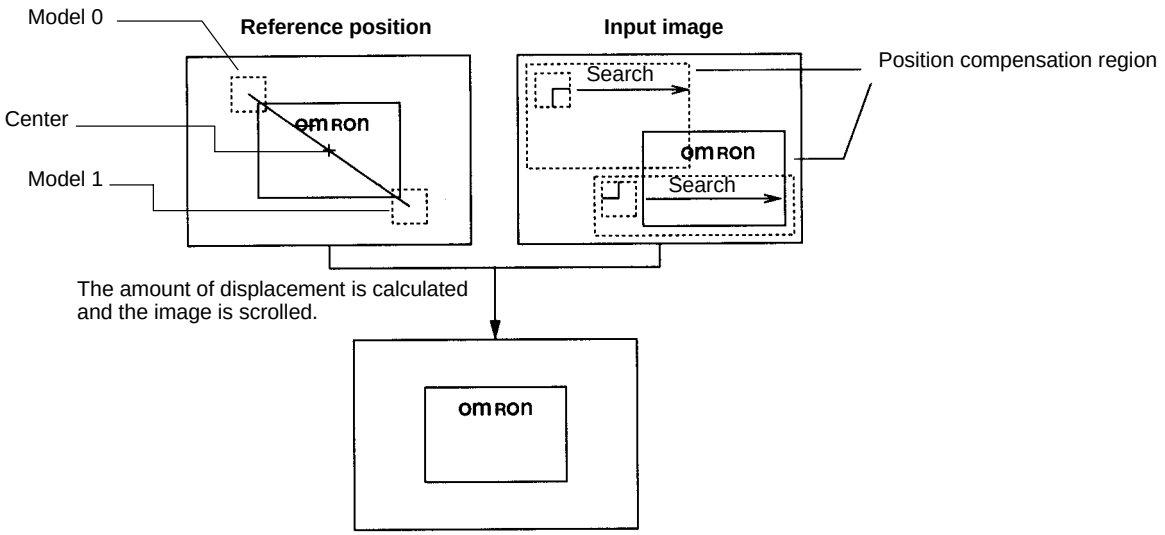


Two-model Positioning

Two-model positioning registers two characteristic parts of the workpiece as the models and searches within each position compensation region for these models. Positions with high correlation values to models 0 and 1 (the center point of the models) are searched for. The displacement (X,Y,) is detected between the coordinates of the center of the line joining the centers of models 0 and 1 and the coordinates of the center of the reference position. The image scrolls by the detected amount of displacement.

A rotation model must be registered to execute rotational position compensation. A rotation model with the same angle as models 0 and 1 is used to search for positions (the center of the models) with the highest correlation value. The amount of displacement (X,Y,θ) between the coordinates of the center of the line joining the models and the reference position coordinates is detected. The image scrolls by the detected amount of displacement.

The registered position of the model becomes the reference position.



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

Automatic Model Registration

When "1.Automatic registration" is set to "Yes" on the position compensation setting screen, the most suitable region for position compensation will be cut automatically and can be registered as a position compensation model. For the registration procedure refer to *One-model Positioning*.

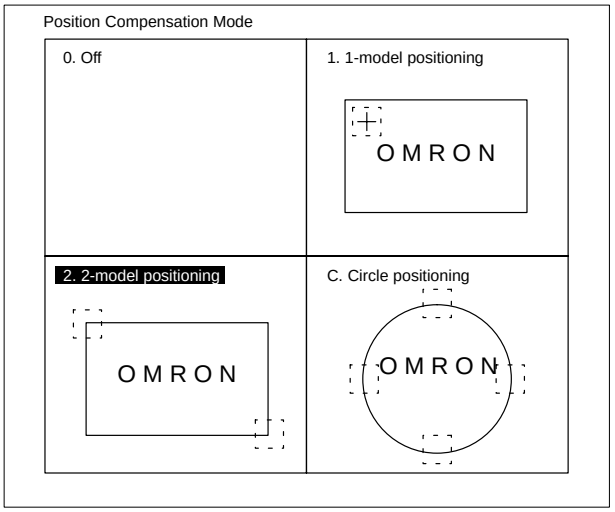
Manual Model Registration

Set the region to be registered as the model.

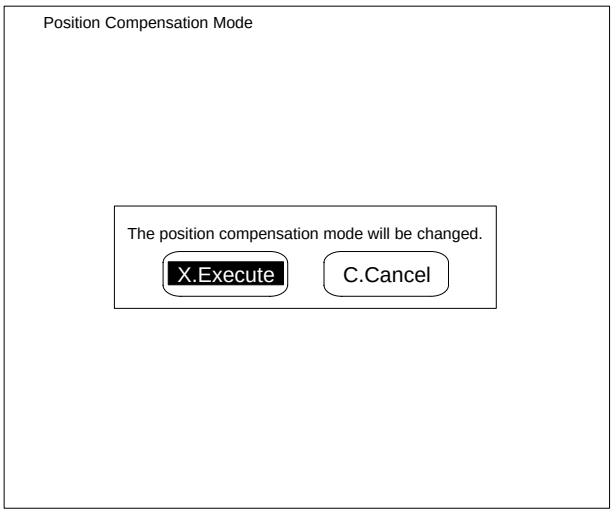
Procedure

1, 2, 3...

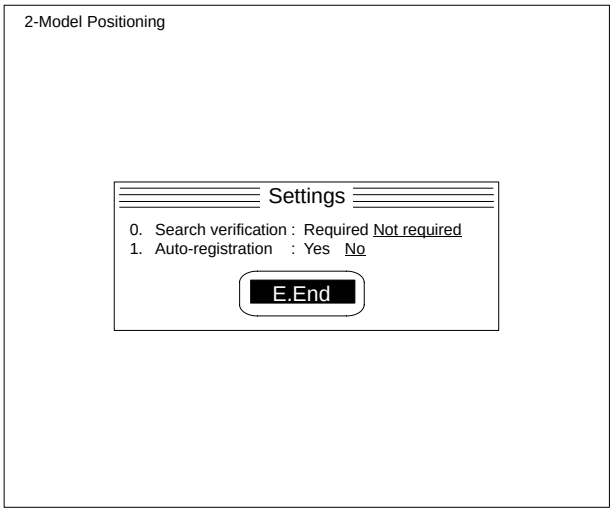
1. Select "R.Registration."
2. Select "2.2-model positioning." When the position compensation mode needs to be changed, carry out steps 3 and 4. When the mode is already set on "2.2-model positioning" go to step 5.



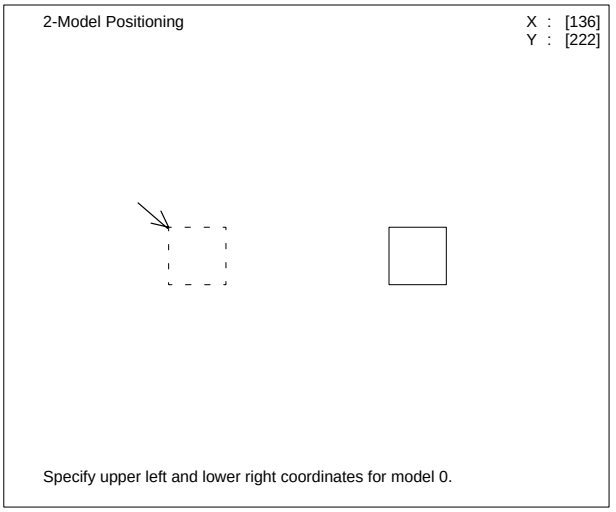
3. Select "X.Execute."



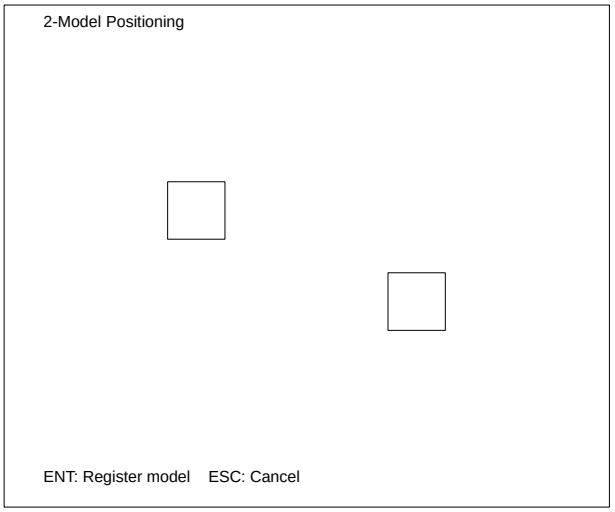
4. Set the position compensation settings. Set “1.Auto-registration” to “No.” Set “0.Search verification” to “Required” or “Not required.”



5. Set the top-left coordinates of the region registered as model 0. Move the arrow cursor and press the Enter Key.
6. Set the bottom-right coordinates of the region registered as model 0. Move the arrow cursor and press the Enter Key.
7. Specify the region to be registered as model 1 in the same way as for model 0.

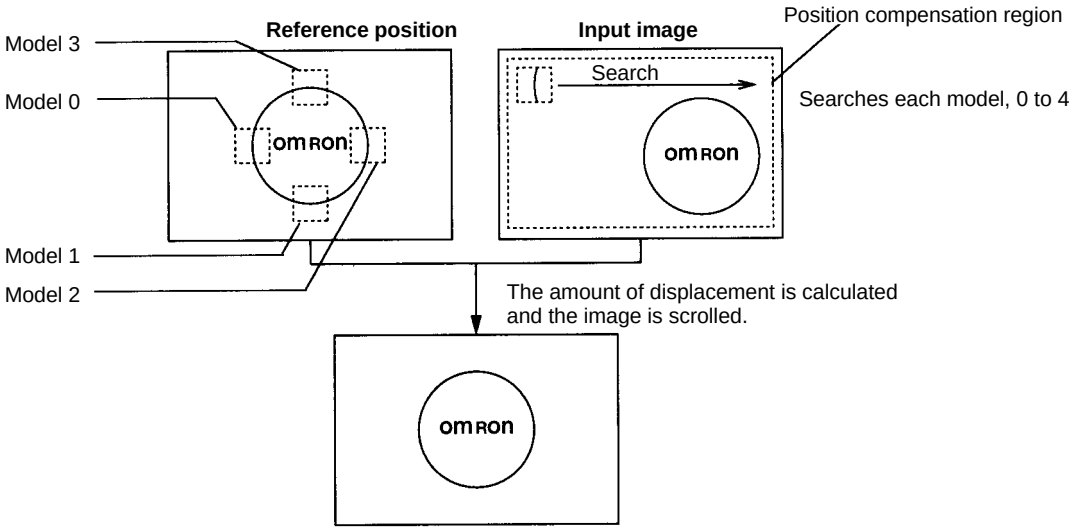


8. Press the Enter Key. The images in the specified region will be registered as the models.



Circle Positioning

Circle positioning registers four regions on the workpiece circumference as models. Positions with the highest correlation values to each model (the center of the models) are searched for. The center coordinates (X,Y) of the circle are detected from the position of these 4 models, and the image scrolls by the detected amount of displacement. Rotational position compensation can also be executed. The registered position of the model becomes the reference position.



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

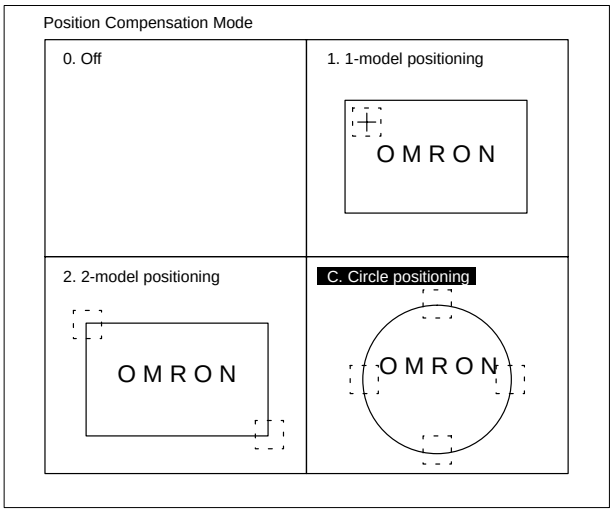
No Rotation

Only X,Y direction position compensation is executed.

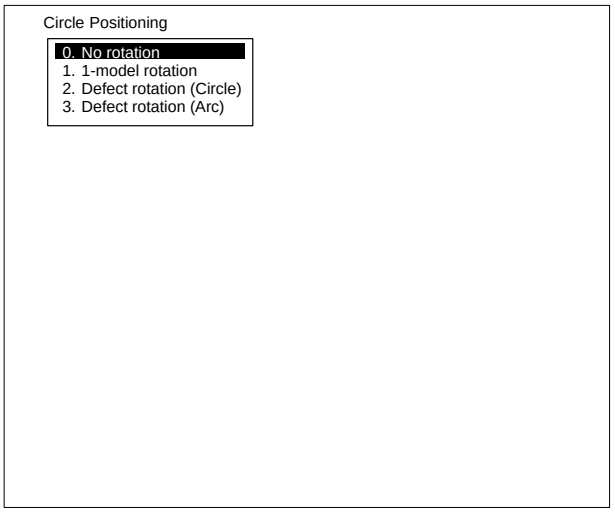
Procedure

1, 2, 3...

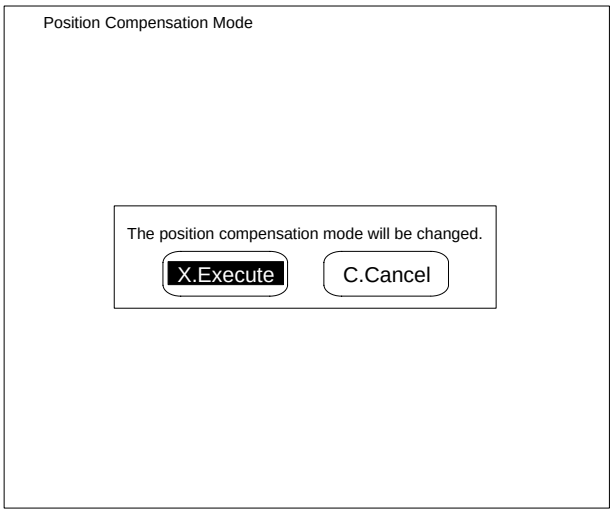
1. Select “R.Registration.”
2. Select “C.Circle positioning.”



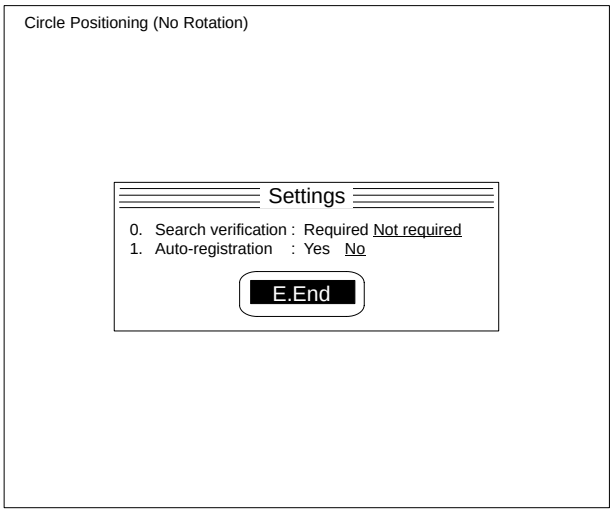
3. Select “0. No rotation.” When the position compensation mode needs to be changed, carry out steps 4 and 5. When the mode is already set on “0. No Rotation” go to step 6.



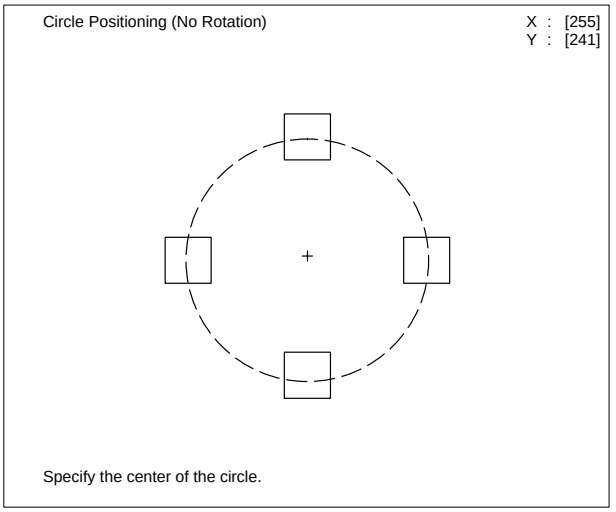
4. Select “X.Execute.”



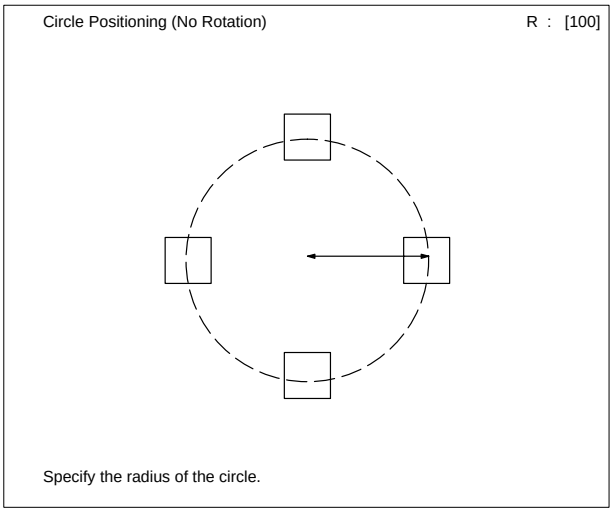
5. Set the position compensation settings. Set “1.Auto-registration” to “No.” Set “0.Search verification” to “Required” or “Not required.”



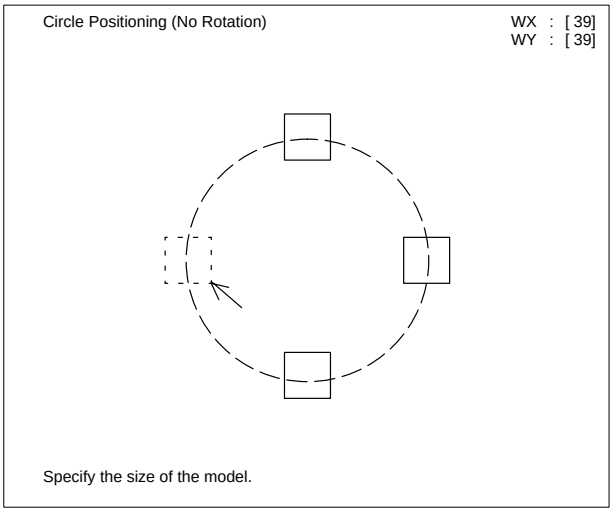
6. Specify the center of the circle by moving the cross cursor and pressing the Enter Key.



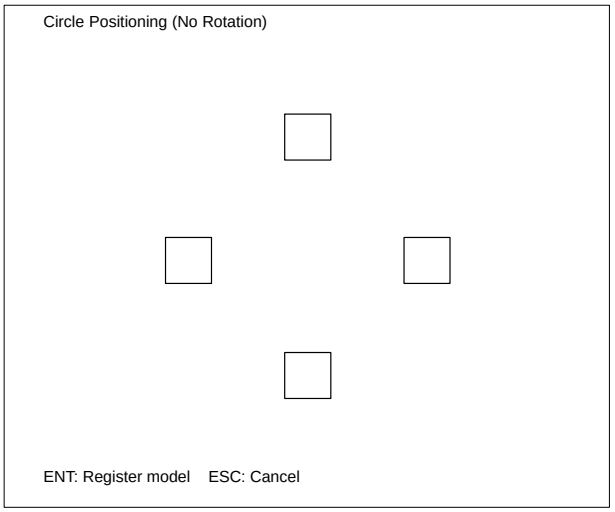
7. Specify the radius of the circle by moving the arrow cursor and pressing the Enter Key.



8. Specify the model size. Only model 0 will be displayed in the dotted line frame. When the arrow cursor is moved, the size of all models will change. Press the Enter Key.



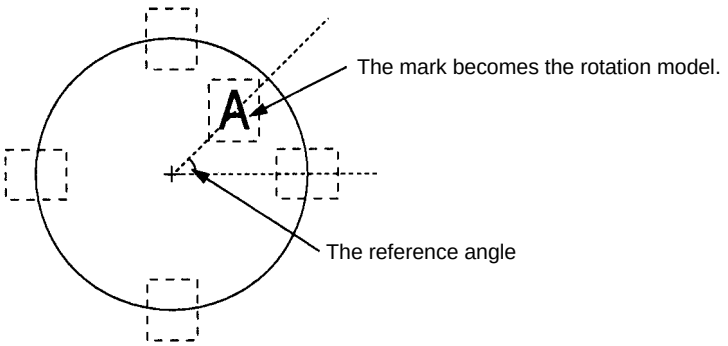
9. Press the Enter Key. The images of the four specified regions will be registered as models.



One-model Rotation

One-model rotation executes position compensation for the X , Y and the rotation directions. When the measurement object (the circle) rotates, any mark on the circle is registered as the rotation model. Rotational direction compensation can be determined from the angle formed by a line joining the position of the mark and the center of the circle.

Set the rotation angle and the pitch angle of the rotation model. Refer to *4-11-2 Setting the Rotation Compensation Parameters*.

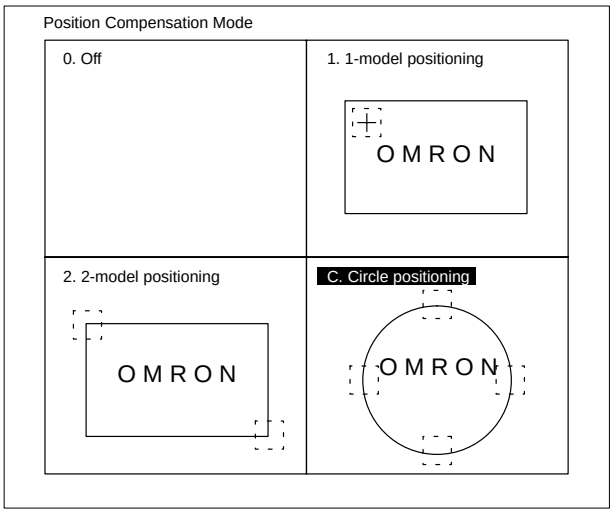


Note Greater stability is possible in position compensation if the rotation model is registered as far away from the center as possible.

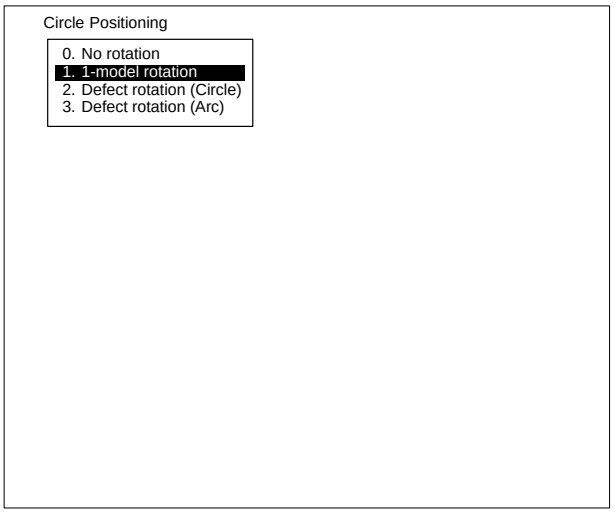
Procedure

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

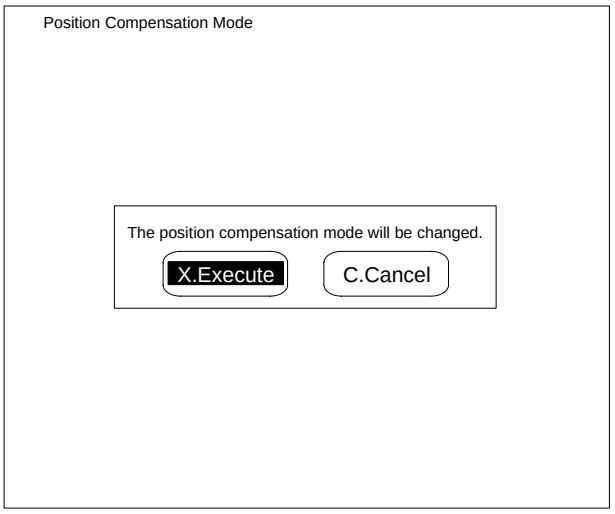
2. Select “C.Circle positioning.”



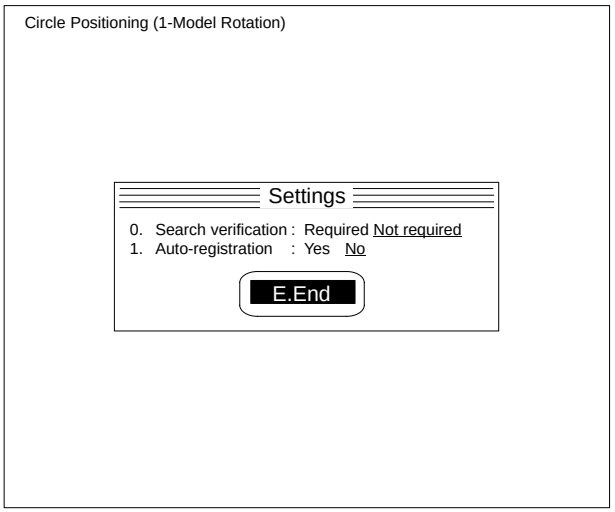
3. Select “1.1-model positioning.” When the position compensation mode needs to be changed, carry out steps 4 and 5. When the mode is already set on “1.1-model rotation” go to step 6.



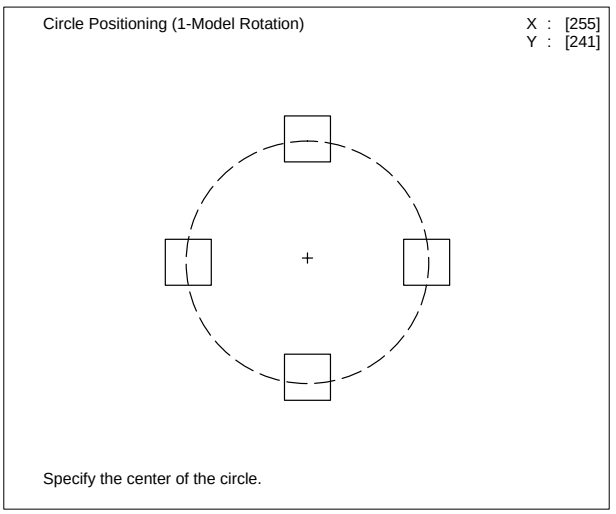
4. Select “X.Execute.”



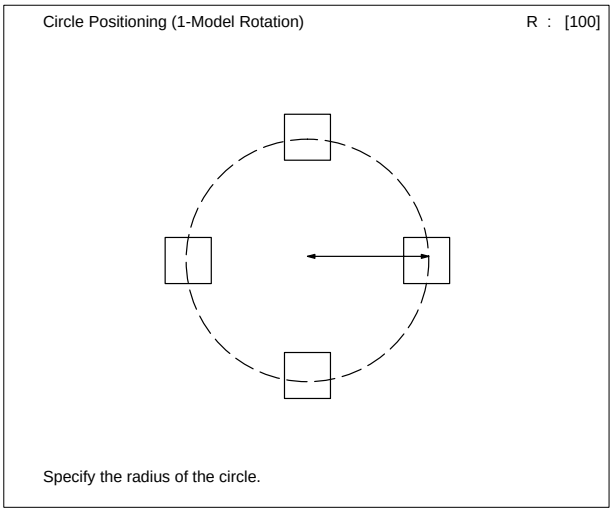
5. Set the position compensation settings. Set “1. Auto-registration” to “No.” Set “0.Search verification” to “Required” or “Not required.”



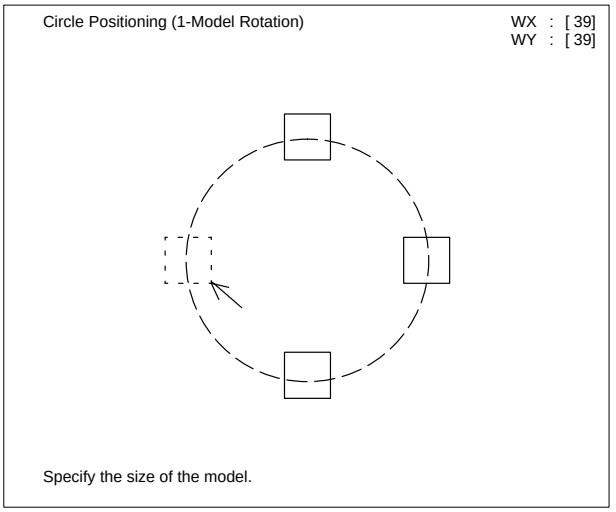
6. Specify the center of the circle. Move the cross cursor and press the Enter Key.



7. Specify the radius of the circle. Move the arrow cursor and press the Enter Key.

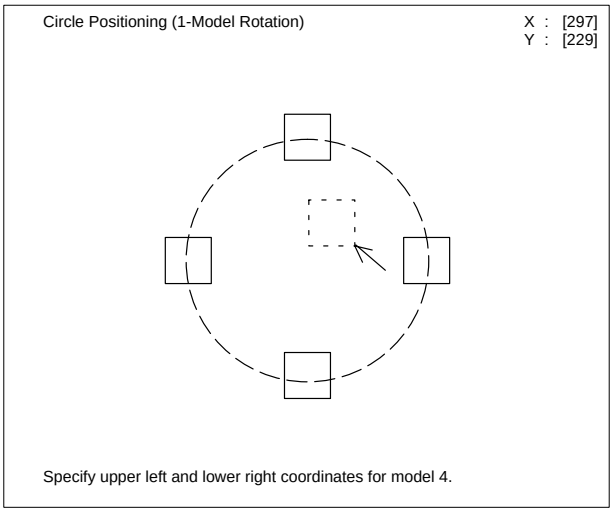


8. Specify the size of the model. Only model 0 will be displayed in the dotted line frame. When the arrow cursor is moved and the size of models 0 to 3 will be changed. Press the Enter Key.

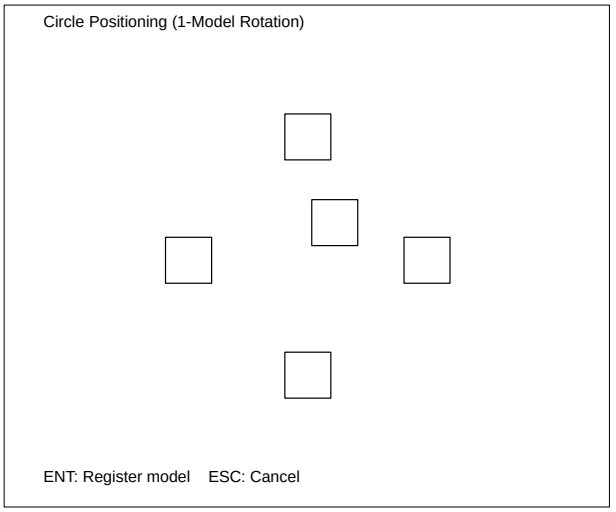


9. Specify the top-left coordinates of the region to be registered as model 4 (the rotation model). Move the arrow cursor and press the Enter Key.

10. Specify the bottom-right coordinates of the region to be registered as model 4. Move the arrow cursor and press the Enter Key.

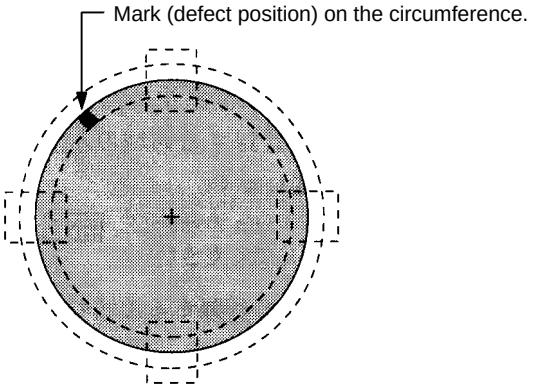


11. Press the Enter Key. The images of the five specified regions will be registered as models.

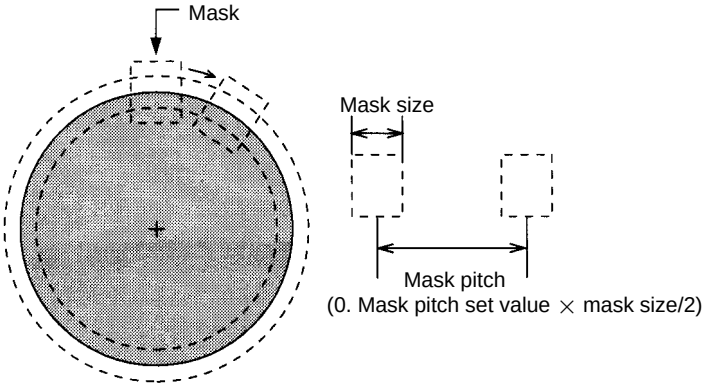


Defect Rotation: Circle/Arc

Defect rotation executes position compensation for the X, Y, and rotation directions. When the measurement object (the circle) rotates, rotation direction position compensation can be executed from the angle formed by a line joining a position on the circumference of the circle with defects, to the center of the circle (and the original rotation model). Defect positions when the rotation region was set will be the reference position. Set the conditions for detecting a mark on the circumference as the defect position.



Item	Details
0.Scratch color	Selects the color of the mark for detecting chips and scratches. Select the color of the gray image.
1.Mask size	Set the size of this mask. Set from 4 to 80. Set the mask size according to the size of the mark. The larger the mask size, the slower the processing speed. The mask is moved a little within the region drawn on the circumference to detect defect positions (mark).
2.Mask pitch	Sets the pitch for moving the mask. Set from 1 to 6. Set the mask size according to the size of the mark. There is no relationship between the mask pitch and processing speed.



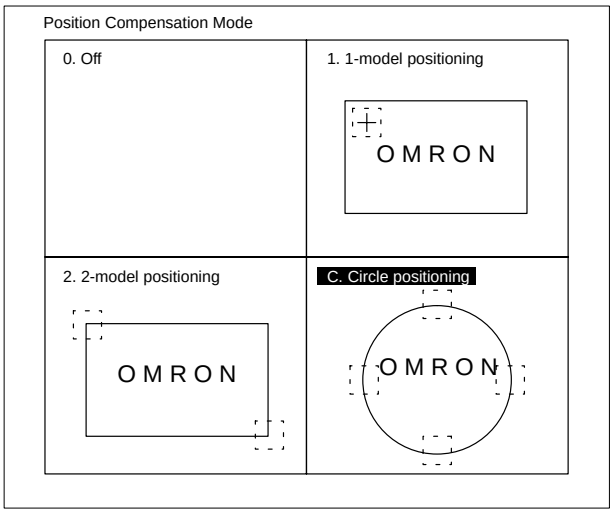
The rotation parameters are indicated below.

Position compensation mode	Rotation parameters
Defect rotation (circle)	All angles
Defect rotation (arc)	From the first point to the last point of the arc.

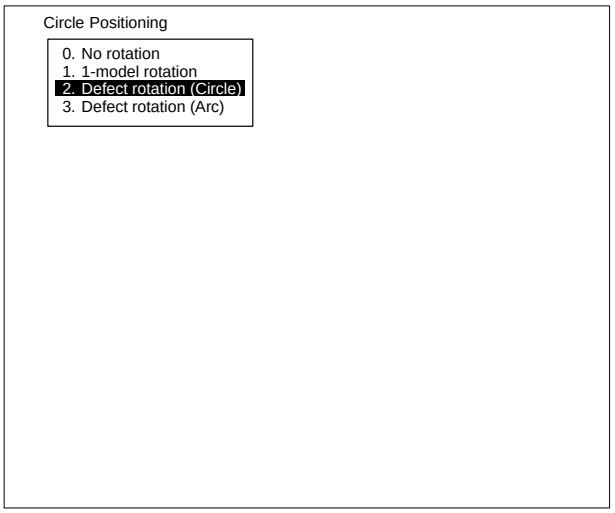
Procedure

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

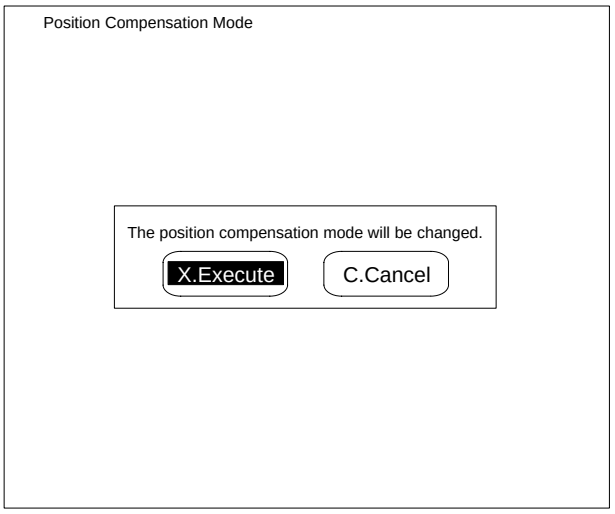
2. Select “C.Circle positioning.”



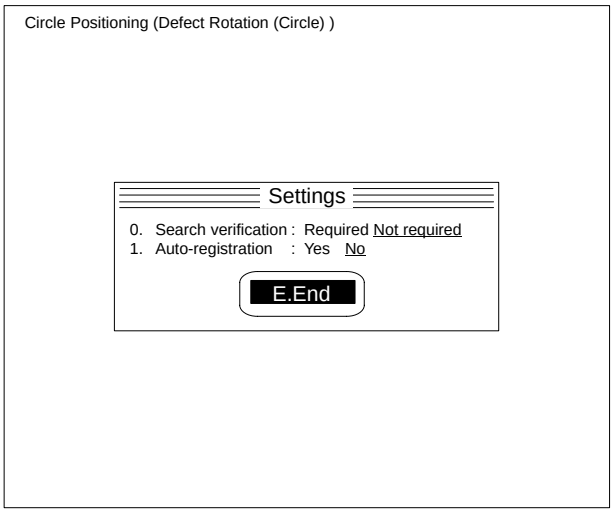
3. Select “2.Defect rotation (Circle/Arc).” When the position compensation mode needs to be changed, carry out steps 4 and 5. When the mode is already set on “2.Defect rotation (Circle/Arc)” go to step 6.



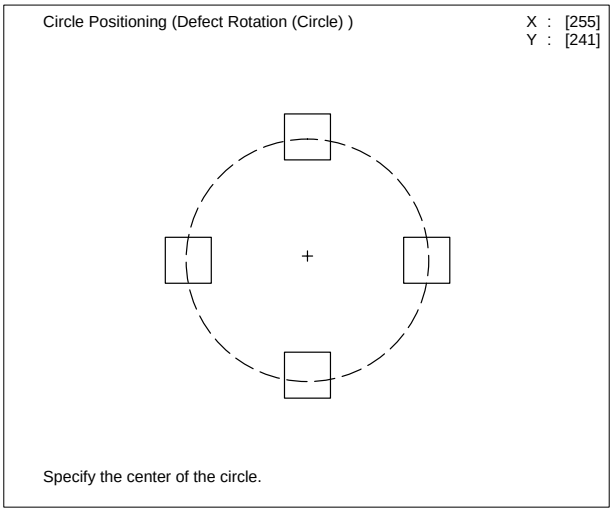
4. Select “X.Execute.”



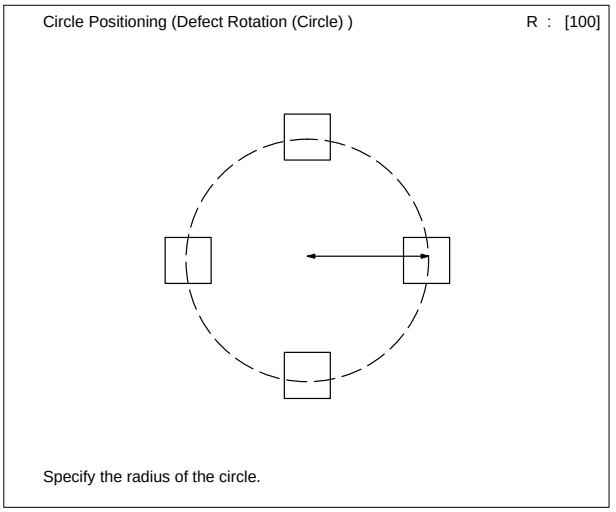
5. Set the position compensation settings. Set “1.Auto-registration” to “No.” Set “O.Search verification” to “Required” or “Not required.”



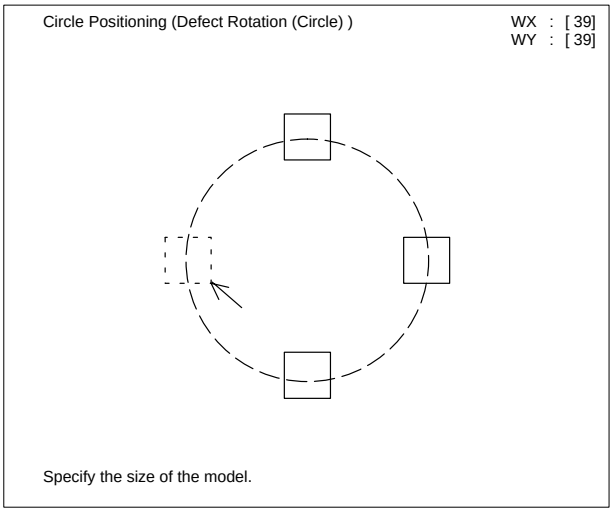
6. Specify the center of the circle by moving the cross cursor and pressing the Enter Key.



7. Specify the radius of the circle by moving the arrow cursor and pressing the Enter Key.

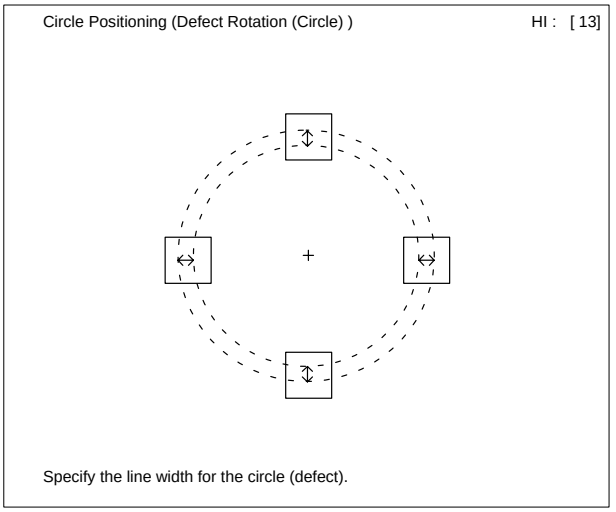


8. Specify the size of the model. Only model 0 will be displayed in the dotted box. When the arrow cursor is moved, the size of models 0 to 3 will be changed. Press the Enter Key.

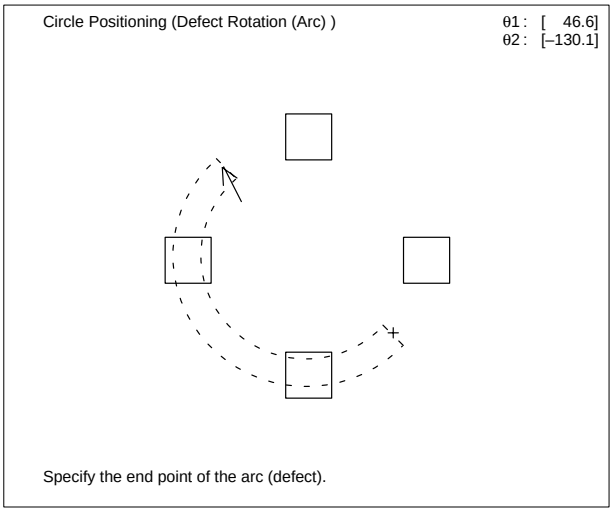


9. Specify the line width and radius of the circumference to be set as the rotation model. Move the arrow cursor and press the Enter Key. When “3. Defect

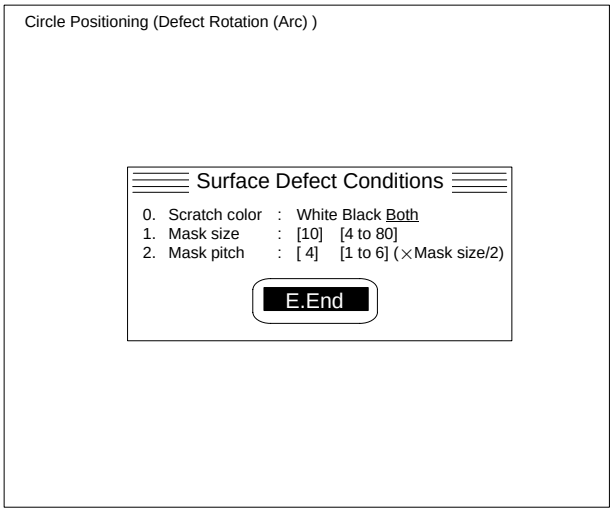
rotation (arc)" is selected, carry out step 10. When "2. Defect rotation (circle)" is selected, go to step 11.



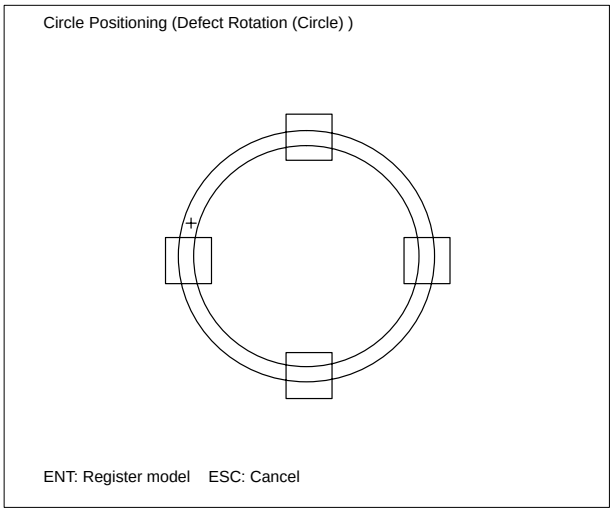
10. Specify the start point and end point of the arc. Move the arrow cursor and press the Enter Key.



11. Set the conditions for detecting the mark on the circumference as a chip or scratch.



12. Press the Enter Key. The image in the specified region will be registered as the model. A cross cursor will be displayed in the defect position of the rotation region, and this will registered as the reference position.

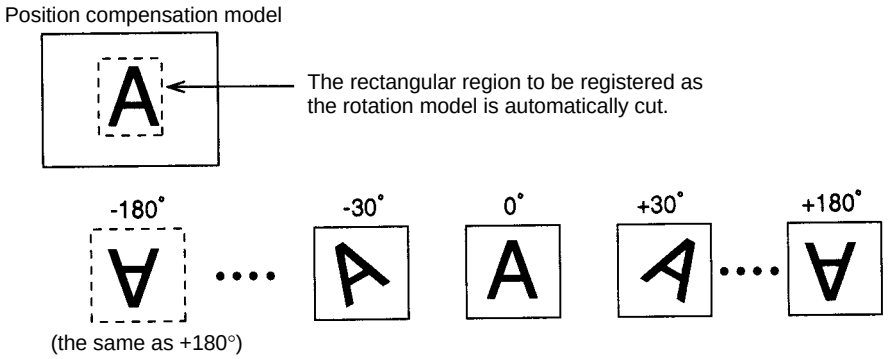


4-11-2 Selecting the Rotation Compensation Parameters: T.Rotation Angle

"T.Rotation angle" is used to set the corresponding rotation angle when the rotation of the measurement object is not consistent. The position models registered in "P.Position compensation/R.Registration" are each rotated by the pitch angle inside this parameter and registered. When the measurement object is rotated further than the "T.Rotation angle," position compensation will not be possible.

Example

Rotation angle: All angles
Pitch angle: 30°



With a rotation angle of "all angles" and a pitch angle of 30°, 12 models that have been rotated by 30° each are registered as rotation models. Rotation models are searched for in the search regions and the image is scrolled by the rotation angle of the model with the highest correlation value. After position compensation according to the rotation model, slight adjustment is made according to the position compensation model.

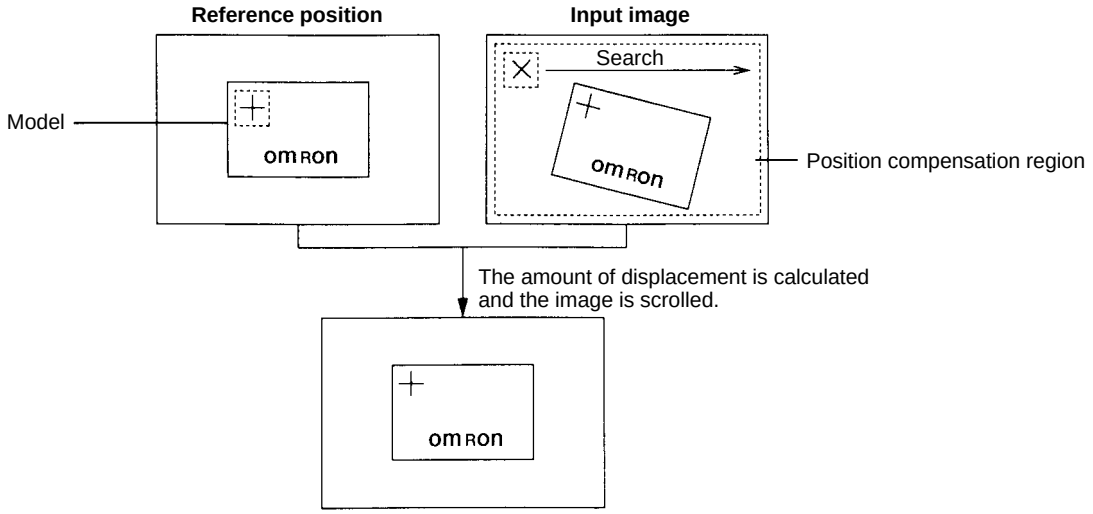
Registering Models Automatically

Automatically register models using the following procedure.

1, 2, 3...

1. Register a provisional model.
   Either automatic or manual registration can be used.
2. Set the rotation angle and pitch angle of the rotation model.
3. Execute automatic model registration once the model is in the correct position.

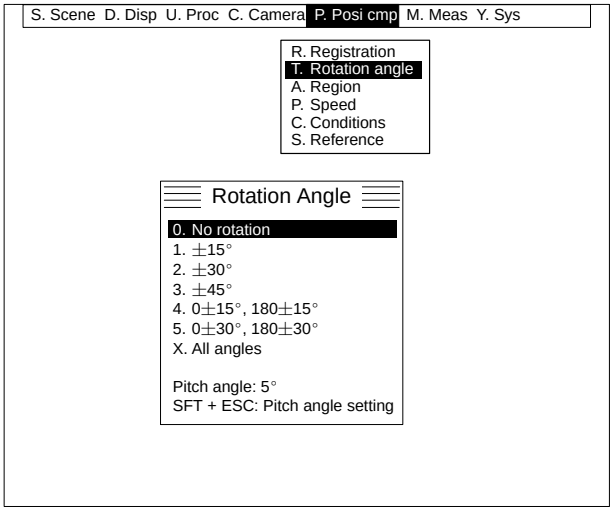
If the rotation angle and pitch angle of the rotation model are changed after auto-registration, measurement will be incorrect.



Processing time based on set data can be monitored on the video monitor. Refer to *4-12 M.Measure/O.Measure monitor* and *4-13-1 Entering Measurement Screens*.

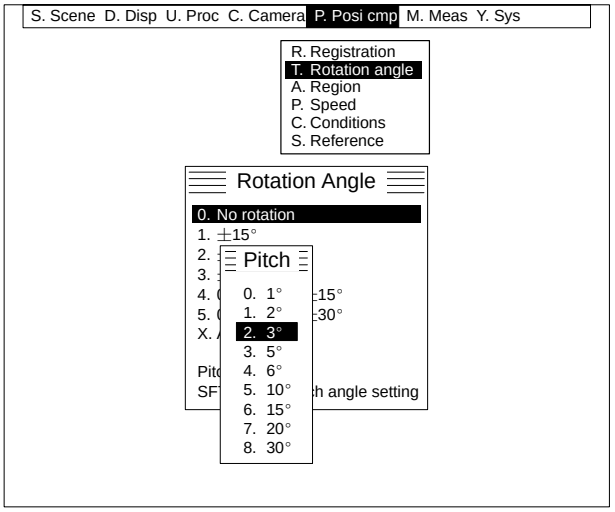
Procedure

1, 2, 3... 1. Select “T.Rotation angle.” To make changes to the set pitch angle, carry out steps 2 and 3. When there are no changes, go to step 4.

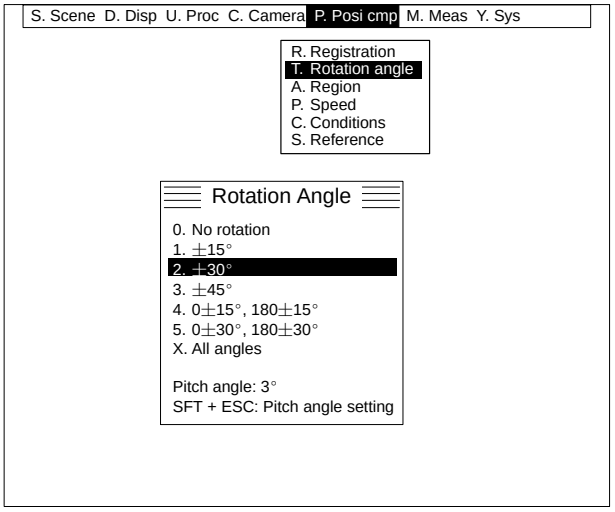


2. Press the Shift+Escape Keys. The pitch angle setting screen will be displayed.

3. Select the pitch angle.



4. Select the rotation angle.



4-11-3 Setting the Position Compensation Region: A.Region

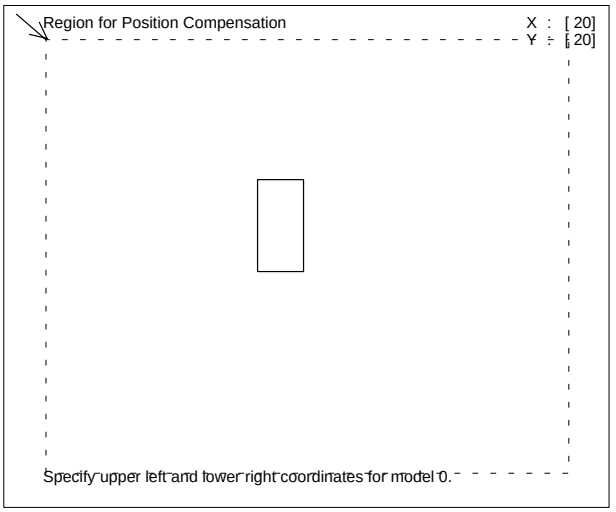
"A.Region" sets the region for searching for the position compensation models. When setting either "2-model positioning" or "C.Circle positioning" under "P.Position compensation/R.Registration," set the position compensation region for models 0 onwards in sequence. Set the region so that position compensation models can be found even if the measurement object moves. Correct position compensation cannot be executed if position compensation models cannot be found in the position compensation region.

Procedure

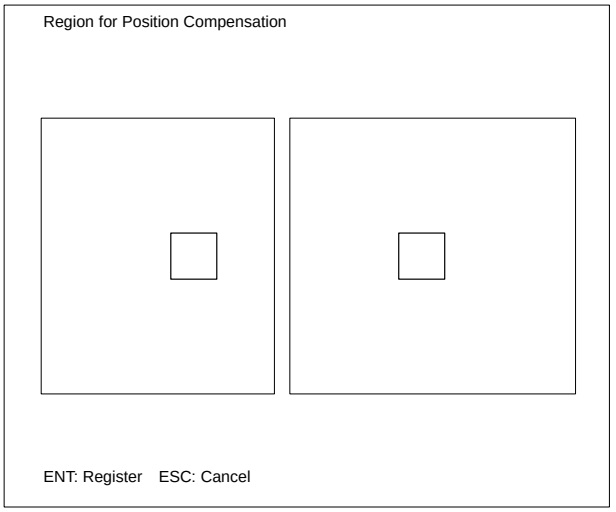
1, 2, 3...

1. Select "A.Region." The position compensation region will be displayed in the dotted line frame. The region registered as the position compensation model will be displayed in the solid line frame.
2. Specify the top-left coordinates of the position compensation region. Move the arrow cursor and press the Enter Key.

3. Specify the bottom-right coordinates of the position compensation region. Move the arrow cursor and press the Enter Key. When registering several models, repeat steps 2 and 3.



4. Press the Enter Key. The specified region will be registered as the position compensation region.



4-11-4 Selecting the Position Compensation Speed: P. Speed

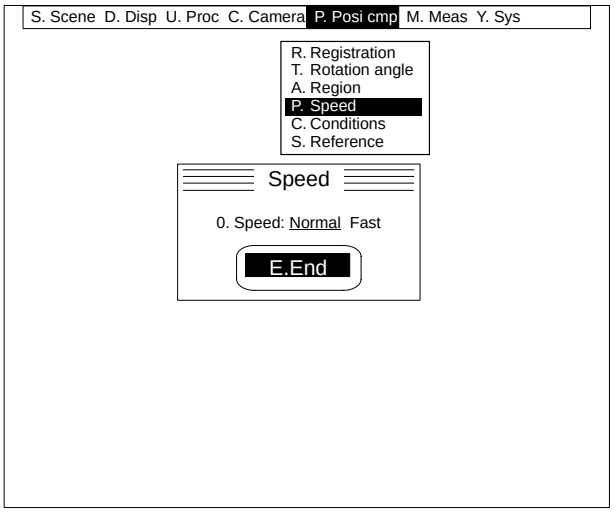
"P.Speed" selects the speed at which position compensation is executed. The position compensation processing speed is set for the currently displayed process number. The processing speed of position compensation set for other process numbers cannot be changed.

Position compensation speed	Details
Normal	Executes position compensation for the image within the frame (33 ms 512×484). The processing speed varies according to factors such as the position compensation mode, the rotation parameters, the pitch angle, and whether search verification is needed.
Fast	Executes position compensation for the image within the field (16.7 ms 512×242). The processing speed varies according to factors such as, the position compensation mode, the rotation parameters, the pitch angle, and whether search verification is needed. If there is no affect on positioning even if vertical resolution is halved, then select "fast" to reduce the time required for measurements. For the F300-A20R Shutter Camera I/F Unit and the F300-A20RS/A22RS Shutter Simultaneously Camera I/F Unit, only the fast speed can be selected.

Processing time based on set data can be monitored on the video monitor. Refer to *4-12 M.Measure/O.Measure Monitor* and *4-13-1 Entering Measurement Screens*.

Procedure

1, 2, 3... 1. Select “P.Speed.”
2. Select the speed.
3. Select “E.End.”



4-11-5 Selecting Position Compensation Conditions: C.Conditions

The conditions set here are used to judge OK/NG for the correlation values of position compensation models found in the position compensation region. Set the “judgement flag” to “ON” for position compensation judgements to be made during measurement. Set the search correlation value to 100 for images which match the models exactly.

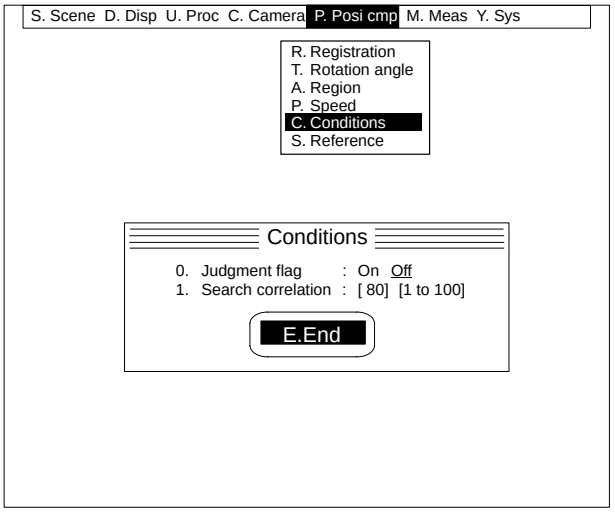
In the following situations, set the “1.Search correlation” value regardless of whether the “O.Judgement flag” is set.

- **Registering a Position Compensation Model Automatically**
  Set the “1.Search correlation” before executing automatic registration for the model. The F350 uses this setting to cut the appropriate position compensation region.
- **“Search Verification” Set to “Required” in the Settings Mode**
  The F350 detects as candidates areas with correlation values greater than the search correlation values.

Procedure

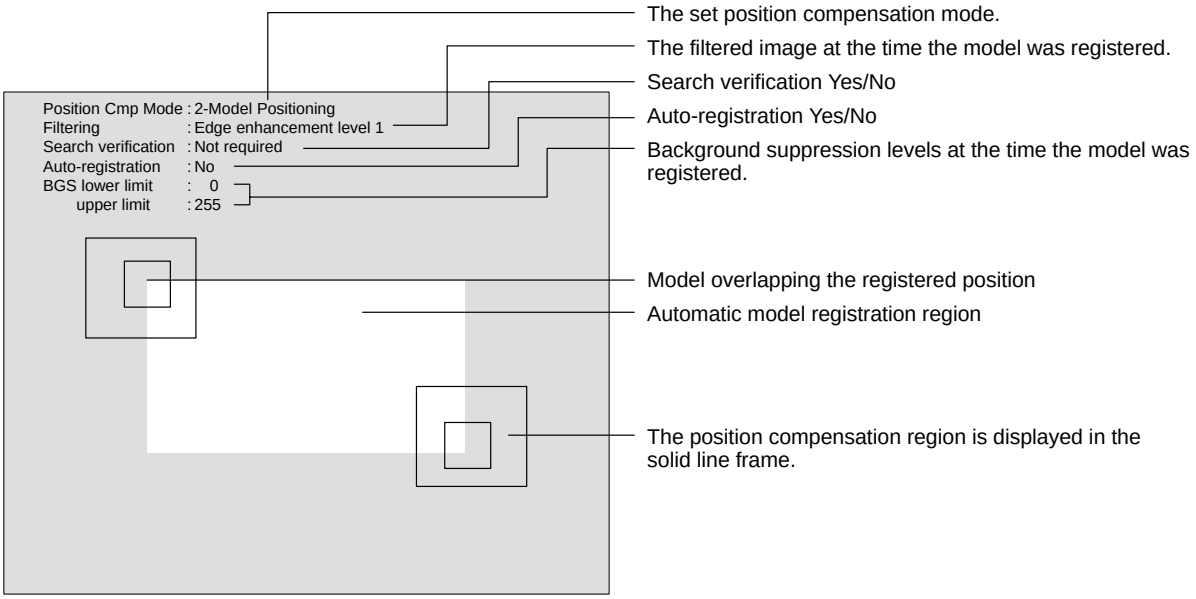
1, 2, 3... 1. Select “C.Condition.”

2. Sets the conditions for position compensation.



4-11-6 Checking the Set Data: S.Reference

“S.Reference” is used to display and monitor data set under position compensation. Data cannot be changed.

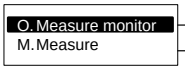


The accuracy of position compensation can be monitored by using the following procedure.

1. Select “D.Display/P.Input image after position compensation” and input the image. Refer to *4-2-3 Inputting Images After Position Compensation*.
2. Select “P.Position compensation/S.Reference.”

4-12 M.Measure/O.Measure Monitor

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



Checking Measurement Values and Times: O.Measure Monitor

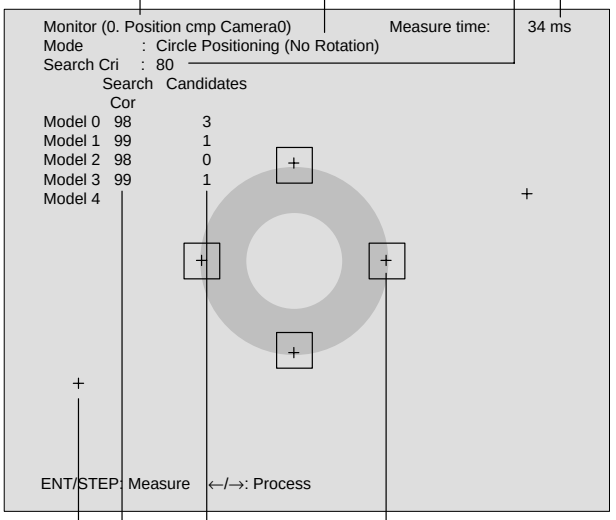
"O.Measure monitor" monitors measurement values based on the set data. Measured results are output to the Video Monitor only, even when a Parallel I/O Unit or Terminal Block Unit is mounted. The measurement time for each process is also displayed on the Video Monitor. When several processes are set,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

Important

Instruction Input Timing

The next instruction must not be input while an instruction is being executed. Neither the instruction currently being executed nor the next instruction will be properly executed. When a Terminal Block Unit or Parallel I/O Unit is mounted,

the BUSY signal will turn ON during instruction execution. Check to be sure that the BUSY signal is OFF before inputting the next instruction.



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

The position compensation mode.

The criteria for determining OK or NG.

The measurement time for the current process.

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

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

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

Refer to *4-13-1 Entering Measurement Screens*.

Without search verification:
The model frame and cross cursor are displayed at the position that has the highest correlation with the search model.

With search verification:
The model frame and cross cursor are displayed at the position that has the highest correlation with the verification model.

Without search verification: “0” is always displayed.

With search verification:
Positions for which the correlation with the search model is greater than or equal to the criteria are displayed as the candidate points.

The correlation with the position compensation model is displayed. If the measured value is less than the criteria, NG is determined. In that case, “NG” is displayed here in reverse video.

Without search verification:
The correlation value of the position that has the highest correlation with the search model is displayed.

With search verification:
The correlation value of the position that has the highest correlation with the verification model is displayed.

When search verification is required, the cross cursor is displayed at the search candidate point.

Console

The following instructions can be input from the Console.

Instruction	Key	Action
Measure	ENT	Executes position compensation. When position compensation is set for the same camera number for the preceding process, (or position compensation is set in succession), position compensation is executed over several stages.
Switch process	◀ / ▶	Switches the process and executes the measurement items as set. Processes with no data set are skipped over. When position compensation is set for the same camera number for the preceding process, position compensation is executed over several stages.
Quit measurement	ESC	Quits the measure monitor screen.

RS-232C

The following instructions can be input via RS-232C. Attach a delimiter to the input code (ASCII). Ensure that it matches the communications specifications of the F350 and the external device.

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

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

Measure

M m	Delimiter

Executes position compensation once. When position compensation is set for the same camera number for the preceding process, position compensation is executed over several stages.

Quit Measurement

Q q	Delimiter

Quits the measure monitor screen.

Parallel I/O

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

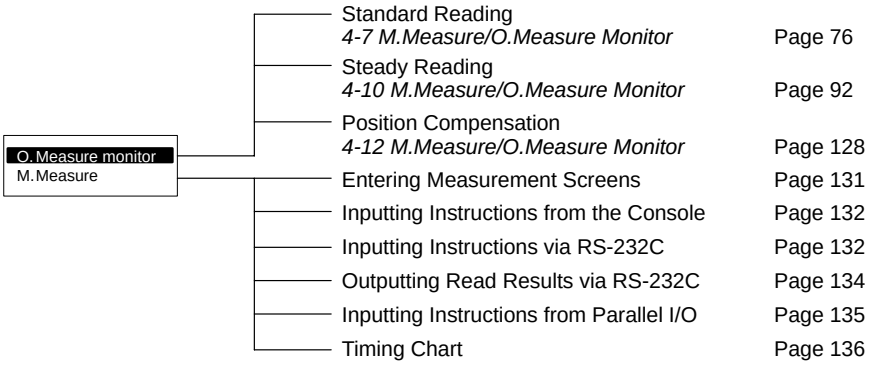
Refer to *2-4 Connecting Peripheral Devices* in the *Setup Menu Operation Manual*.

Instruction	Input data STEP DI: 76543210	Action
Measure	↓	Executes position compensation once in sync with the STEP signal's leading edge (OFF to ON). When position compensation is set for the same camera number for the preceding process, (or position compensation is set in succession), position compensation is executed over several stages.

■ Measurements

4-13 M.Measure/M.Measure

"M.Measure" performs reading operations based on the read conditions that have been set.



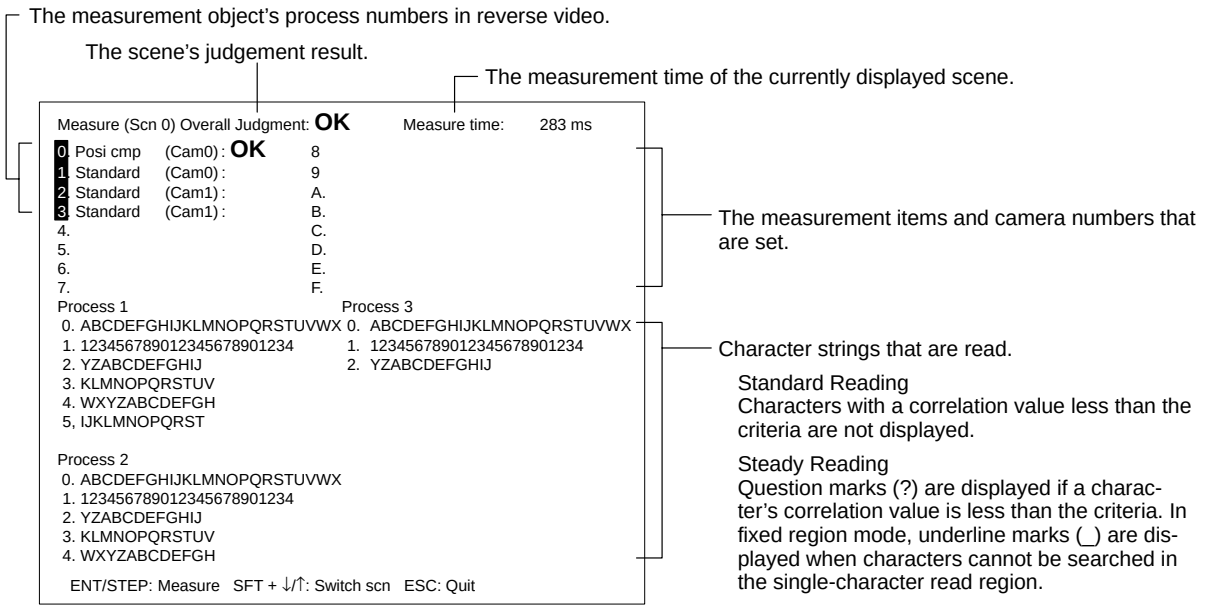
4-13-1 Entering Measurement Screens

While the measurement screen is displayed, measurements start when a measurement instruction is given and the result is displayed on the Video Monitor and output to the RS-232C I/F Unit.

Important When using an F350-C12E IMP Unit, it is necessary to insert a scene data back-up Memory Card in order to use multiple scenes. Install the Memory Card before selecting "M.Measure/M.Measure."

When an error occurs at the F350 during a measurement, the IMP Unit's ERROR indicator lights and the ERR signal turns ON. The type of error, however, cannot be distinguished. The appropriate countermeasure depends on the instruction that was input.

The ERR signal remains ON until the measurement screen is quit. You must exit the measurement screen to turn off the error output. Refer to *Section 5 Troubleshooting*.



Measurement time can be shortened by turning the measurement results display mode OFF. Refer to *4-7-1 Checking Measurement Values and Measurement Times* and *4-10-1 Checking Measurement Values and Measurement Times*.

The measurement screen can be displayed at startup so that instructions can be input immediately. Refer to *4-14-1 Automatic Measurements*.

Finding Multiple Characters

The number of characters that can be found for the same character model will be reduced when there is a large number of registered character models.

Example

Conditions:

Position compensation: 2-model positioning; Rotation angle: 360°; Pitch angle: 5°; Standard reading using 292 character models in the dictionary.

Character model

- **F350-C12E IMP Units**

  When measurement is conducted under the above conditions, up to seven occurrences of the same character model can be found. All other occurrences of the same character will be disregarded.

AAAAAAA AA...

The first 7 occurrences are found. All other occurrences are disregarded.

- **F350-C41E IMP Units**

  When measurement is conducted under the above conditions, up to 17 occurrences of the same character model can be found. All other occurrences of the same character will be disregarded.

AA.....A AA...

The first 17 occurrences are found. All other occurrences are disregarded.

If reading is not possible because not enough of the same character can be found, increase the number of occurrences that can be found by deleting models which are not being used for measurement. When using position compensation, the number of models can also be reduced by decreasing the rotation angle or increasing the pitch angle.

4-13-2 Inputting Instructions from the Console

All Measurement Items

The following commands can be input from the Console.

Instruction	Key	Action
Measure	ENT	Executes the measurement.
Switch scene	SHIFT + ▲/▼	Increments or decrements the currently displayed scene number.
Quit measure	ESC	Quits the measurement screen.

4-13-3 Inputting Instructions via RS-232C

The following instructions can be input via RS-232C. Attach a delimiter to the input ASCII code. Ensure that it matches the communications specifications of the F350 and the external device.

Refer to *5-2-3 Setting RS-232C Communications Specifications* in the *Setup Manual*.

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

All Measurement Items

Measure

M m	Delimiter	

Executes one measurement.

Switch Scene

S s	Scene No.	Delimiter	

Switches to the specified scene number.

Switch Camera

C c	Process number	Delimiter	

Switches to the camera for the specified process number.

Specify Process

U u	Beginning process number	,	Ending process number	Delimiter	

Set so that the measurement items for only the specified processes are measured.

Load Scene Data

OF of	Filename (no extension)	Delimiter	

Loads scene data from the specified file on the Memory Card to the currently displayed scene number.

Quit Measure

Q q	Delimiter	

Quits the measurement screen.

Position Compensation

Automatic Register

R r	Process number	Delimiter	

When automatic registration is specified, the region most suitable for position compensation is cut from the automatic registration region and re-registered as the position compensation model.

Standard and Steady Reading

Load Dictionary Data

OD od	Filename (no extension)	Delimiter	

Loads dictionary data from the specified file on the Memory Card.

When position compensation is set for scenes for which dictionary data is to be loaded, follow the procedure outlined below to load the dictionary data.

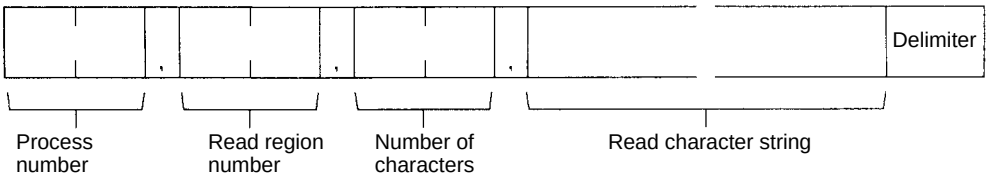
1, 2, 3...

1. Switch to a scene that is not set to “position compensation.”
2. Load the dictionary data.
3. Switch back to the original scene.

4-13-4 Outputting Read Results via RS-232C

The following data format is output via the RS-232C I/F Unit in ASCII. Match the communications specifications to the external devices

Refer to *5-2-3 Setting RS-232C Communications Specification* in the *Setup Manual*.



All Measurement Items

Output item	Contents
Process number	Outputs the process number (00 to 15) in order, beginning with the lowest.
Read region number	Outputs the read region number (00 to 05) in order, beginning with the lowest.

Standard Reading

Output item	Contents
Number of characters	Outputs the number of characters read (00 to 99). Characters found in the search are counted even when the correlation value is less than the criteria. If not even a single character is found, then “0” is output.
Read character string	Outputs the read character string. Only characters for which the correlation value is equal to or greater than the criteria are output, and these are output consecutively.

Steady Reading

Output item	Contents
Number of characters	Automatic cutting mode: Outputs the number of characters read (00 to 99). Fixed region mode: Outputs the number of characters read (i.e., the number of single-character read regions) 00 to 99.
Read character string	Outputs the read character string. If there are no characters in the single-character regions, then an underline is output. When the correlation value is less than the criteria, then a question mark (?) is output.

The following response is output when an instruction other than a measurement instruction is input.

When ended normally:

O	K	Delimiter

When ended abnormally:

E	R	Delimiter	Input instruction	Delimiter

4-13-5 Inputting Instructions from Parallel I/O Units

The commands shown in the following table can be input from a Parallel I/O Unit or a Terminal Block Unit. The measurement results, however, cannot be output to those Units.

ON status of bits is indicated by "1" and OFF status by "0." An asterisk (*) indicates that either is possible. Set DI 0 to 6 and 1 ms later set DI 7 to ON. The leading edge (OFF to ON) of the STEP signal is indicated by ↓. Connect and wire the external devices.

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

All Measurement Items

Instruction	Input data STEP DI: 7 6 5 4 3 2 1 0	Action
Measure	↓	Executes a single measurement in sync with the STEP signal's leading edge (OFF to ON).
	1 0 0 1 * * * *	Executes continuous measurement while instruction is being input.
Switch scene	1 0 1 0 (Scene #) (Example:) 1 0 1 0 0 0 1 0	Switches scene for measurement. This example switches to scene 2.
Switch camera	1 0 1 1 (Process#) (Example:) 1 0 1 1 0 0 1 1	Switches to the camera for the specified process number. This example switches to the camera set for process 3.
Specify beginning process number	1 1 0 1 (Process#)	Set so that measurements are executed from the specified process number through process #15 (or the ending process number). If a number greater than the ending process number is specified, then the ending process number will be changed to the same number as the beginning process number. This setting is valid only for the scene number that is currently being displayed.
Specify ending process number	1 1 1 0 (Process#)	Set so that measurements are executed from process #0 (or the beginning process number) through the specified process number. If a number smaller than the beginning process number is specified, then the beginning process number will be changed to the same number as the ending process number. This setting is valid only for the scene number that is currently being displayed.

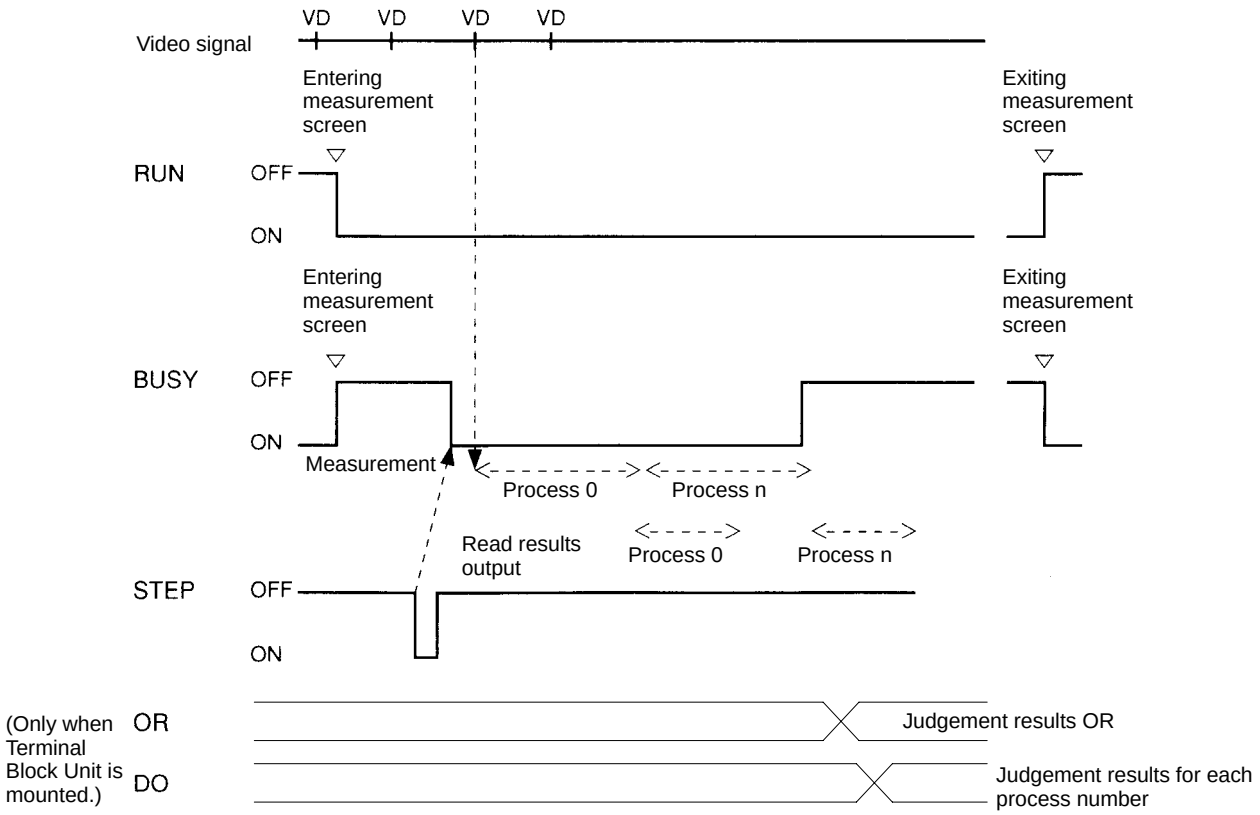
Position Compensation

Instruction	Input data STEP DI: 7 6 5 4 3 2 1 0	Action
Automatic registration	1 1 0 0 (Process#)	When automatic registration is specified, the region most suitable for position compensation is cut from the automatic registration region and re-registered as the position compensation model.

4-13-6 Timing Charts

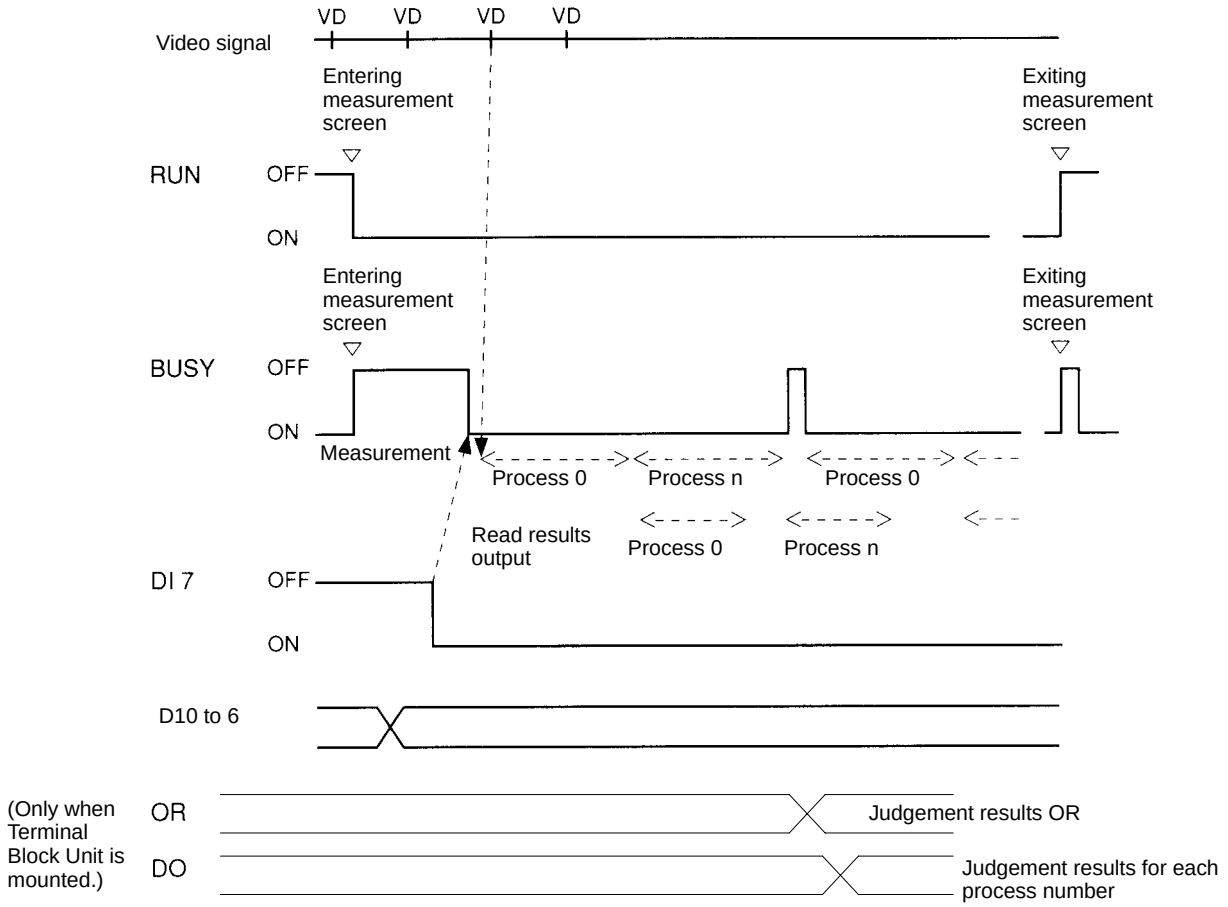
The timing for processing using Parallel I/O is illustrated in the following charts.

Measurement by STEP Input



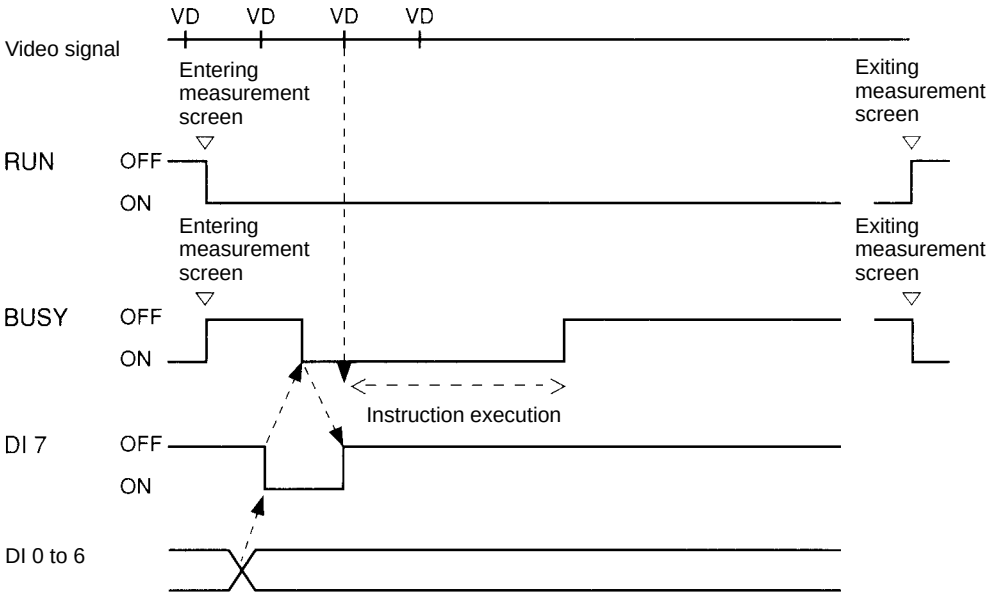
Terminal	Action
RUN	ON while measurement screen is entered.
BUSY	ON while instruction is being processed in the measurement screen. **Important** Do not input the next instruction while the BUSY signal is ON, or neither the current processing nor the instruction that is input will be properly executed.
STEP	Executes a single measurement in synchronicity with the STEP signal's leading edge (OFF to ON).
OR	When a Terminal Block Unit is mounted, a logical OR of the judgement results for all processes is output to the OR terminal. The OR signal turns ON if even one of the results is NG.
DO	When a Parallel I/O Unit or Terminal Block Unit is mounted, judgement results are output for each process number. DO 0 to 15: Judgement results for processes 0 to 15. OFF (0): OK; ON (1): NG DO 16: Logical OR of the judgement results for all processes. OFF (0): All processes are OK. ON (1): At least one process is NG.

Continuous Measurement



Terminal	Action
RUN	ON while measurement screen is entered.
BUSY	ON while instruction is being processed in the measurement screen.
DI	Inputs measurement instructions. Set DI0 to DI6, and turn ON DI7 after 1 ms.
OR	When a Terminal Block Unit is mounted, a logical OR of the judgement results for all processes is output to the OR terminal. The OR signal turns ON if even one of the results is NG.
DO	When a Parallel I/O Unit or Terminal Block Unit is mounted, judgement results are output for each process number. DO 0 to 15: Judgement results for processes 0 to 15. OFF (0): OK; ON (1): NG DO 16: Logical OR of the judgement results for all processes. OFF (0): All processes are OK. ON (1): At least one process is NG.

Instructions for Other than Measurements



Terminal	Action
RUN	ON while measurement screen is entered.
BUSY	ON while instruction is being processed in the measurement screen. **Important** Do not input the next instruction while the BUSY signal is ON, or neither the current processing nor the instruction that is input will be properly executed.
DI	Inputs the instruction. Set DI0 to DI6, and turn ON DI7 after 1 ms.

■ System

4-14 Y.System

"Y.System" saves the set scene data and set the environment data. The data set using "Y.System" does not directly affect the measurement conditions.

4-14-1 Automatic Measurement: M.Initial Mode

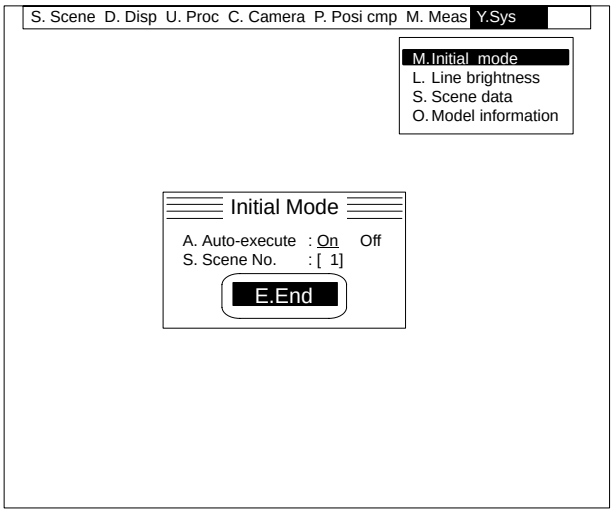
"M.Initial mode" is used to display the measurement screen automatically at startup. Measurements will be started as soon as measurement instructions are input. Use "M.Initial mode" for actual operation after all measurement conditions (i.e. all scene data) have been set.

Procedure

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

2. Set “A.Automatic execution” ON.

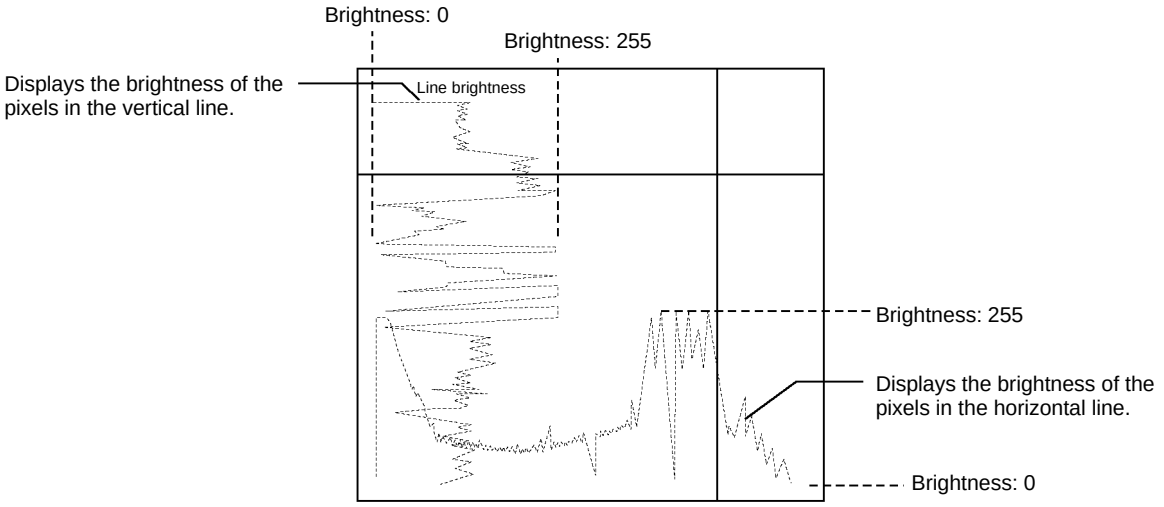
3. Set the scene number in “S.Scene.” The measurement screen for the specified screen number will be automatically displayed the next time the system is started.



4. Select “E.End.”

4-14-2 Displaying the Line Brightness: L.Line Brightness

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

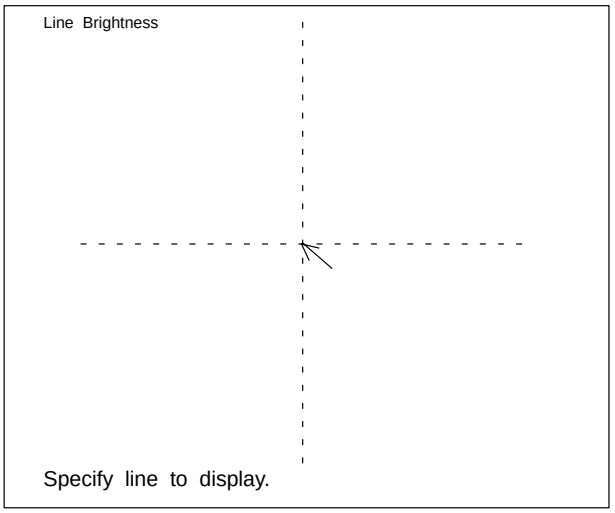


Procedure

1, 2, 3... 1. Select “L.Line brightness.”

Dotted lines are displayed vertically and horizontally through the cursor.

A static (freeze) image is displayed when “L.Line brightness” is selected. If “D.Display/F.Freeze” is set to “U.Unfreeze,” display the required image before selecting “L.Line brightness.”



2. Select the line. Move the cursor to the line and press the Enter Key. The line brightness will be displayed for the selected vertical and horizontal lines.
3. Press the Enter Key or the Escape Key to return to the menu.

4-14-3 Saving and Loading Scene Data: S.Scene Data

“S.Scene data” loads and saves data to and from the Memory Card. The “Y.System/M.Initial mode” setting does not include scene data. The scene data contents differ depending on the menu.

Saving Scene Data

“S.Scene data/S.Save” saves scene data to a Memory Card. The extension “.SCN/.MDL/.VAR” is automatically appended to the saved file name.

When using a new Memory Card for the first time, initialize it using the Setup Menu. Refer to *5-4-1 Initializing Memory Cards* in the *F350 Setup Menu Operation Manual*.

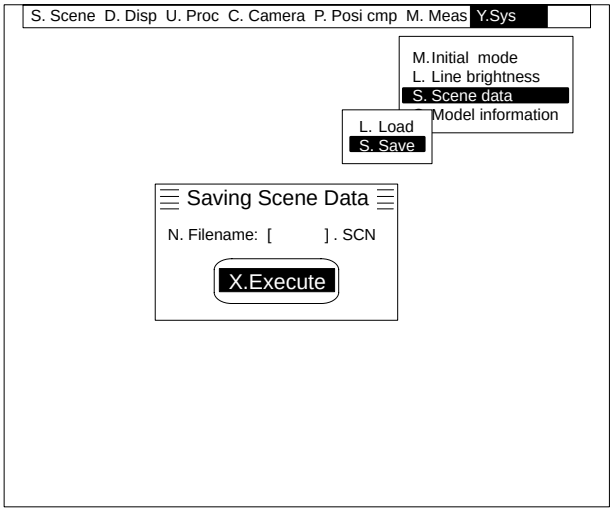
Important When an F350-C12E IMP Unit is used, a Memory Card is required in order to use multiple scenes. Use a separate Memory Card for saving scene data.

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

Procedure

1, 2, 3... 1. Select “S.Scene data.”
2. Select “S.Save.”

3. Input the save destination file name for “N.Filename.”



4. Select “X.Execute.” The data from the specified scene number will be saved in the memory card under the specified file name.

Important Do not turn the power supply switch OFF while data is being saved, or the data will not be saved correctly.

Loading Scene Data

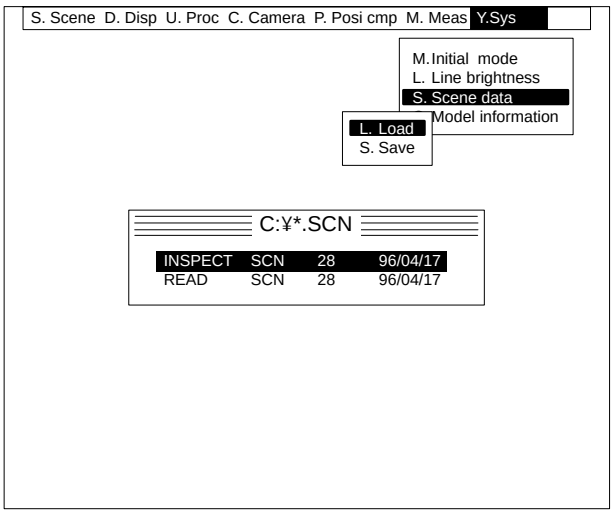
“S.Scene data/L.Load” loads saved scene data from a Memory Card. Insert a Memory Card containing the saved scene data. When the scene data is loaded, it overwrites the scene data for the currently displayed scene number. Display the load destination scene number before loading.

Important Scene data cannot be loaded if the measurement items installed at the time of loading are different from those installed at the time of saving. Be sure to install the same measurement items as at the time of saving. Refer to *2-2 Starting and Quitting an Application Program*.

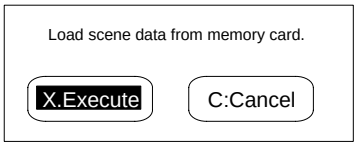
Procedure

1, 2, 3...

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



3. Select the file name. A confirmation message will be displayed.

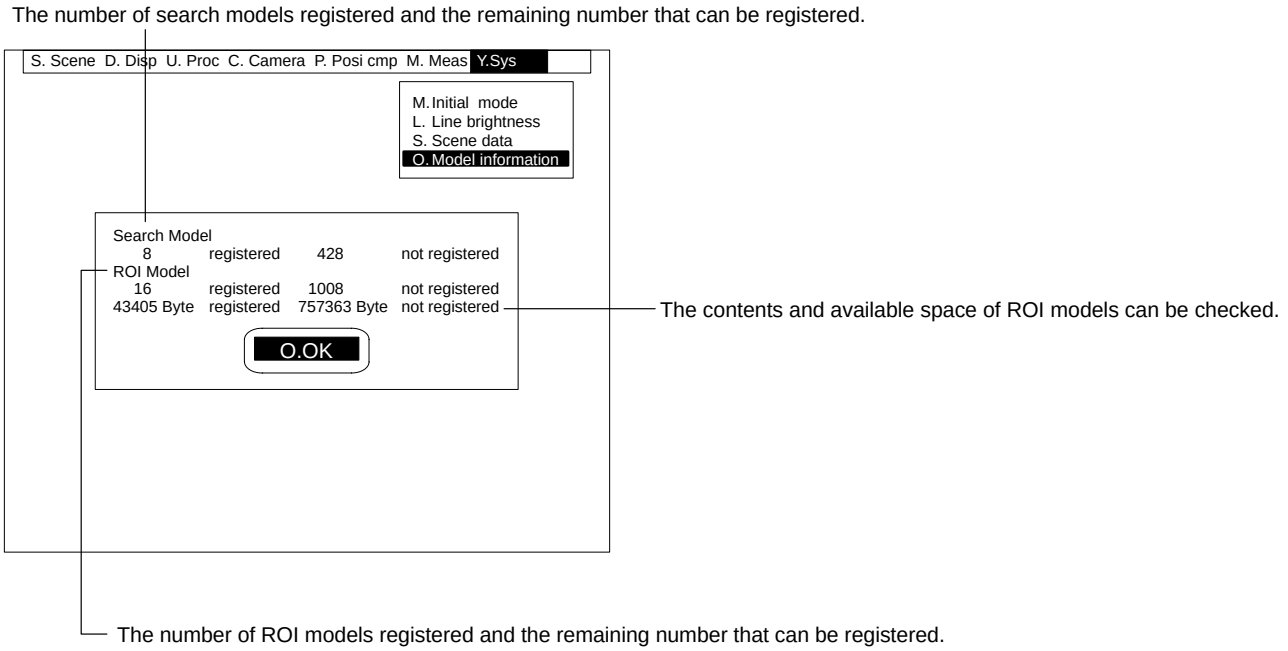


4. Select “X.Execute.” The selected scene data will be loaded to the currently displayed scene number.

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

4-14-4 Checking Model Registration Conditions: O.Model Information

O.Model information displays model registration conditions. It is used to check the number of models that are registered and the number of remaining models that can be registered.



Procedure

1, 2, 3...

1. Select “O.Model information.” The model information will be displayed.
2. Select “O.OK.”

SECTION 5
Troubleshooting

This section provides a list of error messages, and the causes and probable remedies for the errors that they indicate.

Errors and messages for standard and steady reading are listed here in alphabetical order, along with the probable remedied for the errors which are indicated. Refer to this table when explanations of error are needed.

ERR Signal ON

Error	Cause and remedy
Dictionary data load error	The Memory Card is not correctly inserted. Insert it correctly.
	No more models can be registered, because there are too many models or there is insufficient space in the model registration region. Delete any models that are not being used for measurement (including those set for other process numbers).
	The Memory Card has no dictionary data file, use a Memory Card containing the dictionary data.
Insufficient results storage area error	Measurement results cannot be properly obtained because of insufficient storage space. Either raise the search level and reduce the number of search candidate points, or reduce the number of models by deleting any not being used for measurements (including those set for other process numbers).
Model auto-registration error	No more models can be registered, because there are too many models or there is insufficient space in the model registration region. Delete any models that are not being used for measurement (including those set for other process numbers). The models are not changed. Any previously registered models are saved.
	Models cannot be cut because the image is either completely black or completely white and is unsuitable for registration as a model. Take images that can be cut as models.
	The position compensation mode is OFF. Models cannot be registered. The models are not changed. Any previously registered models are saved.
	The position compensation mode is set for circle positioning. Models cannot be auto-registered in this mode. The models are not changed. Any previously registered models are saved.
Scene data load error	The Memory Card is not correctly inserted. Insert the Memory Card correctly.
	There is no scene data saved on the Memory Card. Insert the Memory Card on which the scene data is saved.
	No more models can be registered, because there are too many models or there is insufficient space in the model registration region. Delete any models that are not being used for measurement.
Scene switching error	The Memory Card is not correctly inserted. Insert the Memory Card correctly.
	The scene data is not backed up on a Memory Card. Insert a Memory Card for backing up the scene data.
	No more models can be registered, because there are too many models or there is insufficient space in the model registration region. Delete any models that are not being used for measurement.
Timeout error	A timeout error occurred while data was being output to a Parallel I/O Unit or a Terminal Block Unit. Quit the measurement screen and check the external connections and output specifications.

Error Messages

Error message	Cause and remedy
Cannot be registered. No space in model registration region.	No more models can be registered. Either reduce the size of model regions or delete any unnecessary models in the region.
Cannot copy to the same process number.	The process number is the same for the copy source and the copy destination. Specify different process numbers.
Cannot copy to the same scene number.	The scene number is the same for the copy source and the copy destination. Specify different scene numbers.
Cannot save to Memory Card. Not sufficient space.	The Memory Card does not have enough free space to save to. Insert a Memory Card with sufficient free space and try again.
Cannot switch scenes due to lack of space in the scene data area.	The currently displayed scene data is too large. Reduce its size by deleting some models or by clearing any unnecessary scene data, and then try again.

Error message	Cause and remedy
Circle positioning set for position compensation mode. Cannot use auto-registration.	Auto-registration cannot be used for circular workpiece positioning. Either perform registration manually or use 1-model or 2-model positioning.
Copying is not possible. The same dictionary cannot be used by different processes for character reading.	With standard reading and steady reading, dictionaries cannot be used in common for processes set under different process numbers. It is not possible to specify either standard reading or steady reading as the copy source for copying.
Dictionary data loading cancelled due to an error. Dictionary data will be cleared.	Dictionary loading was cancelled because the Memory Card was not properly inserted. Insert the Memory Card correctly and then try again.
	Dictionary data cannot be loaded from a subdirectory. Try loading it from the root directory.
Dictionary data saving cancelled due to an error.	The Memory Card was not correctly installed, so the dictionary data has not been saved. Install the Memory Card correctly and retry.
	The Memory Card has not been formatted. Always format the Memory Card before use.
Failed to access the scene switching file.	There is no available space on the Memory Card. Either delete any unnecessary scene data, or use the setup menu to delete unnecessary files. Then try again.
	The file could not be created because the Memory Card was not correctly inserted. Insert the Memory Card correctly, and then try again.
	The Memory Card is not initialized. Use a Memory Card that has been initialized.
	The Memory Card is write protected. Clear the write protection and then try again.
Failed to clear scene.	The scene clearing operation was cancelled because the Memory Card was not correctly inserted. Insert the Memory Card correctly, and then try again.
Failed to copy scene data due to lack of space in the scene data area. The scene data in the copy destination area will be cleared.	There is no available space in the scene data area. Delete any unnecessary scene data.
	The scene copying operation was cancelled because the Memory Card was not correctly inserted. Insert the Memory Card correctly, and then try again.
File does not exist.	There is no scene data file. Insert the Memory Card which contains the scene data.
	There is no dictionary data file. Insert the Memory Card which contains the dictionary data.
	The Memory Card is not formatted. Format the Memory Card before using it.
Mask size or mask pitch setting is inappropriate.	The mask does not match the size of the rotation positioning region. Either reduce the size of the mask or increase the diameter of the circle (or arc).
Measure feature is different.	Models cannot be registered to dictionaries with different measurement features. Use another dictionary.
	Dictionaries with different measurement features cannot be deleted.
	Models cannot be deleted from dictionaries with different measurement features.
	Criteria cannot be changed for models from dictionaries with different measurement features.
Measurement item is not set.	There is no measurement item set for the currently displayed process number. Set a measurement item. Refer to *4-3-1 Setting Measurement Items*.
Measurement item is not set in the copy source.	There is no data set for the process number specified as the copy source. Specify a process number for which data is set.
Memory card is write protected.	The operation cannot be executed because the Memory Card is write protected. Clear the write protection, and then try again.
No character model is registered.	Unregistered models cannot be deleted. Correctly specify the model to be deleted.
	A function to delete all character models is not available when models are not registered. Correctly specify the dictionary to be deleted.
	Unregistered models cannot be referenced. Correctly specify the model to be referenced.
	Criteria cannot be set for unregistered models. Correctly specify the model for which criteria are to be set.
	The model is not registered. Register the model for the dictionary to be used.
	“A.Region” cannot be specified when models are unregistered. First register the models.
No dictionary is selected.	There is no dictionary selected. Select the dictionary to use for measurement.

Error message	Cause and remedy
No Memory Card inserted.	The operation is not possible because no memory card is inserted. Insert a memory card and try again.
No more character reading measurement items can be set.	With standard reading and steady reading, dictionaries cannot be used in common among different processes. No more than five processes can be set for standard and steady reading combined.
No more models can be registered in this character.	No more character models can be registered for this dictionary character. The maximum number that can be registered is six.
No registration. Too many models. Reduce rotational region.	No more models can be registered. Reduce the rotational region (i.e., the rotation parameters).
Optimum model was not found.	The region setting for automatic registration is too small, or the image is completely black or completely white. Adjust the region setting or take the optimum image as the model.
Part of the region will be outside the screen.	Part of the region that was created is outside of the screen. Create the region so that it lies completely within the screen.
Pitch angle setting is inappropriate.	The following combination of pitch angle and rotation parameters cannot be set. **Rotation parameters** / **Pitch angle** ±15 ° or 0±15°, 180±15° / 20° or 30° ±45 ° / 20°
Position compensation mode is set to circle positioning (no rotation or defect rotation). Rotation angle is invalid.	The rotation angle setting is not required when either circle positioning with no rotation or defect rotation is set for the position compensation mode. Specify this parameter for a position compensation mode for which the rotation parameters are valid is set.
Same position cannot be specified.	The same position cannot be specified when drawing rectangles. Specify different positions for the two points on the diagonal corners.
Scene data is different.	This is not the scene data for the currently installed application program. Insert the memory card that contains the correct scene data.
Scene data loading cancelled due to an error. Scene data will be cleared.	Loading was cancelled because the memory card was not correctly inserted. Insert the memory card correctly and load the scene data again.
	The scene data in the subdirectory cannot be loaded. Load the scene data in the root directory.
Scene data saving cancelled due to an error.	Saving was cancelled because the memory card was not correctly inserted. Insert the memory card correctly and save the scene data again.
	Saving not possible because the memory card is not initialized. Save the scene data again using an initialized memory card.
	The operation cannot be executed because the Memory Card is write protected. Clear the write protection and try the operation again.
Settings required for measurement have not been completed.	Not even one model has been set for the process. Set the models.
That's being used by another process.	The specified dictionary is being used by a measurement item set for another process number, so it cannot be registered, deleted, or have its criteria changed.
The dictionary data cannot be loaded. The measurement feature differs.	Dictionary data for which measurement features differ cannot be loaded. Load dictionary data for which the measurement feature is the gray-scale correlation.
The file format is in error.	The data cannot be loaded because the file format is wrong.
The position compensation mode is turned Off.	Rotation parameters, position compensation region, position compensation speed, conditions, or referencing was executed without the position compensation registration having been performed. First register the position compensation.
The region cannot be set.	The region is not set. Draw a read region at the place where reading is to be performed.
There are too many 1-character regions. No more can be added.	The number of single-character read regions cannot exceed the maximum number of characters in the read region. Draw another read region.
There is no usable dictionary.	All the dictionaries are being used for other processes. Turn OFF any of the dictionaries being used for another process.
Too many graphics. No more can be created.	No more than ten figures can be created for automatic model registration for position compensation. Do not create more than ten figures.
Too many models. No more can be registered.	No more models can be registered. Delete any unnecessary models.

Error message	Cause and remedy
Wrong model image.	The image is completely white or completely black, without features, and is unsuitable for registration as a model. Take the optimum image as the model.
	The image is completely white or completely black, so it cannot be registered as a character model. Specify the character model regions so that the character parts and background parts are precisely included.
	With steady reading, models cannot be registered by specifying the screen edges (calculated by means of the following formulas) when the model registration region's X size is smaller than 23 or when the Y size is smaller than 16. Upper left X coordinate < (23–X) / 2 or Lower right X coordinate > 512 ((23–X) / 2) Upper left Y coordinate < (18–Y) / 2 or Lower right Y coordinate > 484 ((18–Y) / 2)

Error Codes

Error code	Cause and remedy
23	Line buffer overflow. It is possible that commands were input continuously through the RS-232C port. Check the method for inputting commands.
103	It is possible that commands were incorrectly input through the RS-232C, e.g., without a delimiter. Check the method for inputting commands.

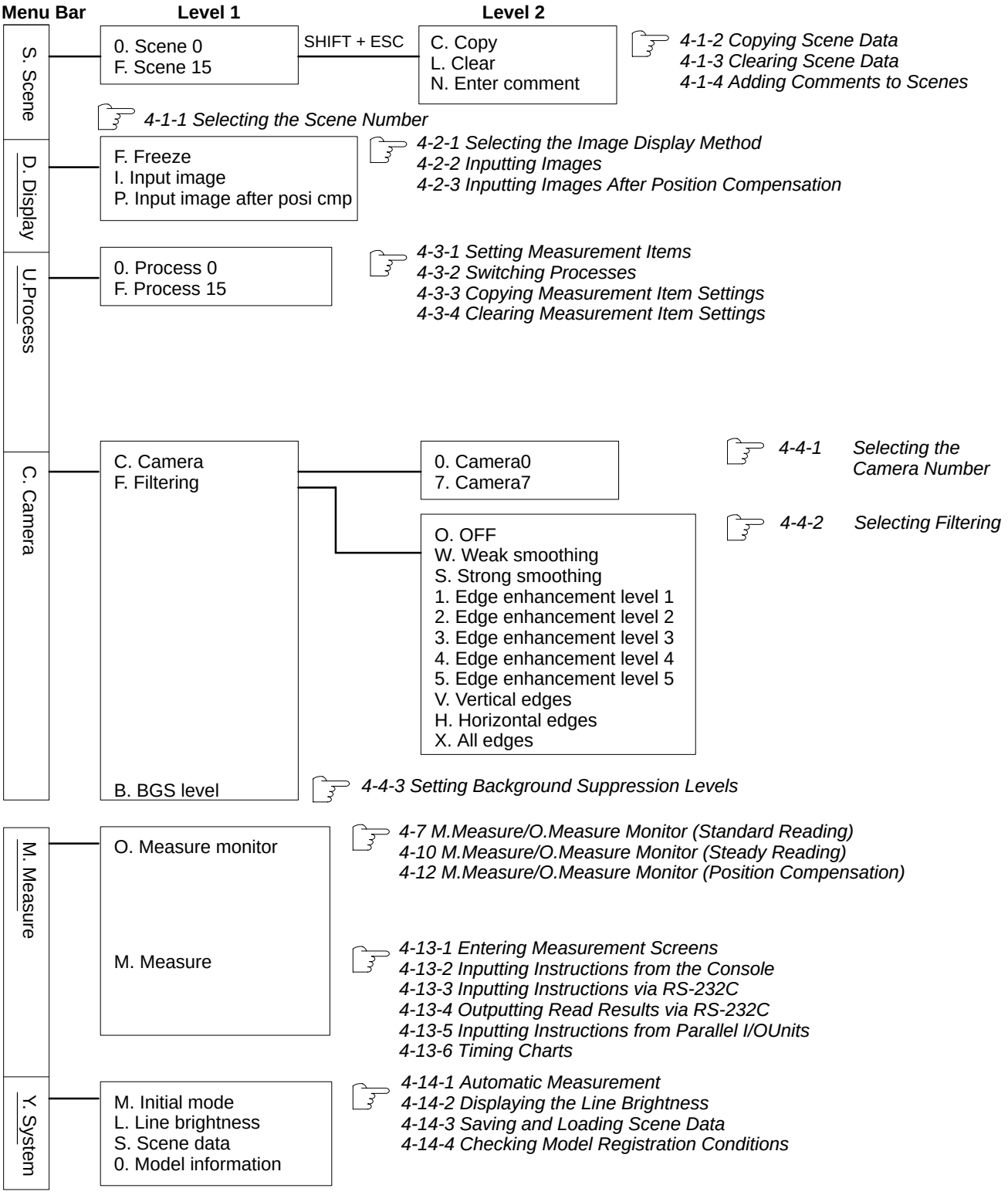
Appendix A
Menu Hierarchy Diagrams

Menu Item Notation

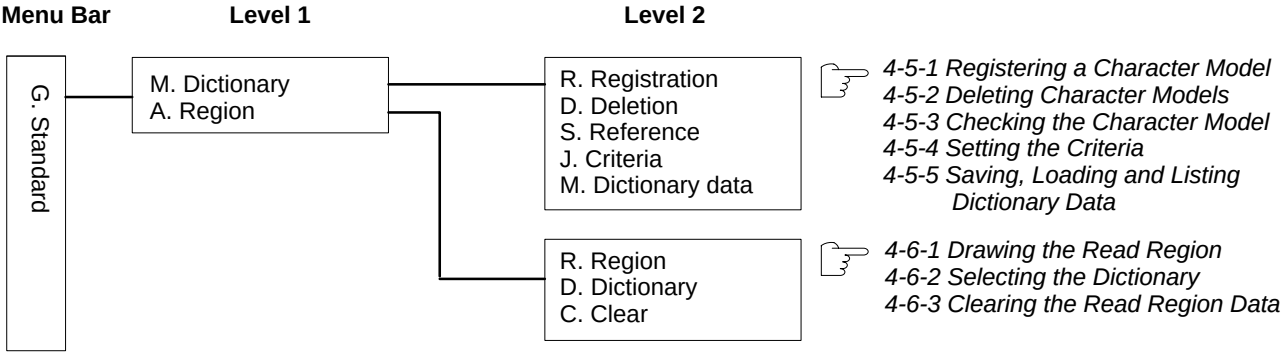
Menu items are sometimes abbreviated on the menu bar due to space limitations. In this manual, the non-abbreviated form of the menu items are used and, if an abbreviation is displayed on the menu bar, the characters that are actually displayed are underlined. If no characters are underlined, then the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

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

Common Items



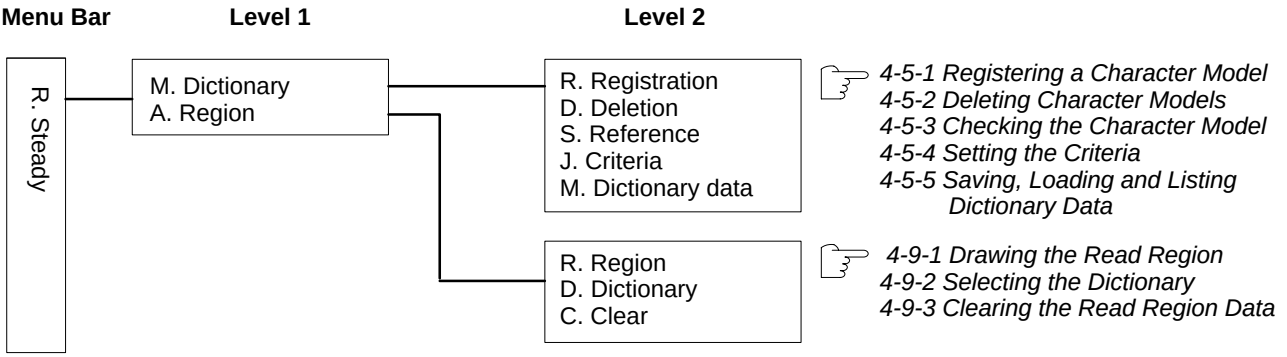
Standard Character Reading



☞ *4-5-1 Registering a Character Model*
4-5-2 Deleting Character Models
4-5-3 Checking the Character Model
4-5-4 Setting the Criteria
4-5-5 Saving, Loading and Listing Dictionary Data

☞ *4-6-1 Drawing the Read Region*
4-6-2 Selecting the Dictionary
4-6-3 Clearing the Read Region Data

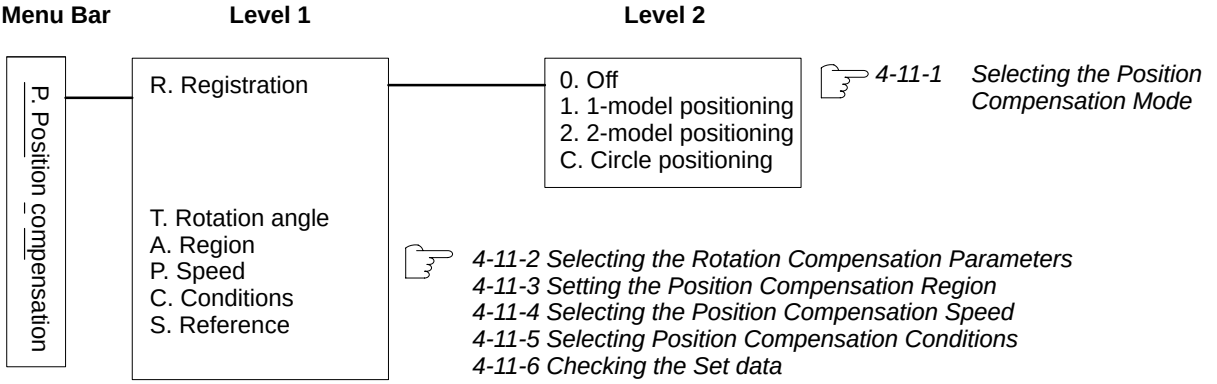
Steady Character Reading



☞ *4-5-1 Registering a Character Model*
4-5-2 Deleting Character Models
4-5-3 Checking the Character Model
4-5-4 Setting the Criteria
4-5-5 Saving, Loading and Listing Dictionary Data

☞ *4-9-1 Drawing the Read Region*
4-9-2 Selecting the Dictionary
4-9-3 Clearing the Read Region Data

Position Compensation

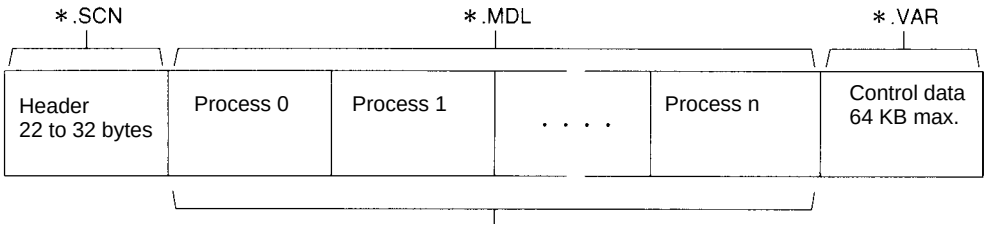


☞ *4-11-1 Selecting the Position Compensation Mode*

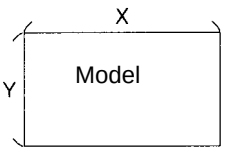
☞ *4-11-2 Selecting the Rotation Compensation Parameters*
4-11-3 Setting the Position Compensation Region
4-11-4 Selecting the Position Compensation Speed
4-11-5 Selecting Position Compensation Conditions
4-11-6 Checking the Set data

Appendix B
Scene Data Size

This appendix shows the formula for finding scene data sizes. Prepare a Memory Card with sufficient capacity for the data. The size found by means of this formula is only a reference. To make a more precise determination of scene data size, it is recommended to actually save the data and then check its size.

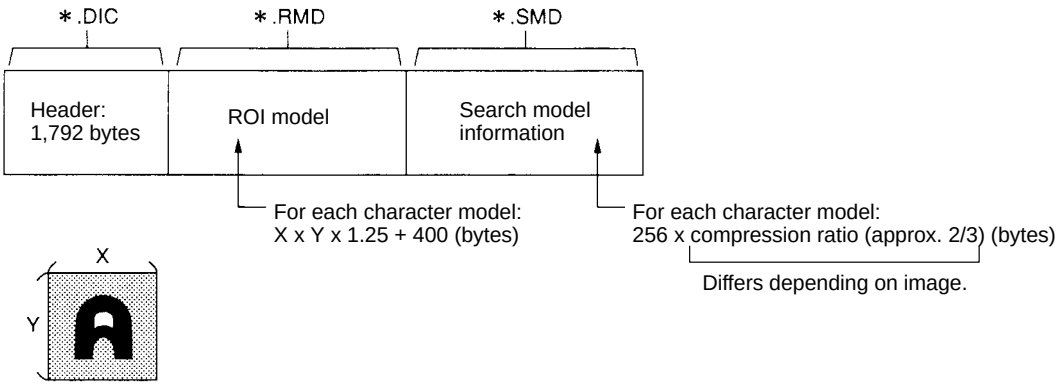


The calculation method differs depending on the measurement items that are set.

Measurement item	Calculation method
Position compensation	For each model: X x Y x 3 + 200 (bytes) Model image Model information 
Standard character reading	0
Steady character reading	

Appendix C
Dictionary Data Size

This appendix shows the formula for finding dictionary data sizes. Prepare a Memory Card with sufficient capacity for the data. The size found by means of this formula is only a reference. To make a more precise determination of dictionary data size, it is recommended to actually save the data and then check its size.



Index

Numbers

A

B

C

D

E

F

G–K

L–M

O

P

R

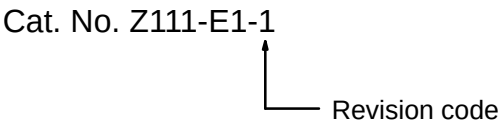
S

T

U–Y

Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.



The following table outlines the changes made to the manual during each revision. Page numbers refer to the previous version.

Revision code	Date	Revised content
1	March 1997	Original production