Cat. No. Z126-E1-1

# F150
# Visual Inspection System

# Manual 3:
# EXPERT MENU
# OPERATION MANUAL

OMRON

# F150 Visual Inspection System

## Expert Menu Operation Manual

*Produced July 1998*

## *Notice:*

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

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

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

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

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

## *Visual Aids*

The following headings will help you locate different types of information.

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

→ Indicates pages where additional information can be found.

1 Indicates a procedure. The step numbers in the procedure correspond to the numbers in any related illustrations.

# TABLE OF CONTENTS

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# About this Manual:

This manual describes the operation of the F150 Visual Inspection System using the Expert Menu and includes the sections described below. This is one of three manuals used to operate the F150. Refer to the following table for the contents of each manual.

| Manual | Contents | Cat. No. |
|---|---|---|
| **1: Setup Manual** | Provides information on system hardware and installation. **Be sure to read this manual first.** | Z124-E1-1 |
| **2: Auto Menu Operation Manual** | Describes operation of the F150 using the Auto Menu. The Auto Menu enables the simplest operation for OK/NG outputs based on registered images of acceptable and unacceptable products. | Z125-E1-1 |
| **3: Expert Menu Operation Manual** | Describes operation of the F150 using the Expert Menu. The Expert Menu enables application of all F150 capabilities, including setting region images and criteria, and outputting OK/NG terminal signals or RS-232C measurement values. | Z126-E1-1 |

Please read the above manuals carefully and be sure you understand the information provided before attempting to install and operate the F150.

***Section 1 The Expert Menu*** outlines the features of the Expert Menu. This section also describes the overall flow of F150 application and basic operations, and the conventions used in this manual.

***Section 2 Introduction*** describes the overall flow of F150 application and basic operations. It also describes the conventions used in this manual.

***Section 3 Operating Procedures*** describes operating the F150 using the Expert Menu mode.

***Section 4 Terminal Block*** describes the communications settings and I/O formats for communications with external devices via the terminal blocks.

***Section 5 RS-232C Communications Settings (Normal)*** describes the communications settings for the RS-232C port when communications are in Normal mode.

***Section 6 RS-232C Communications Settings (Host Link)*** describes the communications settings for the RS-232C port when communications are in Host link mode.

***Section 7 RS-232C Communications Settings (Menu Operation)*** describes the communications settings for the RS-232C port when communications are in Menu operation mode.

***Section 8 Troubleshooting*** lists the errors that may occur, along with their probable causes and remedies

> ⚠ **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.

# PRECAUTIONS

This section provides general precautions for using the F150 Visual Inspection System.

**The information contained in this section is important for the safe and reliable application of the F150 Visual Inspection System. You must read this section and understand the information contained before attempting to set up or operate a F150 Visual Inspection System.**

# 1 Safety Precautions

**⚠ WARNING** Cover the terminal blocks with the Terminal Block Protection Covers. Uncovered terminal blocks can result in electric shock.

**⚠ WARNING** Use DC power supplies with safe extra low-voltage circuits on the secondary side for the main F150 power supply and power supplies for the terminal blocks. Excessively high voltages can result in electric shock.

**⚠ Caution** Do not touch fluorescent or halogen lights while the power is ON or immediately after the power is turned OFF. These lights generate heat and can cause burns.

**⚠ Caution** Do not use the F150 in environments with flammable or explosive gases.

**⚠ Caution** Install the F150 away from high-voltage equipment or motors to ensure safety during operation and maintenance.

**⚠ Caution** Use the power supply cables and crimp terminals of specified sizes.

**⚠ Caution** Use at the power supply voltages specified in this manual.

**⚠ Caution** Be sure to securely tighten the screws when mounting F150 components.

**⚠ Caution** Do not dismantle, repair or modify any F150 components.

**⚠ Caution** Dispose of F150 components as industrial waste.

**Caution** To prevent damage from static electricity, use a wrist strap or another device for preventing electrostatic charges when touching terminals or connector signal lines.

**Caution** Do not turn OFF the power while a message is being displayed indicating that processing is being performed. Data in memory will be destroyed, and the F150 may not operate correctly the next time it is started.

# 2 General Precautions

The user must operate the product according to the performance specifications described in the operation manuals.

Before using the product under conditions which are not described in the manual or applying the product to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment, and other systems, machines, and equipment that may have a serious influence on lives and property if used improperly, consult your OMRON representative.

Make sure that the ratings and performance characteristics of the product are sufficient for the systems, machines, and equipment, and be sure to provide the systems, machines, and equipment with double safety mechanisms.

# SECTION 1
# The Expert Menu Mode

This section outlines the features of the Expert Menu mode and will tell you what can be achieved using it. The Expert Menu mode enables using all the capabilities of the F150.

This section also describes the overall flow of F150 application and basic operations, and the conventions used in this manual.

# 1-1 Features

The F150 features supported by the Expert Menu mode are described below.

## Three Measurement Methods → p 4

Any of the following measurement methods can be used.

**Density Searches**

The position of the measurement object is determined and the image is compared with registered measurement conditions to determine if the object is acceptable or unacceptable.

**Binary Center of Gravity and Area**

The size and position of the measurement object are determined based on the overall image density and the image is compared with the registered measurement conditions to determine if the object is acceptable or unacceptable.

**Binary Axis Angle**

In addition to the binary center of gravity and area, the angle of the measurement object is also determined and the image is compared with the registered measurement conditions to determine if the object is acceptable or unacceptable.

## Position Displacement Compensation → p 9

Position displacement compensation can be used to correct the position of the measurement object based on density searches, the binary center of gravity and area, or the binary axis angle.

## Sample Image Registration → p 41

Acceptable and unacceptable images can be registered as sample images. Measurements on these sample images can be used to set measurement conditions. Any images registered in the Auto Menu can also be used as sample images.

## Shutter Speed → p 33

The shutter speed can be selected to suit the speed of movement of the measurement object. Adjustment of the shutter speed can also be adjusted depending on the level of illumination of the measurement object.

## Filtering → p 34

The camera image can be adjusted to allow easier measurement of objects. The edges of the measurement object can be enhanced, and noise can be reduced.

## Background Suppression → p 35

The background can be excluded from the measurement by setting it to a specific density.

## Calibration → p 37

The measurement value can be converted to actual dimensions (e.g., cm or mm) and output to an external device.

## Scene Changes → p 116

Scenes are used to set up for different measurement objects or measurement conditions. The F150 can thus be automatically switched between different applications merely by changing the scene. Up to 16 scenes be set.

## Terminal Block → pp 85, 133

The F150 can communicate with PLCs and other external devices via the terminal block. Calculations can be performed on measurement results, or math functions can be used to calculate the distance between two regions or the maximum measurement results. Evaluation criteria can then be set for the results to output OK/NG judgements via the terminal block. (Numeric results cannot be output via the terminal block.)

## RS-232C Port → pp 96, 143, 167

The F150 can communicate with computers, PLCs, and other external devices via the RS-232C port. Calculations can be performed on measurement results, or math functions can be used to calculate the distance between two regions or the maximum measurement results. Evaluation criteria can then be set for the results to output OK/NG judgements along with the numeric measurement results.

One of the following three communications methods can be chosen.

- Normal, for communications with a computer or other external device.
- Host Link, for communications with an OMRON PLC.
- Menu Operation, for menu operation from a computer.

### Output Data

The following data can be output via the terminal block and RS-232C port.

| Output device | | Measurement results | Judgements (OK/NG) |
|---|---|---|---|
| Terminal block | | No | Yes |
| RS-232C | Normal | Yes | No |
| | Host Link | Yes | Yes |
| | Menu operation | Yes | No |

### Measurement Images → p 128

Up to 23 measurement images are stored in memory for easy confirmation of past images to see what problems have occurred.

The images in memory are cleared when power is turned OFF or the scene is changed. These images, however, can be backed up to a computer.

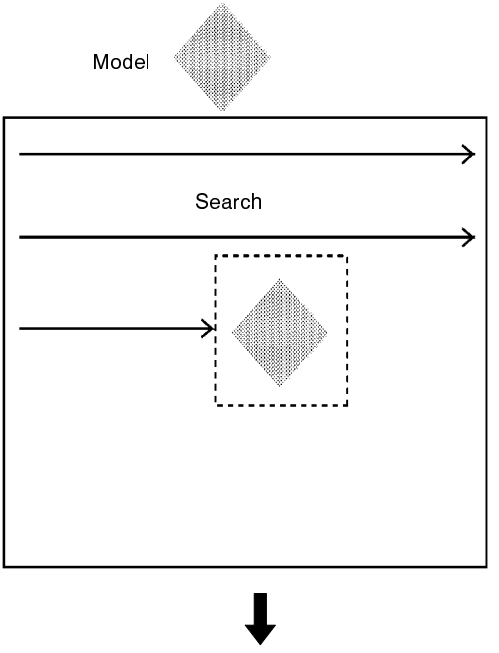
# 1-2 Measurement Methods

The F150 provides three measurement methods: Density searches, the binary center of gravity and area, and the binary axis angle. The measurement method can be set separately for each of the 16 measurement regions.

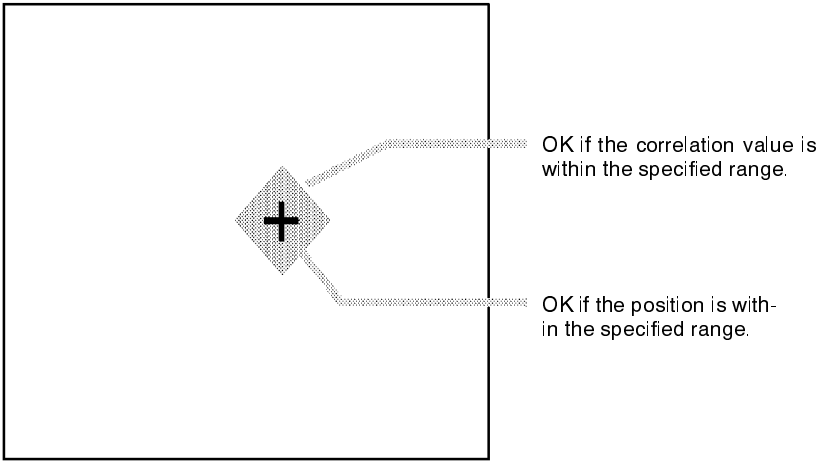
## 1-2-1 Density Searches

Density searches are used when inspecting specific objects. The density image taken by the camera is utilized without modification to measure the object using a registered measurement pattern called a model. The position of the object (X, Y) and the degree of conformity (i.e., the “correlation”) with the model can be calculated.

The part of the input image that most corresponds to the model is found.




The extent of conformity with the model is shown as the correlation value. The OK/NG judgement is determined by comparing the correlation value and the position with an evaluation criteria.




Application Methods. → **p 67**

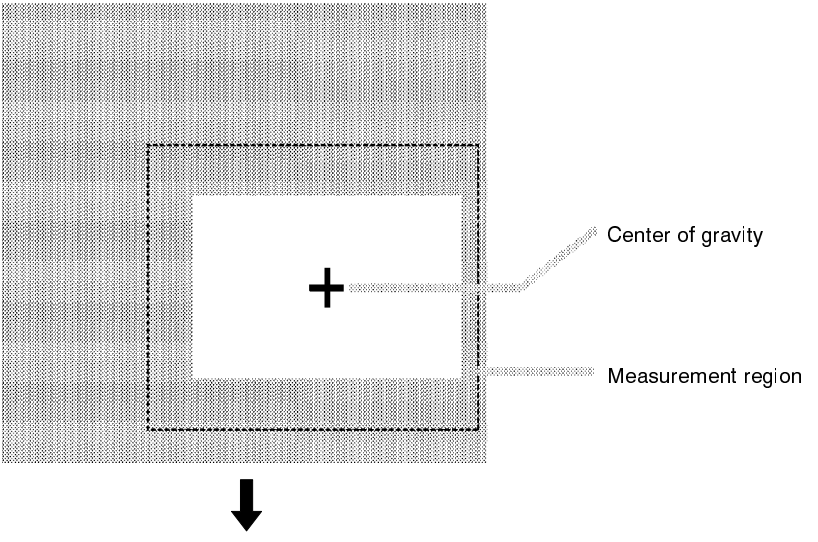
## 1-2-2 Binary Center of Gravity and Area

Density images with 256 gradations are read by the Camera. Binary processing involves separating these density images into black pixels (picture elements) (0) and white pixels (1). The F150 uses the white pixels to measure the object.

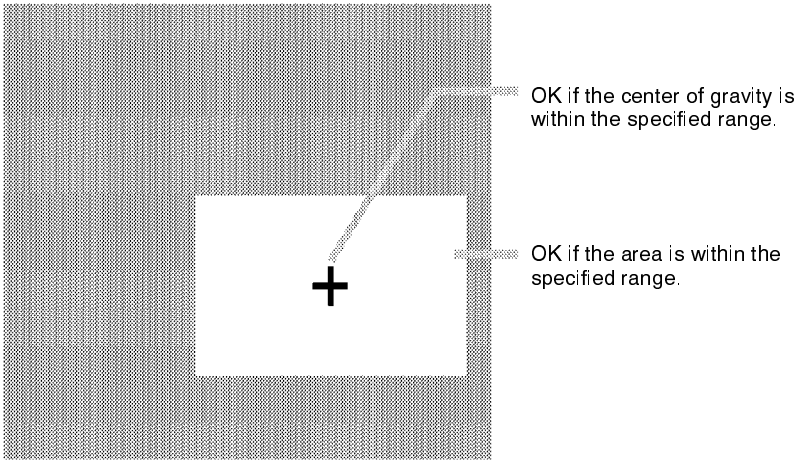
- The size (i.e., area) of the measurement object can be calculated by counting the number of white pixels.
- The position (i.e., center of gravity) of the measurement object can be calculated from the position of the white pixels.

  The center gravity is calculated by taking the white pixels and treating them like a piece of thick paper of uniform thickness. The center of gravity is the point at which the piece of paper would balance when placed on a sharp point. For example, the center of gravity for a circular object would be the center of the circle. The center of gravity of a rectangular object would the intersection of lines drawn from diagonally opposing corners. The center of gravity is used to calculate the position of the object.

The area and center of gravity of the white pixels in the measurement region can be calculated.



The measurement results are compared to evaluation criteria, and the object is judged as OK or NG.




Application Methods. → **p 72**

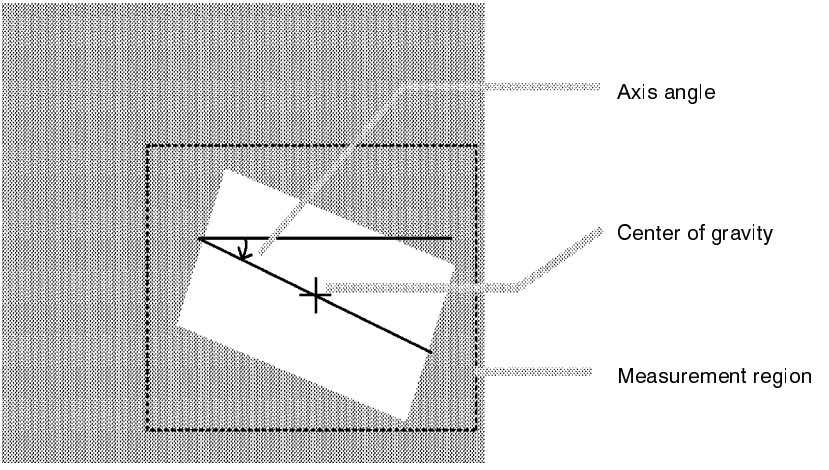
## 1-2-3 Binary Axis Angle

Binary processing is performed on the density image, the same as for binary center of gravity and area calculations, but the inclination of the measurement object, called the axis angle, is also be calculated.

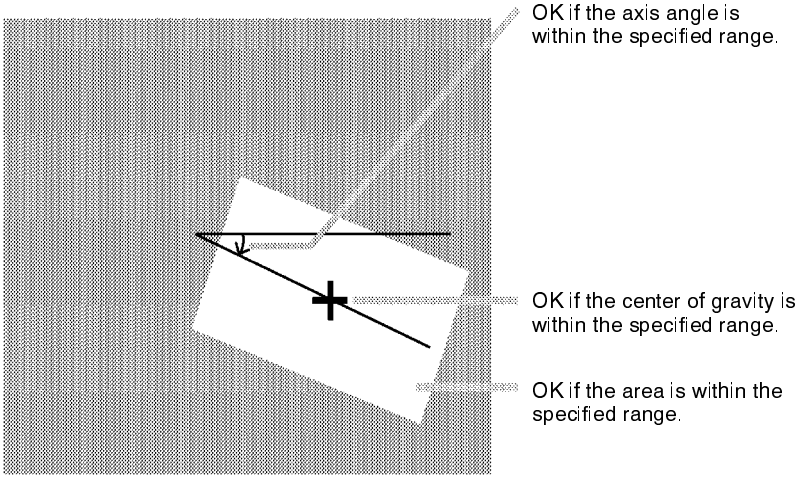
**Note** The axis angle is the angle along the major axis of the ellipse when the white pixels are graphically converted to an ellipse with the same center of gravity and moment around the axis as the white pixels. In simple terms, an ellipse is drawn that approximates the white pixels. It shows the inclination of the object.

More processing time is required to calculate the axis angle. Use the binary center of gravity and area measurement method unless alignment of the axis angle is required.

The area, center of gravity, and axis angle are calculated for the white pixels in the measurement region.




The measurement results are compared to evaluation criteria, and the object is evaluated as OK or NG.




Application Methods. → **p 78**

# 1-3 Position Compensation

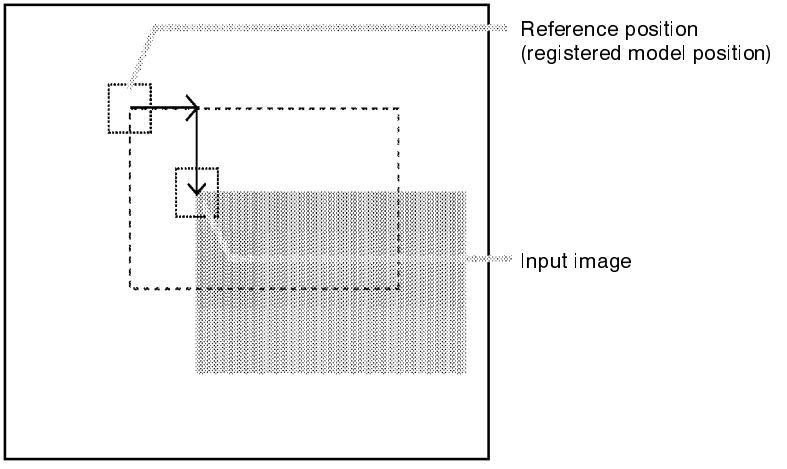
If the measurement object is inclined or displaced, the positional relationship between the image read by the camera and the measurement region can be corrected by using the position displacement compensation function. This function is useful when the position and orientation of the measurement object are not fixed.

The position of the measurement object is compared to a reference position, the amount of displacement is calculated, and the image is scrolled by the detected amount of displacement before measurements are performed.

There are three methods of position compensation, i.e., compensation based on a density search, on the binary center of gravity and area, or on the binary axis angle. These three methods use the same basic processes as the three measurement methods outlined above.

## 1-3-1 Density Searches

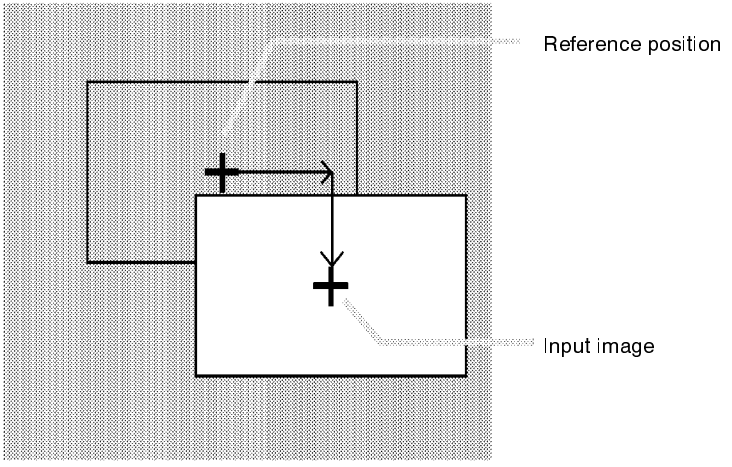
The area of the image that most highly correlates with the model is found, and the amount of displacement is calculated by comparing the actual position of the measurement object and the reference position.




Application Methods. → **p 47**

## 1-3-2 Binary Center of Gravity and Area

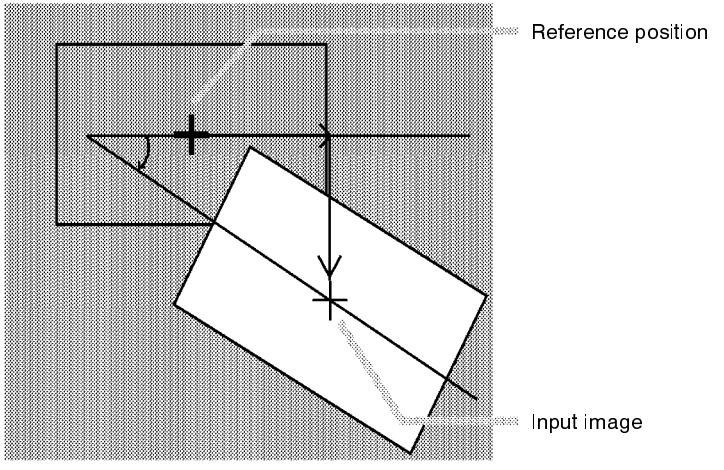
The center of gravity is calculated for the white pixels, and the deviation from the reference position is calculated.




Application Methods. → **p 51**

## 1-3-3 Binary Axis Angle

The center of gravity and the axis angle are calculated, and the deviation from the reference position is calculated.



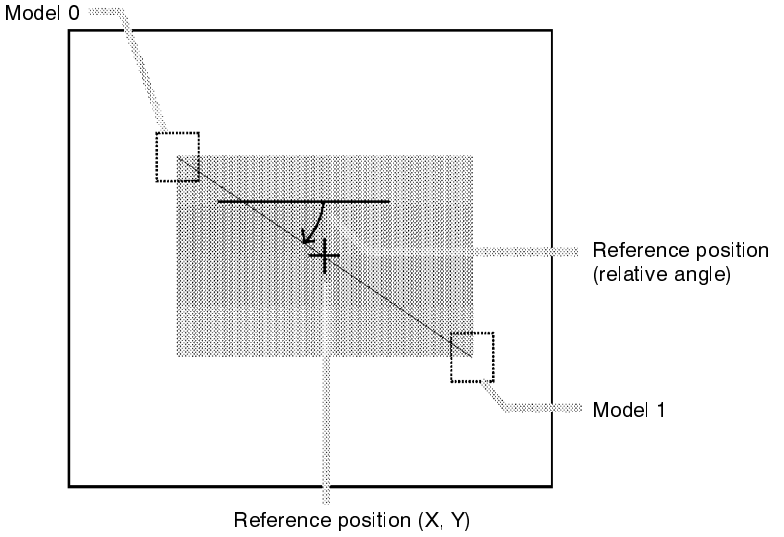

Application methods → **p 57**

## 1-3-4 Rotational Position Compensation

In addition to binary axis angle, the angle between two models is used for rotational position compensation. The angle where two lines joining two models meet is used. This angle has a range of 360°, with the X axis at 0°, and the Y axis in positive direction from the X axis.

- When the density search method is used, the center of two models is joined.
- When the binary center of gravity and area method is used, the center of gravity of the white pixels for each model is joined.

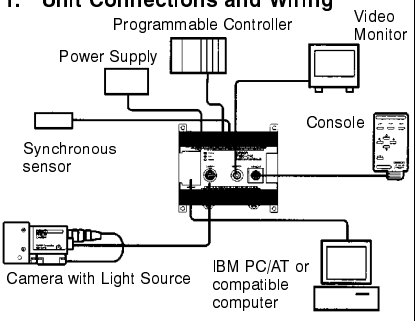
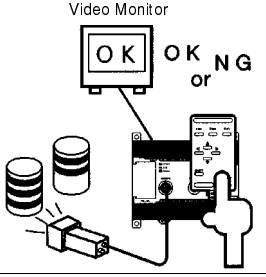
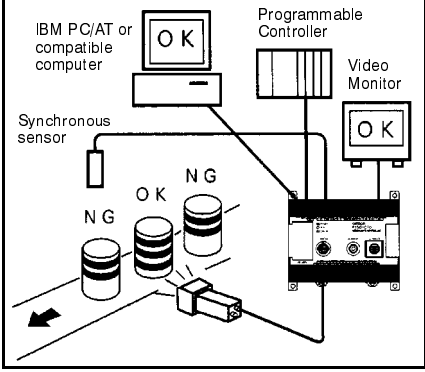
The angle can be calculated using a density search measurement for model 0 and a binary center of gravity and area measurement for model 1.




Application methods → **p 74**

# 1-4 Overview of F150 Installation and Operation

The following table shows the basic steps that must be performed to use the F150.

| Step | Manual |
|---|---|
| **1: Unit Connections and Wiring**<br>  | Setup Manual |
| **2: Setting Measurement Conditions**<br>  | **Easy Operation:**<br>Auto Menu<br>Operation Manual<br>**Advanced Operation:**<br>Expert Menu<br>Operation Manual |
| **3: Confirming Operation, Measuring Objects, and Outputting Results**<br>  | |

# 1-5 Terminology

The following terms are used in describing F150 processing and operation.

**Measurement Conditions**

All of the settings that are input to perform measurements, including registered models, filtering, position compensation settings, measurement regions, and criteria.

**Measurement Results**

The results of a measurement on an image, including the position of the image, the correlation with a model, etc.

**Evaluation Criteria**

Criteria set to determine if the measurement results are to be considered acceptable (OK) or unacceptable (NG). Applying evaluation criteria to measurement results or calculations based on the measurement results produces an OK or NG judgement. Some evaluation criteria are set as measurement conditions and other evaluation criteria are set for specific outputs.

**Judgements**

The results of applying evaluation criteria to measurement results. There are judgement made for individual outputs and an "overall judgement" that is NG is there is one or more NG judgements for individual outputs.

# 1-6 Documentation Conventions

The following conventions are used in this document.

## Console Keys

The names of Console keys are given in bold text.

The **SHIFT** Key is held down when used in combination with other keys. "Press the **SHIFT** + **TRIG** Keys" thus means to press the **TRIG** Key while holding down the **SHIFT** Key.

## Menus

The names of commands and other items on the menus are indicated in bold, italic text with slashes used to separate items on different menu levels. "Select ***Adjust image/Shutter speed***" thus means to select ***Shutter speed*** from the menu that appears when ***Adjust image*** is selected.

# SECTION 2
# Basic Operations

This section describes the overall flow of F150 application and basic operations.

# 2-1 Starting and Quitting

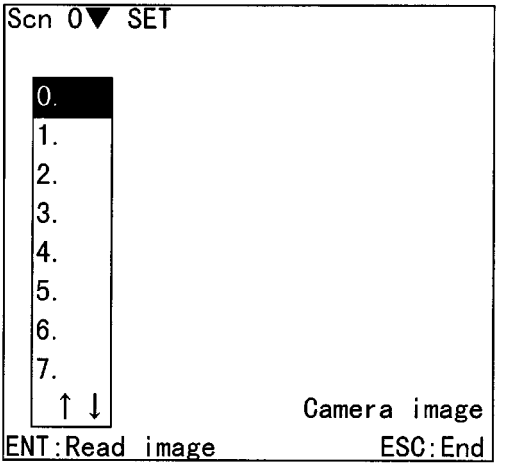
## 2-1-1 Starting

Use the following procedure to

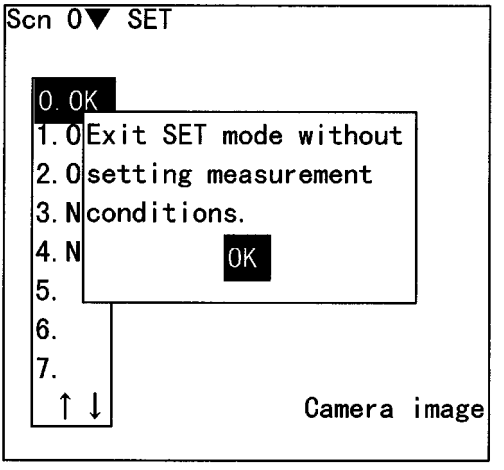
**1** Be sure that the basic F150 components have been connected correctly. → ***Setup Manual***

**2** Turn ON the power supply to the monitor.

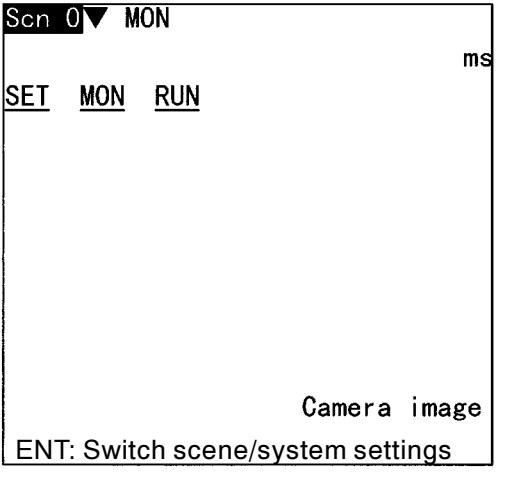
**3** Turn ON the power supply to the F150.
A startup message will appear following by a processing message. After a short pause, either the following screen will appear or the one shown in step (5) will appear. Perform step (4) only if the following screen appears.



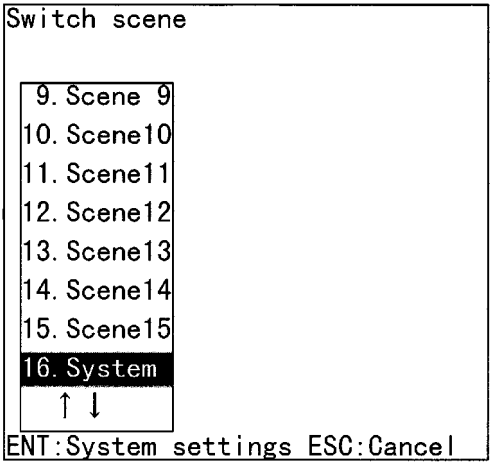
**4** Press the **ESC** Key to display the following screen and then press the **ENT** Key.



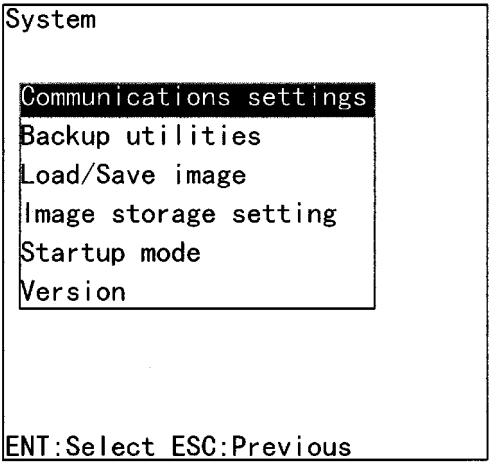

**5** Press the **Up** Key to move the cursor to ***Scn 0*** and then press the **ENT** Key.



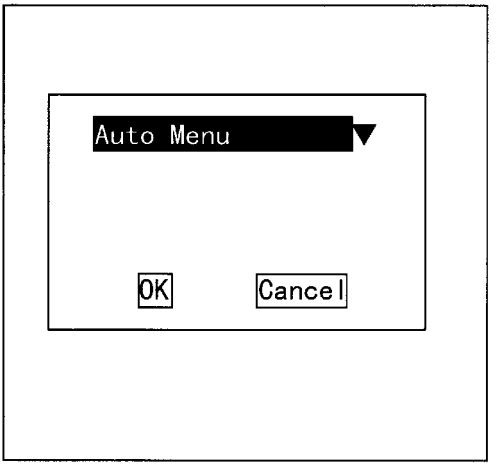
**6** Press the **Down** Key to scroll the scene number until the cursor is on ***16. System***, as shown below, and then press the **ENT** Key.




**7** The following screen will be displayed. Press the **SHIFT** + **ENT** Keys. The screen for switching menus will be displayed.



**8** Move the cursor to **Auto Menu** and press the **ENT** Key. A list of options will be displayed.

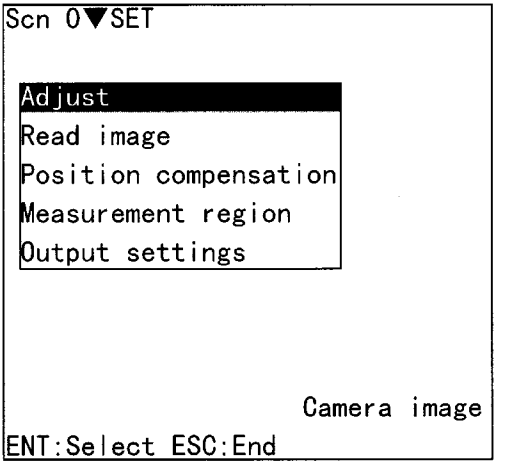



**9** Move the cursor to **Expert Menu** and press the **ENT** Key.

**10** Move the cursor to **OK** and press the **ENT** Key. The Expert menu mode will be started.

The menu selected at this screen will be used the next time power is turned ON.

The following screen will be displayed. This screen shows Set mode. The roles and general outline of each mode are explained on the following pages.



**Note** The startup scene and startup mode that appear when power is turned ON can be set. Use these settings to make daily operation more efficient once the F150 is ready for actual operation.
→ **p 129**

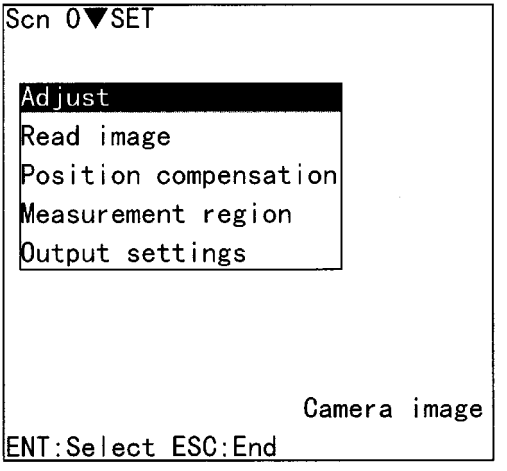
## 2-1-2 Operating Modes

There are three operating modes within the Expert Menu mode. The role of each operating mode is described in the following table.

| Mode | Description |
|---|---|
| Set | Used to set measurement conditions, such as drawing measurement regions and setting criteria for determining if an image is acceptable or unacceptable. |
| Monitor | Used to confirm that measurements can be properly performed under the set conditions. Results are displayed on the video monitor and are not output externally. |
| Run | Used to measure objects. The result is output to an external device via the terminal block or the RS-232C port. |

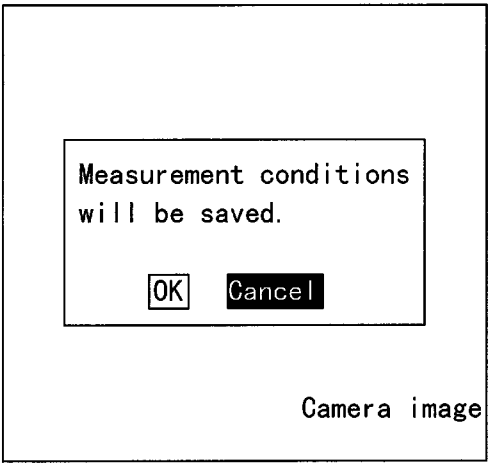
## 2-1-3 Flow of Operation

**1** The following screen will be displayed when the Expert menu mode is started. This screen is in Set mode.

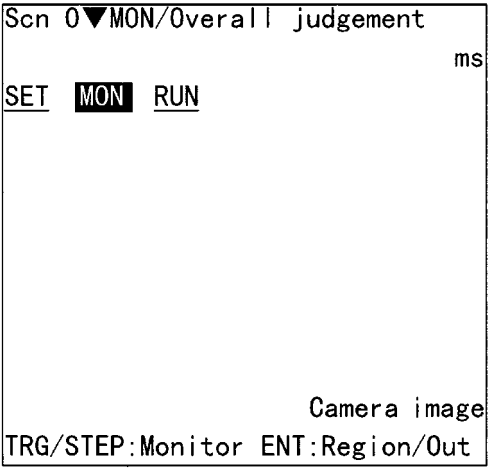



**2** Set the measurement conditions, and then press the **ESC** Key to return to the previous level. Setting procedures are described in the remainder of this manual.

A confirmation message will appear. Press **OK** to save the measurement conditions to flash memory.

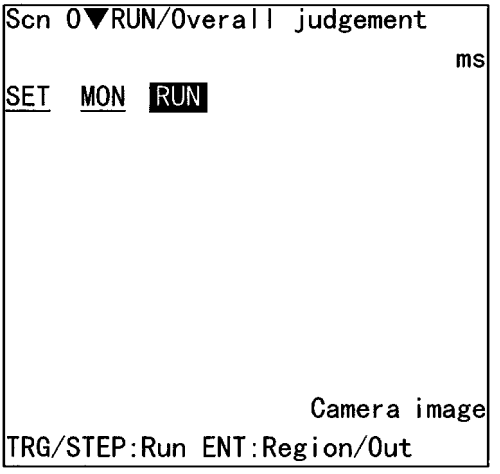



**3** The F150 will automatically enter Monitor mode. Check the set measurement conditions. Results are displayed on the video monitor and are not output externally. The conditions can be altered in Monitor mode.

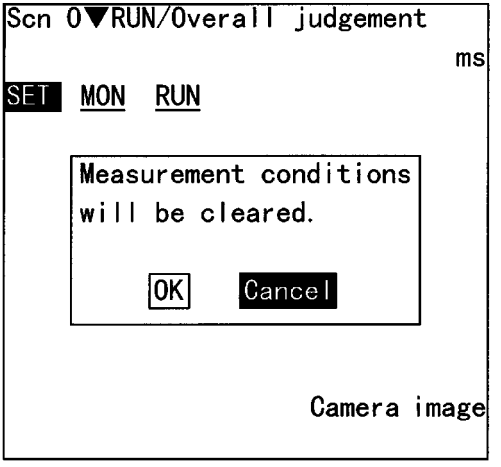



**4** Move the cursor to **RUN** and press the **ENT** Key.

The F150 will enter the Run mode. Adjustments to measurement conditions can also be made in Run mode. Results are also output externally.



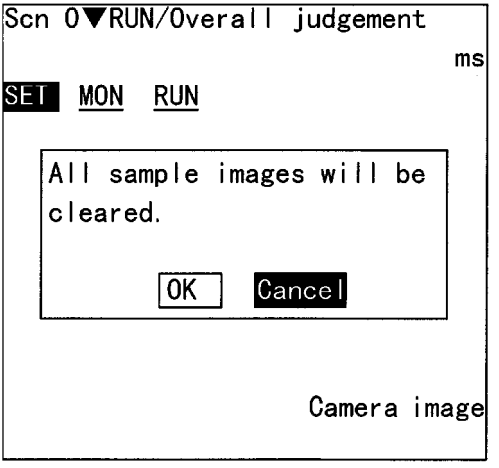

**5** The following screen will be displayed if you try to change to Set mode after entering Monitor or Run modes. Select **Cancel** if you want to correct scene data that has already been set. Select **OK** if you want to clear all settings and set them again from the beginning.




**6** The following screen will be displayed when images are being stored.

Select **Cancel** if you want to save the images.

Select **OK** if you want to clear the images.




## 2-1-4 Quitting

Save all settings to flash memory before turning OFF the power.

The data in flash memory is loaded each time the F150 is started. Any changes made will be lost unless they are saved to the flash memory.

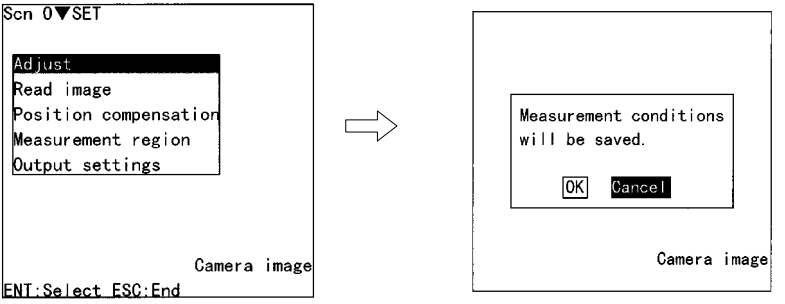
The measurement images and sample images in memory are also cleared when the power is turned OFF. These images cannot be saved to flash memory, but they can be backed up on a computer if required. → **p 126**

⚠ **Caution** Do not turn OFF the power while saving data. Data may be lost, and the F150 may not operate properly the next time it is started.

### Quitting from Set Mode

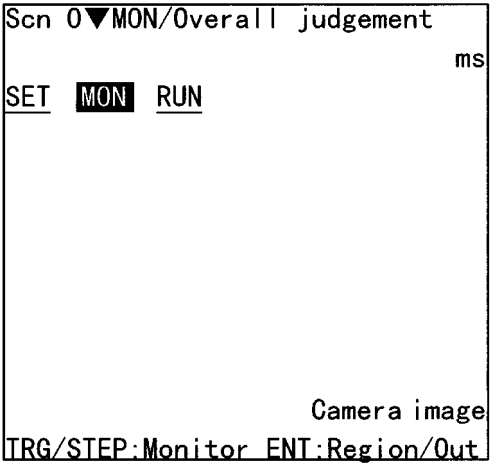
Any data changes will be cleared if the power is turned OFF in Set mode. Perform the following steps to save the data, and then turn OFF the power.

**1** Press the **ESC** Key to exit Set mode. If any changes have been made to the settings, a confirmation message will appear.




**2** Select **OK** to save the changes.

The following screen will be displayed once the data has been saved.

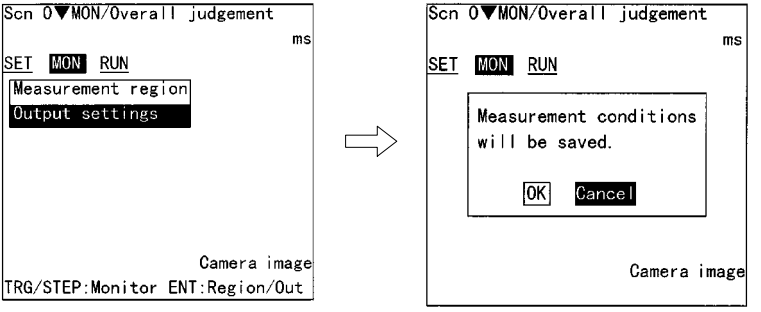



**3** Turn OFF the power to the F150.

## Quitting from Monitor or Run Mode

Any data changes will be cleared if the power is turned OFF in Monitor or Run modes. Perform the following steps to save the data, and then turn OFF the power.

**1** Press the **ESC** Key to return to the previous menu level. If any changes have been made to the settings data a confirmation message will appear.




**2** Select **OK** to save the changes.

**3** Turn OFF the power to the F150.

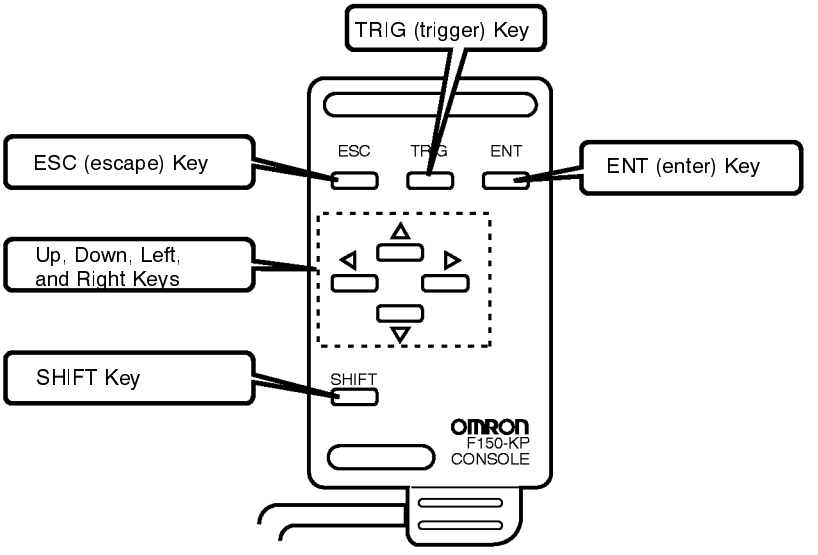
# 2-2 Menu Operations

## 2-2-1 Input Devices

The menu operations are performed from either the Console or the RS-232C.

## Console

The Console is used to perform menu operations. Be sure to familiarize yourself with Console operations before actually using the menus.



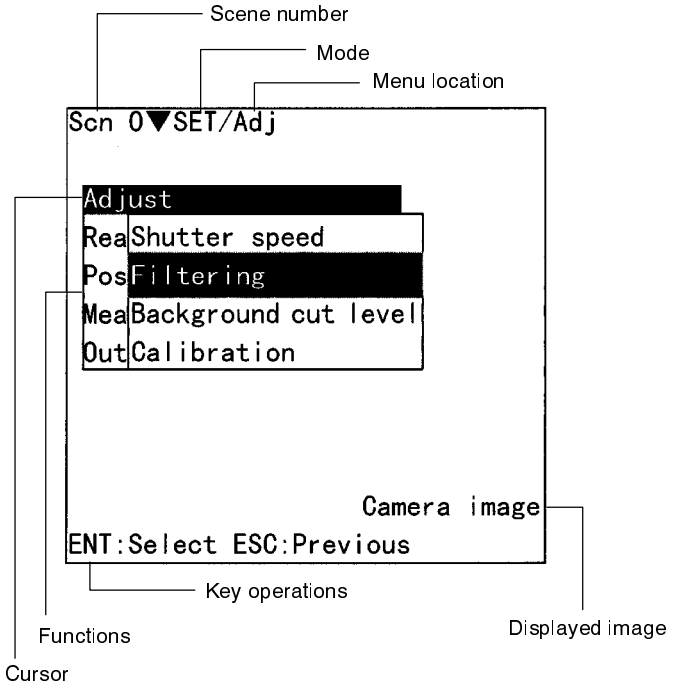

| Key | Function |
|---|---|
| ESC: Escape Key | Interrupts processing and returns the user to the previous menu display. |
| TRIG: Trigger Key | Starts object measurement. |
| ENT: Enter Key | Executes a function or sets a value. |
| Up and Down Keys | Used to move the cursor up and down to select items.<br>Also used to set values. The **Up** Key will increase a value by 1 and the **Down** Key will decrease a value by 1. Continue pressing the **Up** or **Down** Key to quickly increase or decrease a value. |
| Left and Right Keys | Used to move the cursor left or right to select items. |
| SHIFT Key | Must be pressed in combination with another key to have any affect. Specific functions are assigned to **SHIFT** + ***another key*** for specific screens. |

## RS-232C

There are keyboard key combinations for input via RS-232C that correspond to the Console keys. Refer to *Section 7 RS-232C Settings for Menu Operation* to perform menu operations from the RS-232C. → **p 209**

## 2-2-2 Screen Displays

The F150 is operated by selecting functions displayed on the screen. Familiarize yourself with each function before operating the F150.




**Scene Number** The current scene number is given. There are 16 scenes that can be created.

**▼ Mark** Options will appear when an item with the ▼ mark is selected.

**Mode** The current operating mode is displayed (Set, Monitor, or Run).

**Menu Location** Menus are displayed on the screen in hierarchical form. The selected item will be highlighted on the menu.

**Key Operations** The keys that can be used and their corresponding functions are displayed at the bottom of the screen.

**Functions** The available functions are displayed on the menus.

**Cursor** The cursor is moved to the desired function by pressing the Cursor Keys.

**Displayed Image** The type of image being displayed is shown.

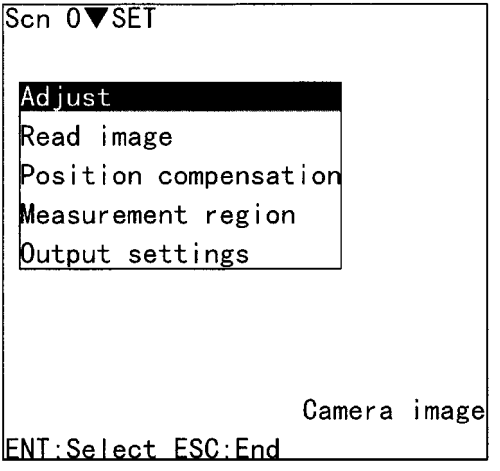
| Display | Meaning |
|---|---|
| Camera image | The latest image read by the camera. |
| Sample□ | Acceptable and unacceptable sample images registered to set the measurement conditions. (Images are displayed with the same number as when the image was registered.) |
| *OK□<br>*NG□ | Measurement images. (You can set either NG images only or all images).<br>A number from 1 to 4,294,967,295 will appear for * to indicate how many measurements have been taken since power was turned ON. (The last measured image will be displayed.) |
| Vacancy□ | No image in memory. (Nothing will be displayed.) |

**Note** A number between 0 and 22 will appear for □. The F150 can store up to 23 images, and each is allocated a number between 0 and 22.

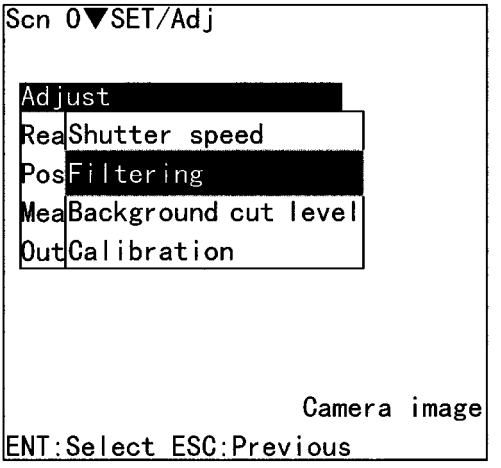
## 2-2-3 Menu Tree

F150 menus are hierarchical. The cursor is moved to the required functions to set measurement conditions. Use the following procedure to move around the menu tree.

**1** Move the cursor to the desired function, using the **Up**, **Down**, **Left**, and **Right** Cursor Keys.



**2** Press the **ENT** Key. In this example, the cursor will move to the **Adjust** menu. Repeat this step to move to lower levels.




**3** Press the **ESC** Key. The display will move to the previous menu level (here, the screen shown in step (1)).

## 2-2-4 Inputting Values

This section explains how to input numeric values when setting measurement conditions.

**1** Move the cursor to the item for which a value is to be changed and press the **ENT** Key. The cursor size will change to a cursor the size of a single digit.

[60-090]

**2** Using the **Left** and **Right** Keys, move the cursor to the digit to be changed.

[60-090]

**3** Use the **Up** and **Down** Keys to change the value.

**4** Press the **ENT** Key when all digits have been changed as desired. The value will be set.

[60-080]

# 2-3 Using Auto Menu Data

Some data registered in the Auto Menu mode can be used with the Expert Menu mode.

### Measurement Conditions

Measurement conditions can be automatically set in the Auto Menu mode by registering sample images of acceptable and unacceptable products. The F150 can then be switched to Expert Menu mode so that these conditions can be checked and adjusted.

**⚠ Caution** If the Auto Menu mode is re-entered and automatic registration is executed, the Expert Menu settings will be cleared. Only the shutter speed settings will remain.

### Sample Images

Sample images saved in Auto Menu mode can be displayed in the Expert Menu mode.

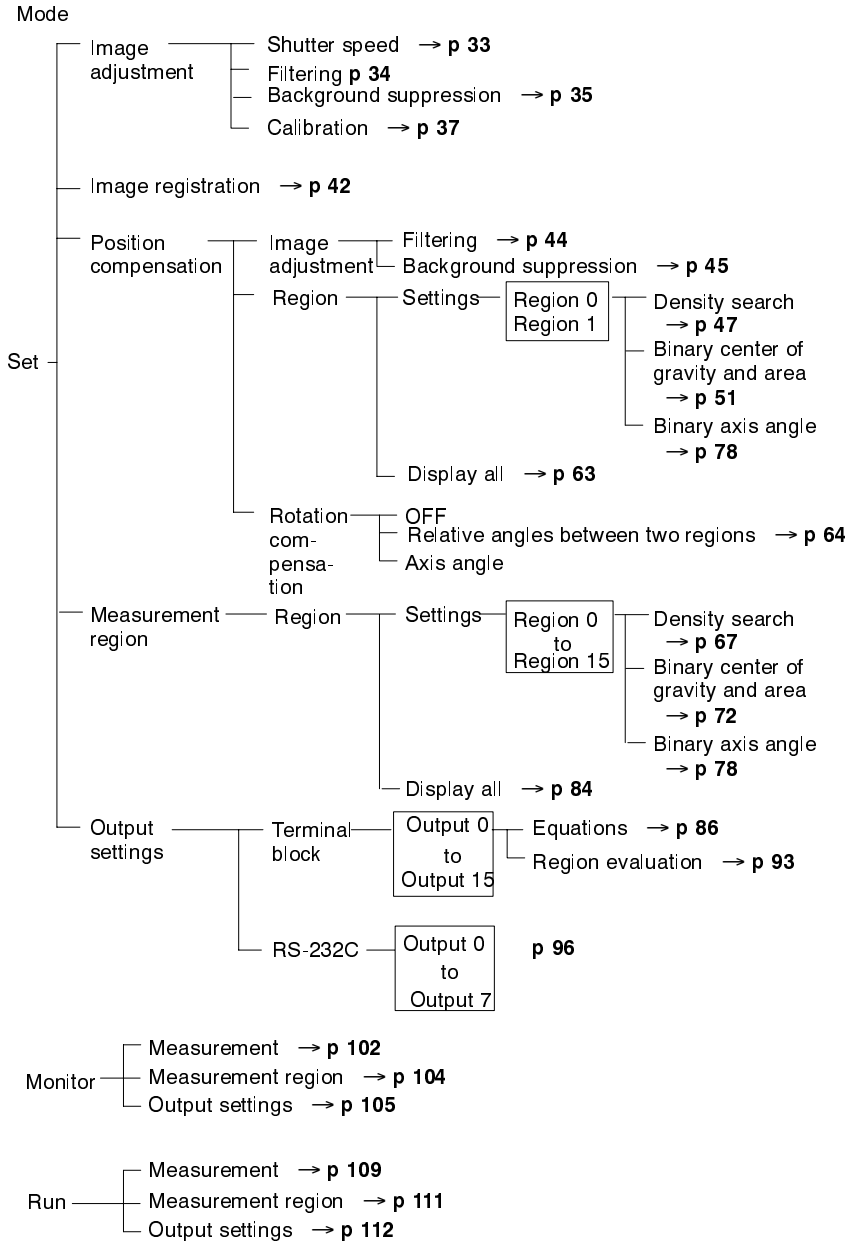
The measurement values shown on-screen when these sample images are displayed in Expert Menu mode can be referred to when adjusting the measurement conditions.

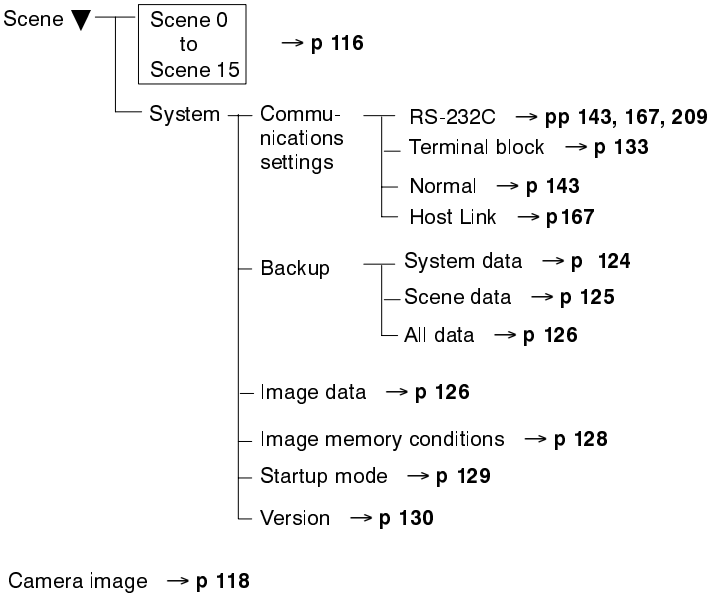
**Note** Images in memory will be cleared if the power is turned OFF or the scene is changed.

# SECTION 3
# Operating Procedures

This section describes operating the F150 using the Expert Menu mode.

# 3-1 Menu Tree


Mode
Set
Image adjustment
Shutter speed → p 33
Filtering p 34
Background suppression → p 35
Calibration → p 37
Image registration → p 42
Position compensation
Image adjustment
Filtering → p 44
Background suppression → p 45
Region
Settings
Region 0 Region 1
Density search → p 47
Binary center of gravity and area → p 51
Binary axis angle → p 78
Display all → p 63
Rotation com-pensa-tion
OFF
Relative angles between two regions → p 64
Axis angle
Measurement region
Region
Settings
Region 0 to Region 15
Density search → p 67
Binary center of gravity and area → p 72
Binary axis angle → p 78
Display all → p 84
Output settings
Terminal block
Output 0 to Output 15
Equations → p 86
Region evaluation → p 93
RS-232C
Output 0 to Output 7
p 96
Monitor
Measurement → p 102
Measurement region → p 104
Output settings → p 105
Run
Measurement → p 109
Measurement region → p 111
Output settings → p 112




# 3-2 Adjusting Images

The functions available for image adjustment are outlined below.

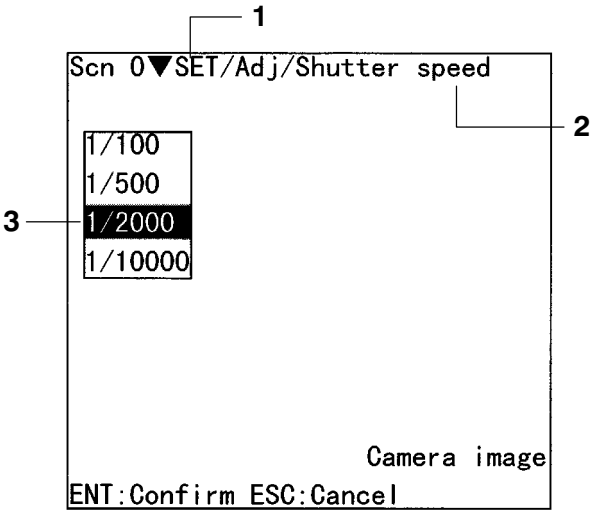
| | |
|---|---|
| Shutter Speed | Sets the shutter speed for object movement/illumination. |
| Filtering | Prepares the Camera image for easier measurement. |
| Background Cut Level | Deletes the background pattern for easier measurement. |
| Calibration | Outputs the measurement result in physical units, such as mm. |

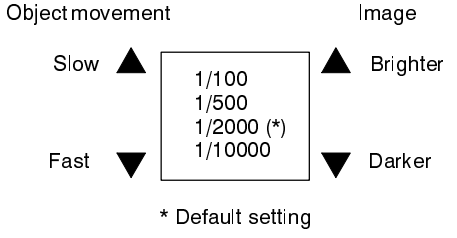
## 3-2-1 Shutter Speed

Change the shutter speed when the object is moving quickly, causing the image to be blurred. The shutter speed can also be adjusted if the image is too dark or too light.

**1** Enter Set mode.

**2** Move the cursor to ***Adjust/Shutter speed*** and press the **ENT** Key. The following screen will be displayed.




**3** Use the **Up** and **Down** Keys to scroll to the appropriate shutter speed and press the **ENT** Key. The shutter speed will be set.

## 3-2-2 Filtering

The image read by the Camera can be manipulated to create an image that is easier to measure, by using smoothing or edge enhancement.

Smoothing displays a smoothed image with reduced noise. Smoothing allows suppression of the effects of uneven lighting due to an uneven or damaged surface.

Edge enhancement displays an image with enhanced edges between bright and dark regions to compensate for blurred images.

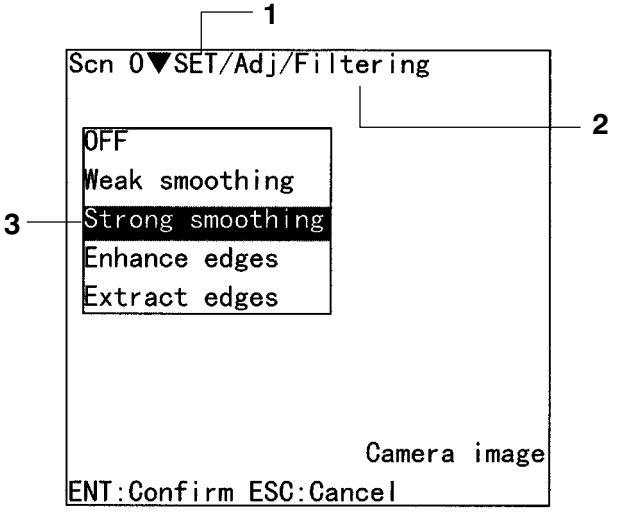
The cursor can be moved on the image to see the effects of filtering.

| Filtering method | Function |
|---|---|
| OFF | No filtering. |
| Smoothing | Displays a smooth image with reduced noise. Select either weak or strong smoothing. |
| Enhance edges | Displays an image with enhanced edges between bright and dark regions. |
| Extract edges | Displays an image with the edges between the bright and dark regions extracted. |

**Note** The filtering set here is used for object measurement. Filtering can be set separately for position compensation. → **p 44**

**1** Enter Set mode.

**2** Move the cursor to ***Adjust/Filtering*** and press the **ENT** Key. The following screen will be displayed.




**3** Use the **Up** and **Down** Keys to move to the desired filtering and press the **ENT** Key. The filtering will be set.

## 3-2-3 Background Suppression

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

BGS changes image areas with densities below the lower limit to 0, and image areas with densities above the upper limit to 255.

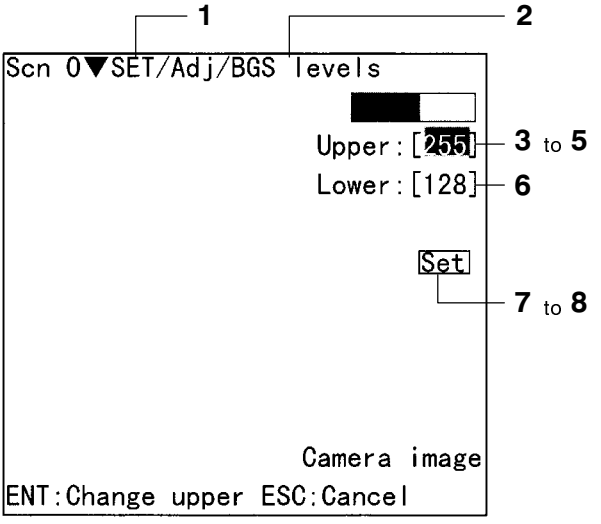
Image areas with densities between the lower and upper limits are graded from 0 to 255 so that only images with densities between the lower and upper limits are measured.

Look at the image and set the upper and lower limits of the density to eliminate the background.

**Note** The BGS levels set here are used for object measurement. BGS levels can be set separately for position compensation. → **p 45**

**1** Enter Set mode.

**2** Move the cursor to ***Adjust/Background cut level*** and press the **ENT** Key. The following screen will be displayed.




**3** Using the **Up** and **Down** Keys, move the cursor to the upper limit.

**4** Use the **Left** and **Right** Keys to decrement and increment the upper limit.

**or** Press the **ENT** Key. A one-digit cursor will appear. Using the **Left** and **Right** Keys, move the cursor to the digit to be changed. Using the **Up** and **Down** Keys, change the value and set the upper limit.

**5** Press the **ENT** Key.

**6** Repeat the previous two steps to change the lower limit.

**7** Using the **Up** and **Down** Keys, move the cursor to **Set**.

**8** Press the **ENT** Key. The upper and lower limits will be set.

## 3-2-4 Output Calibration

Calibration can be set to output the measurement results in physical units, such as mm.

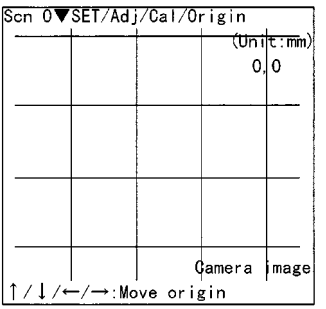
Set the relationship between the physical coordinates and the camera coordinates to convert the measurement results from pixels to physical units, such as μm, mm, or cm.

If calibration data is not set, the default settings will remain, and measurements using the camera coordinates will be output.

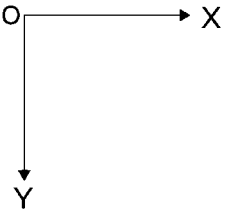
Calibration is set by setting 1) the origin of the real coordinate system, 2) the orientation of the coordinate system, and 3) the magnification and unit.

### Default Settings

0 (origin)




Coordinate system: Left-handed system



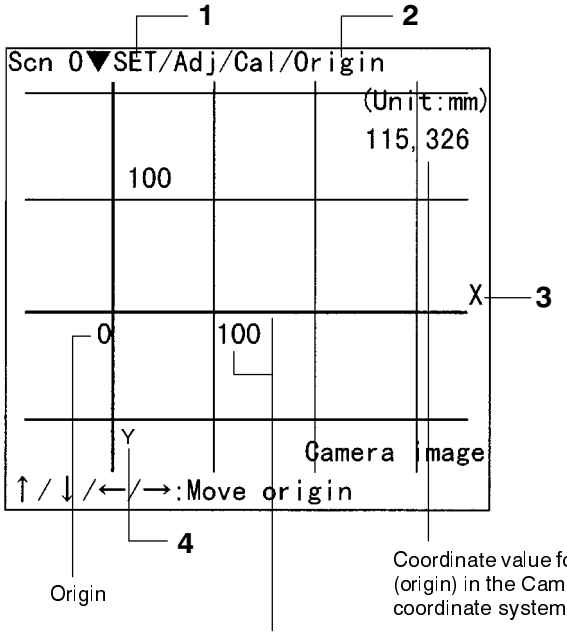

Magnification: 1.000

Unit: mm/pix

## Setting the Origin

Specify the origin of the physical coordinates. The intersection of the X axis and the Y axis is the origin.

Adjust the origin if it is specified outside the image while referring to the coordinate values displayed at the upper right of the screen.




The coordinates of 100 times the magnification (i.e., the actual coordinates) will also be displayed so that the magnification can be set accurately if a ruler or other object of know dimensions is displayed as the camera image. → p 40

**1** Enter Set mode.

**2** Move the cursor to ***Adjust/Calibration/Origin*** and press the **ENT** Key.

**3** Using the **Up** and **Down** Keys, move the X origin. The origin can be moved quickly by pressing the **SHIFT** + **Up** Key or the **SHIFT** + **Down** Key.

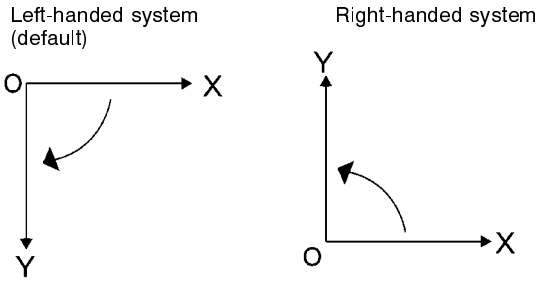
**4** Using the **Left** and **Right** Keys, move the Y origin. The origin can be moved quickly by pressing the **SHIFT** + **Left** Key or the **SHIFT** + **Right** Key.

**5** Press the **ENT** Key. The origin coordinates will be set.

## Setting the Coordinate System

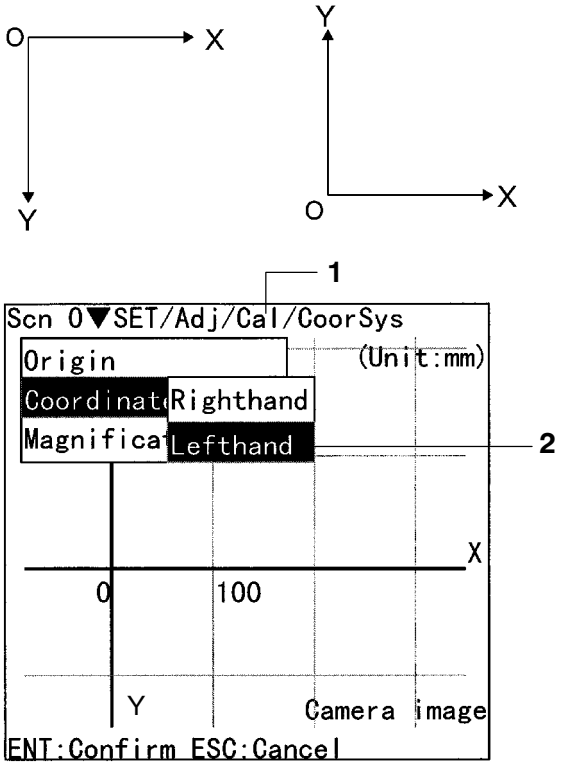
There are two coordinate systems: left-handed and right-handed. Select the system you are going to use for calibration.

**Note** The positive direction for angles will change depending on which coordinate system you use.




**1** Move the cursor to ***Calibration/Coordinate system*** and press the **ENT** Key. The following screen will be displayed.

**2** Using the **Up** and **Down** Keys, select a system and press the **ENT** Key. The coordinate system will be set.



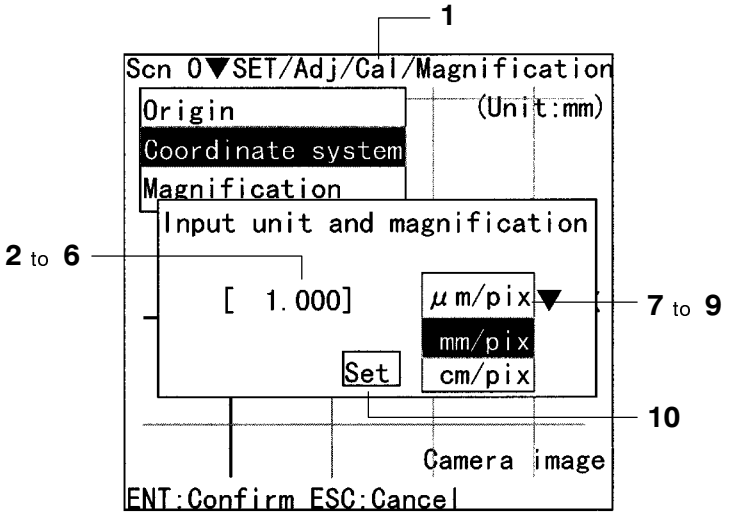

## Setting the Magnification and Unit

The magnification is the actual distance that corresponds to 1 pixel. For example, if a length of 10 mm is displayed on the screen as 100 pixels, the magnification would be 10 mm/100 pixel = 0.1 mm/pixel.

The magnification can be set between 0.001 and 9.999.

The default magnification is 1.000, and the default unit is mm/pix.

**1** Move the cursor to ***Calibration/Magnification*** and press the **ENT** Key. The following screen will be displayed.




**2** Using the **Up** and **Down** Keys, move the cursor to magnification input field, [ ].

**3** Press the **ENT** Key. A one-digit cursor will appear.

**4** Using the **Left** and **Right** Keys, move the cursor to the digit to be changed.

**5** Using the **Up** and **Down** Keys, change the value and set the magnification.

**6** Press the **ENT** Key.

**7** Move the cursor to the unit.

**8** Press the **ENT** Key. A list of options will be displayed.

**9** Use the **Up** and **Down** Keys to move the cursor to the desired unit and press the **ENT** Key.

**10** Move the cursor to **Set** and press the **ENT** Key. The magnification and the unit will be set.

## 3-3 Registering and Clearing Images

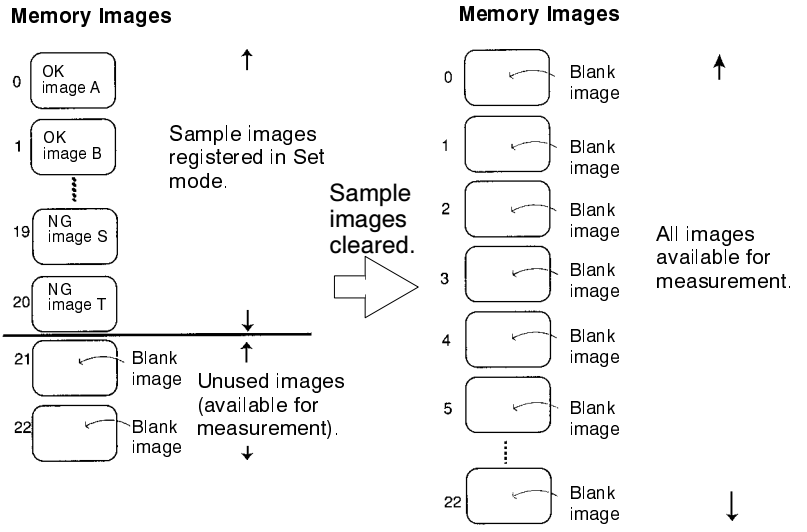
The following images are stored in memory during F150 operation.

- Acceptable and unacceptable sample images used for setting measurement conditions
- Measurement images

A total of 23 images can be stored in memory. The same memory space is used for both sample and measurement images. The number of measurement images that can be stored thus depends on the number of sample images registered for setting measurement conditions. If all sample images are cleared from memory before actual measurements are begun, 23 measurement images can be stored.

All registered images will be cleared when the power is turned OFF or the scene is changed.

The following diagram illustrates the use of memory images.



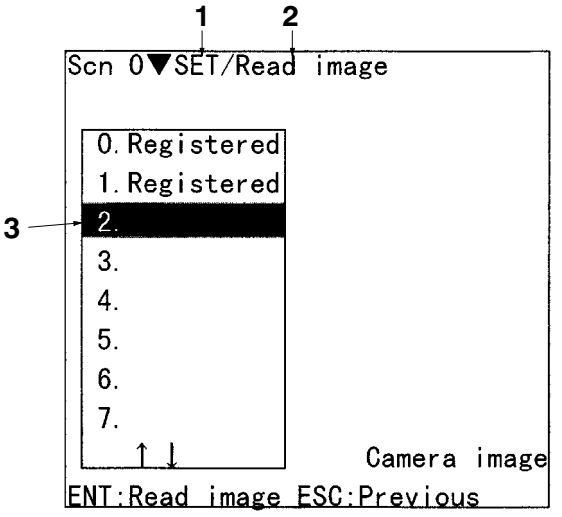

**Note** Sample images can be backed up on a computer connected via the RS-232C port. → **p 126**

## 3-3-1 Registering Sample Images

Register sample images using the following procedure.

**1** Enter Set mode.

**2** Select ***Read image*** from the menu and press the **ENT** Key. The following screen will appear.




**3** Using the **Up** and **Down** Keys, move the cursor to the image number where the sample image is to be registered.

**4** Confirm that the sample image is correctly displayed on the screen and then press the **ENT** Key. A confirmation message will be displayed.

## 3-3-2 Using the STEP Signal

The STEP signal can be input as a trigger on which to register an image.

Press the **SHIFT** + **ESC** Keys after selecting the image number in the procedure in the previous section, and "STEP: Read image" will be displayed on the lower left of the screen. The sample image will now be registered when a STEP signal input is received through the STEP terminal on the terminal block.

Press the **SHIFT** + **ESC** Keys again to return to the image registration screen

This function allows photoelectric sensors or other sync sensors to be used as triggers for image registration.

## 3-3-3 Clearing Images

Clear sample images using the following procedure.

**1** Perform the first two steps in the image registration procedure if they have not already been performed.

**2** Using the **Up** and **Down** Keys, move the cursor to the number of the image to be cleared and then press the **ENT** Key. A confirmation message will be displayed.

**3** Using the **Left** and **Right** Keys, move the cursor to **OK** and then press the **ENT** Key. The image will be cleared.

# 3-4 Position Compensation

Use the position displacement compensation function when the position and orientation of the measurement objects are not consistent. If the measurement object is not in a consistent position, the image read by the camera and the measurement region will not be aligned properly and a correct judgement will not be obtained.

The position of the measurement object is compared to a reference position, the amount of displacement is calculated, and the image is scrolled by that amount before the measurement is performed.

Position compensation can be performed using the same methods as for measurement: Density searches, binary center of gravity and area, binary axis angle. The position compensation settings can be checked on-screen.

Rotational position compensation can also be set as required to correct rotational displacement.

Position compensation can be simplified by using filtering and background suppression.

The methods to achieve position compensation are described in this section. The top-level Position Compensation Menu is shown in the following diagram.

| | |
|---|---|
| Adjust | Sets filtering for images to make position compensation easier. |
| Region | Sets the regions and methods used for position compensation. |
| Rotation | Sets rotational position compensation. |

## 3-4-1 Filtering

The image read by the Camera can be manipulated to create a better image for position compensation, by using smoothing or edge enhancement.

Smoothing displays a smoothed image with reduced noise. Smoothing allows suppression of the effects of uneven lighting due to an uneven or damaged surface.

Edge enhancement displays an image with enhanced edges between bright and dark regions to compensate for blurred images.

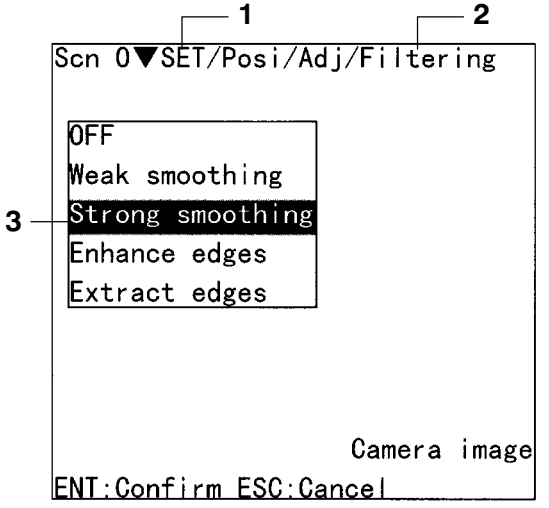
The cursor can be moved on the image to see the effects of filtering.

| Filtering method | Function |
|---|---|
| OFF | No filtering. |
| Smoothing | Displays a smooth image with reduced noise. Select either weak or strong smoothing. |
| Enhance edges | Displays an image with enhanced edges between bright and dark regions. |
| Extract edges | Displays an image with the edges between the bright and dark regions extracted. |

**Note** The filtering set here is used for position compensation. Filtering can be set separately for object measurement. → **p 34**

**1** Enter Set mode.

**2** Move the cursor to ***Position compensation/Adjust/Filtering*** and press the **ENT** Key. The following screen will be displayed.




**3** Use the **Up** and **Down** Keys to move the cursor and press the **ENT** Key. The filtering for position compensation will be set.

## 3-4-2 Background Suppression

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

BGS changes image areas with densities below the lower limit to 0, and image areas with densities above the upper limit to 255.

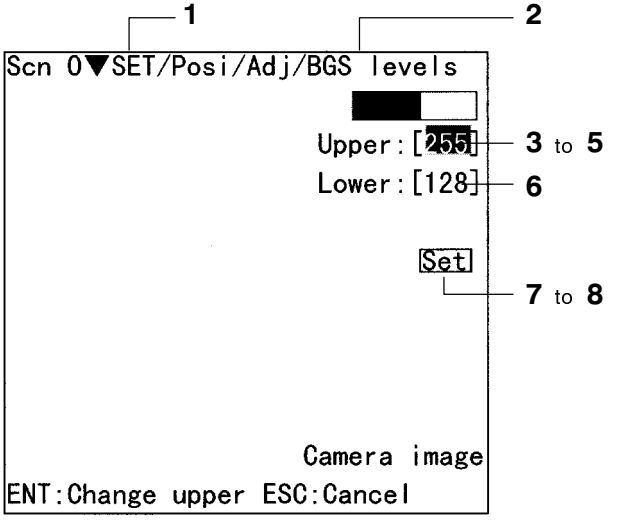
Image areas with densities between the lower and upper limits are graded from 0 to 255 so that only images with densities between the lower and upper limits are measured.

Look at the image and set the upper and lower limits of the density to eliminate the background.

**Note** The BGS levels set here are used for position compensation. BGS levels can be set separately for object measurement. → **p 35**.

**1** Enter Set mode.

**2** Move the cursor to ***Position compensation/Adjust/Background cut level*** and press the **ENT** Key. The following screen will be displayed.




**3** Using the **Up** and **Down** Keys, move the cursor to the upper limit.

**4** Use the **Left** and **Right** Keys to decrement and increment the upper limit.

**or** Press the **ENT** Key. A one-digit cursor will appear. Using the **Left** and **Right** Keys, move the cursor to the digit to be changed. Using the **Up** and **Down** Keys, change the value and set the upper limit.

**5** Press the **ENT** Key.

**6** Repeat the previous two steps to change the lower limit.

**7** Using the **Up** and **Down** Keys, move the cursor to **Set**.

**8** Press the **ENT** Key. The upper and lower limits will be set.

## 3-4-3 Density Searches

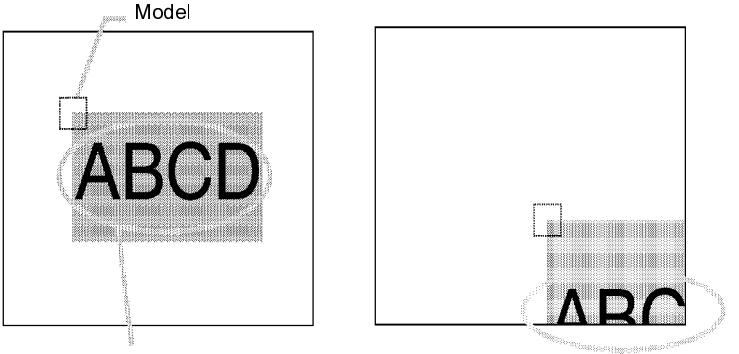
This section explains position displacement compensation using density searches. The following steps must be performed.

1. Register a characteristic part of the measurement image as a model that will be used to search for the measurement region.
2. Set the region in which a search is to be made for the model.
3. Set the evaluation criteria to be used to determine if the correct model has been found.

### Registering a Model

A characteristic part of the measurement image, such as a mark or corner, is registered as a model. The model can be of any size.

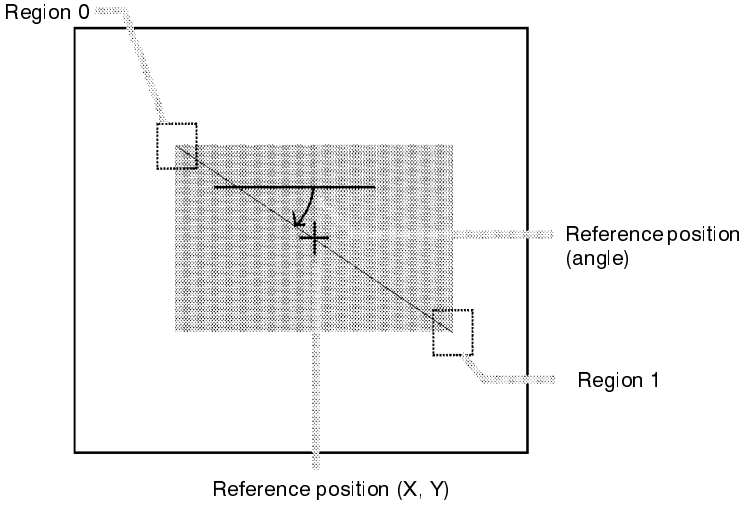
The position in which the model is registered serves as a reference position for position compensation. Position the measurement object so that the portion being measured is in the center of the screen before registering the model.

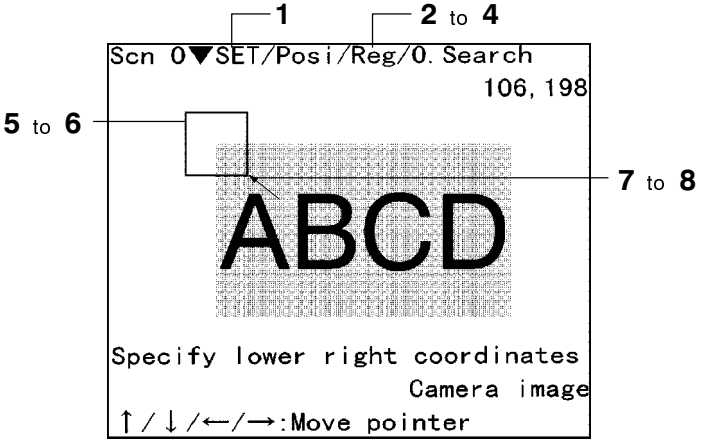



**OK**

**WRONG:**
**Measurement Object**
**Off the Screen**

If the measurement object must also be rotated to compensate for rotation displacement, set models in both region 0 and region 1 and then set rotational position displacement compensation using the angle between the models in the two regions. → **p 64**




**1** Enter Set mode.

**2** Move the cursor to ***Position compensation/Region/Setting*** and press the **ENT** Key.

**3** Move the cursor to either **0.** or **1.** and press the **ENT** Key.

**4** Using the **Up** and **Down** Keys, move the cursor to ***Search*** and press the **ENT** Key.

**5** Using the Cursor Keys, move the cursor to the upper-left corner of the region to be registered as the model.

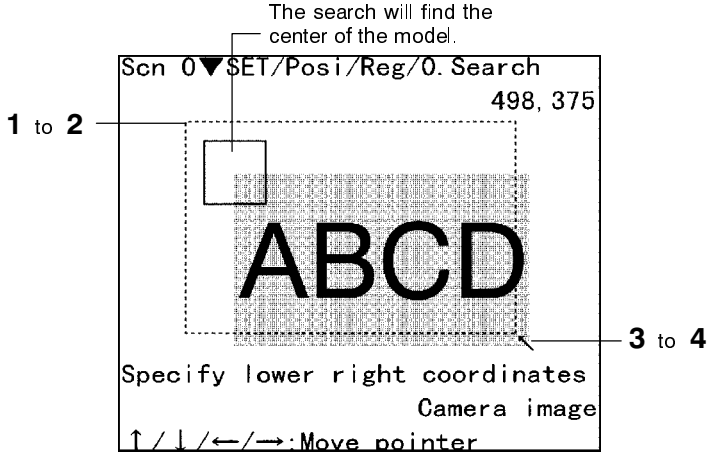
**6** Press the **ENT** Key. The upper-left corner will be set.

**7** Using the Cursor Keys, move the cursor to the lower-right corner of the region to be registered as the model.

**8** Press the **ENT** Key. The model will be set, and the screen to set the search region will be displayed.

## Setting the Search Region

The following screen will be displayed immediately after the model has been registered, or when ***Search region*** has been selected from the Edit Screen.




**1** Using the Cursor Keys, move the cursor to the upper-left corner of the search region.

**2** Press the **ENT** Key. The upper-left corner will be set.

**3** Using the Cursor Keys, move the cursor to the lower-right corner of the search region.

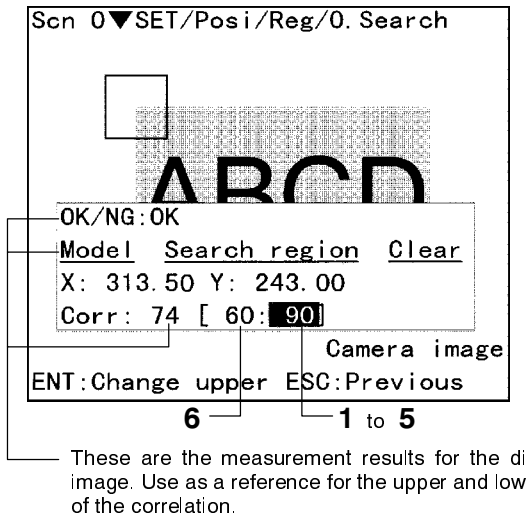
**4** Press the **ENT** Key. The search region will be set, and the Edit Screen will be displayed.

## Setting the Model Evaluation Criteria

Criteria are set for the correlation with the model to enable checking whether or not the correct position compensation model has been found. If the correlation with the model is too low, the wrong position may be found.

- A correlation from 0 to 100 can be set.
- If the model is found according to the evaluation criteria, position compensation will be performed followed by object measurement.
- If the model is not found according to the evaluation criteria, object measurement will be performed without position compensation and the judgement will be output to the terminals and the RS-232C port. The overall judgement, however, to the OR terminal will always be NG regardless.

The following Edit Screen will be displayed immediately after the search region is drawn, or when the region number is selected for a region that has already been registered.



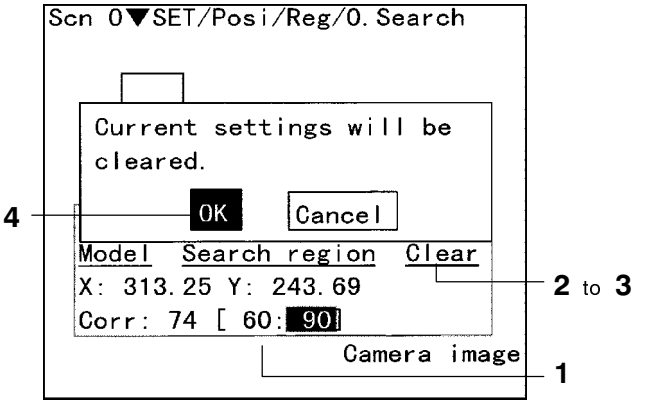

1. Using the **Up** and **Down** Keys, move the cursor to the upper limit.
2. Press the **ENT** Key. A one-digit cursor will appear.
3. Using the **Left** and **Right** Keys, move the cursor to the digit to be input.
4. Change the value using the **Up** and **Down** Keys.
5. Press the **ENT** Key. The upper limit will be set.
6. Repeat the above steps to change the lower limit.

***Model*** or ***Search region*** can be selected at this point to change the settings. ***Clear*** can be selected to clear all settings.

Press the **ESC** Key to exit the Edit Screen.

## Clearing Settings

This section explains how to clear the settings for the selected region. When the settings are cleared, the registered model and the search region will be deleted and the upper and lower limits will be returned to the default settings.




**1** Check that the Edit Screen is displayed.

**2** Using the Cursor Keys, move the cursor to ***Clear***.

**3** Press the **ENT** Key. A confirmation message will be displayed.

**4** Using the **Left** and **Right** Keys, move the cursor to **OK** and press the **ENT** Key. The settings will be cleared.

## 3-4-4 Binary Center of Gravity and Area

This section explains position displacement compensation using the binary center of gravity and area. The following steps must be performed.

**1** Set the binary level used to create a binary image.

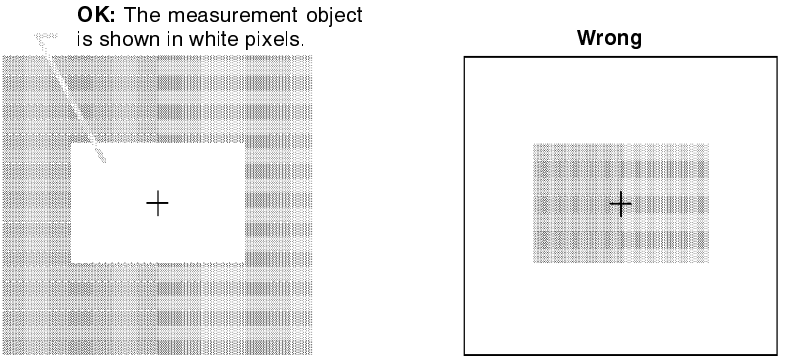
**2** Draw the position compensation region.

**3** Set the evaluation criteria to be used to determine measurement object is within the measurement region.

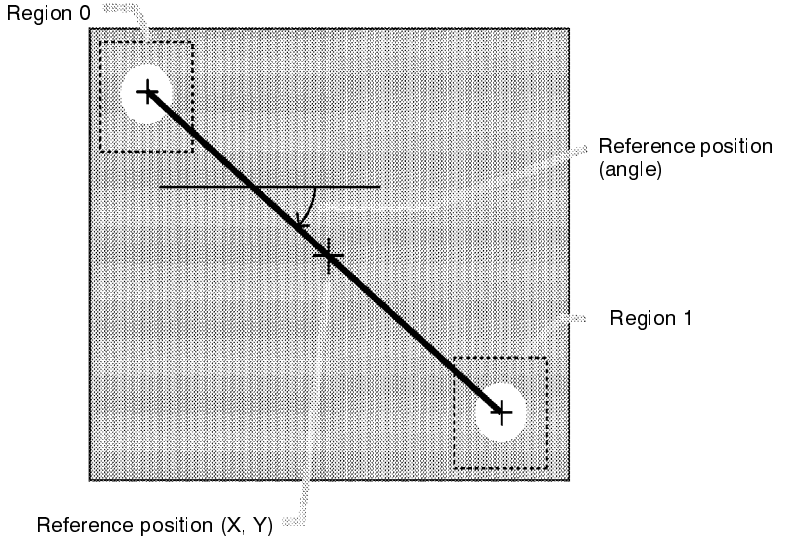
### Setting the Binary Level

Density images with 256 gradations are read by the Camera. Binary processing involves separating these density images into black pixels (picture elements) (0) and white pixels (1). The F150 uses the white pixels to measure the object.

Adjust the binary level so that the area for which the center of gravity and axis angle are to be calculated is white.




If the measurement object must also be rotated to compensate for rotation displacement, set models in both region 0 and region 1 and then set rotational position displacement compensation using the angle between the models in the two regions. → **p 64**

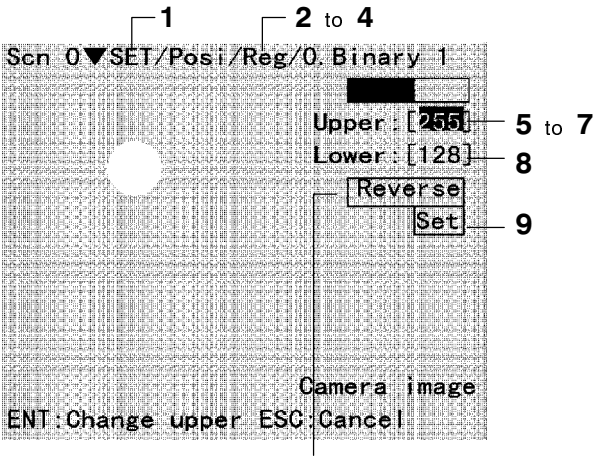



**1** Enter Set mode.

**2** Move the cursor to ***Position compensation/Region/Setting*** and press the **ENT** Key.

**3** Move the cursor to either **0.** or **1.** and press the **ENT** Key.

**4** Using the **Up** and **Down** Keys, move the cursor to ***Binary 1*** and press the **ENT** Key. The following screen will be displayed.




Move the cursor to **Reverse** and press the **ENT** Key to reverse the black and white pixels.

**5** Move the cursor to the upper limit.

**6** Use the **Left** and **Right** Keys to decrement and increment the upper limit.

**or** Press the **ENT** Key. A one-digit cursor will appear. Using the **Left** and **Right** Keys, move the cursor to the digit to be changed. Using the **Up** and **Down** Keys, change the value and set the upper limit.

**7** Press the **ENT** Key.

**8** Repeat the previous two steps to change the lower limit.

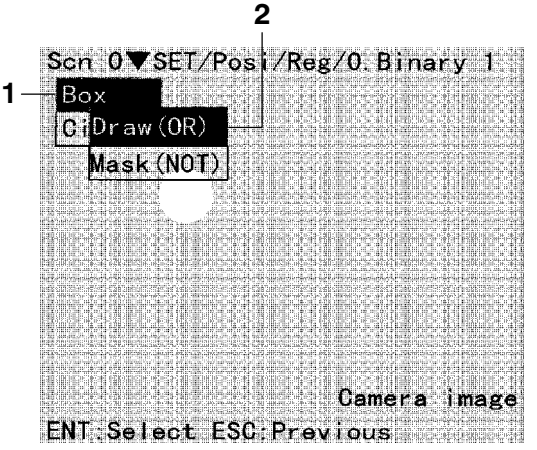
**9** Using the **Up** and **Down** Keys, move the cursor to **Set**, then press the **ENT** Key. The binary level will be set and the screen to draw the region will be displayed.

## Drawing the Position Compensation Region

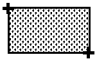
Set the position and size of the region, taking into consideration the range of movement of the measurement object. The center of gravity of the white pixels in the region will be found.

Once the region is drawn, the center of gravity will be calculated. This center of gravity will become the reference position. Position the measurement object so that the measurement region is completely within the screen and then draw the region.

This following screen will be displayed immediately after the binary level is set, or when ***Region*** has been selected in the Edit Screen.




The following two figures can be drawn to create the region.

| Figure | | Drawing method |
|---|---|---|
| Box |  | Specify two diagonally opposing corners. |
| Circle |  | Specify the center, then specify a point on the circumference. |

The following two drawing modes can be used to combine the figures that are drawn.

| Drawing mode | Function |
|---|---|
| Draw (OR) | Draws a region as the measurement region. |
| Mask (NOT) | Masks part of the measurement region. |

**1** Using the **Up** and **Down** Keys, move the cursor to select the figure to draw and press the **ENT** Key.

**2** Using the **Up** and **Down** Keys, move the cursor to select either ***Draw (OR)*** or ***Mask (NOT)*** for the drawing mode and press the **ENT** Key. The screen showing the region will be displayed.

**3** Draw the figure.

Once the second point has been specified, a message will be displayed asking whether or not other figures will be added. Up to 16 figures can be drawn for one region (up to 64 for one scene).

**4** If additional figures are to be drawn, move the cursor to ***Additional drawing*** and press the **ENT** Key. Repeat steps (1) to (3) for each figure.

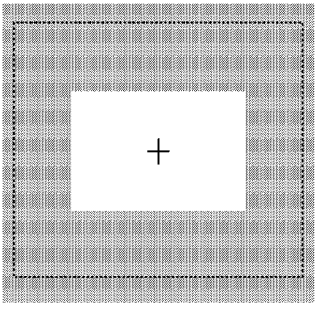
**5** If the drawing for the region is finished, move the cursor to ***End*** and press the **ENT** Key.

The center of gravity in the region will be registered as the reference position and the Edit Screen will be displayed.

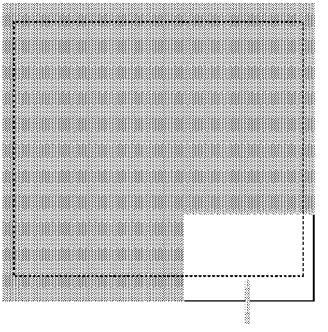
## Setting Evaluation Criteria

Criteria for area is set to determine whether or not the measurement object is properly within the measurement region.

- A correlation from 1 to 999,999 can be set.
- If the measurement object is within the measurement region according to the evaluation criteria, position compensation will be performed followed by object measurement.
- If the measurement object is not within the measurement region according to the evaluation criteria, object measurement will be performed without position compensation and the judgement will be output to the terminals and the RS-232C port. The overall judgement, however, to the OR terminal will always be NG in this case.

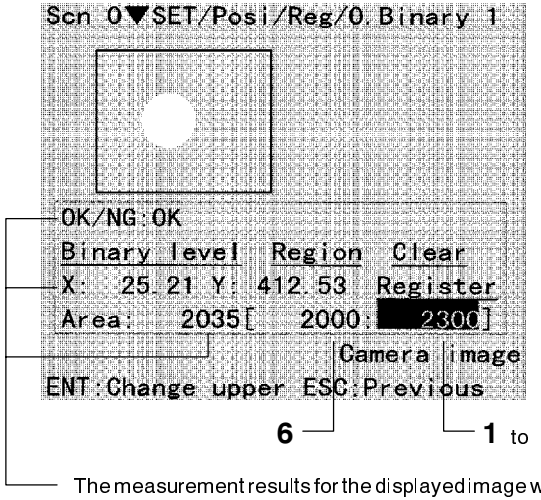


**OK**: Position compensation performed



**NG**: Measurement object not in region

The following Edit Screen will be displayed immediately after the region is drawn or when the region number is selected for a region that has already been registered.




**1** Using the **Up** and **Down** Keys, move the cursor to the upper limit.

**2** Press the **ENT** Key. A one-digit cursor will appear.

**3** Using the **Left** and **Right** Keys, move the cursor to the digit to be input.

**4** Use the **Up** and **Down** Keys to change the value.

**5** Press the **ENT** Key. The upper limit will be set.

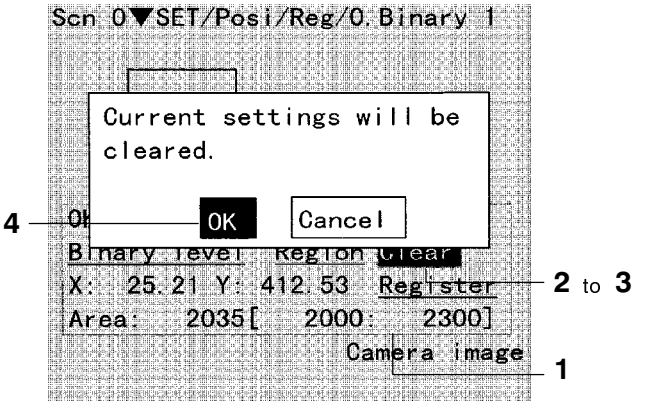
**6** Repeat the above steps to set the lower limit.

**7** ***Binary level*** or ***Region*** can be selected at this point to change the settings. ***Clear*** can be selected to clear all settings. ***Register*** can be selected to register the displayed X and Y measurements as the reference position.

**8** Press the **ESC** Key to exit the Edit Screen.

## Clearing Settings

This section explains how to clear the settings for the selected region. When the settings are cleared, the region will be deleted and the binary level, upper limit, and lower limit will be returned to the default settings.




**1** Check that the Edit Screen is displayed.

**2** Use the Cursor Keys to move the cursor to ***Clear***.

**3** Press the **ENT** Key. A confirmation message will be displayed.

**4** Using the **Left** and **Right** Keys, move the cursor to ***OK*** and press the **ENT** Key. The settings will be cleared.

## 3-4-5 Binary Axis Angle

Position compensation using the binary axis angle is the same as position compensation using the binary center of gravity and area method, except that the axis angle is also found. The processing time increases if the axis angle is calculated. Use the binary center of gravity and area method unless finding the axis angle is required by the application.

The following steps must be performed.

**1** Set the binary level used to create a binary image.

**2** Draw the position compensation region.

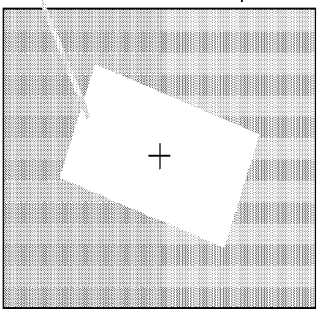
**3** Set the evaluation criteria to be used to determine if the measurement object is within the measurement region.

## Setting the Binary Level

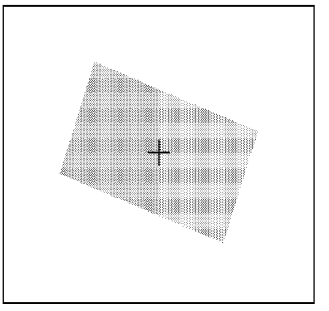
Density images with 256 gradations are read by the Camera. Binary processing involves separating these density images into black pixels (picture elements) (0) and white pixels (1). The F150 uses the white pixels to measure the object.

Adjust the binary level so that the area for which the center of gravity and axis angle are to be calculated is white.

**OK:** The measurement object is shown in white pixels.



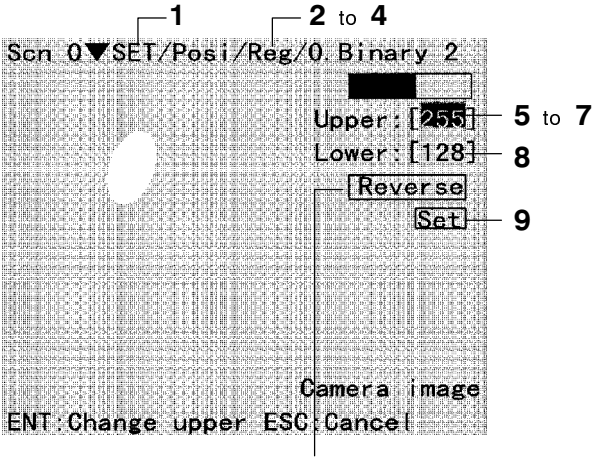
**Wrong**



**Note** If rotation position displacement compensation is used, select ***Axis angle***. Only Axis angle rotational compensation can be used with binary axis angle position compensation. → **p 64**

1. Enter Set mode.
2. Move the cursor to ***Position compensation/Region/Setting*** and press the **ENT** Key.
3. Move the cursor to either ***0.*** or ***1.*** and press the **ENT** Key. Only one of these regions can be drawn when the binary axis angle is used.

**4** Using the **Up** and **Down** Keys, move the cursor to ***Binary 2*** and press the **ENT** Key. The following screen will be displayed.




Move the cursor to **Reverse** and press the **ENT** Key to reverse the black and white pixels.

**5** Move the cursor to the upper limit.

**6** Use the **Left** and **Right** Keys to decrement and increment the upper limit.

**or** Press the **ENT** Key. A one-digit cursor will appear. Using the **Left** and **Right** Keys, move the cursor to the digit to be changed. Using the **Up** and **Down** Keys, change the value and set the upper limit.

**7** Press the **ENT** Key.

**8** Repeat the previous two steps to change the lower limit.

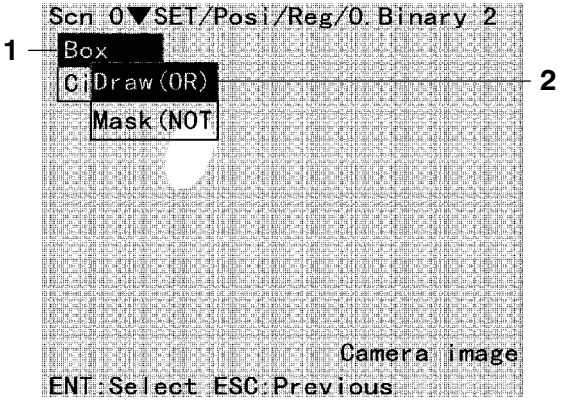
**9** Using the **Up** and **Down** Keys, move the cursor to ***Set***. Press the **ENT** Key. The binary level will be set, and the screen to draw the region will be displayed.

## Drawing the Measurement Region

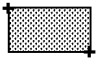
Set the position and size of the region, taking into consideration the range of movement of the measurement object. The center of gravity of the white pixels in the region will be found.

Once the region is drawn, the center of gravity and axis angle will be calculated. This center of gravity and axis angle will become the reference position. Position the measurement object so that the measurement region is completely within the screen and then draw the region.

This following screen will be displayed immediately after the binary level is set, or when ***Region*** has been selected in the Edit Screen.




The following two figures can be drawn to create the region.

| Figure | | Drawing method |
|---|---|---|
| Box |  | Specify two diagonally opposing corners. |
| Circle |  | Specify the center, then specify a point on the circumference. |

The following two drawing modes can be used to combine the figures that are drawn.

| Drawing mode | Function |
|---|---|
| Draw (OR) | Draws a region as the measurement region. |
| Mask (NOT) | Masks part of the measurement region. |

**1** Using the **Up** and **Down** Keys, move the cursor to select the figure to draw and press the **ENT** Key.

**2** Using the **Up** and **Down** Keys, move the cursor to select either ***Draw (OR)*** or ***Mask (NOT)*** for the drawing mode and press the **ENT** Key. The screen showing the region will be displayed.

**3** Draw the figure.

Once the second point has been specified, a message will be displayed asking whether or not other figures will be added. Up to 16 figures can be drawn for one region (up to 64 for one scene).

**4** If additional figures are to be drawn, move the cursor to ***Additional drawing*** and press the **ENT** Key. Repeat steps (1) to (3) for each figure.

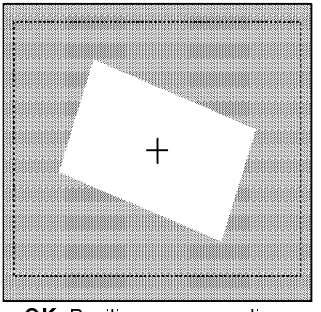
**5** If the drawing for the region is finished, move the cursor to ***End*** and press the **ENT** Key.

The center of gravity and the axis angle in the region will be registered as the reference position and the Edit Screen will be displayed.

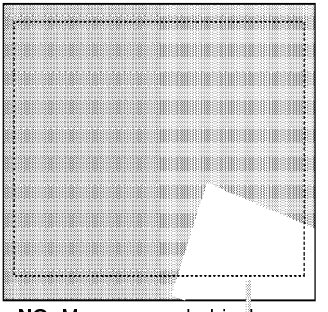
## Setting Evaluation Criteria

Criteria for area is set to determine whether or not the measurement object is properly within the measurement region.

- A correlation from 1 to 999,999 can be set.
- If the measurement object is within the measurement region according to the evaluation criteria, position compensation will be performed followed by object measurement.
- If the measurement object is not within the measurement region according to the evaluation criteria, object measurement will be performed without position compensation and the judgement will be output to the terminals and the RS-232C port. The overall judgement, however, to the OR terminal will always be NG in this case.

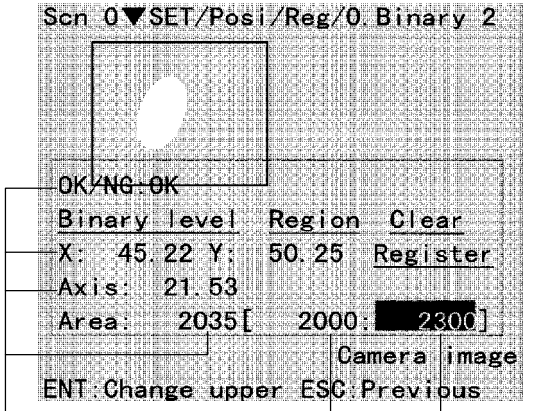


**OK**: Position compensation performed



**NG**: Measurement object not in region

The following Edit Screen will be displayed immediately after the region is drawn or when the region number is selected for a region that has already been registered.




**1** Using the **Up** and **Down** Keys, move the cursor to the upper limit.

**2** Press the **ENT** Key. A one-digit cursor will appear.

**3** Using the **Left** and **Right** Keys, move the cursor to the digit to be input.

**4** Use the **Up** and **Down** Keys to change the value.

**5** Press the **ENT** Key. The upper limit will be set.

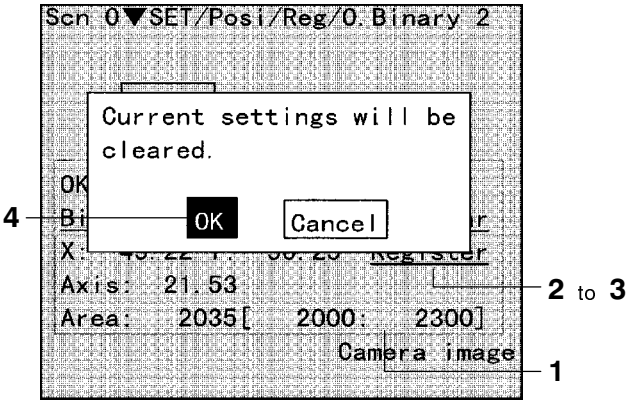
**6** Repeat the above steps to set the lower limit.

**7** ***Binary level*** or ***Region*** can be selected at this point to change the settings. ***Clear*** can be selected to clear all settings. ***Register*** can be selected to register the displayed X and Y measurements as the reference position.

**8** Press the **ESC** Key to exit the Edit Screen.

## Clearing Settings

This section explains how to clear the settings for the selected region. When the settings are cleared, the region will be deleted and the binary level, upper limit, and lower limit will be returned to the default settings.




**1** Check that the Edit Screen is displayed.

**2** Use the Cursor Keys to move the cursor to ***Clear***.

**3** Press the **ENT** Key. A confirmation message will be displayed.

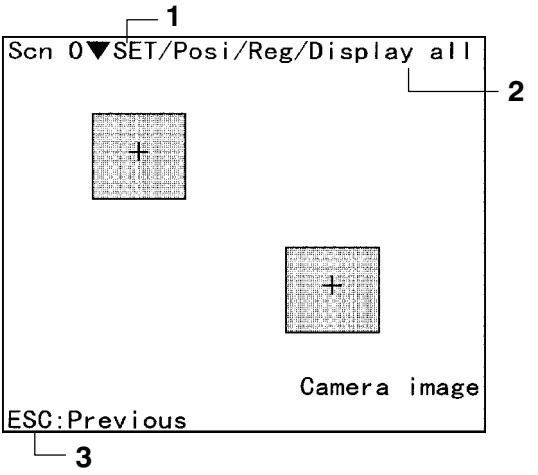
**4** Using the **Left** and **Right** Keys, move the cursor to ***OK*** and press the **ENT** Key. The settings will be cleared.

## 3-4-6 Checking Settings

This section explains how to check that the position compensation settings are correct. The settings made under ***Set/Position compensation*** will be displayed. These settings cannot be changed from this screen.

**1** Enter Set mode.

**2** Move the cursor to ***Position compensation/Region/Display all*** and press the **ENT** Key. The data will be displayed.




**Density Searches:** The registered model will be shown on the display and a cross will appear at the center of the model. The dotted lines indicate the search region.

**Binary Center of Gravity and Area:** The drawn region will be displayed. A cross will appear at the center of gravity.

**Binary Axis Angle:** The drawn region will be displayed. A cross will appear at the center of gravity.

**3** Press the **ESC** Key to exit this screen.

## 3-4-7 Rotational Position Compensation

Position displacement can be compensated not only in the X and Y directions, but also in rotational. There are two methods which can be used: the angle between two regions and the axis angle.

The procedure provided in this section is used to specify the method used for rotational position compensation. All other required settings are made under the position compensation methods already described.

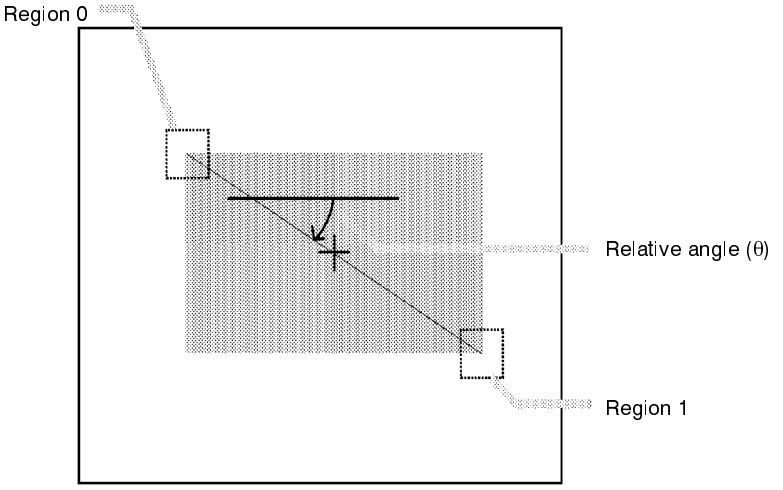
The rotational compensation will be turned OFF if a position compensation region is added or cleared.

**Relative Angle**

The angle between the line connecting the two position compensation regions and a horizontal line is called the relative angle. The X axis is at 0°. The angle is positive in the direction of the Y axis from the X axis. The range of the angle is 360°.

- For the density search method, the lines joins the center of the two models.
- For the binary center of gravity and area method, the line joins the center of gravity of the white pixels of each region.

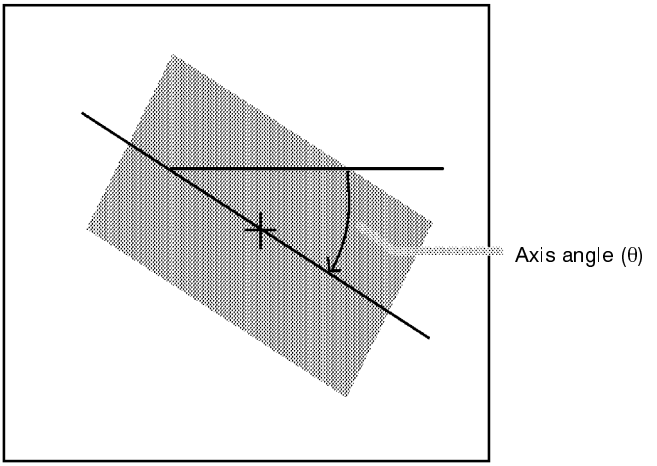
The relative angle can even be calculated by a density search in region 0 and the binary center of gravity and area in region 1.




**Axis Angle**

The axis angle is the angle along the major axis of the ellipse when the white pixels are graphically converted to an ellipse with the same center of gravity and moment around the axis as the white pixels. The X axis is 0°; the angle has a range of 180°; and the angle is positive toward the Y axis. An axis angle cannot be calculated for a figure without direction, such as a square or a circle.

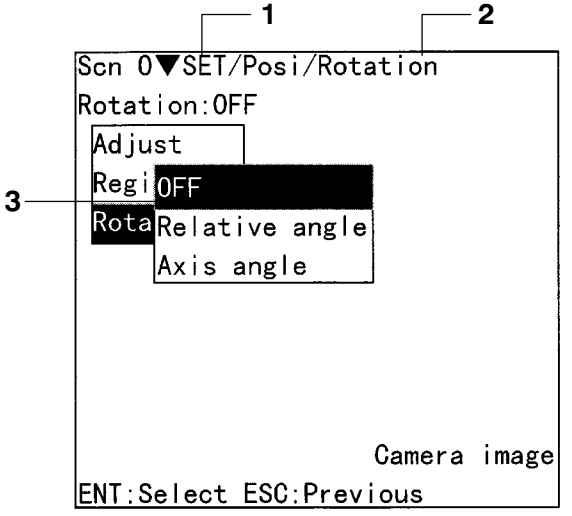
**Note** Axis angle rotational position compensation can be selected only when binary axis angle position compensation is being used.




**Procedure**

**1** Enter Set mode.

**2** Move the cursor to ***Position compensation/Rotation*** and press the **ENT** Key. The following screen will be displayed.



**3** Using the **Up** and **Down** Keys, move the cursor to the desired rotational position compensation method and press the **ENT** Key. The method will be set.

# 3-5 Measurement Region Functions

Three measurement methods can be used with the F150: Density search, binary center of gravity and area, and binary axis angle. There are 16 measurement regions, and a different measurement method can be set for each region.

The methods that can be set for measurement regions are described in this section. The top-level menu is shown in the following diagram.

| | |
|---|---|
| Settings | Sets the measurement regions. |
| Display all | Checks the settings of the measurement regions. |

**Note** Several acceptable and unacceptable product images can be registered as samples, and the evaluation criteria can be set using the measurements from those samples as reference values.

## 3-5-1 Density Searches

This section explains using density searches for object measurement. The following steps must be performed.

**1** Register a characteristic part of the measurement image as a model that will be used to search for the measurement region.

**2** Set the region in which a search is to be made for the model.

**3** Set the evaluation criteria for the model correlation and position.

### Registering the Model

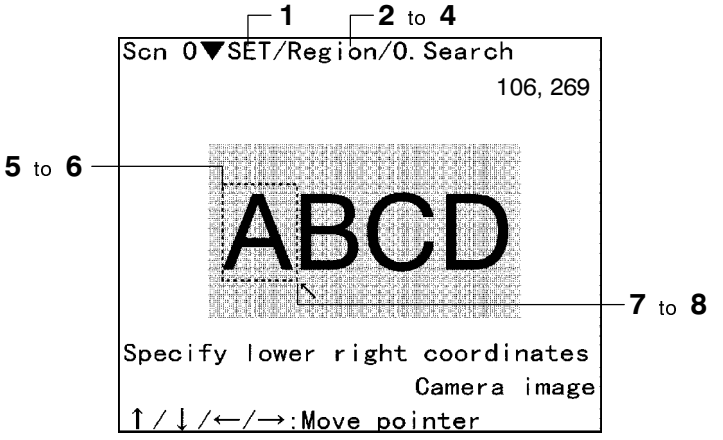
The area of the image to be inspected is registered as a model. The model can be of any size.

**1** Enter Set mode.

**2** Move the cursor to ***Measurement region/Setting*** and press the **ENT** Key.

**3** Move the cursor to the number of the model to be registered and press the **ENT** Key.

**4** Using the **Up** and **Down** Keys, move the cursor to ***Search*** and press the **ENT** Key. The following screen will be displayed.




**5** Using the Cursor Keys, move the cursor to the upper-left corner of the model.

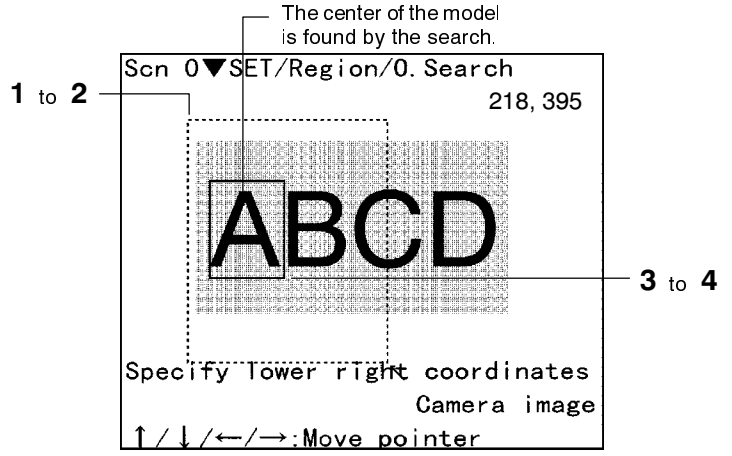
**6** Press the **ENT** Key. The upper-left corner will be set.

**7** Using the Cursor Keys, move the cursor to the lower-right corner of the model.

**8** Press the **ENT** Key. The model will be set, and the screen to set the search region will be displayed.

## Setting the Search Region

The following screen will be displayed immediately after the model has been registered, or when ***Search region*** has been selected from the Edit Screen.




**1** Using the Cursor Keys, move the cursor to the upper-left corner of the search region.

**2** Press the **ENT** Key. The upper-left corner will be set.

**3** Using the Cursor Keys, move the cursor to the lower-right corner of the search region.

**4** Press the **ENT** Key. The search region will be set, and the Edit Screen will be displayed.

## Setting Evaluation Criteria

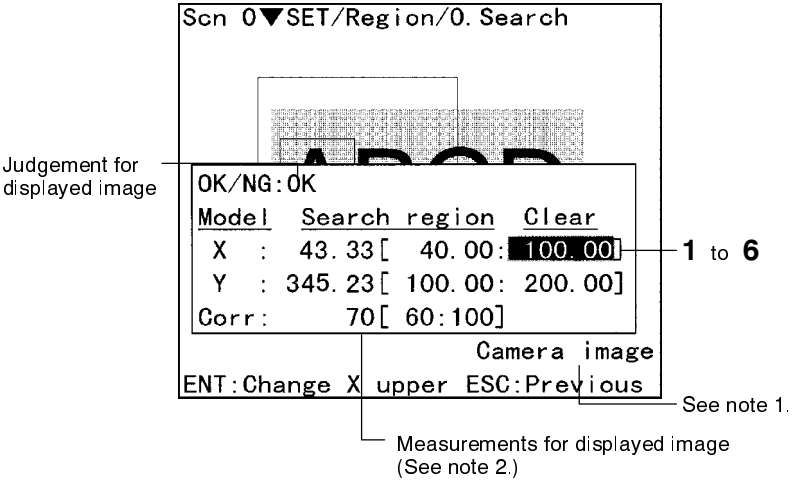
Evaluation criteria are set for the correlation with the model and the coordinates where the model was found. Set upper and lower limits for an OK result for both the model correlation and model coordinates.

The criteria ranges can be set within the following values:

- X: -999.99 to 999.99
- Y: -999.99 to 999.99
- Correlation: 0 to100

**Note** If calibration is being used, set the calibration first and then set the criteria.

The following Edit Screen is displayed immediately after the search region is drawn, or when a region where a model is registered is selected

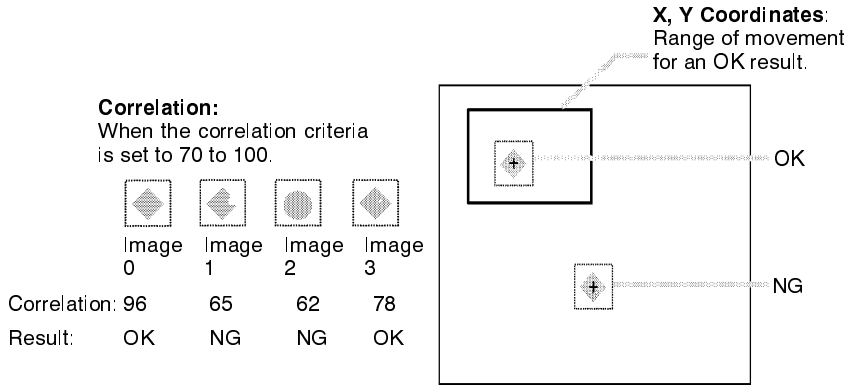



**Note**

1. Press the **SHIFT** + **TRIG** Keys to move to the screen to switch the displayed image. → **p 118**
2. The calibrated values (X, Y) are displayed. Here, X and Y are the coordinates before position displacement compensation is performed. If the measurement is less that -999.99, the display will show "-999.99, NG." If the measurement is greater than 999.99, the display will show "999.99, NG."

### OK and NG Criteria

The following diagram shows the OK or NG judgements made for various images and criteria settings.

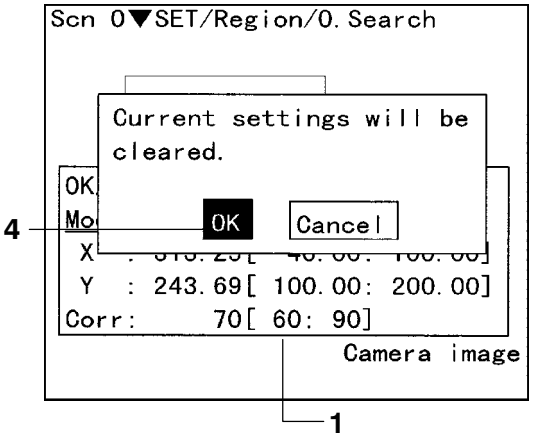



### Procedure

1. Move the cursor to the upper or lower limit to be changed. The cursor can be moved to items in brackets: [ ].
2. Press the **ENT** Key. A one-digit cursor will appear.
3. Using the **Left** and **Right** Keys, move the cursor to the digit to be changed.
4. Use the **Up** and **Down** Keys to change the value.
5. Press the **ENT** Key. The value will be set.
6. Repeat steps (1) to (5) to change other criteria.
7. ***Model*** or ***Search region*** can be selected at this point to change the settings. ***Clear*** can be selected to clear all settings.
8. Press the **ESC** Key to exit the Edit Screen.

## Clearing Settings

This section explains how to clear the settings for the selected region. When the settings are cleared, the registered model and the search region will be deleted and the upper and lower limits will be returned to the default settings.




**1** Check that the Edit Screen is displayed.

**2** Using the Cursor Keys, move the cursor to ***Clear***.

**3** Press the **ENT** Key. A confirmation message will be displayed.

**4** Using the **Left** and **Right** Keys, move the cursor to ***OK*** and press the **ENT** Key. The settings will be cleared.

## 3-5-2 Binary Center of Gravity and Area

This section explains position displacement compensation using the binary center of gravity and area. The following steps must be performed.

**1** Set the binary level used to create a binary image.

**2** Draw the measurement region.

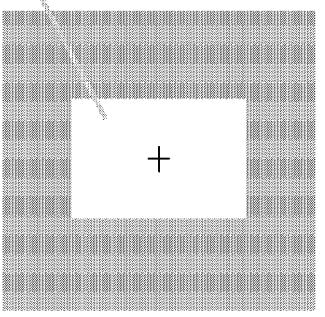
**3** Set the evaluation criteria for the center of gravity and area.

## Setting Binary Levels

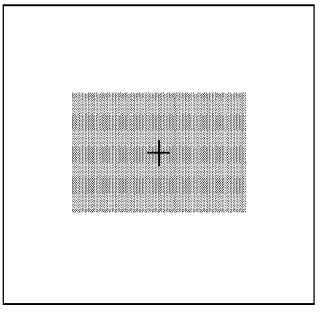
Density images with 256 gradations are read by the Camera. Binary processing involves separating these density images into black pixels (picture elements) (0) and white pixels (1). The F150 uses the white pixels to measure the object.

Adjust the binary level so that the area for which the center of gravity and axis angle are to be calculated is white.

**OK:** The measurement object is shown in white pixels.



**Wrong**

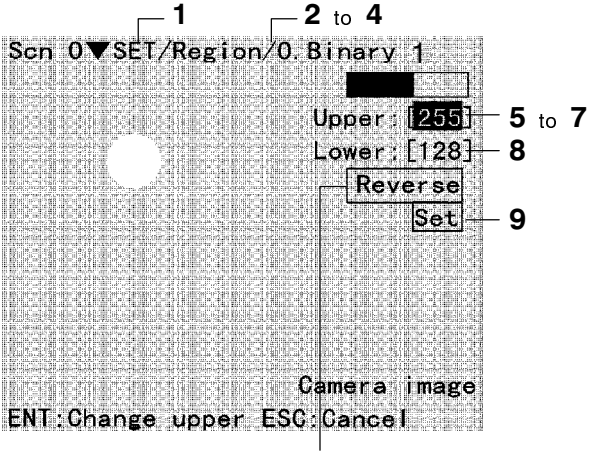


**1** Enter Set mode.

**2** Move the cursor to ***Measurement region/Setting*** and press the **ENT** Key.

**3** Move the cursor to the number of the region to be set and press the **ENT** Key.

**4** Using the **Up** and **Down** Keys, move the cursor to ***Binary 2*** and press the **ENT** Key. The following screen will be displayed.




Move the cursor to **Reverse** and press the **ENT** Key to reverse the black and white pixels.

**5** Move the cursor to the upper limit.

**6** Use the **Left** and **Right** Keys to decrement and increment the upper limit.

**or** Press the **ENT** Key. A one-digit cursor will appear. Using the **Left** and **Right** Keys, move the cursor to the digit to be changed. Using the **Up** and **Down** Keys, change the value and set the upper limit.

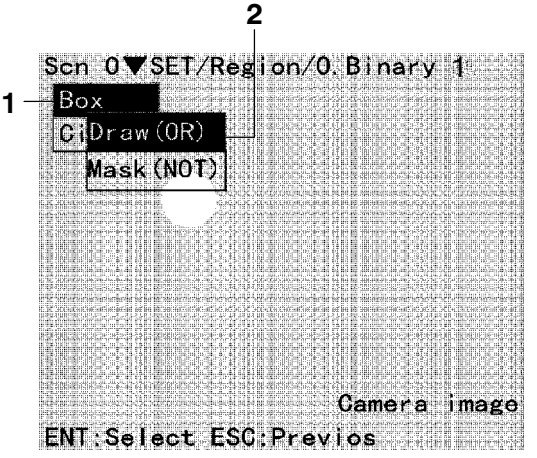
**7** Press the **ENT** Key.

**8** Repeat the previous two steps to change the lower limit.

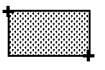
**9** Using the **Up** and **Down** Keys, move the cursor to ***Set***, then press the **ENT** Key. The binary level will be set, and the screen to draw the measurement region will be displayed.

## Drawing the Measurement Region

The screen to draw the measurement region will be displayed immediately after the binary level is set, or when ***Region*** has been selected from the Edit Screen.




The following two figures can be drawn to create the region.

| Figure | | Drawing method |
|---|---|---|
| Box |  | Specify two diagonally opposing corners. |
| Circle |  | Specify the center, then specify a point on the circumference. |

The following two drawing modes can be used to combine the figures that are drawn.

| Drawing mode | Function |
|---|---|
| Draw (OR) | Draws a region as the measurement region. |
| Mask (NOT) | Masks part of the measurement region. |

**1** Using the **Up** and **Down** Keys, move the cursor to select the figure to draw and press the **ENT** Key.

**2** Using the **Up** and **Down** Keys, move the cursor to select either ***Draw (OR)*** or ***Mask (NOT)*** for the drawing mode and press the **ENT** Key. The screen showing the region will be displayed.

**3** Draw the region.

Once the second point is specified, a message will be displayed asking whether or not other figures will be added. Up to 16 figures can be drawn for one region (up to 64 for one scene).

**4** If additional figures are to be drawn, move the cursor to ***Additional drawing*** and press the **ENT** Key. Repeat steps (1) to (3) for each figure.

**5** If the drawing for that region is finished, move the cursor to ***End*** and press the **ENT** Key.

The center of gravity and the axis angle in the region will be registered as the reference position and the Edit Screen will then be displayed.

## Setting the Evaluation Criteria

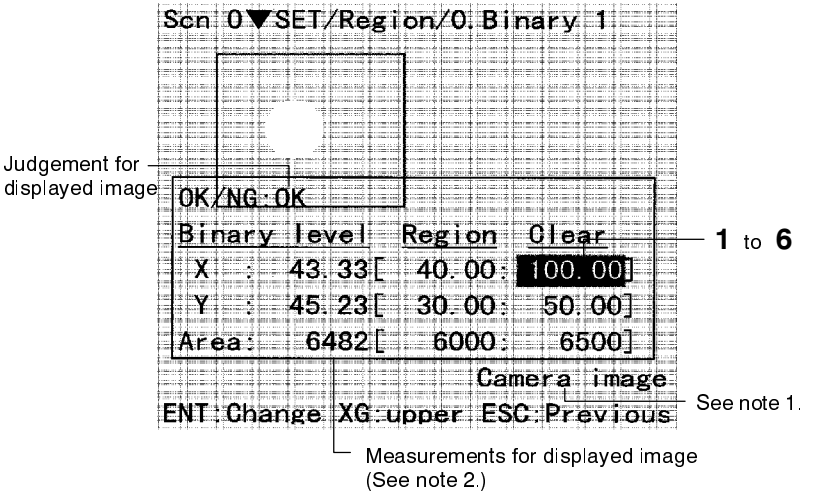
Evaluation criteria are set for the X and Y coordinates of the center of gravity and the area. Set upper and lower limits for an OK result for both the center of gravity and area.

The criteria ranges can be set within the following values:

- X: -999.99 to 999.99
- Y: -999.99 to 999.99
- Area: 0 to 999,999

**Note** If calibration is being used, set the calibration first and then set the criteria.

The following Edit Screen is displayed immediately after the search region is drawn, or when a region where a model is registered is selected.



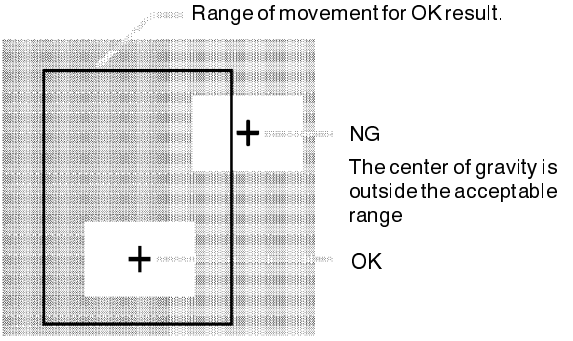

**Note**

1. Press the **SHIFT** + **TRIG** Keys to move to the screen to switch the displayed image. → **p 118**
2. The calibrated values (X, Y) are displayed. Here, X and Y are the coordinates before position displacement compensation is performed. If the measurement for the center of gravity is less that -999.99, the display will shown "-999.99, NG." If the measurement is greater than 999.99, the display will show "999.99, NG." If the measurement for the area is greater than 999,999, the display will show "999,999, NG."

**OK and NG Criteria**

- At **X** and **Y**, set the range of movement for the measurement object that will give an OK result. Movement outside this range will give an NG result.
- At **Area**, set the area range for the measurement object that will give an OK result. Areas outside this range will give an NG result.

The following diagram shows the OK or NG judgements made for the position of the center of gravity.

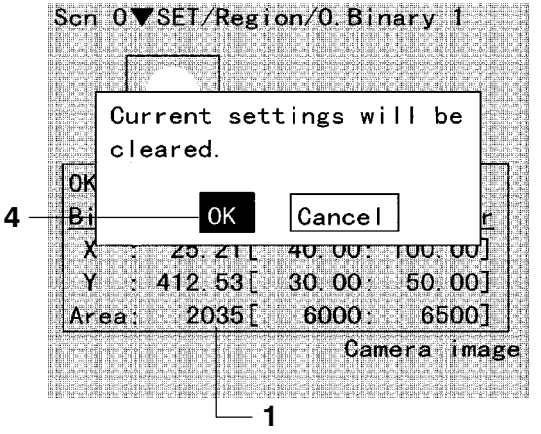



**Procedure**

1. Move the cursor to the upper or lower limit to be changed. The cursor can be moved to items in brackets: [ ].
2. Press the **ENT** Key. A one-digit cursor will appear.
3. Using the **Left** and **Right** Keys, move the cursor to the digit to be changed.
4. Use the **Up** and **Down** Keys to change the value.
5. Press the **ENT** Key. The value will be set.
6. Repeat steps (1) to (5) to change other items.
7. ***Binary level*** or ***Region*** can be selected at this point to change the settings. ***Clear*** can be selected to clear all settings.
8. Press the **ESC** Key to exit the Edit Screen.

## Clearing Settings

This section explains how to clear the settings for the selected region. When the settings are cleared, the region will be deleted and the binary level, upper limit, and lower limit will be returned to the default settings.




**1** Check that the Edit Screen is displayed.

**2** Use the Cursor Keys to move the cursor to ***Clear***.

**3** Press the **ENT** Key. A confirmation message will be displayed.

**4** Using the **Left** and **Right** Keys, move the cursor to ***OK*** and press the **ENT** Key. The settings will be cleared.

## 3-5-3 Binary Axis Angle

Measurement using the binary axis angle is the same as measurement using the binary center of gravity and area method, except that the axis angle is also found. The processing time increases if the axis angle is calculated. Use the binary center of gravity and area method unless finding the axis angle is required by the application.

The following steps must be performed.

**1** Set the binary level used to create a binary image.

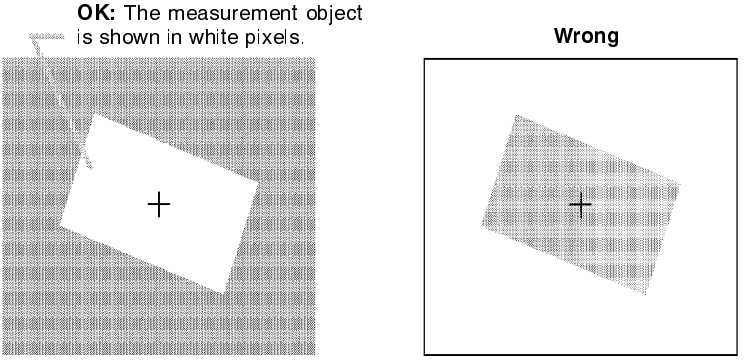
**2** Draw the measurement region.

**3** Set the evaluation criteria for the center of gravity, area, and axis angle.

## Setting the Binary Level

Density images with 256 gradations are read by the Camera. Binary processing involves separating these density images into black pixels (picture elements) (0) and white pixels (1). The F150 uses the white pixels to measure the object.

Adjust the binary level so that the area for which the center of gravity and axis angle are to be calculated is white.

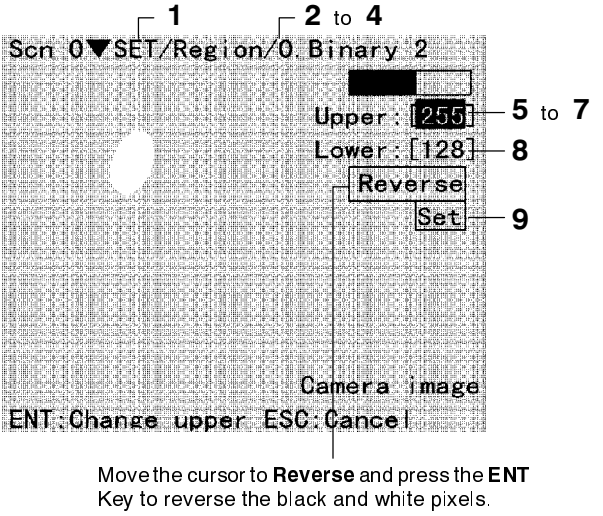



**1** Enter Set mode.

**2** Move the cursor to ***Measurement region/Setting*** and press the **ENT** Key.

**3** Using the **Up** and **Down** Keys, move the cursor to the number of the region to be set and then press the **ENT** Key.

**4** Using the **Up** and **Down** Keys, move the cursor to ***Binary 2***, and then press the **ENT** Key. The following screen will be displayed.




**5** Move the cursor to the upper limit.

**6** Use the **Left** and **Right** Keys to decrement and increment the upper limit.

**or** Press the **ENT** Key. A one-digit cursor will appear. Using the **Left** and **Right** Keys, move the cursor to the digit to be changed. Using the **Up** and **Down** Keys, change the value and set the upper limit.

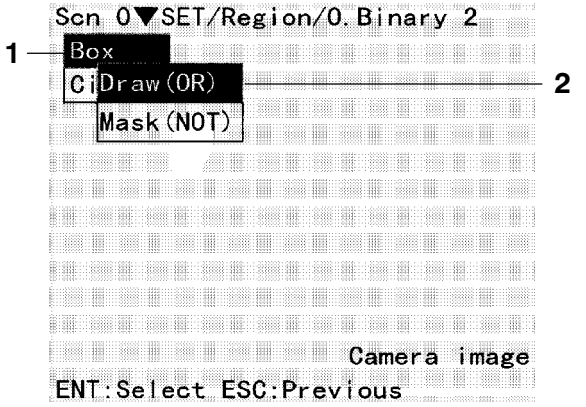
**7** Press the **ENT** Key.

**8** Repeat the previous two steps to change the lower limit.

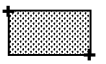
**9** Using the **Up** and **Down** Keys, move the cursor to ***Set*** and press the **ENT** Key. The binary level will be set, and the screen to draw the measurement region will be displayed.

## Drawing the Measurement Region

The screen to draw the measurement region will be displayed immediately after the binary level is set, or when ***Region*** has been selected from the Edit Screen.




The following two figures can be drawn to create the region.

| Figure | | Drawing method |
|---|---|---|
| Box |  | Specify two diagonally opposing corners. |
| Circle |  | Specify the center, then specify a point on the circumference. |

The following two drawing modes can be used to combine the figures that are drawn.

| Drawing mode | Function |
|---|---|
| Draw (OR) | Draws a region as the measurement region. |
| Mask (NOT) | Masks part of the measurement region. |

**1** Using the **Up** and **Down** Keys, move the cursor to select the figure to draw and press the **ENT** Key.

**2** Using the **Up** and **Down** Keys, move the cursor to select either ***Draw (OR)*** or ***Mask (NOT)*** for the drawing mode and press the **ENT** Key. The screen showing the region will be displayed.

**3** Draw the region.

Once the second point is specified, a message will be displayed asking whether or not other figures will be added. Up to 16 figures can be drawn for one region (up to 64 for one scene).

**4** If additional figures are to be drawn, move the cursor to ***Additional drawing*** and press the **ENT** Key. Repeat steps (1) to (3) for each figure.

**5** If the drawing for that region is finished, move the cursor to ***End*** and press the **ENT** Key.

The center of gravity and the axis angle in the region will be registered as the reference position and the Edit Screen will then be displayed.

## Setting the Evaluation Criteria

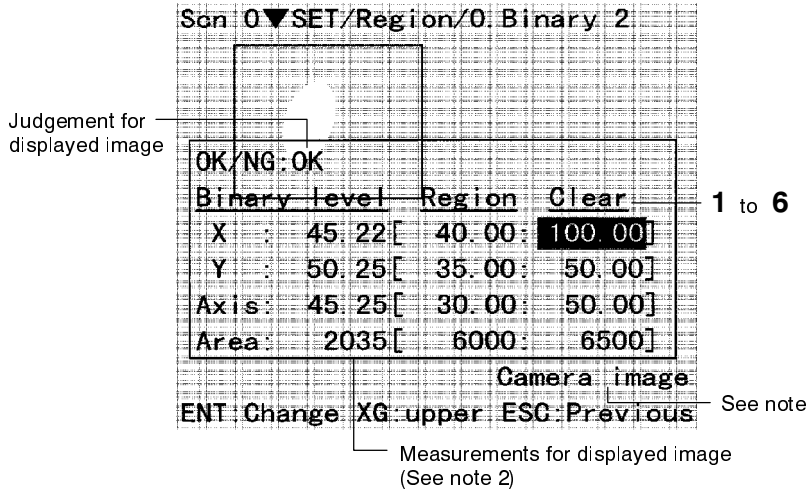
Evaluation criteria are set for the X and Y coordinates of the center of gravity, the area, and the axis angle. Set upper and lower limits for an OK result for the center of gravity, area, and axis angle.

The criteria ranges can be set within the following values:

- X: -999.99 to 999.99
- Y: -999.99 to 999.99
- Area: 0 to 999,999
- Axis angle: -179.99 to 180.00 (Output between 0 and 180.00)

**Note** If calibration is being used, set the calibration first and then set the criteria.

The following Edit Screen is displayed immediately after the search region is drawn, or when a region where a model is registered is selected.



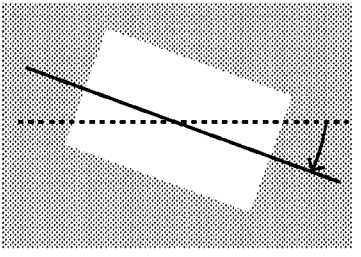

**Note** 1. Press the **SHIFT** + **TRIG** Keys to move to the screen to switch the displayed image. → **p 118**

2. The calibrated values (X, Y) are displayed. Here, X and Y are the coordinates before position displacement compensation is performed. If the measurement for the center of gravity is less that -999.99, the display will show "-999.99, NG." If the measurement is greater than 999.99, the display will show "999.99, NG." If the measurement for the area is greater than 999,999, the display will show "999,999, NG."

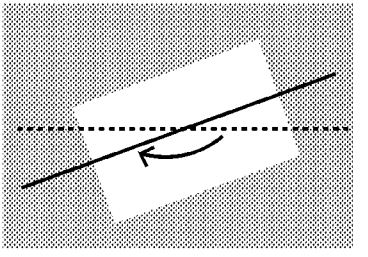
**OK and NG Criteria**

- At **X** and **Y**, set the range of movement for the measurement object that will give an OK result. Movement outside this range will give an NG result.
- At **Area**, set the area range for the measurement object that will give an OK result. Areas outside this range will give an NG result.
- At **Axis**, set the rotational range for the measurement object that will give an OK result. Rotation outside this range will give an NG result.

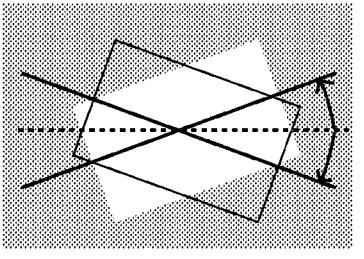
The following diagram shows the OK or NG judgements made for the axis angle.



Axis angle measurement: 10.00



Axis angle measurement: 170.00 (=-10)



Use the following settings for the axis angle criteria to allow rotation within the range shown above.

[ -10.00 : 10.00]

**1** Move the cursor to the upper or lower limit to be changed. The cursor can be moved to items in brackets: [ ].

**2** Press the **ENT** Key. A one-digit cursor will appear.

**3** Using the **Left** and **Right** Keys, move the cursor to the digit to be changed.

**4** Use the **Up** and **Down** Keys to change the value.

**5** Press the **ENT** Key. The value will be set.

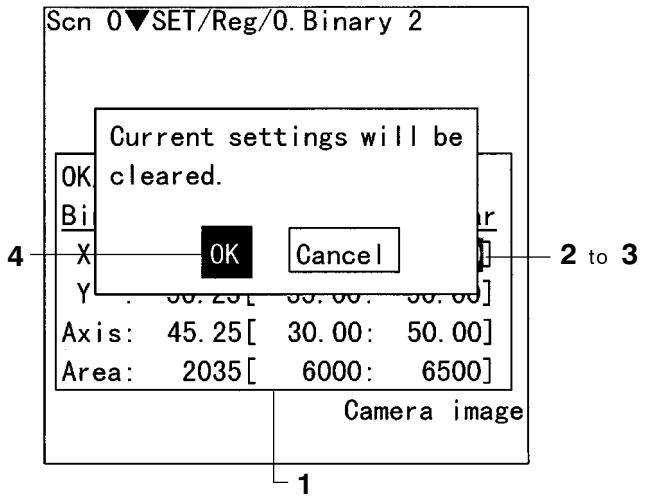
**6** Repeat steps (1) to (5) to change other items.

**7** Select ***Binary level*** or ***Region*** to change the settings. Select ***Clear*** to clear all settings.

**8** Press the **ESC** Key to exit the Edit Screen.

## Clearing Settings

This section explains how to clear the settings for the selected region. When the settings are cleared, the region will be deleted and the binary level, upper limit, and lower limit will be returned to the default settings.




**1** Check that the Edit Screen is displayed.

**2** Use the Cursor Keys to move the cursor to ***Clear***.

**3** Press the **ENT** Key. A confirmation message will be displayed.

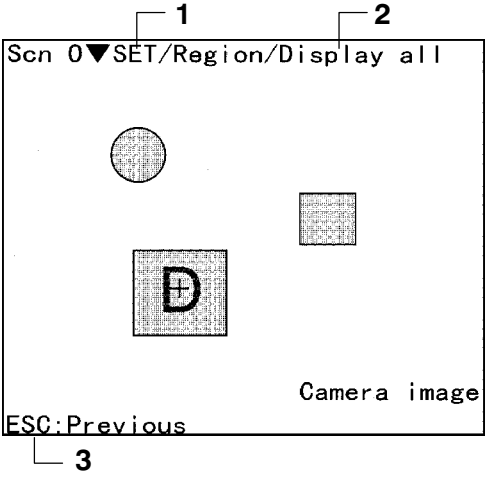
**4** Using the **Left** and **Right** Keys, move the cursor to ***OK*** and press the **ENT** Key. The settings will be cleared.

## 3-5-4 Checking Measurement Conditions

The following procedure can be used to display the data that has been set under ***Measurement region/Setting***. The data cannot be changed at this screen.

**1** Enter Set mode.

**2** Move the cursor to ***Measurement region/Display all*** and press the **ENT** Key. The measurement conditions will be displayed.




**Density Searches:** The registered model will be shown on the display and a cross will appear at the center of the model.

**Binary Center of Gravity and Area:** The drawn region will be displayed.

**Binary Axis Angle:** The drawn region will be displayed.

**3** Press the **ESC** Key to exit this screen.

# 3-6 Settings Outputs

Outputs can be set for the terminal block and the RS-232C port. The top-level menu is shown in the following diagram.

| | |
|---|---|
| DO | Sets outputs on the terminal block. |
| RS-232C | Sets outputs on the RS-232C port. |

## 3-6-1 Terminal Block Outputs

This section describes the procedures to allocate the outputs that will be made from output terminals DO 0 to DO 15 on the terminal block. Judgements are output from the terminal block each time a measurement is made.

Each terminal can be set to output either the results of a equation using the measurement results or to output the results of evaluating regions, as shown in the following table.

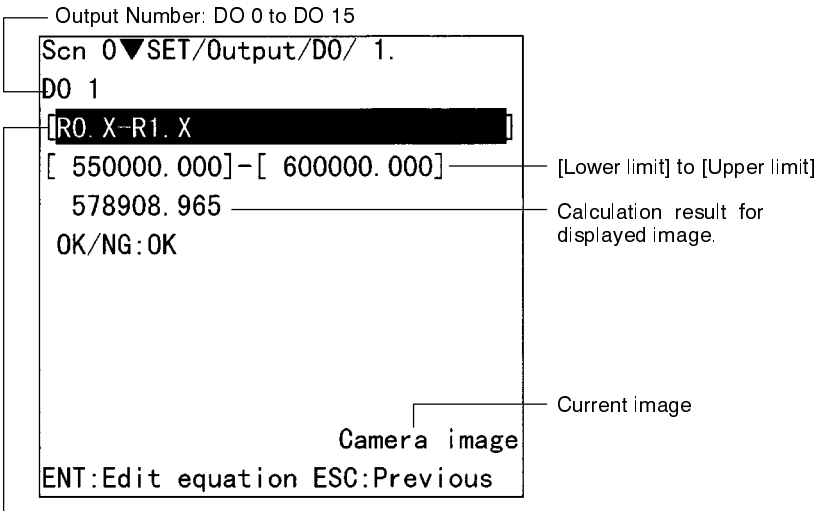
| Allocation | Explanation |
|---|---|
| Equation result | Calculations are performed on measurement results for the regions to create a OK or NG output. Evaluation criteria can be set for the results of the calculations. |
| Region judgement | The judgement from a region is output (using the measurement conditions set for that region). |

**Note** Output format → **p 134**

## Equations

Calculations are performed on measurement results for the regions to create a OK or NG output. Evaluation criteria can be set for the results of the calculations.

**Basic Screen**



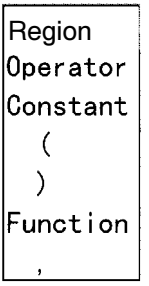

The OK/NG judgement for the equation results and evaluation criteria is output.

The upper and lower limits of the criteria are set at this screen.

### Possible Settings

The items set in the equations are selected using the following menu. The settings possible for each item on this menu are given

in the following tables. The basic procedure for setting an equation is given later in this section.




**Regions**

The regions are displayed as shown in the following table.

| Item | Display |
|---|---|
| Region 0 | Search, Binary 1, or Binary 2 will be displayed. |
| Region 1 | |
| Region 2 | |
| Region 3 | |
| Region 4 | |
| Region 5 | |
| Region 5 | |
| Region 7 | |
| Region 8 | |
| Region 9 | |
| Region 10 | |
| Region 11 | |
| Region 12 | |
| Region 13 | |
| Region 14 | |
| Region 15 | |

Once the region number has been selected, the screen for selecting the measurement item will be displayed.

**Measurement Items**

The following items can be used in equations.

| Item | | Display | Explanation |
|---|---|---|---|
| Search | Measured position X | X | X coordinate of found model |
| | Measured position Y | Y | Y coordinate of found model |
| | Reference position X | RX | X coordinate of registered model |
| | Reference position Y | RY | Y coordinate of registered model |
| | Difference in X | DX | Difference between reference and measured X coordinate |
| | Difference in Y | DY | Difference between reference and measured Y coordinate |
| | Correlation | CR | Correlation with model |
| Binary center of gravity | Center of gravity X | X | X coordinate of measured center of gravity |
| | Center of gravity Y | Y | Y coordinate of measured center of gravity |
| | Area | AR | Area of measurement result |
| Binary axis angle | Center of gravity X | X | X coordinate of measured center of gravity |
| | Center of gravity Y | Y | Y coordinate of measured center of gravity |
| | Axis angle | TH | Axis angle of measurement result |
| | Area | AR | Area of the measurement result |

**Constants**

0 to 9,999.999

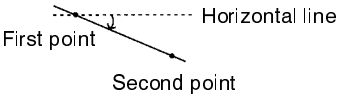
**Math Operations**

The following basic math operations can be used in equations.

| Symbol | Meaning |
|---|---|
| + | Addition |
| - | Subtraction |
| * | Multiplication |
| / | Division |

**Functions**

The following functions can be used in equations.

| Function | Meaning | Arguments |
|---|---|---|
| DIST | Calculates the distance between two points, such as the center of gravity or the center of the model.<br>DIST(*X coordinate of first point, Y coordinate of first point, X coordinate of second point, Y coordinate of second point*)<br>• Example:<br>Set the following to calculate the distance between the center of gravity for region 0 and center of gravity for region 1.<br>DIST(R0.X,R0.Y,R1.X,R1.Y)<br>• The following calculation is performed internally.<br>$\sqrt{(R1.X-R0.X)^2+(R1.Y-R0.Y)^2}$ | 4 |
| ANGL | Calculates the angle between two straight lines joining two points, such as the center of gravity or the center of a model.<br>The angle from a horizontal line is calculated. The result will be in the range of -180° and 180°.<br>  <br><br>ANGL(*Y component, X component*)<br>• Example:<br>Set the following to calculate the angle between straight lines joining the center of gravity for region 0 and the center of gravity for region 1.<br>ANGL(R1.Y-R0.Y,R1.X-R0.X)<br>If both arguments are 0, the result will also be 0 and the judgement will be NG. | 2 |
| SQRT | Calculates the square root. If the argument is negative, the calculation result will be 0 and the judgement will be NG.<br>SQRT(*argument*) | 1 |
| MAX | Gives the larger of two arguments.<br>MAX(*argument 1, argument 2*) | 2 |
| MIN | Gives the smaller of two arguments.<br>MIN(*argument 1,argument 2*) | 2 |

| Function | Meaning | Argu-ments |
|---|---|---|
| ABS | Gives the absolute value.<br>ABS(*argument*) | 1 |
| ATN2 | Calculates the arc tangent for the Y component/X component. The result is given as a radian of $-\pi$ to $\pi$.<br>ATN2(*Y component, X component*)<br>• Example:<br>Set the following to calculate the angle between a straight line joining the center of gravity for region 0 and the center of gravity for region 1 and a horizontal line.<br>ATN2(R1.Y-R0.Y,R1.X-R0.X)<br>If both arguments are 0, the calculation result will also be 0 and the judgement will be NG. | 2 |

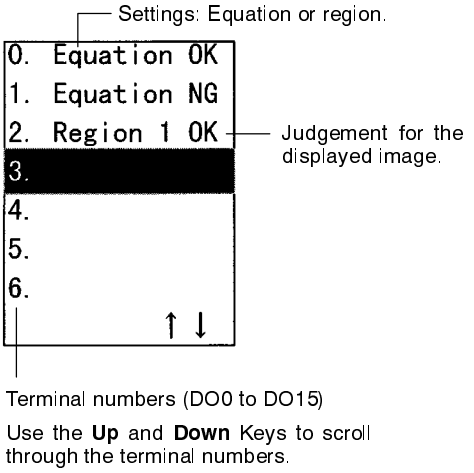
### Setting Equations

Use the following procedure to set the items to be used in the equation.

**1** Enter Set mode.

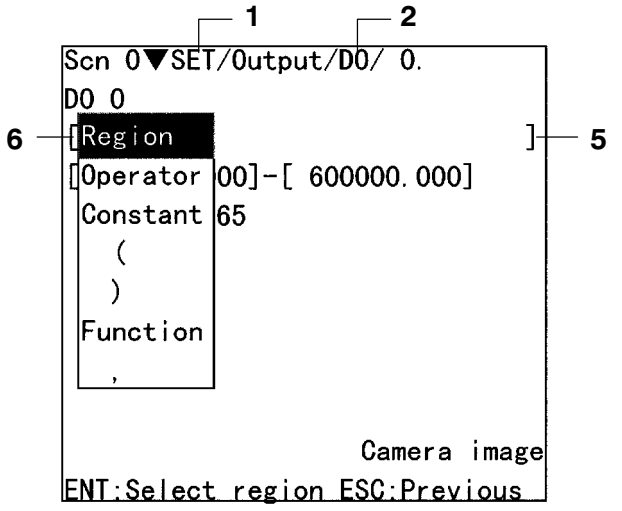
**2** Move the cursor to ***Output settings/D0*** and press the **ENT** Key. The screen displaying terminal numbers will be displayed.

**3** Move the cursor to the terminal number to be set and press the **ENT** Key. The screen for selecting either an equation or a region judgement will be displayed. An example screen is shown below.



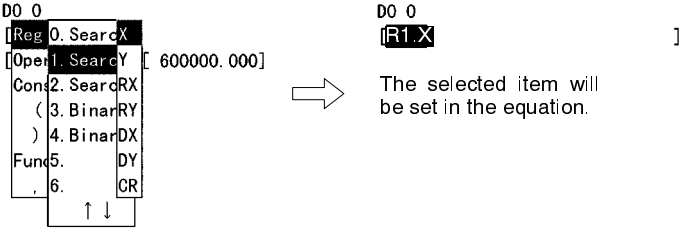

**4** Move the cursor to ***Equation*** and press the **ENT** Key.

**5** Be sure that the cursor is within the brackets [ ] and press the **ENT** Key. The following screen will be displayed.




**6** Move the cursor to the item to be set and press the **ENT** Key.

Example




**7** To set the next item, move the cursor using the **Right** Key, press the **ENT** Key, and repeat step (6).

Example:

```
DO 0
[R1.X                    ]
```

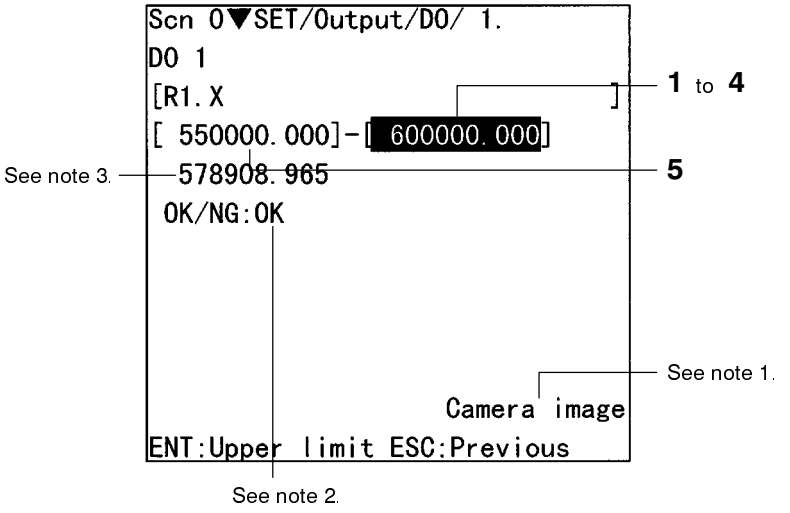
**8** Once all the items have been set in the equations, press the **ESC** Key. The equation will be set.

Example:

```
DO 0
[R1.X-R2.X                ]
```

### Setting Evaluation Criteria for the Calculation Result

Criteria are set to evaluate the calculation result as either OK or NG. Set the minimum and maximum values for the OK range as the criteria. The values can be set between -999,999.999 and 999,999.999.




**Note**

1. Press the **SHIFT** + **TRIG** Keys to display the screen to switch the displayed image. → **p 118**
2. This is the judgement for the displayed image.
3. This is the calculation result for the displayed image. The calculation is performed after the measurement for each region has been calibrated.
   If the calculated value is less than -999,999.999, the output will be "-999,999.999, NG".
   If the calculated value is greater than 999,999.999, the output will be "999,999.999, NG."

**Procedure**

**1** Using the **Up** and **Down** Keys, move the cursor to the upper limit and press the **ENT** Key. A one-digit cursor will appear.

**2** Using the **Left** and **Right** Keys, move the cursor to the digit to be changed.

**3** Using the **Up** and **Down** Keys, change the value.

**4** Press the **ENT** Key. The value will be set.

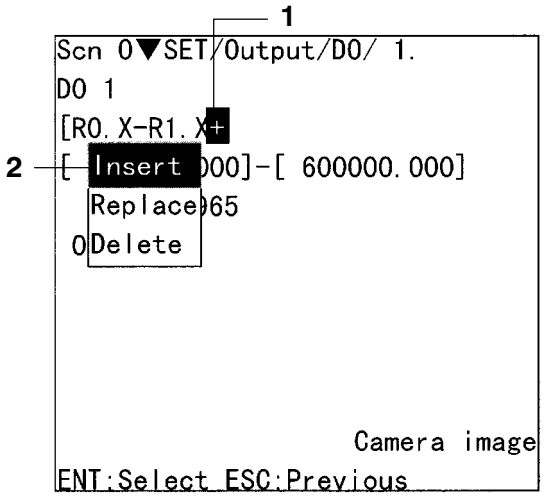
**5** Use the same procedure to change the lower limit.

**6** Press the **ESC** Key to return to the screen where the terminal number can be selected.

**Note** Several acceptable and unacceptable product images can be registered as samples, and the evaluation criteria can be set using the measurements from those samples.

**Editing Equations**

Each item in the equation can be edited or deleted, and new items can be added.




**1** Using the **Left** and **Right** Keys, move the cursor to the item to be edited and press the **ENT** Key. A following list of options will be displayed: Insert, Replace, and Delete

**2** Using the **Up** and **Down** Keys, move to the desired option and press the **ENT** Key.

- If ***Insert*** is selected, the screen to select equation items will be displayed. Select an item to insert it at the cursor position.
- If ***Replace*** is selected, the screen to select the equation items will be displayed. Select an item to replace the item at the cursor position.
- If you select ***Delete***, the item at the cursor position will be deleted. The next item will move up one position.

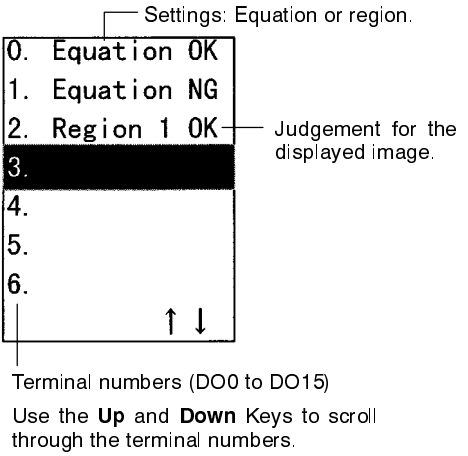
## Region Judgement

This section explains how to output the judgement for a region to a terminal (DO 0 to DO 15) by allocating that region to the terminal.

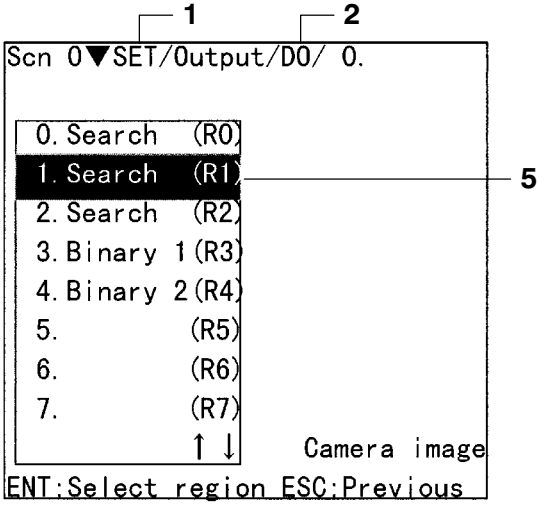
**1** Enter Set mode.

**2** Move the cursor to ***Output settings/D0*** and press the **ENT** Key.

**3** Move the cursor to the terminal number to be set and press the **ENT** Key. The screen for selecting either an equation or a region judgement will be displayed. An example screen is shown below.



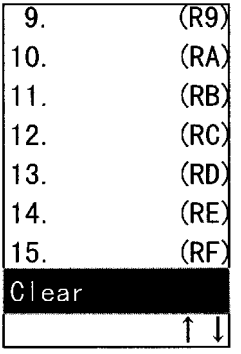

**4** Move the cursor to ***Region*** and press the **ENT** Key. The following screen will be displayed.



**5** Using the **Up** and **Down** Keys, move the cursor to the region for which the judgement is to be output and press the **ENT** Key. The terminal number selected in step (3) will be set.

**Clearing Settings**

**1** Use the **Down** Key to scroll down the region numbers.

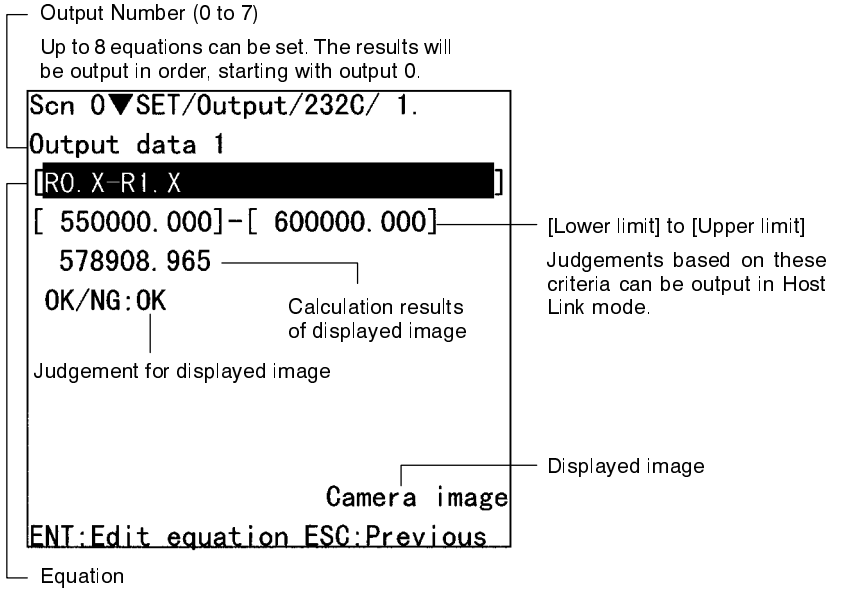



**2** Move the cursor to **Clear** and press the **ENT** Key. The settings will be cleared.

## 3-6-2 RS-232C Outputs

This section explains how to set the output of measurement results via the RS-232C port.

The set measurement results will be output each time a measurement is performed.




The following items can be output via the RS-232C port.

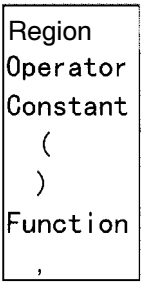
| Communications mode | Results from Equations | Judgements (OK/NG) |
|---|---|---|
| Normal | Yes | No |
| Host Link | Yes | Yes |
| Menu operation* | Yes | No |

**Note** Outputs for menu operation mode communications are in Normal mode.

**Note**
1. Normal Output Format → **p 165**
2. Host Link Output Format → **p 206**

**Possible Settings**

The items set in the equations are selected using the following menu. The settings possible for each item on this menu are given in the following tables. The basic procedure for setting an equation is given later in this section.




**Regions**

The regions are displayed as shown in the following table.

| Item | Display |
|---|---|
| Region 0 | Search, Binary 1, or Binary 2 will be displayed. |
| Region 1 | |
| Region 2 | |
| Region 3 | |
| Region 4 | |
| Region 5 | |
| Region 5 | |
| Region 7 | |
| Region 8 | |
| Region 9 | |
| Region 10 | |
| Region 11 | |
| Region 12 | |
| Region 13 | |
| Region 14 | |
| Region 15 | |

Once the region number has been selected, the screen for selecting the measurement item will be displayed.

**Measurement Items**

The following items can be used in equations.

| Item | | Display | Explanation |
|---|---|---|---|
| Search | Measured position X | X | X coordinate of found model |
| | Measured position Y | Y | Y coordinate of found model |
| | Reference position X | RX | X coordinate of registered model |
| | Reference position Y | RY | Y coordinate of registered model |
| | Difference in X | DX | Difference between reference and measured X coordinate |
| | Difference in Y | DY | Difference between reference and measured Y coordinate |
| | Correlation | CR | Correlation with model |
| Binary center of gravity | Center of gravity X | X | X coordinate of measured center of gravity |
| | Center of gravity Y | Y | Y coordinate of measured center of gravity |
| | Area | AR | Area of measurement result |
| Binary axis angle | Center of gravity X | X | X coordinate of measured center of gravity |
| | Center of gravity Y | Y | Y coordinate of measured center of gravity |
| | Axis angle | TH | Axis angle of measurement result |
| | Area | AR | Area of the measurement result |

**Constants**

0 to 9,999.999

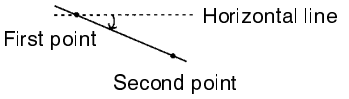
**Math Operations**

The following basic math operations can be used in equations.

| Symbol | Meaning |
|---|---|
| + | Addition |
| - | Subtraction |
| * | Multiplication |
| / | Division |

**Functions**

The following functions can be used in equations.

| Function | Meaning | Arguments |
|---|---|---|
| DIST | Calculates the distance between two points, such as the center of gravity or the center of the model.<br>DIST(*X coordinate of first point, Y coordinate of first point, X coordinate of second point, Y coordinate of second point*)<br>• Example:<br>Set the following to calculate the distance between the center of gravity for region 0 and center of gravity for region 1.<br>DIST(R0.X,R0.Y,R1.X,R1.Y)<br>• The following calculation is performed internally.<br>$\sqrt{(R1.X-R0.X)^2+(R1.Y-R0.Y)^{-2}}$ | 4 |
| ANGL | Calculates the angle between two straight lines joining two points, such as the center of gravity or the center of a model.<br>The angle from a horizontal line is calculated. The result will be in the range of -180° and 180°.<br>  <br><br>ANGL(*Y component, X component*)<br>• Example:<br>Set the following to calculate the angle between straight lines joining the center of gravity for region 0 and the center of gravity for region 1.<br>ANGL(R1.Y-R0.Y,R1.X-R0.X)<br>If both arguments are 0, the result will also be 0 and the judgement will be NG. | 2 |
| SQRT | Calculates the square root. If the argument is negative, the calculation result will be 0 and the judgement will be NG.<br>SQRT(*argument*) | 1 |
| MAX | Gives the larger of two arguments.<br>MAX(*argument 1, argument 2*) | 2 |
| MIN | Gives the smaller of two arguments.<br>MIN(*argument 1,argument 2*) | 2 |

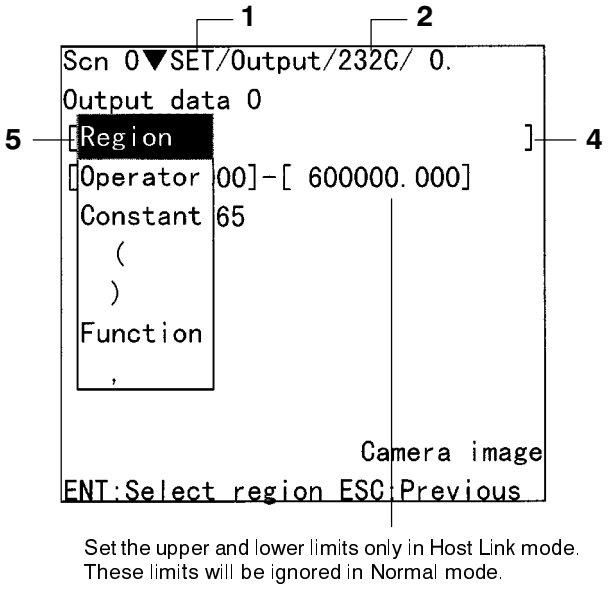
| Function | Meaning | Arguments |
|---|---|---|
| ABS | Gives the absolute value.<br>ABS(*argument*) | 1 |
| ATN2 | Calculates the arc tangent for the Y component/X component. The result is given as a radian of $-\pi$ to $\pi$.<br>ATN2(*Y component, X component*)<br>• Example:<br>Set the following to calculate the angle between a straight line joining the center of gravity for region 0 and the center of gravity for region 1 and a horizontal line.<br>ATN2(R1.Y-R0.Y,R1.X-R0.X)<br>If both arguments are 0, the calculation result will also be 0 and the judgement will be NG. | 2 |

### Setting Equations

Use the following procedure to set the items to be used in the equation.

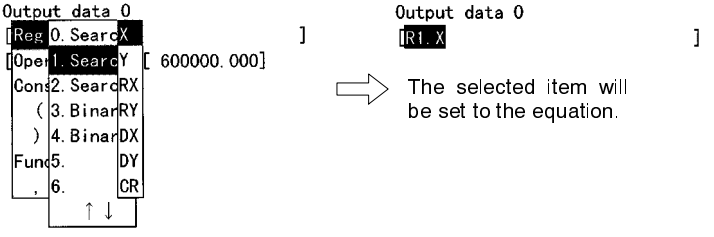
1. Enter Set mode.
2. Move the cursor to ***Output settings/RS-232C***. The screen for selecting the output order will be displayed.
3. Move the cursor to the terminal number for which the equation is to be set and press the **ENT** Key.

**4** Check the cursor is within the brackets [] and press the **ENT** Key. The following screen will be displayed.




**5** Move the cursor to the item to be set and press the **ENT** Key.

Example




**6** To set the next item, move the cursor using the **Right** Key, press the **ENT** Key, and repeat step (5).

Example:

**7** Once all the items have been set in the equations, press the **ESC** Key. The equation will be set.

Example:


**8** Press the **ESC** Key to return to the screen for selecting the output order.

**Note** 1. Setting the Evaluation Criteria in Host Link Mode. → **p 92**

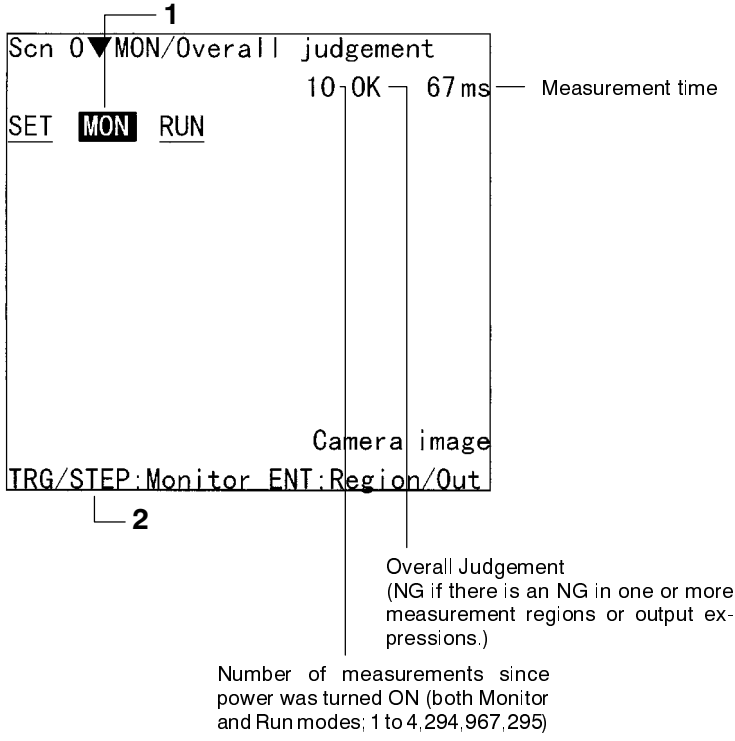
2. Editing the Set Equation. → **p 93**

# 3-7 Monitor Mode

## 3-7-1 Checking Measurements

This section explains how to check if measurements are being correctly performed using the set measurement conditions. Measurements are performed using the conditions set for the displayed image.

The measurement results cannot be output to an external device, but the results can be confirmed on-screen.




**1** Move the cursor to ***MON*** and press the **ENT** Key.
The F150 will now be in Monitor mode.

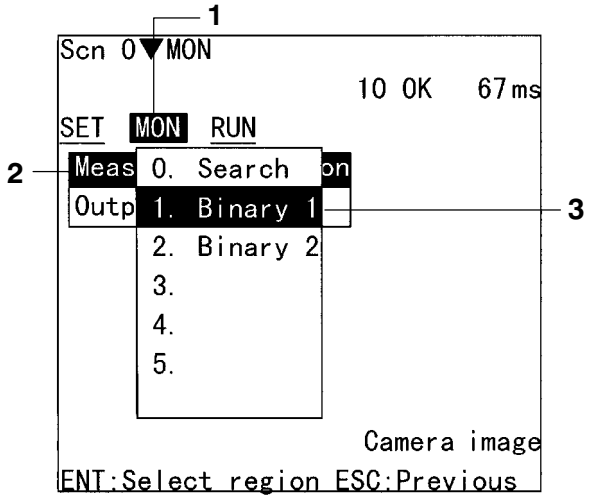
Monitor mode will automatically be entered when Set mode is exited.

**2** Press the **TRIG** Key on the Console, or enter the STEP signal. A measurement will be performed.

**Note** Checking Measurements for Each Region → **p 104**
Checking Measurements for Each Output Expression → **p 105**

## 3-7-2 Adjusting Criteria for Measurement Regions

The evaluation criteria can be adjusted while referring to measurement results in Monitor mode.



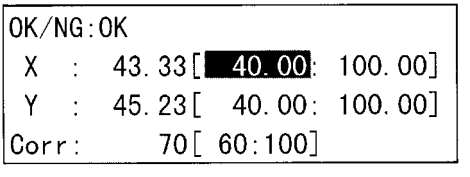

**1** Check that Monitor mode is selected and press the **ENT** Key. A screen to select **Measurement region** or **Output settings** will be displayed.

**2** Move the cursor to **Measurement region** and press the **ENT** Key.

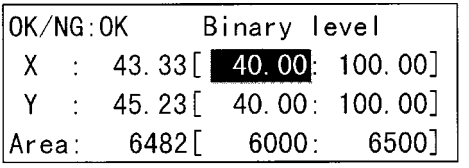
**3** Move the cursor to the region to be adjusted and press the **ENT** Key. The screen to set evaluation criteria will be displayed.

**4** Adjust the settings.
The measurement values and judgement can be checked for each region if the STEP signal is input or the **TRIG** Key pressed while this screen is displayed.

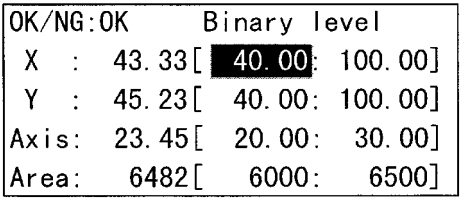
**Density Search Regions:** The evaluation criteria for X and Y correlations can be changed.



**Binary Center of Gravity and Area Regions:** The evaluation criteria for the binary level, X, Y, and area can be changed.




**Binary Axis Angle Regions:** The evaluation criteria for the binary level, X, Y, area and the axis angle can be changed.



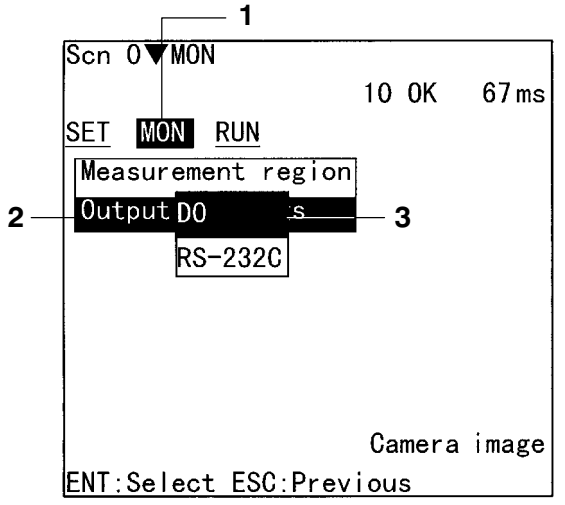

**Note**

1. Measurement results will be for the displayed image. Press the **SHIFT** + **TRIG** Keys to switch the image.
2. If a measurement command is input, measurements will be performed in the background even if the camera image is not displayed.

## 3-7-3 Adjusting Criteria for Output Expressions

The evaluation criteria for each output expression can be adjusted while referring to measurements in Monitor mode. Only the evaluation criteria can be changed. The output expressions cannot be changed.

**Note** Measurements can be performed even while the evaluation criteria are being set by inputting the STEP signal or pressing the **TRIG** Key. This is useful for adjusting the evaluation criteria without stopping assembly line operation.



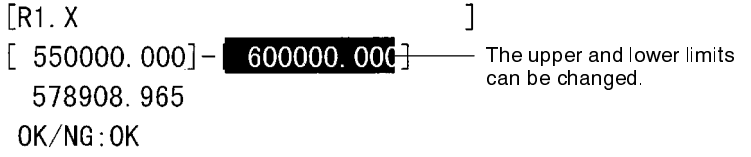

**1** Check that Monitor mode is selected and press the **ENT** Key. A screen to select ***Measurement region*** or ***Output settings*** will be displayed.

**2** Move the cursor to ***Output settings*** and press the **ENT** Key.

**3** Select either ***D0*** or ***RS-232C***. The output numbers will be displayed.

**4** Move the cursor to the output number to be adjusted and press the **ENT** Key. The screen for setting the evaluation criteria will be displayed.

**5** Adjust the settings.
The measurement results and judgements for each output expression can be checked if the STEP signal is input or the **TRIG** Key is pressed while this screen is displayed.




**Note** 1. Measurement results will be for the displayed image. Press the **SHIFT** + **TRIG** Keys to switch the image.

2. If a measurement command is input, measurements will be performed in the background even if the camera image is not displayed.

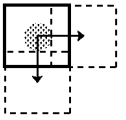
## 3-7-4 Changing Search Intervals and Levels

The search interval and level can be changed when performing density search measurements or position displacement compensation.

When a model is registered, the F150 automatically determines and sets the most appropriate search interval and level. The settings may differ even for similar images due to differences in the registered position or quality of the images.

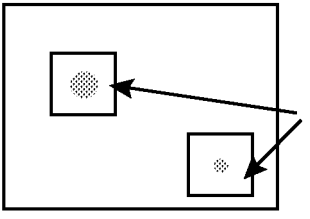
The search interval and level affect processing time. To maintain uniform processing times, use the same search interval and level settings when registering models. The search interval and level will be overwritten when a model is registered.

**Search Interval**



Set the number of pixels to shift while searching.

**Search Level**



Points with a correlation higher than the search level will be detected as candidates.

**Settings and Processing Time**

| Setting | | Processing Time | Accuracy | No. of Candidates |
|---|---|---|---|---|
| Search interval | Large | Short | Low | --- |
| | Small | Long | High | --- |
| Search level | High | Short | --- | Few |
| | Low | Long | --- | Many |

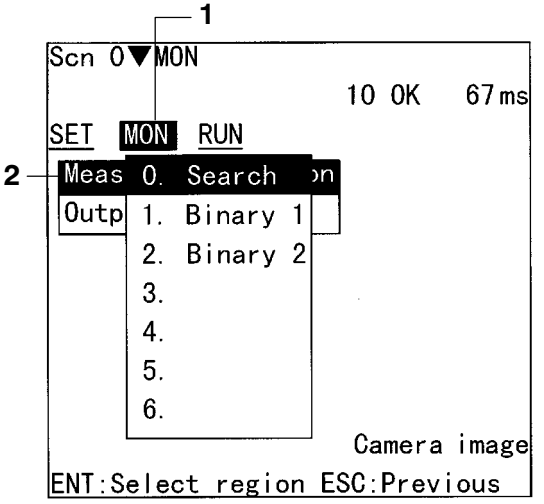
A larger search interval reduces the processing time, but it reduces the search accuracy. The mark may not be found if the interval is too large.

After changing the settings, perform actual measurements and check that the mark can be found dependably.

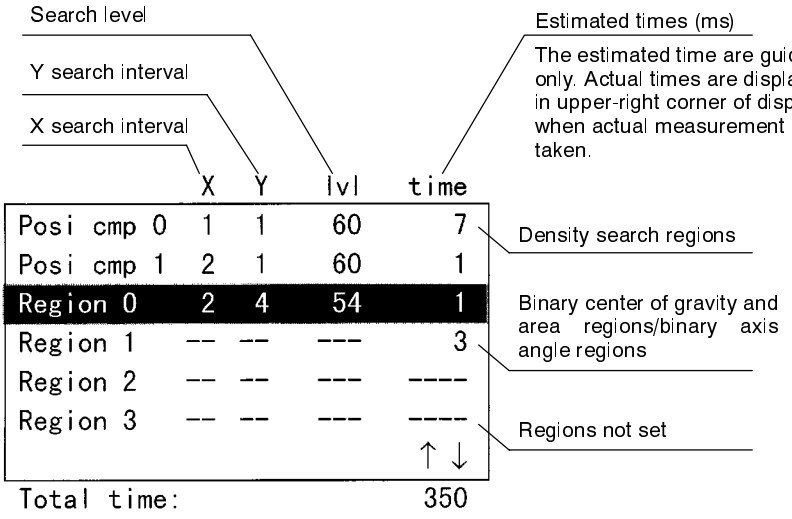
**Procedure**

**1** Check that Monitor mode is selected and press the **ENT** Key.
The screen to select either ***Measurement region*** or ***Output settings*** will be displayed.

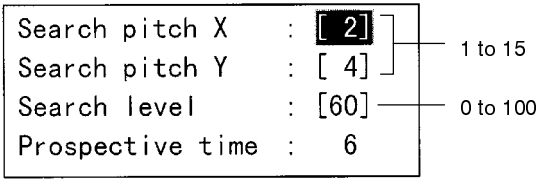
**2** Move the cursor to ***Measurement region*** and press the **ENT** Key. The following screen will be displayed.



**3** Press the **SHIFT** + **ESC** Keys. A list of regions will be displayed. Only density search regions can be selected.




**4** Move the cursor to the region for which the settings are to be changed. Press the **ENT** Key.
The screen where the search interval and level can be changed will be displayed.




**5** Change the settings.

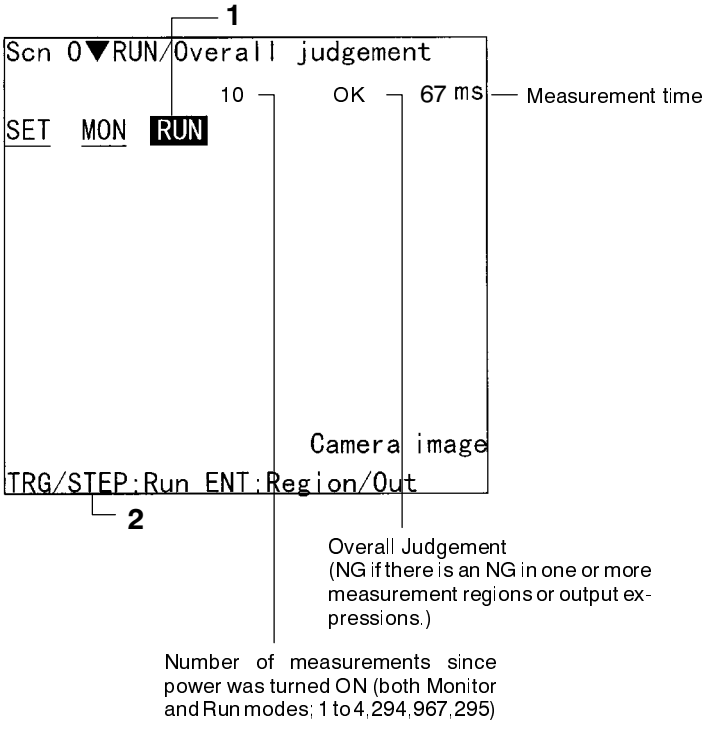
**6** Press the **ESC** Key to exit this screen.

# 3-8 Run Mode

## 3-8-1 Measuring

Measurements are performed according to the conditions set for the current scene.

The measurement results will also be output to an external device.




**Procedure**

**1** Move the cursor to **Run** and press the **ENT** Key. The F150 will be in Monitor mode.

**2** Press the **TRIG** Key on the Console or input the STEP signal. The measurements will be performed and the measurement results will be output to an external device.

**Input Commands**

Various commands can be input from an external device, in addition to the trigger and STEP signal.

Via the Terminal Block → **p 134**

Via the RS-232C Port, Normal Communications → **p 165**

Via the RS-232C Port, Host Link Communications → **p 178**

**Output Formats**

Via the Terminal Block → **p 134**

Via the RS-232C Port, Normal Communications → **p 165**

Via the RS-232C Port, Host Link Communications → **p 206**

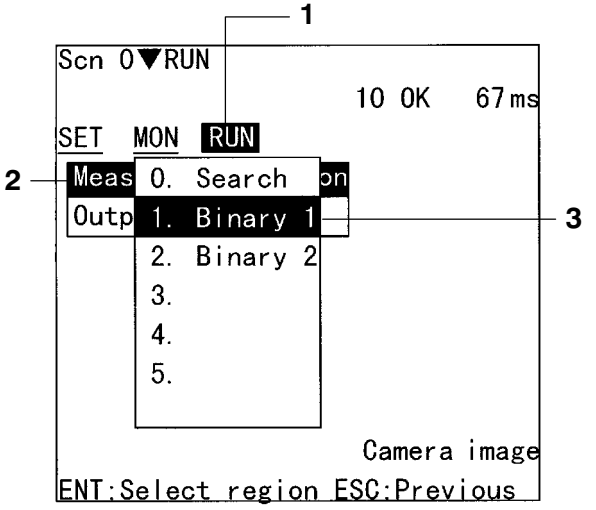
**Note** Checking Measurements for Each Region → **p 111**
Checking Measurements for Each Output Expressions → **p 112**

**⚠ Caution** The lighting will become progressively darker if used for long periods. Make periodic adjustments to the evaluation criteria. The lighting will lose approximately 20% illumination after 1,500 hours of use.

## 3-8-2 Adjusting Criteria for Measurement Regions

The evaluation criteria can be adjusted while referring to the measurement results in Run mode.

**Note** Measurements can be performed even while the evaluation criteria are being set by inputting the STEP signal or pressing the **TRIG** Key. This is useful for adjusting the evaluation criteria without stopping line operation.



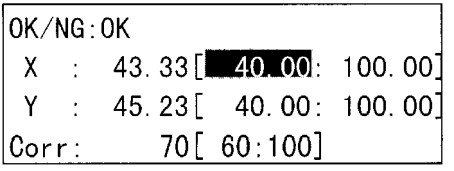

**1** Check that Run mode is selected and press the **ENT** Key. The screen for selecting either ***Measurement region*** or ***Output settings*** will be displayed.

**2** Move the cursor to ***Measurement region*** and press the **ENT** Key.

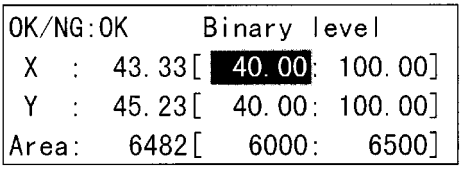
**3** Move the cursor to the region to be adjusted and press the **ENT** Key. The screen to set the evaluation criteria will be displayed.

**4** Adjust the settings.
The measurement results and judgements can be checked for each region if the STEP signal is input or the **TRIG** Key pressed while this screen is displayed.

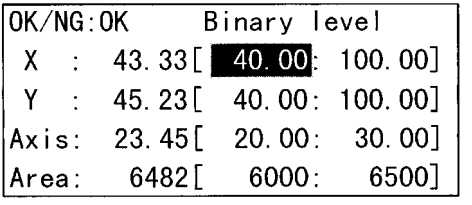
**Density Search Regions:** The evaluation criteria for X and Y correlations can be changed.




**Binary Center of Gravity and Area Regions:** The evaluation criteria for the binary level, X, Y, and area can be changed.




**Binary Axis Angle Regions:** The evaluation criteria for the binary level, X, Y, area and the axis angle can be changed.

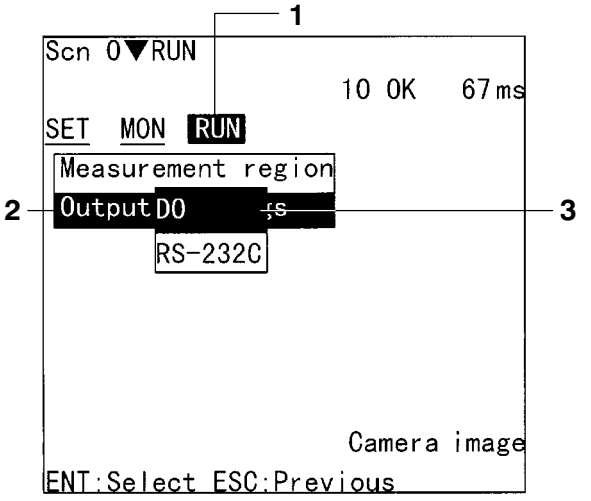



**Note**
1. Measurement results will be for the displayed image. Press the **SHIFT** + **TRIG** Keys to switch the image.
2. If a measurement command is input, measurements will be performed in the background even if the camera image is not displayed.

## 3-8-3 Adjusting Criteria for Output Expressions

The evaluation criteria for each output expression can be adjusted while referring to measurements in Run mode. Only the evaluation criteria can be changed. The output expressions cannot be changed.

**Note** Measurements can be performed even while the evaluation criteria are being set by inputting the STEP signal or pressing the **TRIG** Key. This is useful for adjusting the evaluation criteria without stopping assembly line operation.



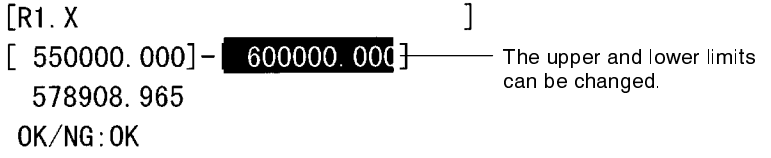

**1** Check that Run mode is selected and press the **ENT** Key. The screen to select ***Measurement region*** or ***Output settings*** will be displayed.

**2** Move the cursor to ***Output settings*** and press the **ENT** Key.

**3** Select either ***D0*** or ***RS-232C***. The output numbers will be displayed.

**4** Move the cursor to the output number to be adjusted and press the **ENT** Key. The screen for setting the evaluation criteria will be displayed.

**5** Adjust the settings.
The measurement results and judgements for each output expression can be checked if the STEP signal is input or the **TRIG** Key is pressed while this screen is displayed.




**Note** 1. Measurements results will be for the displayed image. Press the **SHIFT** + **TRIG** Keys to switch the image.

2. If a measurement command is input, measurements will be performed in the background even if the camera image is not displayed.

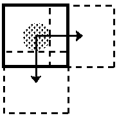
## 3-8-4 Changing Search Intervals and Levels

The search interval and level can be changed when performing density search measurements or position displacement compensation.

When a model is registered, the F150 automatically determines and sets the most appropriate search interval and level. The settings may differ even for similar images due to differences in the registered position or quality of the images.

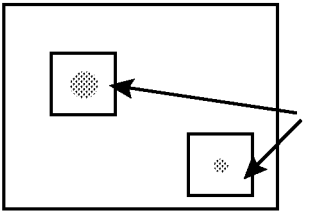
The search interval and level affect processing time. To maintain uniform processing times, use the same search interval and level settings when registering models. The search interval and level will be overwritten when a model is registered.

**Search Interval**



Set the number of pixels to shift while searching.

**Search Level**



Points with a correlation higher than the search level will be detected as candidates.

**Settings and Processing Time**

| Setting | | Processing Time | Accuracy | No. of Candidates |
|---|---|---|---|---|
| Search interval | Large | Short | Low | --- |
| | Small | Long | High | --- |
| Search level | High | Short | --- | Few |
| | Low | Long | --- | Many |

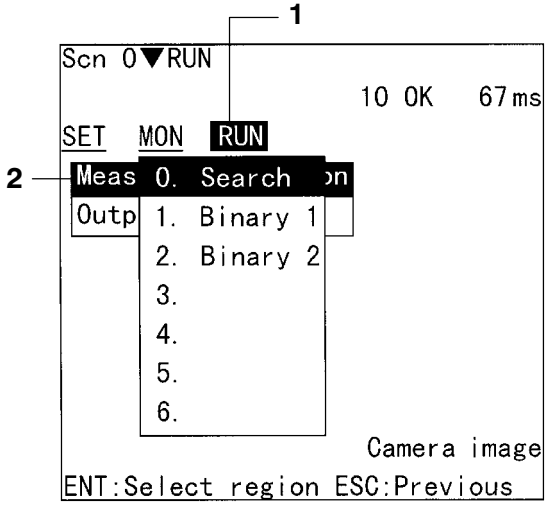
A larger search interval reduces the processing time, but it reduces the search accuracy. The mark may not be found if the interval is too large.

After changing the settings, perform actual measurements and check that the mark can be found dependably.

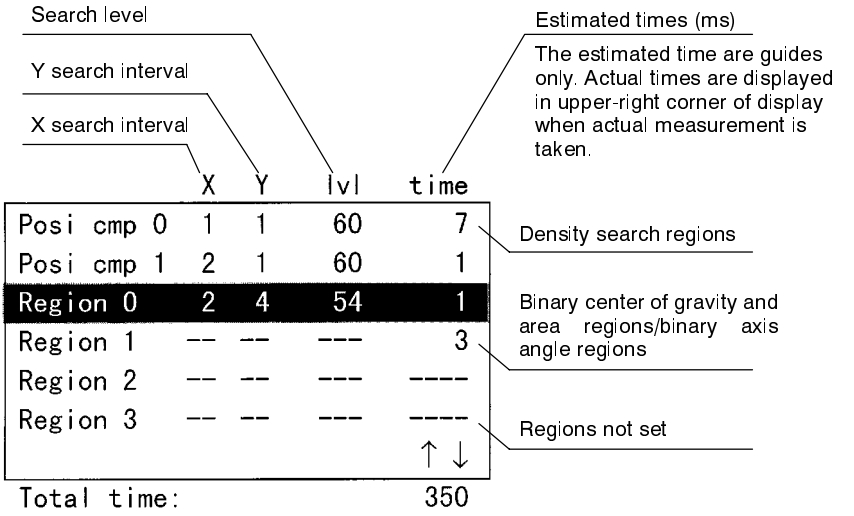
**Procedure**

**1** Check that Monitor mode is selected and press the **ENT** Key.
The screen to select either ***Measurement region*** or ***Output settings*** will be displayed.

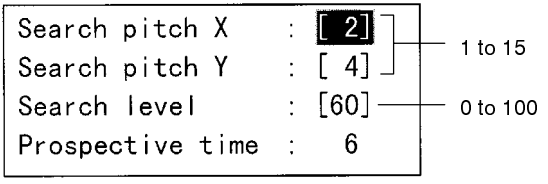
**2** Move the cursor to ***Measurement region*** and press the **ENT** Key. The following screen will be displayed.



**3** Press the **SHIFT** + **ESC** Keys. A list of regions will be displayed. Only density search regions can be selected.




**4** Move the cursor to the region for which the settings are to be changed. Press the **ENT** Key.
The screen where the search interval and level can be changed will be displayed.




**5** Change the settings.

**6** Press the **ESC** Key to exit this screen.

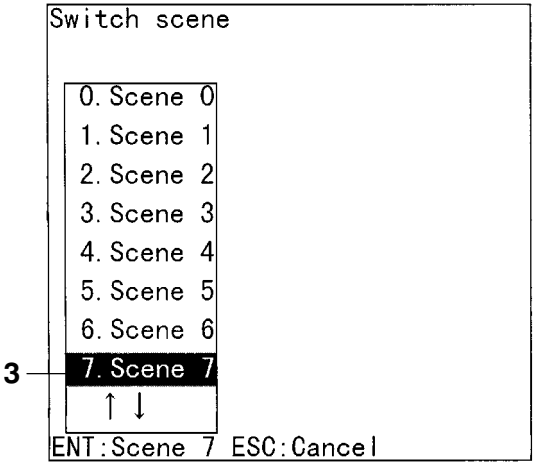
## 3-9 Changing Scenes

All the settings for measurement conditions are input under "scenes." Up to 16 scenes can be set, numbered from 0 to 15. Scenes can be changed to switch between different measurement conditions for different measurement setups or measurement objects. Scene 0 will be displayed by default when the power is turned ON.

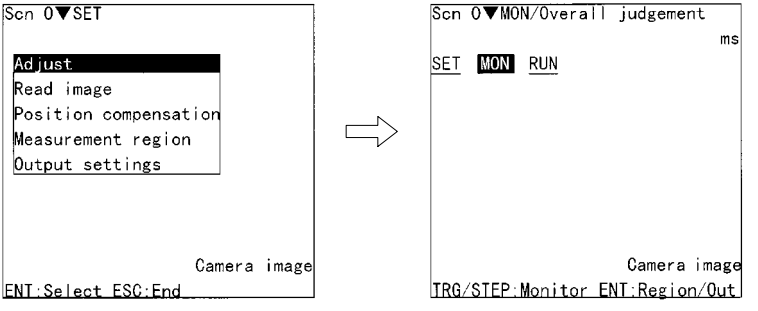
Use the following procedure to change from one scene to another.

**Note**
1. The mode will remain the same after the scene is changed.
2. The scene can be changed by inputting a command from the terminal block. → **p 134**
3. To clear scenes, select ***OK*** on the confirmation message that appears when you enter Set mode.

⚠ **Caution** All images stored in memory will be cleared when the scene is changed. Back up any images to be kept on a computer before changing scenes. → **p 126**




**1** Move to the Basic Screen (where you can change between the three modes).
You cannot move the cursor to ***Scene***▼ when in the menu tree shown below. Press the **ESC** Key to move to the Basic Screen.



If the settings have been changed, a confirmation message will be displayed. Save any required settings to flash memory before moving to the Basic Screen.

**2** Move the cursor to ***Scene 0***▼ and press the **ENT** Key. A list of scenes, from scene 0 to scene 7, will be displayed. Use the **Down** Key to scroll down and display the rest of the list, from scene 8 to scene 15.

**3** Using the **Up** and **Down** Keys, move the cursor to the desired scene and press the **ENT** Key. The selected scene will be displayed.

## 3-10 Displaying Memory Images

The image displayed on the monitor can be changed by pressing the **SHIFT** + **TRIG** Keys from any menu level. Up to 23 images are stored in memory.

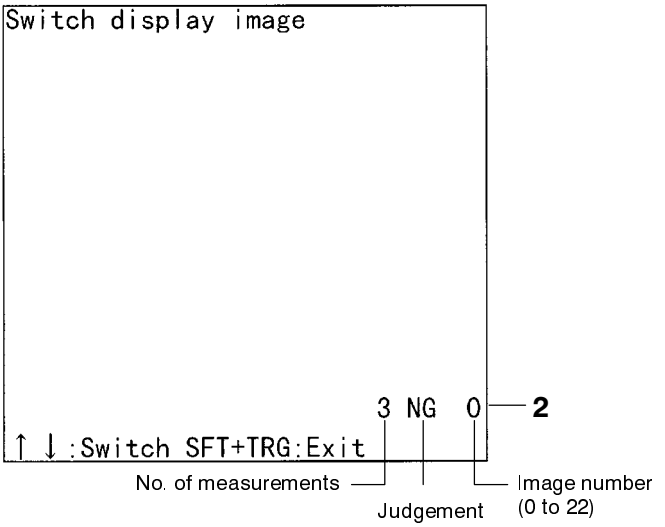
The measurement results can be checked if the displayed image is changed to a measurement image.

The original image, without filtering or any other type of image adjustment, will initially be displayed in this screen.

The filtered image will be displayed by using the **Up** and **Down** Keys to change the display after selecting the desired image and returning to the original screen.

**Note** Measurements are performed in the background whenever the camera image is not being displayed. The monitor display will not

be updated when the original screen is returned to, even if the measurement command has been input.




**1** Press the **SHIFT+ TRIG** Keys from any menu level. The window for changing the displayed image will be displayed.

**2** Using the **Up** and **Down** Keys, specify the image to be displayed. The original image will be displayed.

**3** Press the **SHIFT + TRIG** Keys to return to the original menu screen.

| Display | Meaning |
|---|---|
| Camera image | The latest image read by the camera. |
| Sample□ | Acceptable and unacceptable sample images registered to set the measurement conditions. (Images are displayed with the same number as when the image was registered.) |
| *OK□<br>*NG□ | Measurement images. (You can set either NG images only or all images).<br>A number from 1 to 4,294,967,295 will appear for * to indicate how many measurements have been taken since power was turned ON. (The last measured image will be displayed.) |
| Vacancy□ | No image in memory. (Nothing will be displayed.) |

**Note** A number between 0 and 22 will appear for □. The F150 can store up to 23 images, and each is allocated a number between 0 and 22.

# 3-11 System Menu

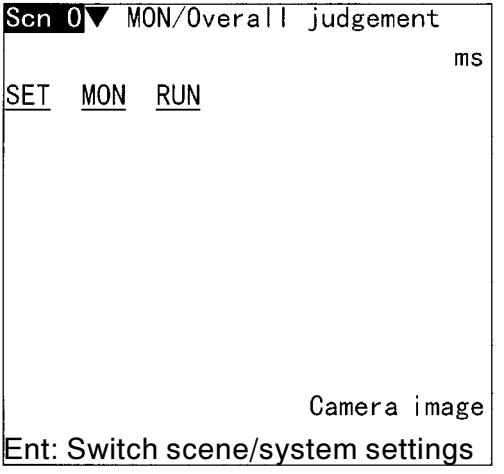
The System Menu is used to set system parameters and to back up images on a computer. The top-level menu is shown in the following diagram.

| | |
|---|---|
| Communications settings | |
| Backup utilities | Backs up settings to a computer. |
| Load/Save image | Backs up images to a computer. |
| Image storage settings | Sets the measurement images to be saved in memory. |
| Startup mode | Sets the startup scene and startup mode. |
| Version | Displays the system version. |

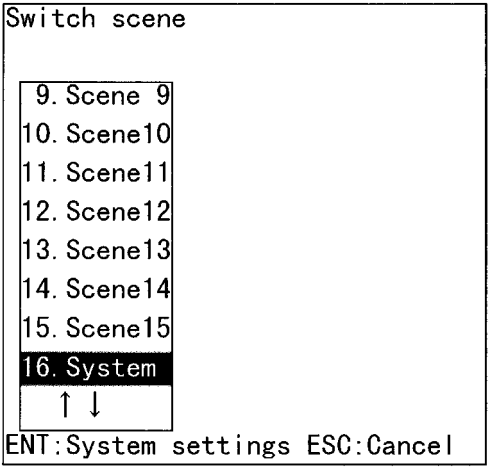
## 3-11-1 System Menu

**1** Move to the Basic Screen.
You cannot move the cursor to ***Scn 0*** ▼ when in Set mode.
Press the **ESC** Key to move to the Basic Screen.

**2** Move the cursor to ***Scn 0*** ▼ and press the **ENT** Key.



**3** Use the **Down** Key to move the cursor to ***16. System*** and press the **ENT** Key.




The System Screen will be displayed.

## 3-11-2 Saving/Loading System and Scene Data

The system and scene data can be backed up on a computer. The same data can also be loaded from a computer to the F150. Saving and loading data enables using the same data on other F150 Controllers.

It is recommended that data is backed up in case data is lost or the F150 malfunctions.

| Data | Contents |
|---|---|
| System data | Communications settings, image storage setting, and startup mode |
| Scene data | Settings for each scene |
| All data | Both the system data and scene data |

Communications are performed using Xmodem protocol.

This section explains data transfer using the HyperTerminal provided by Windows95/NT. In this example, an RS-232 cable is connected to the COM1 port of the computer. Alter the example to suit your communications software or COM port number.

**⚠ Caution** Do not turn OFF the power while a message is being displayed in any save or load operations. Data in memory will be destroyed, and the F150 may not operate correctly the next time it is started.

**Note** Data is saved from the F150 to a computer, and loaded from a computer to the F150.

### Saving Data to the Computer

**1** Connect the COM 1 port on the computer and the F150 using an RS-232C cable.

**2** Make the F150 communications settings. → **p 146**

**Note** The default communications settings are as shown in the following table. These setting can normally be used.

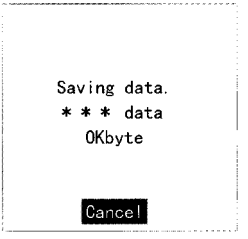
| Item | Setting |
|---|---|
| Baud rate | 38,400 bps |
| Data length | 8 (bits) |
| Parity | None |
| Stop bits | 1 (bit) |
| Delimiter | CR |
| Operating mode | Normal (No protocol). Host Link can also be used. |

**3** Start the HyperTerminal program on the computer and make the following communications settings.

**Note** The same communications settings must be used on both the F150 and the modem on the computer.

| Item | Setting |
|---|---|
| Speed | 38,400 bps |
| Data bits | 8 (bits) |
| Parity | None |
| Stop bits | 1 (bit) |
| Flow control | None (Xmodem protocol is used.) |

**4** Execute one of the procedures on the following pages to save data from the F150. The data transfer screen will be displayed.




The F150 will generate a timeout error if no response is received from the external device within 30 seconds. An error

message will be displayed, and the error terminal will turn ON.

5 Select ***Transfer/Receive File*** from the HyperTerminal menu.

6 Specify where the file is to be saved and set the protocol to ***Xmodem***.

7 Click **Receive**. The data will be transferred from the F150 to the computer.

**Loading Data from the Computer**

1 Follow steps 1 to 3 in the above procedure to connect the F150 and the computer.

2 Select ***Transfer/Send File*** from the HyperTerminal menu.

3 Select the file to be sent and set the protocol to ***Xmodem***.

4 Click **Send**. The data transfer screen will be displayed.

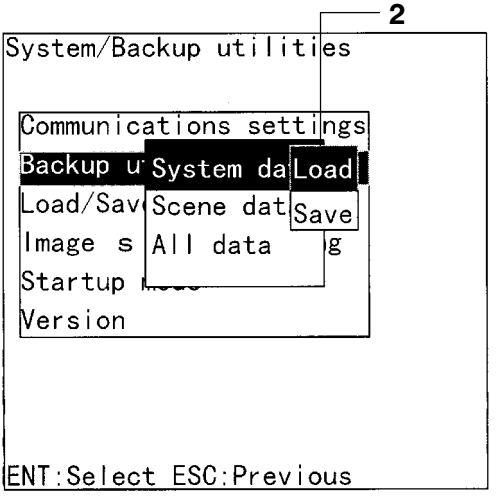
5 Execute one of the procedures on the following pages to load data from the computer to the F150.

The F150 will generate a timeout error if no response is from the external device for 30 seconds. An error message will be displayed, and the error terminal on the F150 will turn ON.

## System Data

Use the following procedure to save or load the communications settings, image storage setting, and startup mode.

**1** Move the cursor to ***System/Backup utilities/System data*** and press the **ENT** Key. The following screen will be displayed.




**2** Move the cursor to ***Load*** or ***Save*** and press the **ENT** Key. A confirmation message will be displayed.

**3** Move the cursor to **OK** and press the **ENT** Key.

The data transfer will start, and a message saying the transfer is being performed will be displayed. End message will appear when the transfer is finished.

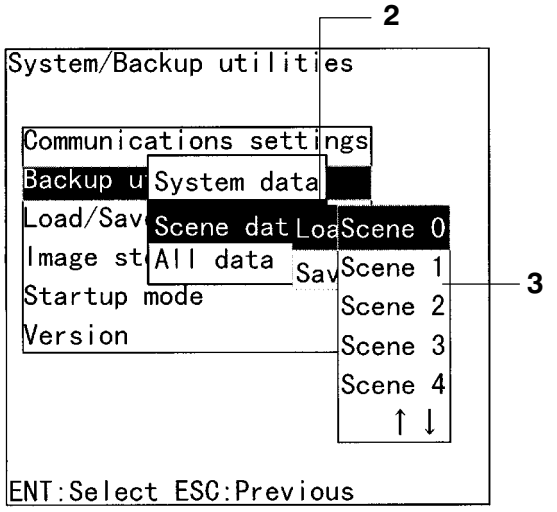
**4** Move the cursor to **OK** and press the **ENT** Key.

**Note** Data is saved from the F150 to a computer, and loaded from a computer to the F150.

**⚠ Caution** Do not turn OFF the power while a message is being displayed in any save or load operations.
Data in memory will be destroyed, and the F150 may not operate correctly the next time it is started.

## Scene Data

Use the following procedure to save or load the data for individual scenes.




**1** Move the cursor to ***System/ Backup utilities/Scene data*** and press the **ENT** Key. The screen shown above is displayed.

**2** Move the cursor to ***Load*** or ***Save*** and press the **ENT** Key. A list of scene numbers will be displayed.

**3** Move the cursor to the scene number to be loaded or saved and press the **ENT** Key. A confirmation message will be displayed.

**4** Move the cursor to **OK** and press the **ENT** Key.

The data transfer will start, and a message saying the transfer is being performed will be displayed. End message will appear when the transfer is finished.

**5** Move the cursor to **OK** and press the **ENT** Key.

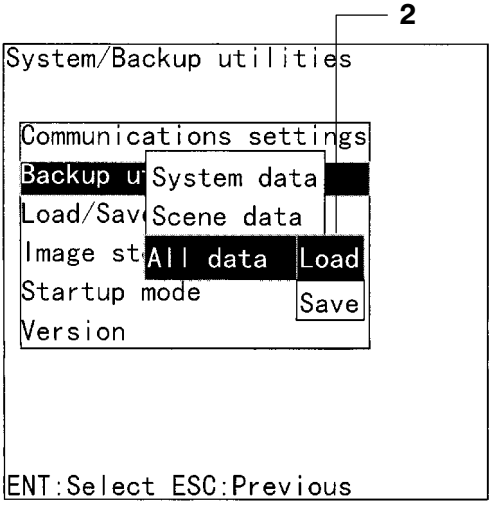
**Note** Data is saved from the F150 to a computer, and loaded from a computer to the F150.

⚠ **Caution** Do not turn OFF the power while a message is being displayed in any save or load operations.
Data in memory will be destroyed, and the F150 may not operate correctly the next time it is started.

## All Data

Use the following procedure to save or load both the system data and scene data.

**1** Move the cursor to ***System/ Backup utilities/All data*** and press the **ENT** Key. The following screen will be displayed.




**2** Move the cursor to ***Load*** or ***Save*** and press the **ENT** Key. A confirmation message will be displayed.

**3** Move the cursor to **OK** and press the **ENT** Key.

The data transfer will start, and a message saying the transfer is being performed will be displayed. End message will appear when the transfer is finished.

**4** Move the cursor to **OK** and press the **ENT** Key.

**Note** Data is saved from the F150 to a computer, and loaded from a computer to the F150.

⚠ **Caution** Do not turn OFF the power while a message is being displayed in any save or load operations.
Data in memory will be destroyed, and the F150 may not operate correctly the next time it is started.

## 3-11-3 Saving/Loading Image Data

Image data can be backed up on a computer via the RS-232C port. Image data can also be loaded from a computer to the

F150. It is recommended that any required images are backed up in case data is lost or the F150 malfunctions.

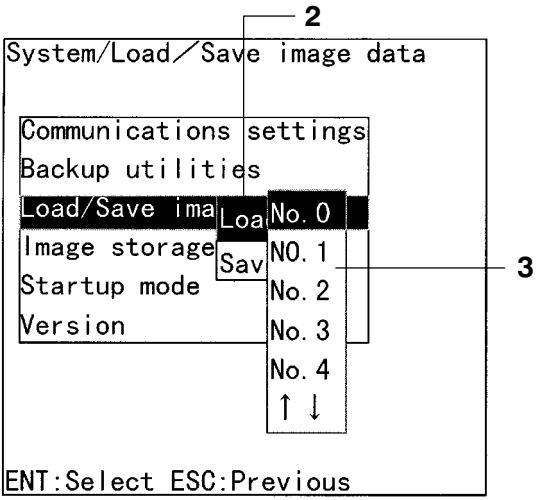
Two kinds of images are stored temporarily in F150 memory.

- The sample images used for setting measurement conditions
- Measurement images

A total of 23 images can be stored in memory, made up of a combination of both sample and measurement images. Any images in memory will be cleared, however, when the power is turned OFF or the scene is changed.

Images are saved as bit maps (*.BMP) so they can be view on the computer.

**⚠ Caution** Do not turn OFF the power while a message is being displayed in any save or load operation. Data in memory will be destroyed, and the F150 may not operate correctly the next time it is started.




**1** Move the cursor to ***System/ Load/Save image*** and press the **ENT** Key.

**2** Move the cursor to ***Load*** or ***Save*** and press the **ENT** Key. A list of sample image numbers will be displayed.

**3** Move the cursor to the image number that is to be loaded or saved and press the **ENT** Key. A confirmation message will appear.

**4** Move the cursor to **OK** and press the **ENT** Key.

The data transfer will start, and a message saying the data is being loaded or saved will appear. End message will appear when the transfer is finished.

**5** Move the cursor to **OK** and press the **ENT** Key.

**Note** Data is saved from the F150 to a computer, and loaded from a computer to the F150.

**⚠ Caution** Do not turn OFF the power while a message is being displayed in any save or load operations.
Data in memory will be destroyed, and the F150 may not operate correctly the next time it is started.

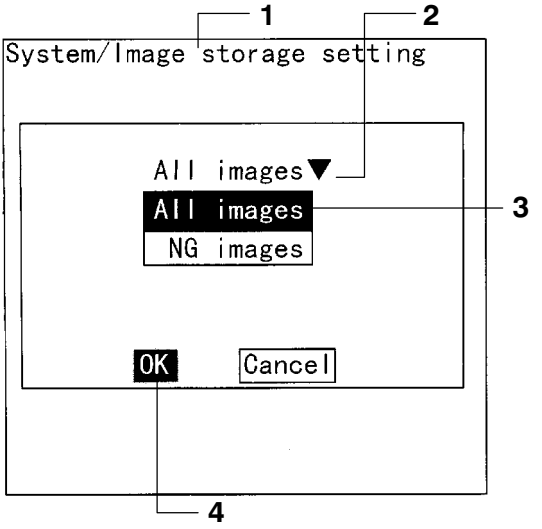
## 3-11-4 Image Storage

Images are stored in F150 memory in Monitor and Run modes. You can set whether all images or only NG images are stored in memory.

- **All images**: All images will be stored, regardless of the OK/NG judgement.
- **NG images**: Only NG images will be stored.

The default is for only NG images to be stored. Use the following procedure to change the setting.

**1** Move the cursor to ***System/Image storage setting***. The following screen will be displayed.



**2** Use the **Up** and **Down** Keys to move the cursor to the ▼ and press the **ENT** Key. A menu will be displayed.

**3** Move the cursor to either ***All images*** or ***NG images*** and press the **ENT** Key. The selected setting will be entered.

**4** Move the cursor to **OK** and press the **ENT** Key. The setting will be saved.

**Note** The last measured image is always stored in memory regardless of the image storage setting.

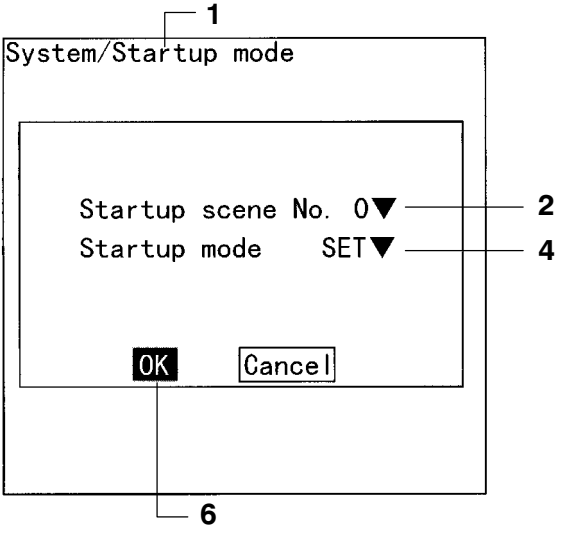
## 3-11-5 Startup Scene and Mode

Use the following procedure to set the startup scene and mode that will be used when the power is turned ON.

If the F150 is set to start in Run mode for the scene where the desired measurement conditions are registered, measurement of objects can be started by simply turning the power ON and press the **TRIG** Key or input the STEP signal.

The default setting is for scene 0 and Set mode.

**1** Move the cursor to ***System/Startup mode*** and press the **ENT** Key. The following screen will be displayed.




**2** Using the **Up** and **Down** Keys, move the cursor ***Startup scene*** and press the **ENT** Key. A list of options will be displayed.

**3** Move the cursor to the number of the scene to be set and press the **ENT** Key. The startup scene number is now set.

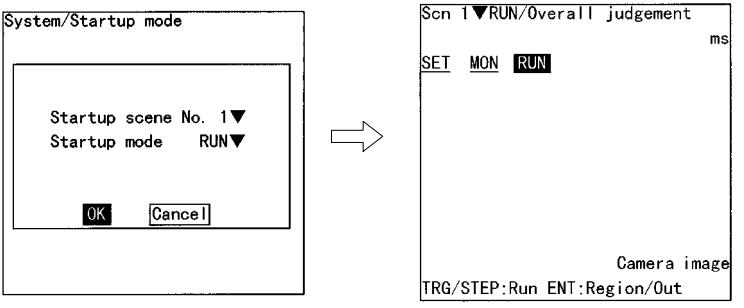
4 Using the **Up** and **Down** Keys, move the cursor to ***Startup mode*** and press the **ENT** Key. A list of options will be displayed.

5 Move the cursor to the mode to be set and press the **ENT** Key. The startup mode is now set.

6 Once all settings have been made, move the cursor to **OK** and press the **ENT** Key. The settings will be saved.

The following example illustrates operation when the startup scene is set to 1 and the startup mode to Run.

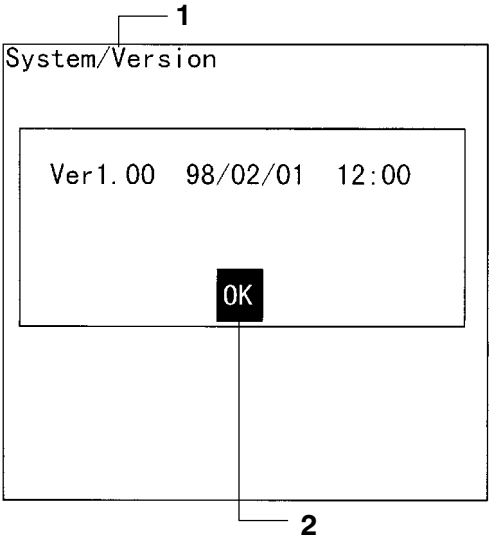
The next time the power is turned ON, the F150 will start at scene 1 and in Run mode.




## 3-11-6 Checking the Software Version

Use the following procedure to check the software system version.

**1** Move the cursor to ***System/Version***. The following screen will be displayed. The version and date will be displayed.




**2** Move the cursor to ***OK*** and press the **ENT** Key.

# SECTION 4
# Terminal Blocks

This section describes the communications settings and I/O formats for communications with external devices via the terminal blocks.

# 4-1 I/O Formats

The terminal blocks can be used to input and output various signals, e.g., to input a measurement trigger from a photoelectric or other sensor and to output the overall judgement to a PLC or other external device.

The I/O formats are described below. The operation of the terminals signals is described in the following section.

## 4-1-1 Inputs

The following commands can be input in Run mode.

### STEP Input

One measurement will be performed when the STEP signal turns ON.

### DI0 to DI 7 Inputs

The DI0 to DI7 inputs can be used to execute measurements continuously or to switch scenes as shown in the following table.

To use these inputs, turn ON DI7 1 ms or more after setting the status of the DI0 to DI6 inputs.

| Command | DI inputs | | | | | | | | Function |
|---|---|---|---|---|---|---|---|---|---|
| | Execute | Command | | | Operand | | | | |
| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
| Continuous measurement | 1 | 0 | 0 | 1 | * | * | * | * | Measurement is performed continually during command input. |
| Switching scenes | 1 | 0 | 1 | 0 | Scene no. (binary value) | | | | Switches the scene. |
| Example | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | Switches to scene 2. |

0: OFF
1: ON
*: Status is not read by F150, i.e., the status does not matter.

## 4-1-2 Outputs

The judgements for equations or regions can be output by allocating them to terminals, DO0 to DO15. The overall judgement is output to the OR terminal.

The data is only output in Run mode. There is no output to the terminals in Monitor mode.

The F150 can be set to turn ON terminals for either OK or NG results. The default is for output to be ON for NG results.
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**⚠ Caution** The initial status of the output terminals is OFF. The terminals, however, may turn ON for approximately 0.5 s when the power is turned ON. Be sure to allow for this when reading the status at an external device.

**OR Terminal**

The overall judgement is output to the OR terminal. This overall judgement will be NG if there is even just one NG judgement for the set measurement regions or output expressions.

**DO Terminals**

| DO terminals | Output |
|---|---|
| 0 to 15 | The evaluation results of the equations and/or regions allocated to DO 0 to DO 15 will be output. |

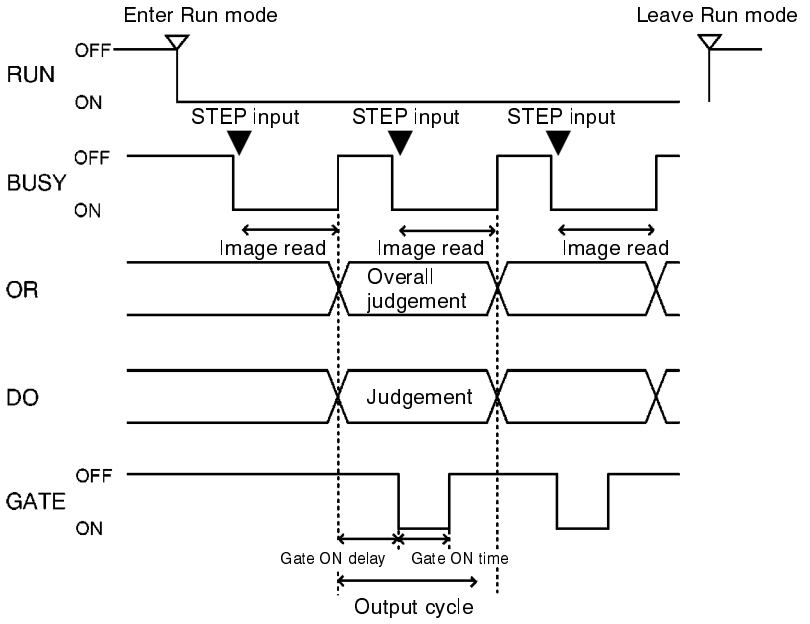
# 4-2 Terminal Signal Operation and Timing

This section describes the operation of the terminal signals based on the various communications settings that are possible. Use the information provided in this section to determine the proper settings to be made in the next section.

## 4-2-1 No Handshaking

The F150 outputs the measurement results without synchronizing with the external device. Read the measurement results at the external device while the GATE terminal is ON.

## Using the STEP Signal as a Measurement Trigger



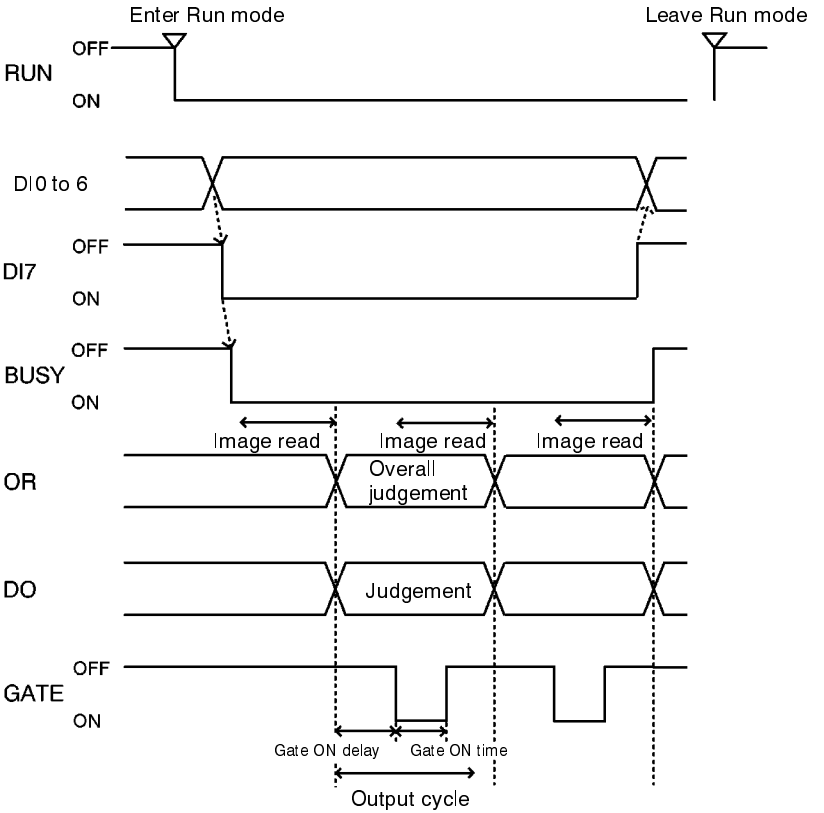

### Output Terminals

| Terminal | Function |
|---|---|
| RUN | Turns ON during Run mode. |
| BUSY | Shows that the F150 is reading an image, changing a scene, etc.<br>Do not input the next command while the BUSY signal is ON. Otherwise, commands may not be properly executed. |
| OR | Outputs the overall judgements. (Can be set to turn ON for either OK or NG judgement.)<br>The overall result will be NG if there is one or more NG judgements for the measurement regions or output expressions. |
| DO 0 to DO 15 | Output the judgements for the items allocated to the terminals. (Can be set to turn ON for either OK or NG judgement.) |
| GATE | Used to time the reading of the measurement result at the external device.<br>The time that GATE is turned ON can be set as required for the external device to correctly read the measurement result.<br>Make the output time shorter than the duration of the measurement (STEP input). If the cycle is longer, the output timing will fall behind as measurements are repeated. |

**Input Terminals**

| Terminal | Function |
|---|---|
| STEP | Inputs a measurement trigger from a photoelectric sensor or other external device.<br>One measurement will be taken on the rising edge of the STEP signal. Turn ON the STEP for at least 0.5 ms. |

## Performing Continuous Measurements



### Output Terminals

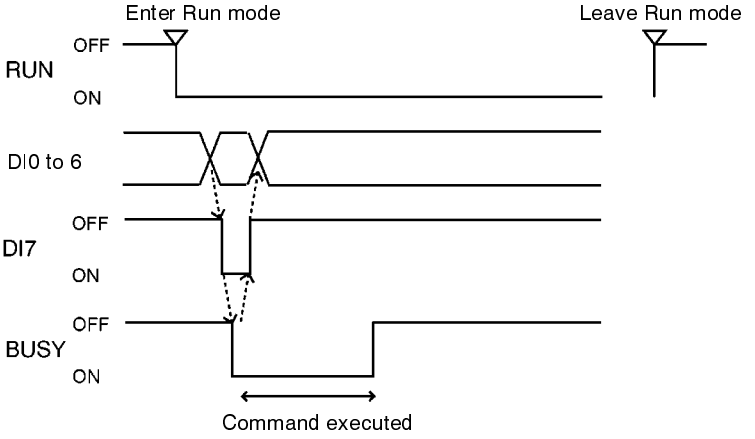
| Terminal | Function |
|---|---|
| RUN | Turns ON during Run mode. |
| BUSY | Shows that the F150 is reading an image, changing a scene, etc.<br>Do not input the next command while the BUSY signal is ON. Otherwise, commands may not be properly executed. |
| OR | Outputs the overall judgements. (Can be set to turn ON for either OK or NG images.)<br>The overall result will be NG if there is even one NG judgement for the measurement regions or output expressions. |
| DO 0 to DO 15 | Output the judgements for the items allocated to the terminals. (Can be set to turn ON for either OK or NG judgement.) |
| GATE | Used to time the reading of the measurement results at the external device.<br>The time that GATE is turned ON can be set as required for the external device to correctly read the measurement results.<br>Make the output time shorter than the duration of the measurement (STEP input). If the cycle is longer, the output timing will fall behind as measurements are repeated. |

### Input Terminals

| Terminal | Function |
|---|---|
| DI 0 to DI 6 and DI 7 | Input the continuous measurement command. Set DI0 to DI6, wait at least 1 ms and then turn on the DI7 execution signal. The BUSY terminal will turn ON while the command is being executed. |

## Non-measurement Commands

The following timing chart shows the basic flow of command execution.



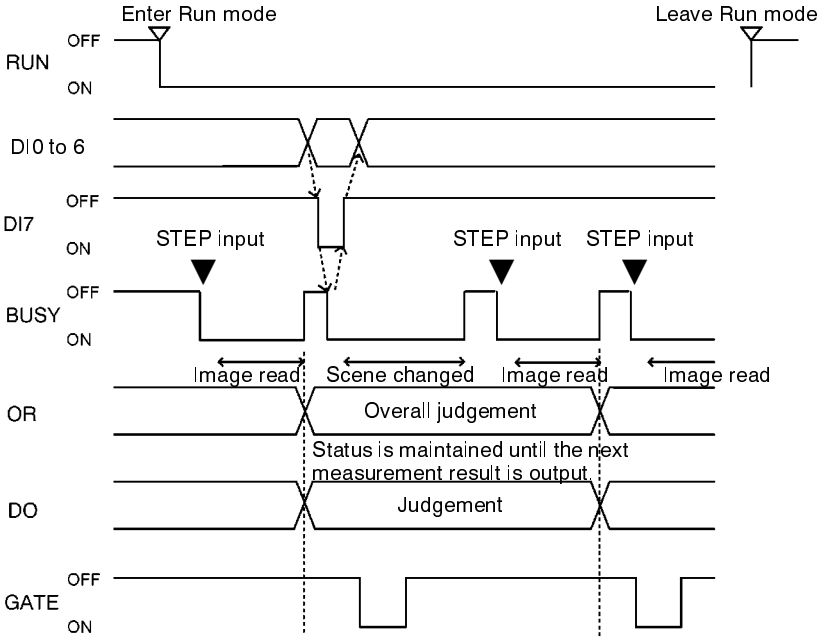
**Output Terminals**

| Terminal | Function |
|---|---|
| RUN | Turns ON during Run mode. |
| BUSY | Shows that the F150 is reading an image, changing a scene, etc.<br>Do not input the next command while the BUSY signal is ON. Otherwise, commands may not be properly executed. |

**Input Terminals**

| Terminal | Function |
|---|---|
| DI 0 to DI 6 and DI 7 | Input the command. Set DI0 to DI6, wait at least 1 ms and then turn on the DI7 execution signal. The BUSY terminal will turn ON while the command is being executed. Turn OFF the DI7 terminal after confirming the BUSY terminal is turned ON, and turn OFF the DI0 to 6. |

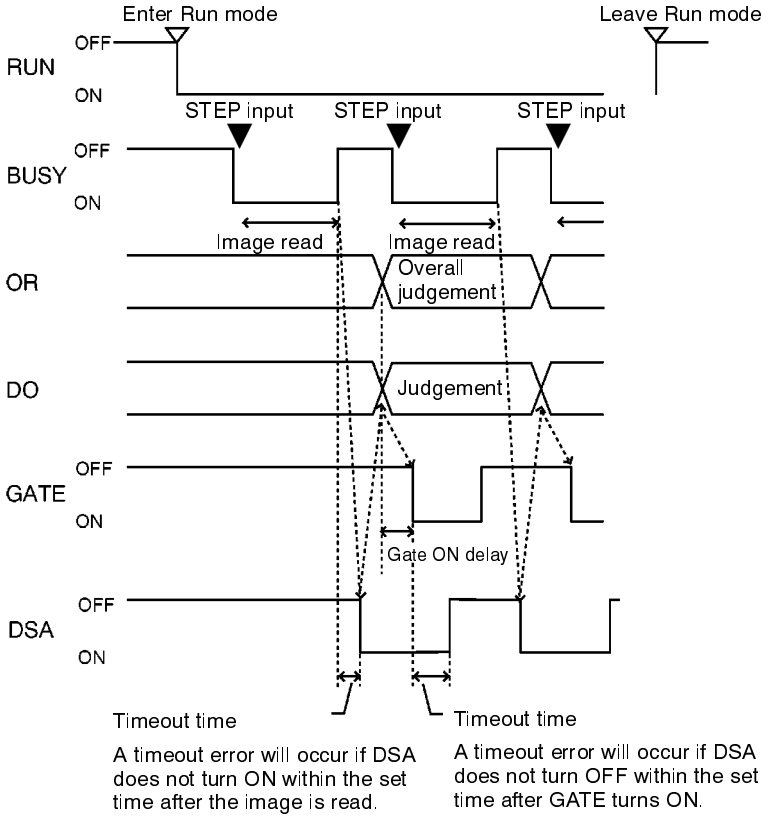
The following timing chart shows changing the scene and then reading images.




## 4-2-2 Using Handshaking

Handshaking can be used to sync the F150 with an external device to output the measurement result. This is an effective way to output several measurement results in order, allowing data to be properly transferred.

## Using the STEP Signal as a Measurement Trigger




The function of all terminals except DSA is the same as for communications without handshaking. The DSA terminal is used only with handshaking.

**DSA Terminal**

| Terminal | Function |
|---|---|
| DSA | Requests the next data output from the external device. The F150 will not output data until this terminal is turned ON.<br>Turn ON the DSA terminal when the external device is ready to receive data and the F150 has finished measurement.<br>The BUSY terminal is ON during measurement, i.e., measurement will be completed when the BUSY terminal turns OFF. Use the BUSY signal to time reading measurement results. |

# 4-3 Communications Settings

The communications specifications must be set when communicating with an external device.

This section describes the operations required to make the following communications settings. Operation based on these setting is described in the previous section.

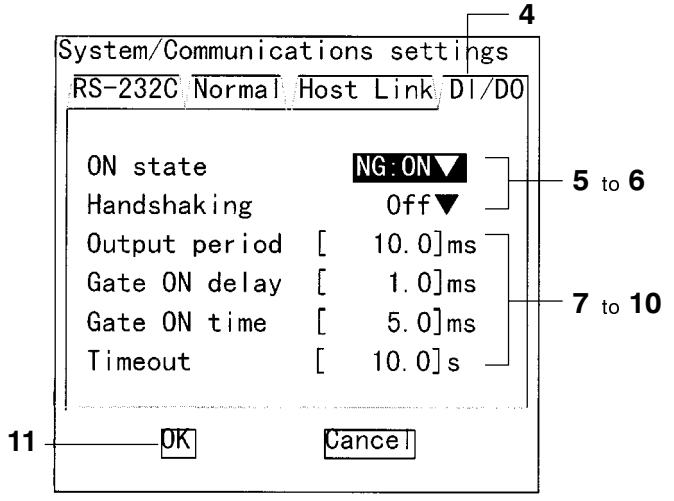
| Item | | Description |
|---|---|---|
| Output polarity | | Select to turn ON the OR and DO0 to DO15 terminals for either OK or NG. The default is ON for NG. |
| Handshake | OFF | Used to output the measurement result without synchronizing with the external device.<br>This is the default setting. |
| | ON | Used to output the measurement result while synchronizing with the external device. |
| Output period<br>(Only effective without handshaking) | | Set the output period for the measurement result.<br>Set a value between 2 and 10,000.0 ms that is greater than the rising time + output time, and less than the measurement interval. If this cycle is longer than the measurement interval, the output timing will fall behind as the measurements are repeated.<br>The default setting is 10.0 ms. |
| Gate ON delay<br>Rise time<br>Gate | | Set the time from when the result is output to the terminal block to when the GATE signal is turned ON.<br>This time is used to wait until the data output becomes stable. Set a time between 1.0 and 1,000 ms that is longer than the delay time for the external device.<br>The default setting is 1.0 ms. |
| Gate ON time<br>(Only effective without handshaking) | | Set the time during which the GATE signal is ON.<br>Set a value between 1.0 and 1,000 ms so that the external device can read the measurement result.<br>The default setting is 5.0 ms. |
| Timeout<br>(Only effective with handshaking) | | A timeout error will occur if there is no response from the external device within the set time.<br>Set the value to between 0.5 and 120.0 s.<br>The default setting at 10.0 s. |

1 Move to the Basic Screen (where one of the three modes can be selected).
If the current mode is Set mode, press the **ESC** Key to return to the Basic Screen. The cursor cannot be moved to ***Scn*** ▼ when in Set mode.

2 Move the cursor to ***Scn*** ▼ and press the **ENT** Key.

**3** Move the cursor to ***System/Communications settings*** and press the **ENT** Key.

**4** Move the cursor to ***DI/DO***. The following screen will be displayed.




**5** Use the **Up** and **Down** Keys to move the cursor to items marked with a ▼ and press the **ENT** Key. A list of options will be displayed.

**6** Move the cursor to the desired setting and press the **ENT** Key. The item will be set.

**7** Use the **Up** and **Down** Keys to move the cursor to the item for which a value is to be changed and press the **ENT** Key. The cursor will change to the size of one digit.

**8** Use the **Left** and **Right** Keys to move the cursor to the position of the digit to be changed.

**9** Use the **Up** and **Down** Keys to change the value.

**10** Press the **ENT** Key. The value will be set.

**11** Once all settings have been made, move the cursor to ***OK*** and press the **ENT** Key. The communications settings will be saved.

# SECTION 5
# RS-232C Normal Settings

This section describes the communications settings for the RS-232C port when communications are set for Normal mode.

# 5-1 Communications Settings

## 5-1-1 Flowcharts

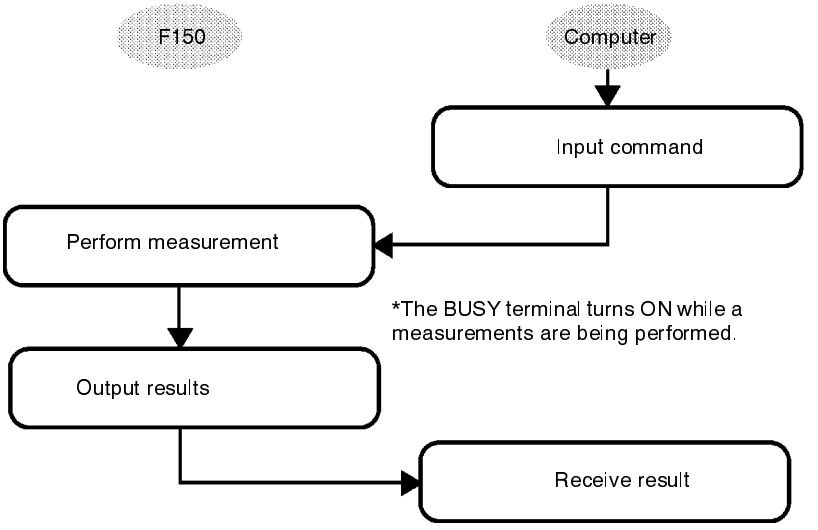
If the Normal communications mode is selected, data can be output in non-procedural format to an external device via the RS-232C port.

The F150 must be in Run mode to input commands and output measurement results. These operations cannot be performed in Set or Monitor modes.

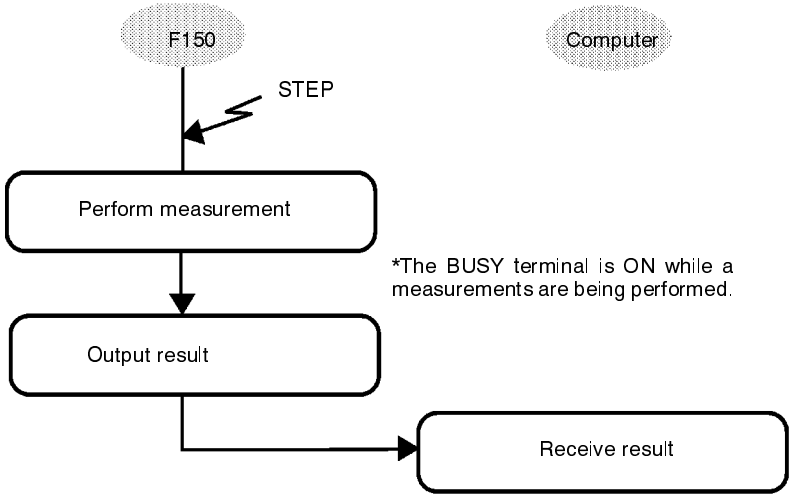
**Note** A timeout error will occur if there is no response from the computer within the set time when RS/CS or Xon/off is selected for flow control. An error message will appear on the screen, and the error terminal will turn ON.

### Measurement Commands

#### I/O via the RS-232C Port

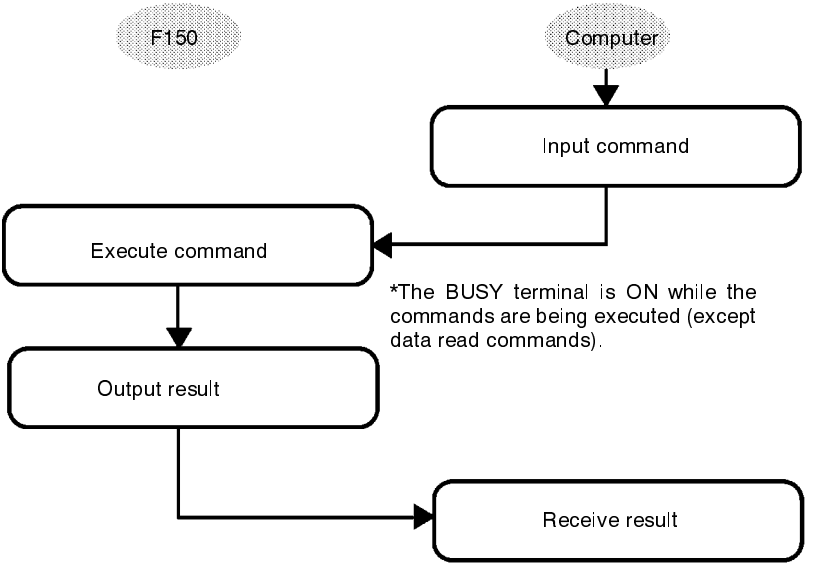


**STEP Signal as Measurement Trigger**




## Non-measurement Commands

The following timing chart shows the basic flow of command execution.



## 5-1-2 Communications Settings

The RS-232C port can be used to save and load data, on an external device. This section describes the setting used for the RS-232C port.

The same communications settings must be used on both the F150 and the external device.

| Item | Setting | |
|---|---|---|
| Baud rate | 2,400, 4,800, 9,600, 19,200, 38,400* (bps) | Use the same settings on the IBM PC/AT or compatible computer. |
| Data length | 7, 8* (bits) | |
| Parity | None, even, odd | |
| Stop bit | 1*, 2 (bits) | |
| Delimiter | CR*, LF, CR+LF | |
| Operating mode | Normal*, Host Link, Menu operation. Select Normal. | |

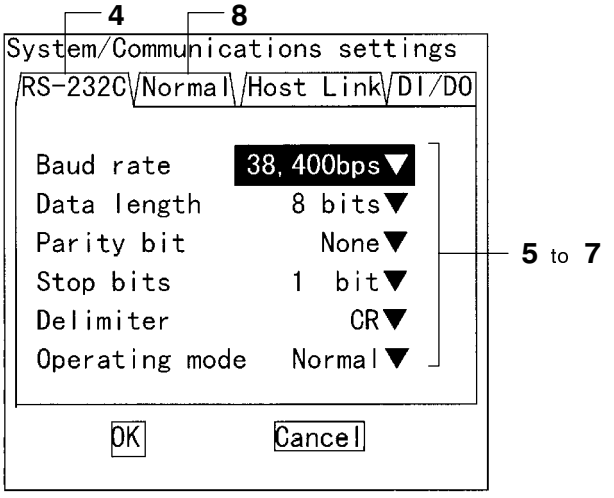
**Note** The default settings are marked with asterisks.*

1 Move to the Basic Screen (where one of the three modes can be selected).
If the current mode is Set mode, press the **ESC** Key to return to the Basic Screen. The cursor cannot be moved to ***Scn*** ▼ when in Set mode.

2 Move the cursor to ***Scn*** ▼ and press the **ENT** Key.

3 Move the cursor to ***System/Communications settings*** and press the **ENT** Key.

**4** Move the cursor to ***RS-232C***. The following screen will appear.




**5** Use the **Up** and **Down** Keys to move the cursor to the item to be changed and press the **ENT** Key. A list of options will be displayed.

**6** Move the cursor to the desired setting and press the **ENT** Key. The item will be set.

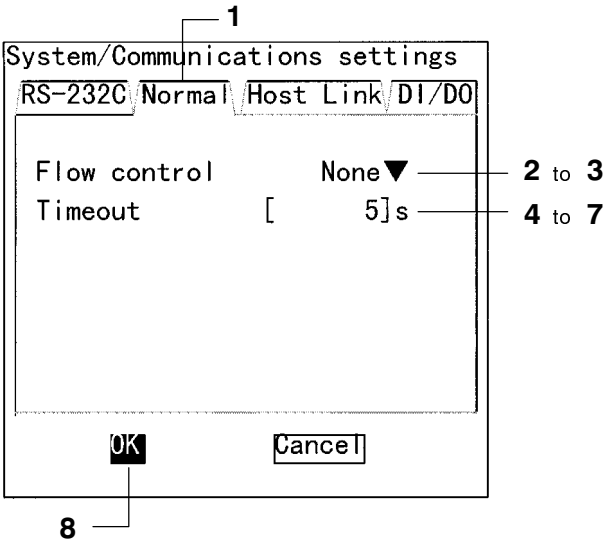
**7** Repeat above steps to change other settings.

**8** Once all settings have been made, move the cursor to ***OK*** and press the **ENT** Key. Then move the cursor to ***Normal*** and proceed to the flow control settings described in the next procedure.

## Flow Control Settings

Flow control allows communications to be performed while checking the status of the external device. Timeout errors can be set to occur when there is no response from the external device after a set number of seconds.

An error message will appear on the screen if a timeout error has occurred, and the error terminal will turn ON.




| Item | Setting | |
|---|---|---|
| Flow control | None* | No flow control. |
| | RS/CS | The hardware performs flow control.<br>Use a cable that connects the RS and CS signals of the F150 and external device.<br>Data is transferred when the CS signal from the external device is ON. |
| | Xon/off | The software performs flow control.<br>Data is transferred according to the Xon/off codes from the external device. |
| Timeout error | Set the number of seconds (1 to 120 s) before a timeout error occurs.<br>The default is 5 s. | |

**Note** The default settings are marked with asterisks.*

**1** Check that the cursor is on ***Normal***.

**2** Move the cursor to ***Flow control*** and press the **ENT** Key. A list of options will be displayed.

3 Using the **Up** and **Down** Keys, move the cursor to the desired flow control method and press the **ENT** Key.
The flow control method will be set.

4 Move the cursor to ***Timeout*** and press the **ENT** Key.
A digit cursor will appear.

5 Using the **Left** and **Right** Keys, move the cursor to the digit to be input.

6 Use the **Up** and **Down** Keys to change the value.

7 Press the **ENT** Key. The value will be set.

8 Once all the settings have been made, move the cursor to ***OK*** and press the **ENT** Key. The communications settings will be saved.

# 5-2 Command List

The following commands can be input from the a computer or other host device connected to the RS-232C port. Commands are input in ASCII.

### Commands that Control Operation

The following commands are used to control F150 operation.

| Command | Function |
|---|---|
| MEASURE or M | Performs one measurement.<br>Starts continuous measurement.<br>Stops continuous measurement. |
| DATASAVE | Saves all data to flash memory. |
| RESET | Resets the F150. |
| SCENE | Changes the scene. |
| SCNLOAD | Loads scene data from an external device. |

### Commands that Read Measurement Results

The following commands obtain measurement results for images stored in F150 memory.

| Command | Function | |
|---|---|---|
| MEASDATA | Measurement results | Judgement |
| | | X coordinate |
| | | Y coordinate |
| | | Axis angle |
| | | Area/correlation |
| POSIDATA | Position displacement compensation | X displacement |
| | | Y displacement |
| | | Displacement angle (θ) |
| EXP | Output expressions | Terminal block |
| | | RS-232C |

### Commands that Read/Change Settings

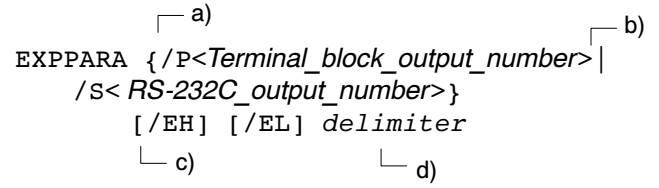
The following commands read or set measurement conditions.

| Command | Setting | |
|---|---|---|
| SCENE | Current scene number | |
| SRCHPARA | Density search | X criteria (upper and lower limits) |
| | | Y criteria (upper and lower limits) |
| | | Correlation criteria (upper and lower limits) |
| AREAPARA | Binary center of gravity and area | X criteria for center of gravity (upper and lower limits) |
| | | Y criteria for center of gravity (upper and lower limits) |
| | | Area criteria (upper and lower limits) |
| | | Binary level (upper and lower limits, reversal) |
| AXISPARA | Binary axis angle | X criteria for center of gravity (upper and lower limits) |
| | | Y criteria for center of gravity (upper and lower limits) |
| | | Axis angle criteria (upper and lower limits) |
| | | Area criteria (upper and lower limits) |
| | | Binary level (upper and lower limits, reversal) |

| Command | Setting | |
|---|---|---|
| EXPPARA | Output equations | Terminal block (upper and lower limits) |
| | | RS-232C (upper and lower limits) |

# 5-3 Input Format

The commands are input in ASCII. Both upper-case letters and lower-case letters are available.




a) Brackets {} indicate options. At least one of the options must be input. Options are separated by a vertical line (|).

b) Variables are indicated in italics in pointed brackets< >. Actual values must be input for the variables.

c) Square brackets [ ] indicated optional arguments. Optional argument can be omitted.

d) A delimiter is required at the end of the command.

**Note** The delimiters have been omitted from the commands and responses in this manual except where required for clarity. Be sure to allow for delimiters in programming.

# 5-4 Input Commands

The commands are explained in alphabetical order.

## 5-4-1 AREAPARA: Area Parameter

AREAPARA is used to read or set measurement conditions for regions set for binary center of gravity and area measurement.

### Reading Measurement Conditions

**Input**

```
AREAPARA /A<Region_number> [/U] [/XH]
    [/XL] [/YH] [/YL] [/SH] [/SL] [/BH]
    [/BL] [/BR]
```

- Set the value between 0 and 15 for the region number.
- The options are given in the following table. If all options are omitted, all measurement conditions will be output.

| Option | Meaning |
|---|---|
| U | Unit |
| XH | Upper limit of X criteria for center of gravity |
| XL | Lower limit of the X criteria for the center of gravity |
| YH | Upper limit of Y criteria for center of gravity |
| YL | Lower limit of Y criteria for center of gravity |
| SH | Upper limit of area criteria |
| SL | Lower limit of area criteria |
| BH | Upper limit of binary level |
| BL | Lower limit of binary level |
| BR | Reversal of binary level |

**Output**

| Output | Meaning |
|---|---|
| U=*value* | Unit<br>0: μm, 1: mm, 2: cm |
| X_HIGH=*value* | Upper limit of X criteria for center of gravity |
| X_LOW=*value* | Lower limit of X criteria for center of gravity |
| Y_HIGH=*value* | Upper limit of Y criteria for center of gravity |
| Y_LOW=*value* | Lower limit of Y criteria for center of gravity |
| S_HIGH=*value* | Upper limit of area criteria |
| S_LOW=*value* | Lower limit of area criteria |
| B_HIGH=*value* | Upper limit of binary level |
| B_LOW=*value* | Lower limit of binary level |
| B_REV=*value* | Reversal of binary level<br>0: Not reversed, 1: Reversed |

"ER" will be output if the input command is incorrect.

**Example**

**Input:** `AREAPARA /A0 /U /XL /XH`

The unit and the upper and lower limits of the X criteria will be read for region 0.

**Output:** `U=1,X_LOW=200.00,X_HIGH=300.00`

The unit is mm, the lower limit of the X criteria is 200.00, and the upper limit is 300.00.

## Setting Measurement Conditions

**Input**

AREAPARA /A<*Region_number*> [/U:<*Unit*>]
[/XH:<*Upper_limit_of_X_criteria*>]
[/XL:<*Lower_limit_of_X_criteria*>]
[/YH:<*Upper_limit_of_Y_criteria*>]
[/YL:<*Lower_limit_of_Y_criteria*>]
[/SH:<*Upper_limit_of_area_criteria*>]
[/SL:<*Lower_limit_of_area_criteria*>]
[/BH:<*Upper_limit_of_binary_level*>]
[/BL:<*Lower_limit_of_binary_level*>]
[/BR:<*Reversal_of_binary_level*>]

- Set the value between 0 and 15 for the region number.
- The options are given in the following table. Any measurement condition that is not specified will not be changed. If all options are omitted, all measurement conditions will be output.

| Option | Meaning |
|---|---|
| U:*value* | Unit<br>0: μm, 1: mm, 2: cm |
| XH:*value* | Upper limit of X criteria for center of gravity (-999.99 to 999.99) |
| XL:*value* | Lower limit of X criteria for center of gravity (-999.99 to 999.99) |
| YH:*value* | Upper limit of Y criteria for center of gravity (-999.99 to 999.99) |
| YL:*value* | Lower limit of Y criteria for center of gravity (-999.99 to 999.99) |
| SH:*value* | Upper limit of area criteria (0 to 999,999) |
| SL:*value* | Lower limit of area criteria (0 to 999,999) |
| BH:*value* | Upper limit of binary level (0 to 255) |
| BL:*value* | Lower limit of binary level (0 to 255) |
| BR:*value* | Reversal of binary level<br>0: Not reversed, 1: Reversed |

**Output**

Settings correctly made: OK
Settings not correctly made: ER

**Example**

**Input:** AREAPARA /A1 YL:250.00 YH:350.00

The lower limit for the Y criteria will be set to 250.00, and the upper limit will be set to 350.00 for region 1.

**Output:** OK

## 5-4-2 AXISPARA: Axis Parameter

AXISPARA is used to read or set measurement conditions for regions set for binary axis angle measurement.

### Reading Measurement Conditions

**Input**

```
AXISPARA /A<Region_number> [/U] [/XH]
    [/XL] [/YH] [/YL] [/TH] [/TL] [/SH]
    [/SL] [/BH] [/BL] [/BR]
```

- Set the value between 0 and 15 for the region number.
- The options are given in the following table. If all options are omitted, all measurement conditions will be output.

| Option | Meaning |
|---|---|
| U | Unit |
| XH | Upper limit of X criteria for center of gravity |
| XL | Lower limit of X criteria for center of gravity |
| YH | Upper limit of Y criteria for center of gravity |
| YL | Lower limit of Y criteria for center of gravity |
| TH | Upper limit of axis angle criteria |
| TL | Lower limit of axis angle criteria |
| SH | Upper limit of area criteria |
| SL | Lower limit of area criteria |
| BH | Upper limit of binary level |
| BL | Lower limit of binary level |
| BR | Reversal of binary level |

**Output**

| Output | Meaning |
|---|---|
| U=*value* | Unit<br>0: μm, 1: mm, 2: cm |
| X_HIGH=*value* | Upper limit of X criteria for center of gravity |
| X_LOW=*value* | Lower limit of X criteria for center of gravity |
| Y_HIGH=*value* | Upper limit of Y criteria for center of gravity |
| Y_LOW=*value* | Lower limit of Y criteria for center of gravity |
| T_HIGH=*value* | Upper limit of axis angle criteria |
| T_LOW=*value* | Lower limit of axis angle criteria |
| S_HIGH=*value* | Upper limit of area criteria |
| S_LOW=*value* | Lower limit of area criteria |
| B_HIGH=*value* | Upper limit of binary level |
| B_LOW=*value* | Lower limit of binary level |
| B_REV=*value* | Reversal of binary level<br>0: Not reversed, 1: Reversed |

"ER" will be output if the input command is incorrect.

**Example**

**Input:** `AXISPARA /A0 /U /XL /XH`

The unit and the upper and lower limits for the X criteria will be read for region 0.

**Output:** `U=1,X_LOW=200.00,X_HIGH=300.00`

The unit is mm, the lower limit of the X criteria is 200.00, and the upper limit is 300.00.

## Setting Measurement Conditions

**Input**

`AXISPARA /A<`*Region_number*`> [/U:<`*Unit*`>]`
`[/XH:<`*Upper_limit_of_X_criteria*`>]`
`[/XL:<`*Lower_limit_of_X_criteria*`>]`
`[/YH:<`*Upper_limit_of_Y_criteria*`>]`
`[/YL:<`*Lower_limit_of_Y_criteria*`>]`
`[/TH:<`*Upper_limit_of_axis_angle_criteria*`>]`
`[/TL:<`*Lower_limit_of_axis_angle_criteria*`>]`
`[/SH:<`*Upper_limit_of_area_criteria*`>]`
`[/SL:<`*Lower_limit_of_area_criteria*`>]`
`[/BA:<`*Upper_limit_of_binary_level*`>]`
`[/BI:<`*Lower_limit_of_binary_level*`>]`
`[/BR:<`*Reversal_of_binary_level*`>]`

- Set a value between 0 and 15 for the region number.
- The options are given in the following table. Any measurement condition that is not specified will not be changed. If all options are omitted, all measurement conditions will be output.

| Option | Meaning |
|---|---|
| U:*value* | Unit<br>0: μm, 1: mm, 2: cm |
| XH:*value* | Upper limit of X criteria for center of gravity (–999.99 to 999.99) |
| XL:*value* | Lower limit of X criteria for center of gravity (–999.99 to 999.99) |
| YH:*value* | Upper limit of Y criteria for center of gravity (–999.99 to 999.99) |
| YL:*value* | Lower limit of Y criteria for center of gravity (–999.99 to 999.99) |
| TH:*value* | Upper limit of axis angle criteria (0 to 180.00) |
| TL:*value* | Lower limit of axis angle criteria (0 to 180.00) |
| SH:*value* | Upper limit of area criteria (0 to 999,999) |
| SL:*value* | Lower limit of area criteria (0 to 999,999) |
| BH:*value* | Upper limit of binary level (0 to 255) |
| BL:*value* | Lower limit of binary level (0 to 255) |
| BR:*value* | Reversal of binary level<br>0: Not reversed, 1: Reversed |

**Output**

Settings correctly made: `OK`
Settings not correctly made: `ER`

**Example**

**Input:** `AXISPARA /A1 YL:250.00 YH:350.00`

The lower limit for the Y criteria will be set to 250.00 and the upper limit will be set to 350.00 for region 1.

**Output:** `OK`

## 5-4-3 DATASAVE: Data Save

DATASAVE is used to save all data to flash memory.

**Input**

`DATASAVE`

**Output**

Data correctly saved: `OK`
Data not correctly saved: `ER`

**Note** Do not turn OFF the power until a response has been received.

## 5-4-4 EXP: Expression

EXP is used to read the results of output expressions for images in F150 memory.

**Input**

EXP /I<*Image_number*>
[/P<*Terminal_block_output_number*>]
[/S<*RS-232C_output_number*>]

- Specify an image number between 0 and 22.
- The output expression results for the terminal block outputs will be read when /P is specified. Specify a number between 0 and 15 for the terminal block output number.
- The output expression results for RS-232C outputs will be read when /S is specified. Specify a number between 0 and 7 for the RS-232C output number.
- The output expressions for both terminal block outputs and RS-232C outputs will be read when /P<*output_number*> and /S<*output_number*> are omitted.

**Output**

Para=:*Results_of_terminal_block_output_expressions*

SCI=:*Results_of_RS-232C_output_expressions*

The calibrated results will be output between -999,999.999 and 999,999.999.

If a result is less than -999,999.999, then-999,999.999 will be output. If a result is greater than 999,999.999, then 999,999.999 will be output

"ER" will be output if the input command is incorrect.

**Example**

**Input:** EXP /I10

The results for image 10 will be read.

**Output:**

The results are output in order, according to the output expression numbers.

Para=15.612,22.563
Two output expressions are set for the terminal block:
The result for DO 0 (output 0) is 15.612, and the result for DO 1 (output 1) is 22.563.

SCI=12.953, -36.195,0.000
Three output equations are set for the RS-232C port:
The result for DO 0 is 12.953, the result for DO 1 is -36.195, and the result for DO 2 is 0.000.

## 5-4-5 EXPPARA: Export Parameter

EXPPARA is used to read or set evaluation criteria set for terminals or RS-232C outputs.

### Reading Evaluation Criteria

**Input**

EXPPARA {/P<*Terminal_block_output_number*> |
/S<*RS-232C_output_number*>}[/EH][/EL]

- Specify /P to output the evaluation criteria for terminal block output expressions. Specify a number between 0 and 15 for the terminal block output number.
- Specify /S to output the evaluation criteria for RS-232C output expressions. Specify a number between 0 and 7 for the RS-232C output number.
- Specify /EH to output the upper limit.
- Specify /EL to output the lower limit.
- The upper and lower limits will both be output if both /EH and /EL are omitted.

**Output**

E_LOW=:*Lower_limit*
E_HIGH=:*Upper_limit*

"ER" will be output if the input command is incorrect.

**Example**

**Input:** EXPPARA /P0

The evaluation criteria will be read for the terminal block terminal DO 0.

**Output:** E_LOW=80.000,E_HIGH=100.000

The lower limit is 80.000, and the upper limit is 100.000.

### Setting Evaluation Criteria

**Input**

EXPPARA {/P<*Terminal_block_output_number*> |
/S<*RS-232C_output_number*>}
[/EH:<*Upper_limit*>][/EL:<*Lower_limit*>]

- Set the value between 0 and 15 for the terminal output number.
- Specify an RS-232C output number between 0 and 7.
- Specify the upper limit between -999,999.999 and 999,999.999 after /EH in the command.
- Specify the lower limit (between -999,999.999 and 999,999.999) after /EL in the command.

- If either the upper or lower limit is omitted, the setting will remain unchanged for the omitted value. Both criteria will be output if both the upper and lower limits are omitted.

**Output**

Correct settings made: `OK`

Correct settings not made: `ER`

**Example**

**Input:** `EXPPARA /S2 /EL:100.000 /EH:150.000`

The lower limit for RS-232C output 2 is changed to 100.000, and the upper limit is changed to 150.000.

**Output:** `OK`

## 5-4-6 MEASDATA: Measure Data

MEASDATA is used to read measurement results of each region for images stored in memory.

**Input**

`MEASDATA /I`*<Image_number>*
`{/P`*<Position_compensation_region_number>*`|`
`/M`*<Current_measurement_region_number>*`}`
`[/R] [/X] [/Y] [/T] [/S]`

- Specify an image number between 0 and 22.
- Specify /P to output measurement results for the position displacement compensation region. Specify 0 or 1 for the position compensation region number.
- Specify /M to output measurement results for the current measurement region. Specify the current measurement region number between 0 and 15.
- The options are given in the following table. If all options are omitted, all measurement conditions will be output.

| Option | Meaning |
|---|---|
| R | Judgement |
| X | X coordinate |
| Y | Y coordinate |
| T | Axis angle |
| S | Area (for binary center of gravity and area or binary axis angle regions)<br>Correlation (for density search regions) |

**Output**

| Output | Meaning |
|---|---|
| R=*value* | Judgement (16-bit hexadecimal)<br>0: OK<br>A value other than 0: NG |
| X=*value* | X coordinate (-999,999.000 to 999,999.999) * |
| Y=*value* | Y coordinate (-999,999.000 to 999,999.999) * |
| T=*value* | Axis angle (0 to 180.00) |
| S=*value* | Area (0 to 999,999) * for binary center of gravity and area or binary axis angle<br>Correlation (0 to 100) for density search region |

**Note** Calibrated values will be output for items marked with asterisks (*).

**X and Y coordinates:** The output will be -999,999.999 if the measurement result is less than -999,999.999. The output will be 999,999.999 if the measurement result is greater than 999,999.999.

**Area:** The output will be 999,999 if the measurement is greater than 999,999.

"ER" will be output if the input command is incorrect.

**Example**

**Input:** `MEASDATA /I2 /M4 /R /X /Y`

The judgement and actual X and Y coordinates will be read for measurement region 4 or stored image 2.

**Output:** R=0X0010,X=156.42,Y=243.91

The judgement is NG, the actual X coordinate is 156.42, and the actual Y coordinate is 243.91.

## 5-4-7 MEASURE: Measure

MEASURE is used to perform measurements one at a time or to stop and start continuous measurements.

### Performing One Measurement

**Input**

`MEASURE`

or

`M`

**Output**

Measurement correctly performed:

OK *delimiter Measurement_results* → **p 165**

Measurement not correctly performed: ER

## Starting Continuous Measurements

**Input**

```
MEASURE /C
```

**Output**

Measurement correctly performed:
OK *delimiter Continuous_measurement_results*
→ **p 165**

Measurement not correctly performed: ER

## Stopping Continuous Measurements

**Input**

```
MEASURE /E
```

**Output**

Measurement correctly stopped: OK

Measurement not correctly stopped: ER

# 5-4-8 POSIDATA: Position Data

POSIDATA is used to obtain the X, Y, or position displacement compensation of a stored image.

**Input**

POSIDATA /I<*Image_number*> [/X] [/Y] [/T]

- Specify an image number between 0 and 22.
- The options are given in the following table. If all options are omitted, all measurement conditions will be output.

| Option | Meaning |
|---|---|
| X | Displacement in the X direction |
| Y | Displacement in the Y direction |
| T | Rotational displacement (θ) |

**Output**

| Output | Meaning |
|---|---|
| X=*value* | Displacement in the X direction |
| Y= *value* | Displacement in the Y direction |
| T= *value* | Rotational displacement (θ) |

The output values are not calibrated.

"ER" will be output if the input command is incorrect.

**Example**

**Input:** `POSIDATA /I2 /X /Y`

The X and Y displacements will be read for image 2.

**Output:** X=95.65,Y=459.25

The X displacement is 95.65, and the Y displacement is 459.25.

## 5-4-9 RESET: Reset

RESET is used to reset the F150.

**Input**

`RESET`

**Output**

Nothing is output for this command.

## 5-4-10 SCENE: Scene

SCENE is used to read or set the scene number.

### Reading the Scene Number

**Input**

`SCENE`

**Output**

The current scene number is output.

"`ER`" will be output if the input command is incorrect.

**Example**

**Input:** `SCENE`

**Output:** 0

Scene 0 is displayed.

### Setting the Scene Number

**Input**

`SCENE` <*Scene_number*>

**Output**

Scene correctly switched: `OK`

Scene not correctly switched: `ER`

**Example**

**Input:** `SCENE 2`

The measurement scene will be changed to scene 2.

**Output:** `OK`

## 5-4-11 SCNLOAD: Scene Load

SCNLOAD is used to load scene data from the computer or other external device connected to the RS-232C port.

**Input**

`SCNLOAD` <*Scene_number*>

- Specify a scene number between 0 and 15.
- The F150 will begin preparations when the SCNLOAD command is input. Once the preparations have been completed, the READY signal will be turned ON. Wait until the external device receives the READY signal before starting to send data.
- Scene data can also be saved and loaded from the menus. → **p 121**

**Output**

Data correctly loaded: `OK`

Data not correctly loaded: `ER`

**Example**

**Input:** SCNLOAD 2

Data will be loaded to scene 2 from an external device.

**Output:** `OK`

## 5-4-12 SRCHPARA: Search Parameter

SRCHPARA is used to read or set measurement conditions for regions set for density search measurement.

### Reading Measurement Conditions

**Input**

`SRCHPARA /A`<*Region_number*> `[/U] [/XH] [/XL] [/YH] [/YL] [/RH] [/RL]`

- Specify a region number between 0 and 15.
- The options are given in the following table. If all options are omitted, all measurement conditions will be output.

| Option | Meaning |
|---|---|
| U | Unit |
| XH | Upper limit of X criteria |
| XL | Lower limit of X criteria |
| YH | Upper limit of Y criteria |
| YL | Lower limit of Y criteria |
| RH | Upper limit of correlation criteria |
| RL | Lower limit of correlation criteria |

**Output**

| Output | Meaning |
|---|---|
| U=*value* | Unit<br>0: μm, 1: mm, 2: cm |
| XH=*value* | Upper limit of X criteria |
| XL=*value* | Lower limit of X criteria |
| YH=*value* | Upper limit of Y criteria |
| YL=*value* | Lower limit of Y criteria |
| RH=*value* | Upper limit of correlation criteria |
| RL=*value* | Lower limit of correlation criteria |

"ER" will be output if the input command is incorrect.

**Example**

**Input:** SRCHPARA /A0 /U /XL /XH

The unit, and upper and lower limits of the X criteria will be read for region 0.

**Output:** u=1,X_LOW=200.00,X_HIGH=300.00

The unit is mm, the lower limit of the X criteria is 200.00, and the upper limit is 300.00.

## Setting Measurement Conditions

**Input**

SRCHPARA /A<*Region_number*>
[/U:<*Unit*>] [/XH:<*Upper_limit_of_X_criteria*>]
[/XL:<*Lower_limit_of_X_criteria*>]
[/YH:<*Upper_limit_of_Y_criteria*>]
[/YL:<*Lower_limit_of_Y_criteria*>]
[/RH:<*Upper_limit_of_correlation_criteria*>]
[/RL:<*Lower_limit_of_correlation_criteria*>]

- Specify a region number between 0 and 15.

- The options are given in the following table. Any measurement condition that is not specified will not be changed. If all options are omitted, all measurement conditions will be output.

| Option | Meaning |
|---|---|
| U=*value* | Unit<br>0: μm, 1: mm, 2: cm |
| XH=*value* | Upper limit of X criteria (-999.99 to 999.99) |
| XL=*value* | Lower limit of X criteria (-999.99 to 999.99) |
| YH=*value* | Upper limit of Y criteria (-999.99 to 999.99) |
| YL=*value* | Lower limit of Y criteria (-999.99 to 999.99) |
| RH=*value* | Upper limit of correlation criteria (0 to 100) |
| RL=*value* | Lower limit of correlation criteria (0 to 100) |

**Output**

Settings correctly made: `OK`

Settings not correctly made: `ER`

**Example**

**Input:** `SRCHPARA /A1 YL:250.00 YH:350.00`

The lower limit of the Y criteria will be set to 250.00, and the upper limit will be set to 350.00 for the region 1.

**Output:** `OK`

## 5-5 Measurement Results Output Format

Measurement results are output in ASCII in order from the smallest output number to the largest.

The measurement results are output in the normal format even in Menu operation mode.

<*Measurement_No.*>,
[<*Measurement_results_for_output_0*>],
[<*Measurement_results_for_output_1*>],
[<*Measurement_results_for_output_2*>],
[<*Measurement_results_for_output_3*>],
[<*Measurement_results_for_output_4*>],
[<*Measurement_results_for_output_5*>],
[<*Measurement_results_for_output_6*>],
[<*Measurement_results_for_output_7*>]

| Output | Meaning |
|---|---|
| Measurement number | The number of the measurement counting since the power was turned ON.<br>This number, from 1 to 4,294,967,295, is the total number of measurements in Monitor and Run modes. |
| Measurement results for output number * | The measurement results are output in order of the output numbers.<br>A decimal integer consisting of a 6-digit integer component and a 3-digit decimal component will be output.<br>The output values are calibrated.<br>Values between −999,999.999 and 999,999.999 are output.<br>If the measurement is less than −999,999.999, the output will be −999,999.999.<br>If the measurement is greater than 999,999.999, the output will be 999,999.999. |

# SECTION 6
# RS-232C Host Link Settings

This section describes the communications settings for the RS-232C port when communications are in Host Link mode.

# 6-1 Communications Settings

## 6-1-1 Flow Chart

Select Host Link for the communications mode to communicate in Host Link format with a PLC or other host device via the RS-232C port.

Communications are possible only in Run mode, and cannot be performed in Set or Monitor modes.

**PLC Programming Precautions**

The F150 will send a command to the PLC to change the PLC to MONITOR mode if the F150 in Host Link mode enters Run mode when it is connected to a PLC via the RS-232C port. If the PLC was originally in PROGRAM mode, entering MONITOR mode will cause the program in the PLC to be executed.

⚠ **Caution** Switching the PLC from PROGRAM mode to MONITOR mode will automatically execute the ladder program and may begin operation of peripheral devices. Confirm the results of PLC program executing before allowing the ladder program to be executed.

Peripheral devices connected to the PLC may make changes to the PLC program or data when the PLC is in MONITOR mode.

### RS-232C Communications

Communications between the F150 and the PLC can be performed in one of the following three ways. These methods use the Read Area and Write Area allocated in the PLC for the F150.

**RS-232C communications alone** can be used to send commands from the PLC to the F150 and read the results returned by the F150. All communications in the PLC can be handled by reading and writing the Read Area and Write Area in local memory from the ladder program. Data transfers between the PLC and F150 will be handled automatically.

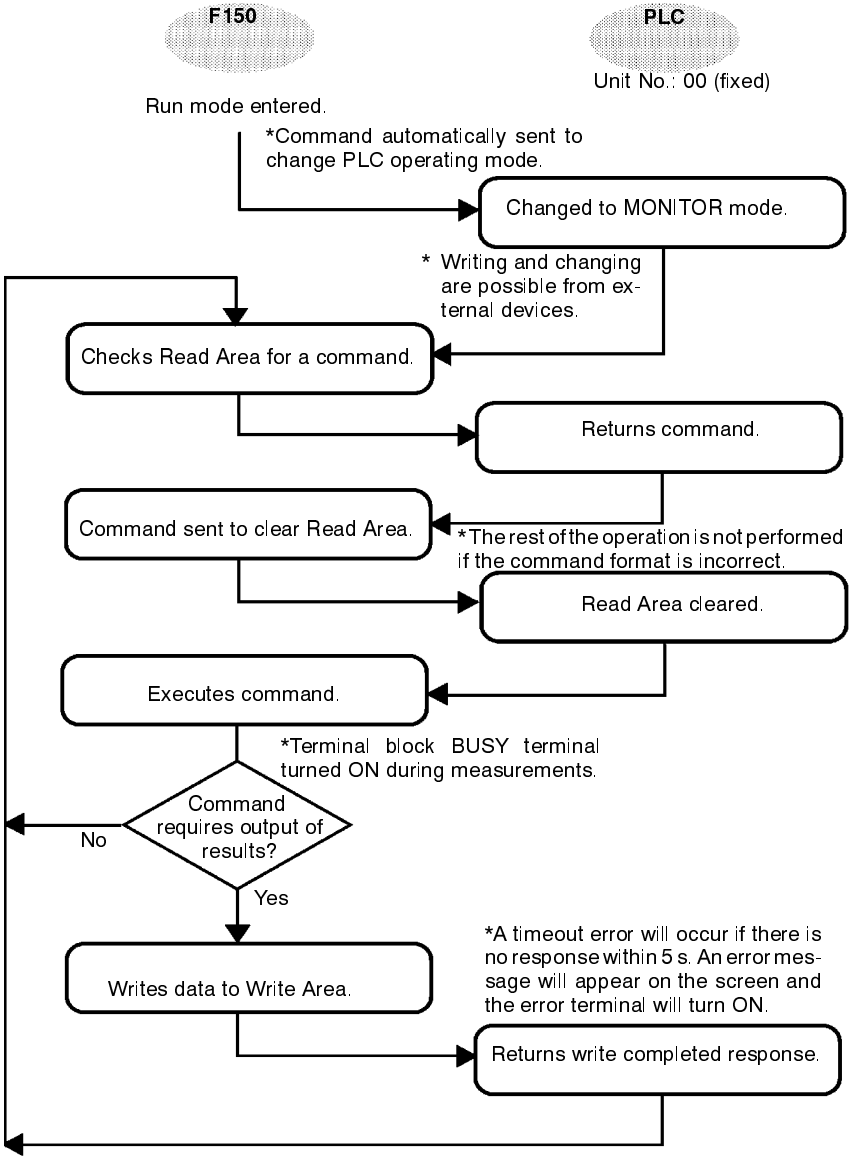
The **STEP signal** can be used to trigger measurements. When a measurement is taken, the measurement results will be automatically written to PLC memory and can be read locally from the ladder program.

The **TXD instruction** can be executed from the ladder program to send commands to the F150. The results of command execution will be automatically written to PLC memory and can be read locally from the ladder program.

Flow charts for these three forms of communications are provided next.

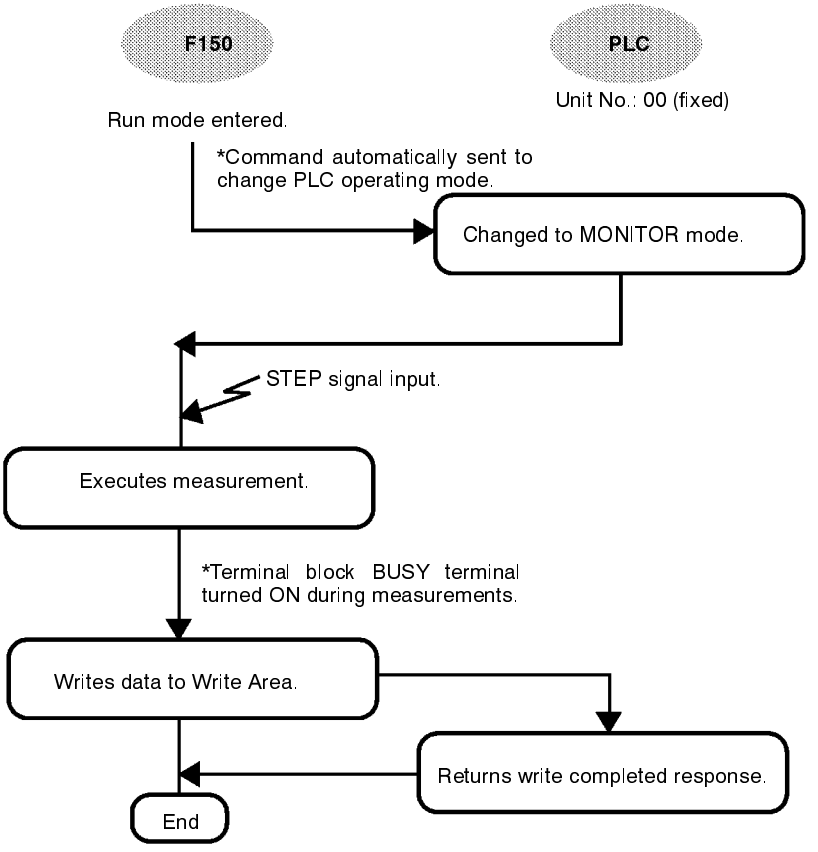
## RS-232C Communications Alone

Commands for the F150 are written to the Read Area in the PLC. The F150 will automatically read these commands, execute them, and write any results to the Write Area.



## Using the STEP Signal

Measurements are performed when the STEP signal is received and measurement results are written to the Write Area.

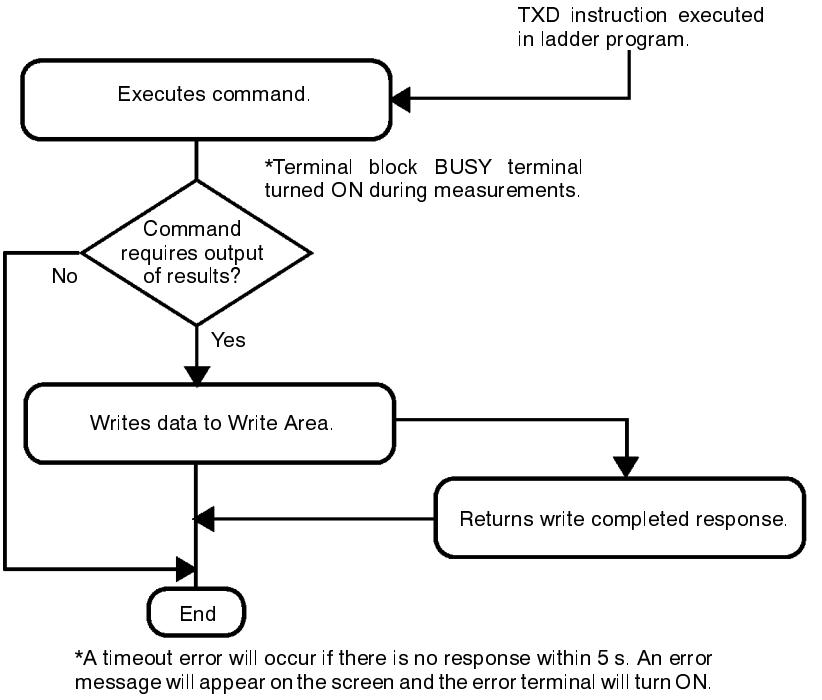



*A timeout error will occur if there is no response within 5 s. An error message will appear on the screen and the error terminal will turn ON.

## Using TXD Instructions

Commands are sent from the PLC to the F150 using TXD instructions in the PLC's ladder program instead of the Read Area.

If TXD instructions are to be used to send commands, set the Read Area to "None."




# 6-1-2 Setting Methods

## Baud Rate and Communications Mode

This section explains how to set the baud rate, data length, and other communications specifications.

The same communications settings must be used on both the F150 and the external device (PLC).

| Item | Setting | |
|---|---|---|
| Baud rate | 2,400/4,800/9,600/19,200/ 38,400* (bps) | Use the same settings on the PLC. |
| Data length | 7, 8* (bits) | |
| Parity | None, even, odd | |
| Stop bit | 1*, 2 (bits) | |
| Delimiter | CR*, LF, CR+LF | |
| Operating mode | Select Host Link from Normal*, Host Link, and Menu operation. | |

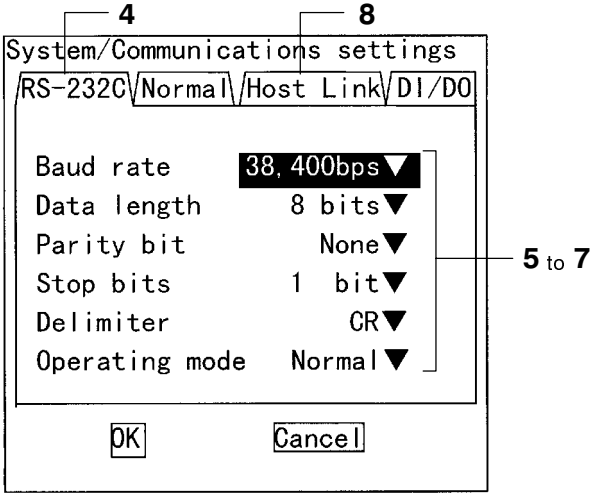
**Note** The default settings are marked with asterisks.*

**1** Move to the Basic Screen (where the three modes can be selected).
The cursor cannot be moved to ***Scn*** ▼ when in Set mode. Press the **ESC** Key to move to the Basic Screen.

**2** Move the cursor to ***Scn*** ▼ and press the **ENT** Key.

**3** Move the cursor to ***System/Communications settings*** and press the **ENT** Key.

**4** Move the cursor to ***RS-232C***. The following screen will be displayed.




**5** Using the **Up** and **Down** Keys, move the cursor to the item to be changed and press the **ENT** Key. A list of options will be displayed.

**6** Move the cursor to the item to be selected and press the **ENT** Key. The item will be set.

**7** Repeat steps (5) and (6) to change other items.

**8** Once all settings have been made, move the cursor to ***Host Link*** and proceed to the next procedure to set the PLC Read and Write Areas.

## Setting the Read and Write Areas in the PLC

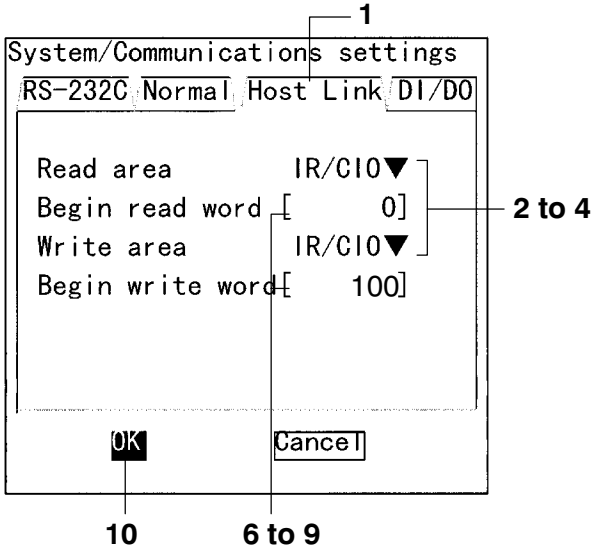
This section explains how to set the Read Area from which the F150 reads commands and the Write Area to which the F150 outputs results. Both of these areas are in the memory of the PLC.

| Item | Selection |
|---|---|
| Read Area | IR/CIO*, HR (holding relay), LR (link relay), DM (data memory), None (See note 2.) |
| Begin read word | Set the first word to read in area specified above (0 to 65,535). The default is 0. |
| Write Area | IR/CIO*, HR (holding relay), LR (link relay), DM (data memory), None (See note 2.) |
| Begin write word | Set the first word to write in the area specified above (0 to 65,535). The default is 100. |

**Note**

1. The default settings are marked with asterisks.*
2. If no Read Area is set, commands will not be automatically read from the PLC, but they can be sent from the PLC by executing the TXD instruction in the ladder program. If no Write Area is set, the results will not be written to the PLC.

**1** Check that the cursor is on **Host Link** and press the **ENT** Key. The following screen will be displayed.




**2** Using the **Up** and **Down** Keys, move the cursor to ***Read Area*** and press the **ENT** Key. A list of areas will be displayed.

**3** Using the **Up** and **Down** Keys, move the cursor to the desired area and press the **ENT** Key. The area will be set.

**4** Repeat steps (2) and (3) for the ***Write Area***.

**5** Using the **Up** and **Down** Keys, move the cursor to the ***Begin read word*** settings and press the **ENT** Key. The digit cursor will appear.

**6** Using the **Left** and **Right** Keys, move the cursor to the digits to be changed.

**7** Using the **Up** and **Down** Keys, change the setting to the desired first word.

**8** Press the **ENT** Key. The first read word will be set.

**9** Repeat steps (5) to (8) for the ***Begin write word***.

**10** Once all setting have been made, move the cursor to ***OK*** and then press the **ENT** Key. The Read and Write Word settings will be saved.

# 6-2 Sample Programming

This section describes sample programming and the data settings used with it.

## PLC Settings

Use the following communications setting for a Host Link Unit on the PLC, or the Host Link port built into the CPU Unit.

Refer to the PLC manuals for detailed setting instructions.

| Item | Setting |
|---|---|
| Communications protocol | SYSWAY (Host Link) |
| 1:1/1:N | 1:N |
| Unit no. | 00 |
| Baud rate | Make the same settings as for the F150. |
| Data length | |
| Parity | |
| Stop bits | |

## F150 Settings

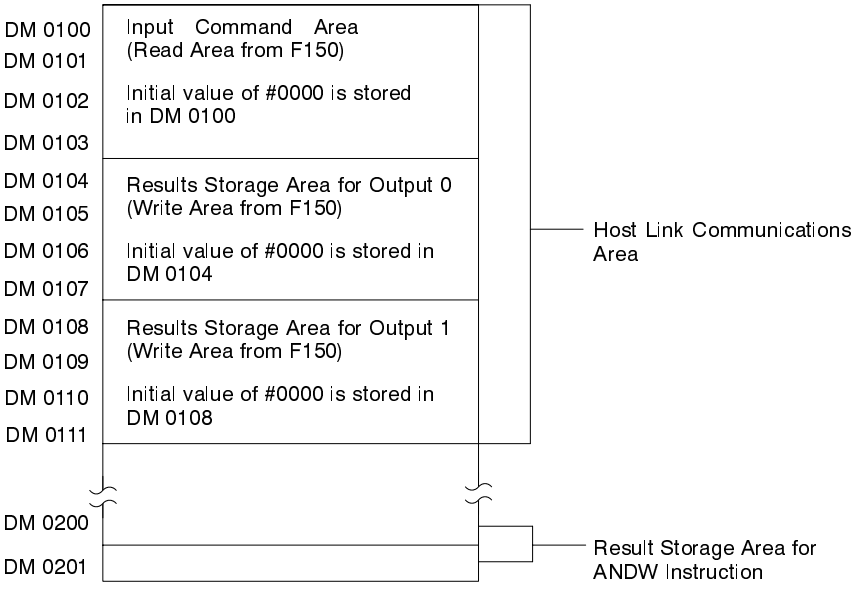
| Item | Setting |
|---|---|
| Baud rate | Make the same settings as for the PLC. |
| Data length | |
| Parity | |
| Stop bits | |
| Read Area | DM |
| Begin read word | 0100 |
| Write Area | DM |
| Begin write word | 0104 |

## Sample Program

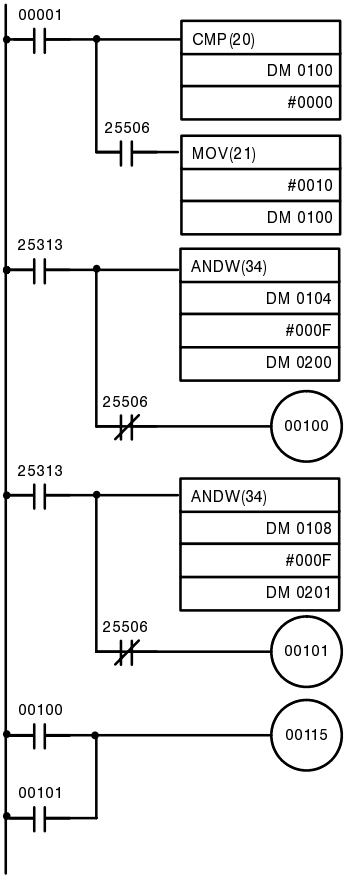
The following sample program is for an OMRON C200H/C200HS PLC.

The MEASUREMENT command is input from the PLC, and the F150 outputs the results to the PLC. Suitable output methods would need to be set for RS-232C outputs 0 and 1.

**Data Area Allocations**



## PLC Ladder Diagram




(1) When CIO 00001 turns ON, the first word (begin read word) in the Input Command Area is checked to see if it has been cleared to #0000.

(2) If the first word is #0000, the MEASUREMENT command is moved to the Input Command Area.

(3) The status of the rightmost 4 bits of the first word for output 0 is checked, and the judgement is output to CIO 00100. (OK: OFF, NG: ON)

(4) The status of the rightmost 4 bits of the first word for output 1 is checked, and the judgement is output to CIO 00101. (OK: OFF, NG: ON)

(5) An OR of the judgements for output 0 and output 1 is output to CIO 00115.

# 6-3 Command Tables

The following commands can be input from the PLC or other external device to the F150.

In the PLC, set the command to be executed starting at the begin read word.

## Commands that Control F150 Operation

The following commands control F150 operation.

| Command code | Function |
|---|---|
| 0010 | Executes one measurement. |
| 0011 | Starts continuous measurement. |
| 0012 | Stops continuous measurement. |
| 0020 | Changes to a specified scene number. |
| 0021 | Increases the displayed scene number by one. |
| 0022 | Decreases the displayed scene number by one. |
| 0066 | Saves all data to flash memory. |
| 0092 | Resets the F150. |

## Commands that Read Measurement Results for Stored Images

The following commands read measurement results for stored images. The measurement results are written to the Write Area.

| Command code | Function | |
|---|---|---|
| 1200 | Current measurement | Judgment |
| 1201 | | X coordinate |
| 1202 | | Y coordinate |
| 1203 | | Axis angle |
| 1204 | | Measurement (Area/correlations) |
| 1210 | Position displacement compensation | X displacement |
| 1211 | | Y displacement |
| 1212 | | Angular displacement (θ) |
| 1220 | Output expressions | Terminal block |
| 1221 | | RS-232C |

## Commands that Read Measurement Conditions

The following commands read measurement conditions. The measurement conditions are written to the Write Area.

| Command code | Function | |
|---|---|---|
| 0023 | Current scene number | |
| 1010 | Density search | X criteria (upper and lower limits) |
| 1011 | | Y criteria (upper and lower limits) |
| 1012 | | Correlation criteria (upper and lower limits) |
| 1030 | Binary center of gravity and area | X criteria for center of gravity (upper and lower limits) |
| 1031 | | Y criteria for center of gravity (upper and lower limits) |
| 1032 | | Area criteria (upper and lower limits) |
| 1033 | | Binary level (upper and lower limits, reversal) |
| 1050 | Binary axis angle | X criteria for center of gravity (upper and lower limits) |
| 1051 | | Y criteria for center of gravity (upper and lower limits) |
| 1052 | | Axis angle criteria (upper and lower limits) |
| 1053 | | Area criteria (upper and lower limits) |
| 1054 | | Binary level (upper and lower limits, reversal) |
| 1110 | Output expression | Terminal block (upper and lower limits) |
| 1111 | | RS-232C (upper and lower limits) |

## Commands that Change F150 Settings

The following commands change measurement conditions.

| Command code | Function | |
|---|---|---|
| 1000 | Density search measurement | X criteria (upper and lower limits) |
| 1001 | | Y criteria (upper and lower limits) |
| 1002 | | Correlation criteria (upper and lower limits) |
| 1020 | Binary center of gravity and area measurement | X criteria for center of gravity (upper and lower limits) |
| 1021 | | Y criteria for center of gravity (upper and lower limits) |
| 1022 | | Area criteria (upper and lower limits) |
| 1023 | | Binary level (upper and lower limits, reversal) |
| 1040 | Binary axis angle measurement | X criteria for center of gravity (upper and lower limits) |
| 1041 | | Y criteria for center of gravity (upper and lower limits) |
| 1042 | | Axis angle criteria (upper and lower limits) |
| 1043 | | Area criteria (upper and lower limits) |
| 1044 | | Binary level (upper and lower limits, reversal) |
| 1100 | Output expression | Terminal block (upper and lower limits) |
| 1101 | | RS-232C (upper and lower limits) |

# 6-4 Host Link Commands

This section explains the command formats in order of the command codes. Commands are input in BCD. Set the commands starting from the begin read word of the Read Area.

## 6-4-1 0010: MEASUREMENT

Executes one measurement of the camera image.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0000 | 0000 | 0001 | 0000 | Command code |

The measurement results are output. → **p 206**

## 6-4-2 0011: CONTINUOUS MEASUREMENT

Starts continuous measurement of the camera image.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0000 | 0000 | 0001 | 0001 | Command code |

The measurement results are output. → **p 206**

## 6-4-3 0012: STOP MEASUREMENT

Stops continuous measurement.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0000 | 0000 | 0001 | 0010 | Command code |

## 6-4-4 0020: SWITCH SCENE

Switches to a specified scene number.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0000 | 0000 | 0010 | 0000 | Command code |
| +1 | ---- | ---- | 10's digit | 1's digit | Scene No. (00 to 15) |

## 6-4-5 0021: INCREMENT SCENE

Increments the current scene number.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0000 | 0000 | 0010 | 0001 | Command code |

## 6-4-6 0022: DECREMENT SCENE

Decrements the current scene number.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0000 | 0000 | 0010 | 0010 | Command code |

## 6-4-7 0023: READ SCENE NUMBER

Reads the scene number of the image being displayed.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0000 | 0000 | 0010 | 0011 | Command code |

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | ---- | ---- | 10's digit | 1's digit | Scene No. (00 to 15) |

## 6-4-8 0066: SAVE DATA

Saves all data to flash memory.

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0000 | 0000 | 0110 | 0110 | Command code |

## 6-4-9 0092: RESET

Resets the F150.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0000 | 0000 | 1001 | 0010 | Command code |

## 6-4-10 1000: SET X CRITERIA FOR DENSITY

Sets the X coordinate criteria for density search measurement to between -999.99 and 999.99.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0000 | 0000 | 0000 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Region No. (00 to 15) |
| +2 | 0000 | 0000 | 0000 | 00** | Unit |
| +3 | 0000 | 100's digit | 10's digit | 1's digit | Integer of upper limit |
| +4 | Sign | 0000 | 0000 | 0000 | Sign |
| +5 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of upper limit |
| +6 | 0000 | 100's digit | 10's digit | 1's digit | Integer of lower limit |
| +7 | Sign | 0000 | 0000 | 0000 | Sign |
| +8 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of lower limit |

**Unit:** μm: 00, mm: 01, cm: 10

**Sign:** Positive: 0000, Negative: 1111

## 6-4-11 1001: SET Y CRITERIA FOR DENSITY

Sets the Y coordinate criteria for density search measurement to between -999.99 and 999.99.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0000 | 0000 | 0001 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Region number (00 to 15) |
| +2 | 0000 | 0000 | 0000 | 00** | Unit |
| +3 | 0000 | 100's digit | 10's digit | 1's digit | Integer of upper limit |
| +4 | Sign | 0000 | 0000 | 0000 | Sign |
| +5 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of upper limit |
| +6 | 0000 | 100's digit | 10's digit | 1's digit | Integer of lower limit |
| +7 | Sign | 0000 | 0000 | 0000 | Sign |
| +8 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of lower limit |

**Unit:** μm: 00, mm: 01, cm: 10

**Sign:** Positive: 0000, Negative: 1111

## 6-4-12 1002: SET CORRELATION FOR DENSITY

Sets the correlation criteria for density search measurement to between 0 and 100.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0000 | 0000 | 0010 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Region No. (00 to 15) |
| +2 | 0000 | 100's digit | 10's digit | 1's digit | Upper limit |
| +3 | 0000 | 100's digit | 10's digit | 1's digit | Lower limit |

## 6-4-13 1010: READ X CRITERIA FOR DENSITY

Reads the X coordinate criteria for density search measurement.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0000 | 0001 | 0000 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Region No. (00 to 15) |

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | 0000 | 00** | Unit |
| +1 | 0000 | 100's digit | 10's digit | 1's digit | Integer of upper limit |
| +2 | Sign | 0000 | 0000 | 0000 | Sign |
| +3 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of upper limit |
| +4 | 0000 | 100's digit | 10's digit | 1's digit | Integer of lower limit |
| +5 | Sign | 0000 | 0000 | 0000 | Sign |
| +6 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of lower limit |

**Write Flag:** Changes between 0000 and 1111 each time data is output. Monitor the flag to check if the data has been written.
**Unit:** μm: 00, mm: 01, cm: 10
**Sign:** Positive: 0000, Negative: 1111

## 6-4-14 1011: READ Y CRITERIA FOR DENSITY

Reads the Y coordinate criteria for density search measurement.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0000 | 0001 | 0001 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Region No. (00 to 15) |

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | 0000 | 00** | Unit |
| +1 | 0000 | 100's digit | 10's digit | 1's digit | Integer of upper limit |
| +2 | Sign | 0000 | 0000 | 0000 | Sign |
| +3 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of upper limit |
| +4 | 0000 | 100's digit | 10's digit | 1's digit | Integer of lower limit |
| +5 | Sign | 0000 | 0000 | 0000 | Sign |
| +6 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of lower limit |

**Write Flag:** Changes between 0000 and 1111 each time data is output. Monitor the flag to check if the data has been written.

**Unit:** μm: 00, mm: 01, cm: 10

**Sign:** Positive: 0000, Negative: 1111

## 6-4-15 1012: READ CORRELATION FOR DENSITY

Reads the correlation criteria for density search measurement.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0000 | 0001 | 0010 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Region No. (00 to 15) |

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | 0000 | 0000 | Write verification flag |
| +1 | 0000 | 100's digit | 10's digit | 1's digit | Upper limit |
| +2 | 0000 | 100's digit | 10's digit | 1's digit | Lower limit |

**Write Flag:** Changes between 0000 and 1111 each time data is output. Monitor the flag to check if the data has been written.

**Correlation Range:** 000 to 100.

## 6-4-16 1020: SET X CRITERIA FOR GRAVITY

Sets the X coordinate criteria for binary center of gravity and area measurement to between -999.99 and 999.99.

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0000 | 0010 | 0000 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Region No. (00 to 15) |
| +2 | 0000 | 0000 | 0000 | 00** | Unit |
| +3 | 0000 | 100's digit | 10's digit | 1's digit | Integer of upper limit |
| +4 | Sign | 0000 | 0000 | 0000 | Sign |
| +5 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of upper limit |
| +6 | 0000 | 100's digit | 10's digit | 1's digit | Integer of lower limit |
| +7 | Sign | 0000 | 0000 | 0000 | Sign |
| +8 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of lower limit |

**Unit:** μm: 00, mm: 01, cm: 10

**Sign:** Positive: 0000, Negative: 1111

## 6-4-17 1021: SET Y CRITERIA FOR GRAVITY

Sets Y coordinate criteria for binary center of gravity and area measurement to between -999.99 and 999.99.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0000 | 0010 | 0001 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Region No. (00 to 15) |
| +2 | 0000 | 0000 | 0000 | 00** | Unit |
| +3 | 0000 | 100's digit | 10's digit | 1's digit | Integer of upper limit |
| +4 | Sign | 0000 | 0000 | 0000 | Sign |
| +5 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of upper limit |
| +6 | 0000 | 100's digit | 10's digit | 1's digit | Integer of lower limit |
| +7 | Sign | 0000 | 0000 | 0000 | Sign |
| +8 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of lower limit |

**Unit:** μm: 00, mm: 01, cm: 10

**Sign:** Positive: 0000, Negative: 1111

## 6-4-18 1022: SET AREA CRITERIA FOR GRAVITY

Sets area criteria for binary center of gravity and area measurement to between 0 and 999,999.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0000 | 0010 | 0010 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Region No. (00 to 15) |
| +2 | 1,000's digit | 100's digit | 10's digit | 1's digit | Last 4 digits of Integer of upper limit |
| +3 | Sign | 0000 | 100,000's digit | 10,000's digit | First 2 digits of Integer of upper limit, sign |
| +4 | 0000 | 0000 | 0000 | 0000 | --- |
| +5 | 1,000's digit | 100's digit | 10's digit | 1's digit | Last 4 digits of Integer of lower limit |
| +6 | Sign | 0000 | 100,000's digit | 10,000's digit | First 2 digits of Integer of lower limit, sign |
| +7 | 0000 | 0000 | 0000 | 0000 | --- |

**Sign:** Positive: 0000, Negative: 1111

## 6-4-19 1023: SET BINARY LEVEL FOR GRAVITY

Sets the binary level for binary center of gravity and area measurement to between 0 and 255.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0000 | 0010 | 0011 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Region No. (00 to 15) |
| +2 | 0000 | 100's digit | 10's digit | 1's digit | Upper limit of binary level |
| +3 | 0000 | 100's digit | 10's digit | 1's digit | Lower limit of binary level |
| +4 | 0000 | 0000 | 0000 | Reversal | Reversal Flag |

**Reversal Flag:** Not reversed: 0000, Reversed: 0001

## 6-4-20 1030: READ X CRITERIA FOR GRAVITY

Reads the X coordinate criteria for binary center of gravity and area measurement.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0000 | 0011 | 0000 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Region No. (00 to 15) |

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | 0000 | 00** | Unit |
| +1 | 0000 | 100's digit | 10's digit | 1's digit | Integer of upper limit |
| +2 | Sign | 0000 | 0000 | 0000 | Sign |
| +3 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of upper limit |
| +4 | 0000 | 100's digit | 10's digit | 1's digit | Integer of lower limit |
| +5 | Sign | 0000 | 0000 | 0000 | Sign |
| +6 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of lower limit |

**Write Flag:** Changes between 0000 and 1111 each time data is output. Monitor the flag to check if the data has been written.

**Unit:** μm: 00, mm: 01, cm: 10

**Sign:** Positive: 0000, Negative: 1111

## 6-4-21 1031: READ Y CRITERIA FOR GRAVITY

Reads the Y coordinate criteria for binary center of gravity and area measurement.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0000 | 0011 | 0001 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Region No. (00 to 15) |

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | 0000 | 00** | Unit |
| +1 | 0000 | 100's digit | 10's digit | 1's digit | Integer of upper limit |
| +2 | Sign | 0000 | 0000 | 0000 | Sign |
| +3 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of upper limit |
| +4 | 0000 | 100's digit | 10's digit | 1's digit | Integer of lower limit |
| +5 | Sign | 0000 | 0000 | 0000 | Sign |
| +6 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of lower limit |

**Write Flag:** Changes between 0000 and 1111 each time data is output. Monitor the flag to check if the data has been written.

**Unit:** μm: 00, mm: 01, cm: 10

**Sign:** Positive: 0000, Negative: 1111

## 6-4-22 1032: READ AREA CRITERIA FOR GRAVITY

Reads the area criteria for binary center of gravity and area measurement.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0000 | 0011 | 0010 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Region No. (00 to 15) |

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | 0000 | 0000 | Write verification flag |
| +1 | 1000's | 100's digit | 10's digit | 1's digit | Right 4 digits of Integer of upper limit |
| +2 | Sign | 0000 | 100,000's digit | 10,000's digit | Left 2 digits of Integer of upper limit, sign |
| +3 | 0000 | 0000 | 0000 | 0000 | --- |
| +4 | 1,000's digit | 100's digit | 10's digit | 1's digit | Right 4 digits of Integer of lower limit |
| +5 | Sign | 0000 | 100,000's digit | 10,000's digit | Left 2 digits of Integer of lower limit |
| +6 | 0000 | 0000 | 0000 | 0000 | --- |

**Write Flag:** Changes between 0000 and 1111 each time data is output. Monitor the flag to check if the data has been written.

**Unit:** μm: 00, mm: 01, cm: 10

**Sign:** Positive: 0000, Negative: 1111

## 6-4-23 1033: READ BINARY LEVEL FOR GRAVITY

Reads the binary level for binary center of gravity and area measurement.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0000 | 0011 | 0011 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Region No. (00 to 15) |

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | 0000 | 0000 | Write verification flag |
| +1 | 0000 | 100's digit | 10's digit | 1's digit | Upper limit of binary level |
| +2 | 0000 | 100's digit | 10's digit | 1's digit | Lower limit of binary level |
| +3 | 0000 | 0000 | 0000 | Reversal | Reversal Flag |

**Write Flag:** Changes between 0000 and 1111 each time data is output. Monitor the flag to check if the data has been written.

**Unit:** μm: 00, mm: 01, cm: 10

**Reversal Flag:** Not reversed: 0000, Reversed: 0001

## 6-4-24 1040: SET X CRITERIA FOR ANGLE

Sets X coordinate criteria for binary axis angle measurement to between -999.99 and 999.99.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0000 | 0100 | 0000 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Region No. (00 to 15) |
| +2 | 0000 | 0000 | 0000 | 00** | Unit |
| +3 | 0000 | 100's digit | 10's digit | 1's digit | Integer of upper limit |
| +4 | Sign | 0000 | 0000 | 0000 | Sign |
| +5 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of upper limit |
| +6 | 0000 | 100's digit | 10's digit | 1's digit | Integer of lower limit |
| +7 | Sign | 0000 | 0000 | 0000 | Sign |
| +8 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of lower limit |

**Unit:** μm: 00, mm: 01, cm: 10

**Sign:** Positive: 0000, Negative: 1111

## 6-4-25 1041: SET Y CRITERIA FOR ANGLE

Sets Y coordinate criteria for binary axis angle measurement to between -999.99 and 999.99.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0000 | 0100 | 0001 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Region No. (00 to 15) |
| +2 | 0000 | 0000 | 0000 | 00** | Unit |
| +3 | 0000 | 100's digit | 10's digit | 1's digit | Integer of upper limit |
| +4 | Sign | 0000 | 0000 | 0000 | Sign |
| +5 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of upper limit |
| +6 | 0000 | 100's digit | 10's digit | 1's digit | Integer of lower limit |
| +7 | Sign | 0000 | 0000 | 0000 | Sign |
| +8 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of lower limit |

**Unit:** μm: 00, mm: 01, cm: 10
**Sign:** Positive: 0000, Negative: 1111

## 6-4-26 1042: SET ANGLE CRITERIA FOR ANGLE

Sets the axis angle criteria for binary axis angle measurement to between 0 and 180.00.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0000 | 0100 | 0010 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Region No. (00 to 15) |
| +2 | 0000 | 0000 | 0000 | 00** | Unit |
| +3 | 0000 | 100's digit | 10's digit | 1's digit | Integer of upper limit |
| +4 | Sign | 0000 | 0000 | 0000 | Sign |
| +5 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of upper limit |
| +6 | 0000 | 100's digit | 10's digit | 1's digit | Integer of lower limit |
| +7 | Sign | 0000 | 0000 | 0000 | Sign |
| +8 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of lower limit |

**Unit:** μm: 00, mm: 01, cm: 10
**Sign:** Positive: 0000, Negative: 1111

## 6-4-27 1043: SET AREA CRITERIA FOR ANGLE

Sets the area criteria for binary axis angle measurement to between 0 and 999,999.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0000 | 0100 | 0011 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Region No. (00 to 15) |
| +2 | 1,000's digit | 100's digit | 10's digit | 1's digit | Last 4 digits of Integer of upper limit |
| +3 | Sign | 0000 | 100,000's digit | 10,000's digit | First 2 digits of Integer of upper limit |
| +5 | 0000 | 0000 | 0000 | 0000 | --- |
| +6 | 1,000's digit | 100's digit | 10's digit | 1's digit | Last 4 digits of Integer of lower limit |
| +7 | Sign | 0000 | 100,000's digit | 10,000's digit | First 2 digits of Integer of lower limit |
| +8 | 0000 | 0000 | 0000 | 0000 | --- |

**Sign:** Positive: 0000, Negative: 1111

## 6-4-28 1044: SET BINARY LEVEL FOR ANGLE

Sets the binary level for binary axis angle measurement to between 0 and 255.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0000 | 0100 | 0100 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Region No. (00 to 15) |
| +2 | 0000 | 100's digit | 10's digit | 1's digit | Upper limit of binary level |
| +3 | 0000 | 100's digit | 10's digit | 1's digit | Lower limit of binary level |
| +4 | 0000 | 0000 | 0000 | Reversal | Reversal Flag |

**Reversal Flag:** Not reversed: 0000, Reversed: 0001

## 6-4-29 1050: READ X CRITERIA FOR ANGLE

Reads the upper and lower limits of the X coordinate criteria for binary axis angle measurement.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0000 | 0101 | 0000 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Region No. (00 to 15) |

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | 0000 | 00** | Unit |
| +1 | 0000 | 100's digit | 10's digit | 1's digit | Integer of upper limit |
| +2 | Sign | 0000 | 0000 | 0000 | Sign |
| +3 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of upper limit |
| +4 | 0000 | 100's digit | 10's digit | 1's digit | Integer of lower limit |
| +5 | Sign | 0000 | 0000 | 0000 | Sign |
| +6 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of lower limit |

**Write Flag:** Changes between 0000 and 1111 each time data is output. Monitor the flag to check if the data has been written.

**Unit:** μm: 00, mm: 01, cm: 10

**Sign:** Positive: 0000, Negative: 1111

## 6-4-30 1051: READ Y CRITERIA FOR ANGLE

Reads the Y coordinate criteria for binary axis angle measurement.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0000 | 0101 | 0001 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Region No. (00 to 15) |

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | 0000 | 00** | Unit |
| +1 | 0000 | 100's digit | 10's digit | 1's digit | Integer of upper limit |
| +2 | Sign | 0000 | 0000 | 0000 | Sign |
| +3 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of upper limit |
| +4 | 0000 | 100's digit | 10's digit | 1's digit | Integer of lower limit |
| +5 | Sign | 0000 | 0000 | 0000 | Sign |
| +6 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of lower limit |

**Write Flag:** Changes between 0000 and 1111 each time data is output. Monitor the flag to check if the data has been written.

**Unit:** μm: 00, mm: 01, cm: 10

**Sign:** Positive: 0000, Negative: 1111

## 6-4-31 1052: READ ANGLE CRITERIA FOR ANGLE

Reads axis angle criteria for binary axis angle measurement.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0000 | 0101 | 0010 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Region No. (00 to 15) |

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | 0000 | 00** | Unit |
| +1 | 0000 | 100's digit | 10's digit | 1's digit | Integer of upper limit |
| +2 | Sign | 0000 | 0000 | 0000 | Sign |
| +3 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of upper limit |
| +4 | 0000 | 100's digit | 10's digit | 1's digit | Integer of lower limit |
| +5 | Sign | 0000 | 0000 | 0000 | Sign |
| +6 | 0000 | 1st decimal | 2nd decimal | 0000 | Decimal portion of lower limit |

**Write Flag:** Changes between 0000 and 1111 each time data is output. Monitor the flag to check if the data has been written.
**Unit:** μm: 00, mm: 01, cm: 10
**Sign:** Positive: 0000, Negative: 1111

## 6-4-32 1053: READ AREA CRITERIA FOR ANGLE

Reads the area criteria for binary axis angle measurement.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0000 | 0101 | 0011 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Region No. (00 to 15) |

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | 0000 | 0000 | Write verification flag |
| +1 | 1,000's digit | 100's digit | 10's digit | 1's digit | Last 4 digits of Integer of upper limit |
| +2 | Sign | 0000 | 100,000's digit | 10,000's digit | First 2 digits of Integer of upper limit |
| +3 | 0000 | 0000 | 0000 | 0000 | --- |
| +4 | 1,000's digit | 100's digit | 10's digit | 1's digit | Last 4 digits of Integer of lower limit |
| +5 | Sign | 0000 | 100,000's digit | 10,000's digit | First 2 digits of Integer of lower limit |
| +6 | 0000 | 0000 | 0000 | 0000 | --- |

**Write Flag:** Changes between 0000 and 1111 each time data is output. Monitor the flag to check if the data has been written.

**Sign:** Positive: 0000, Negative: 1111

## 6-4-33 1054: READ BINARY LEVEL FOR ANGLE

Reads the binary level for binary axis angle measurement.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0000 | 0101 | 0100 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Region No. (00 to 15) |

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | 0000 | 0000 | Write verification flag |
| +1 | 0000 | 100's digit | 10's digit | 1's digit | Upper limit of binary level |
| +2 | 0000 | 100's digit | 10's digit | 1's digit | Lower limit of binary level |
| +3 | 0000 | 0000 | 0000 | Reversal | Reversal Flag |

**Write Flag:** Changes between 0000 and 1111 each time data is output. Monitor the flag to check if the data has been written.

**Reversal Flag:** Not reversed: 0000, Reversed: 0001

## 6-4-34 1100: SET TERMINAL EXPRESSION CRITERIA

Sets correlation criteria for the output expression for a terminal block output to between-999,999.999 and 999,999.999.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0001 | 0000 | 0000 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Output No. (00 to 15) |
| +3 | 1,000's digit | 100's digit | 10's digit | 1's digit | Last 4 digits of Integer of upper limit |
| +4 | Sign | 0000 | 100,000's digit | 10,000's digit | First 2 digits of Integer of upper limit |
| +5 | 0000 | 1st decimal | 2nd decimal | 3rd decimal | Decimal portion of upper limit |
| +6 | 1,000's digit | 100's digit | 10's digit | 1's digit | Last 4 digits of Integer of lower limit |
| +7 | Sign | 0000 | 100,000's digit | 10,000's digit | First 2 digits of Integer of lower limit |
| +8 | 0000 | 1st decimal | 2nd decimal | 3rd decimal | Decimal portion of lower limit |

**Sign:** Positive: 0000, Negative: 1111

## 6-4-35 1101: SET RS-232C EXPRESSION CRITERIA

Sets correlation criteria for the output expression for an RS-232C output to between-999,999.999 and 999,999.999.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0001 | 0000 | 0001 | Command code |
| +1 | 0000 | 0000 | 0000 | 1's digit | Output No. (0 to 7) |
| +2 | 1,000's digit | 100's digit | 10's digit | 1's digit | Last 4 digits of Integer of upper limit |
| +3 | Sign | 0000 | 100,000's digit | 10,000's digit | First 2 digits of Integer of upper limit |
| +4 | 0000 | 1st decimal | 2nd decimal | 3rd decimal | Decimal portion of upper limit |
| +5 | 1000's | 100's digit | 10's digit | 1's digit | Last 4 digits of Integer of lower limit |
| +6 | Sign | 0000 | 100,000's digit | 10,000's digit | First 2 digits of Integer of lower limit |
| +7 | 0000 | 1st decimal | 2nd decimal | 3rd decimal | Decimal portion of lower limit |

**Sign:** Positive: 0000, Negative: 1111

## 6-4-36 1110: READ TERMINAL EXPRESSION CRITERIA

Reads the correlation criteria for the output expression for a terminal block output.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0001 | 0001 | 0000 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Output No. (00 to 15) |

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | 0000 | 0000 | Write verification flag |
| +1 | 1,000's digit | 100's digit | 10's digit | 1's digit | Last 4 digits of Integer of upper limit |
| +2 | Sign | 0000 | 100,000's digit | 10,000's digit | First 2 digits of Integer of upper limit |
| +3 | 0000 | 1st decimal | 2nd decimal | 3rd decimal | Decimal portion of upper limit |
| +4 | 1,000's digit | 100's digit | 10's digit | 1's digit | Last 4 digits of Integer of lower limit |
| +5 | Sign | 0000 | 100,000's digit | 10,000's digit | First 2 digits of Integer of lower limit |
| +6 | 0000 | 1st decimal | 2nd decimal | 3rd decimal | Decimal portion of lower limit |

**Write Flag:** Changes between 0000 and 1111 each time data is output. Monitor the flag to check if the data has been written.

**Sign:** Positive: 0000, Negative: 1111

## 6-4-37 1111: READ RS-232C EXPRESSION CRITERIA

Reads the correlation criteria for the output expression for an RS-232C output.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0001 | 0001 | 0001 | Command code |
| +1 | 0000 | 0000 | 0000 | 1's digit | Output No. (0 to 7) |

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | 0000 | 0000 | Write verification flag |
| +1 | 1,000's digit | 100's digit | 10's digit | 1's digit | Last 4 digits of Integer of upper limit |
| +2 | Sign | 0000 | 100,000's digit | 10,000's digit | First 2 digits of Integer of upper limit |
| +3 | 0000 | 1st decimal | 2nd decimal | 3rd decimal | Decimal portion of upper limit |
| +4 | 1,000's digit | 100's digit | 10's digit | 1's digit | Last 4 digits of Integer of lower limit |
| +5 | Sign | 0000 | 100,000's digit | 10,000's digit | First 2 digits of Integer of lower limit |
| +6 | 0000 | 1st decimal | 2nd decimal | 3rd decimal | Decimal portion of lower limit |

**Write Flag:** Changes between 0000 and 1111 each time data is output. Monitor the flag to check if the data has been written.

**Sign:** Positive: 0000, Negative: 1111

## 6-4-38 1200: READ STORED IMAGE JUDGEMENT

Reads the judgement for a stored image.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0010 | 0000 | 0000 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Image No. (00 to 22) |
| +2 | 0000 | 0000 | 0000 | 000* | Position compensation/ current measurement |
| +3 | 0000 | 0000 | 10's digit | 1's digit | Region No. |

**Position Compensation/Current Measurement:** Position compensation (0) or current measurement (1)

**Region No.:** 00 to 01 for position compensation and 00 to 15 for current measurement

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | Judgement | | Judgement |

**Write Flag:** Changes between 0000 and 1111 each time data is output. Monitor the flag to check if the data has been written.

**Judgement:** OK: 00000000, NG: If any bit is 1

## 6-4-39 1201: READ X FOR STORED IMAGE

Reads the X coordinate for a stored image. The X coordinate of the center of the model is obtained for density search measurement regions, and the X coordinate of the center of gravity is obtained for binary center of gravity and area and binary axis angle regions. The output values are calibrated.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0010 | 0000 | 0001 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Image No. (00 to 22) |
| +2 | 0000 | 0000 | 0000 | 000* | Position compensation/ current measurement |
| +3 | 0000 | 0000 | 10's digit | 1's digit | Region No. |

**Position Compensation/Current Measurement:**
Position compensation: 0, Current measuremen: 1

**Region No.:** 00 to 01 for position compensation or 00 to 15 for current measurement.

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | 0000 | 0000 | Write verification flag |
| +1 | 1,000's digit | 100's digit | 10's digit | 1's digit | Last four digits of measurement |
| +2 | Sign | 0000 | 100,000's digit | 10,000's digit | First two digits of measurement value and sign |

**Write Flag:** Changes between 0000 and 1111 each time data is output. Monitor the flag to check if the data has been written.

**Sign:** Positive: 0000, Negative: 1111

The output is the measurement (-999.99 to 999.99) multiplied by 1,000. If the measurement is less than -999.99, the output will be -999.99 × 1000. If the measurement is greater than 999.99, the output will be 999.99 × 1000.

## 6-4-40 1202: READ Y FOR STORED IMAGE

Reads the Y coordinate for a stored image. The Y coordinate of the center of the model is obtained for density search measurement regions, and theY coordinate of the center of gravity is obtained for binary center of gravity and area and binary axis angle regions. The calibrated value is output.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0010 | 0000 | 0010 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Image No. (00 to 22) |
| +2 | 0000 | 0000 | 0000 | 000* | Position compensation/ current measurement |
| +3 | 0000 | 0000 | 10's digit | 1's digit | Region No. |

**Position Compensation/Current Measurement:**
Position compensation (0) or current measurement (1)

**Region No.:** 00 to 01 for position compensation or 00 to 15 for current measurement.

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | 0000 | 0000 | Command code |
| +1 | 1,000's digit | 100's digit | 10's digit | 1's digit | Last four digits of measurement |
| +2 | Sign | 0000 | 100,000's digit | 10,000's digit | First two digits of measurement and sign |

**Write Flag:** Changes between 0000 and 1111 each time data is output. Monitor the flag to check if the data has been written.

**Sign:** Positive: 0000, Negative: 1111

The output is the measurement (-999.99 to 999.99) multiplied by 1,000. If the measurement is less than -999.99, the output will be -999.99 × 1000. If the measurement is greater than 999.99, the output will be 999.99 × 1000.

## 6-4-41 1203: READ ANGLE FOR STORED IMAGE

Reads the axis angle on the real coordinate system for a stored image. The axis angle coordinates can be read using this command only for binary axis angle measurement regions.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0010 | 0000 | 0011 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Image No. (00 to 22) |
| +2 | 0000 | 0000 | 0000 | 000* | Position compensation/ current measurement |
| +3 | 0000 | 0000 | 10's digit | 1's digit | Region No. |

**Position Compensation/Current Measurement:**
Position compensation (0) or current measurement (1)

**Region No.:** 00 to 01 for position compensation or 00 to 15 for current measurement.

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | 0000 | 0000 | Write verification flag |
| +1 | 1,000's digit | 100's digit | 10's digit | 1's digit | Last four digits of measurement |
| +2 | Sign | 0000 | 0000 | 10,000's digit | First two digits of measurement and sign |

**Write Flag:** Changes between 0000 and 1111 each time data is output. Monitor the flag to check if the data has been written.

**Sign:** Positive: 0000, Negative: 1111

## 6-4-42 1204: READ STORED IMAGE AREA/CORRELATION

Reads the correlation (for density search regions) or the area (for binary center of gravity and binary axis angle regions) for a stored image. The calibrated area is output.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0010 | 0000 | 0100 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Image No.(00 to 22) |
| +2 | 0000 | 0000 | 0000 | 000* | Position compensation/ current measurement |
| +3 | 0000 | 0000 | 10's digit | 1's digit | Region No. |

**Position Compensation/Current Measurement:**
Position compensation (0) or current measurement (1)

**Region No.:** 00 to 01 for position compensation or 00 to 15 for current measurement.

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | 0000 | 0000 | Write verification flag |
| +1 | 1,000's digit | 100's digit | 10's digit | 1's digit | Last four digits of measurement |
| +2 | Sign | 0000 | 100,000's digit | 10,000's digit | First two digits of measurement and sign |

**Write Flag:** Changes between 0000 and 1111 each time data is output. Monitor the flag to check if the data has been written.
**Sign:** Positive: 0000, Negative: 1111
**Correlation output:** 0 to 100
**Area output**: 0 to 999,999.
If the area is greater than 999,999, the output will be "999,999".

## 6-4-43 1210: READ X DISPLACEMENT

Reads the X displacement for a stored image. The output value is not calibrated.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0010 | 0001 | 0000 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Image No. (00 to 22) |

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | 0000 | 0000 | Write verification flag |
| +1 | 1,000's digit | 100's digit | 10's digit | 1's digit | Last four digits of scroll amount |
| +2 | Sign | 0000 | 100,000's digit | 10,000's digit | First two digits of the scroll amount and sign |

**Write Flag:** Changes between 0000 and 1111 each time data is output. Monitor the flag to check if the data has been written.
**Sign:** Positive: 0000, Negative: 1111
The output will be the measurement × 1,000.

## 6-4-44 1211: READ Y DISPLACEMENT

Reads the Y displacement for a stored image. The output value is not calibrated.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0010 | 0001 | 0001 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Image No. (00 to 22) |

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | 0000 | 0000 | Write verification flag |
| +1 | 1,000's digit | 100's digit | 10's digit | 1's digit | Last four digits of scroll amount |
| +2 | Sign | 0000 | 100,000's digit | 10,000's digit | First two digits of scroll amount and sign |

**Write Flag:** Changes between 0000 and 1111 each time data is output. Monitor the flag to check if the data has been written.

**Sign:** Positive: 0000, Negative: 1111

The output will be the measurement × 1,000.

## 6-4-45 1212: READ ANGULAR DISPLACEMENT

Reads the angular displacement for a stored image (θ). The output value is not calibrated.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0010 | 0001 | 0010 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Image No. (00 to 22) |

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | 0000 | 0000 | Write verification flag |
| +1 | 1,000's digit | 100's digit | 10's digit | 1's digit | Last four digits of scroll amount |
| +2 | Sign | 0000 | 100,000's digit | 10,000's digit | First two digits of scroll amount and sign |

**Write Flag:** Changes between 0000 and 1111 each time data is output. Monitor the flag to check if the data has been written.

**Sign:** Positive: 0000, Negative: 1111

The output will be the measurement × 1,000.

## 6-4-46 1220: READ TERMINAL EXPRESSION RESULT

Reads the result of the output expression set for a terminal block output for a stored image. The calibrated value is output.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0010 | 0010 | 0000 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Image No. (00 to 22) |
| +2 | 0000 | 0000 | 10's digit | 1's digit | Output No. (00 to 15) |

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | 0000 | Judge-ment | Judgement |
| +1 | 1,000's digit | 100's digit | 10's digit | 1's digit | Last four digits of calculation result |
| +2 | Sign | 0000 | 100,000's digit | 10,000's digit | First two digits of calculation result and sign |
| +3 | 0000 | 1st decimal | 2nd decimal | 3rd decimal | Decimal portion of calculation result |

**Write Flag:** Changes between 0000 and 1111 each time data is output. Monitor the flag to check if the data has been written.

**Judgement:** OK: 0000, NG: If any bit is 1

**Sign:** Positive: 0000, Negative: 1111

The measurement is output between -999,999.999 and 999,999.999. If the measurement is less than -999,999.999, the output will be "-999,999.999". If the measurement is greater than 999,999.999, the output will be "999,999.999".

## 6-4-47 1221: READ RS-232C EXPRESSION RESULT

Reads the result of the output expression set for an RS-232C output for a stored image. The calibrated value is output.

**Input**

| Begin read word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | 0001 | 0010 | 0010 | 0001 | Command code |
| +1 | 0000 | 0000 | 10's digit | 1's digit | Image No. (00 to 22) |
| +2 | 0000 | 0000 | 0000 | 1's digit | Output No. (0 to 7) |

**Output**

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | 0000 | Judge-ment | Judgement |
| +1 | 1,000's digit | 100's digit | 10's digit | 1's digit | Last four digits of calculation result |
| +2 | Sign | 0000 | 100,000's digit | 10,000's digit | First two digits of calculation result, sign |
| +3 | 0000 | 1st decimal | 2nd decimal | 3rd decimal | Decimal portion of calculation result |

**Write Flag:** Changes between 0000 and 1111 each time data is output. Monitor the flag to check if the data has been written.

**Judgement:** OK: 0000, NG: If any bit is 1

**Sign:** Positive: 0000, Negative: 1111

The measurement is output between -999,999.999 and 999,999.999. If the measurement is less than -999,999.999, the output will be "-999,999.999". If the measurement is greater than 999,999.999, the output will be "999,999.999".

# 6-5 Output Format

When a measurement is executed, the results are output in BCD to the Write Area of the PLC. The output will be in order, starting with the smallest output number.

Write Flag switches between 0000 and 1111 each time data is output.
Monitor this flag to see when measurement results have been written.

Will contain 0 to 7 indicating the output number.
Measurement are output in order of output numbers.

0000: OK
One or more 1 bits: NG

| Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| +0 | Write Flag | 0000 | Output No. | Judge-ment | --- |
| +1 | 1,000's digit | 100's digit | 10's digit | 1's digit | Right four digits of integer |
| +2 | Sign | 0000 | 100,000's digit | 10,000's digit | Left two digits of integer, sign |
| +3 | 0000 | 1st decimal | 2nd decimal | 3rd decimal | Decimal portion |

0000: Positive
1111: Negative

Calibrated values are output.

Measurements from -999,999.999 to 999,999.999 can be output.
Measurements less than -999,999.999 are output as "-999,999.999".
Measurement greater than 999,999.999 are output as "999,999.999".

**Example 1:**
NG result and measurement of 143.25 for output 0.
OK result and measurement of -6943.298 for output 3.

| | Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|---|
| | | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| Output 0 | +0 | 0000 | 0000 | 0000 | 1111 | Judgement of output 0 |
| | +1 | 0000 | 0001 | 0100 | 0011 | Last four digits of integer |
| | +2 | 0000 | 0000 | 0000 | 0000 | First two digits of integer, sign |
| | +3 | 0000 | 0010 | 0101 | 0000 | Decimal portion |
| Output 3 | +4 | 0000 | 0000 | 0011 | 0000 | Judgement of output 3 |
| | +5 | 0110 | 1001 | 0100 | 0011 | Last four digits of integer |
| | +6 | 1111 | 0000 | 0000 | 0000 | First two digits of integer, sign |
| | +7 | 0000 | 0010 | 1001 | 1000 | Decimal portion |

**Example 2:**
If all outputs from 0 to 7 are set, the measurement results will be output in two groups.
Group 1: Measurement results for outputs 0 to 6.
Group 2: Measurement result for output 7.

| | Begin write word | Bits | | | | Setting |
|---|---|---|---|---|---|---|
| | | 15 to 12 | 11 to 8 | 7 to 4 | 3 to 0 | |
| Group 1 | +0 | 0000 | 0000 | 0000 | 1111 | Judgement of output 0 |
| | +1 | 0000 | 0001 | 0100 | 0011 | Last four digits of integer |
| | +2 | 0000 | 0000 | 0000 | 0000 | First two digits of integer, sign |
| | +3 | 0000 | 0010 | 0101 | 0000 | Decimal portion |
| | . . . | | | Output n | | |
| | +(4 x n) + 0 | 0000 | 0000 | 0*** | 0000 | Judgement of output *n*. (0*** = *n*) |
| | +(4 x n) + 1 | 0110 | 1001 | 0100 | 0011 | Last four digits of integer |
| | +(4 x n) + 2 | 1111 | 0000 | 0000 | 0000 | First two digits of integer, sign |
| | +(4 x n) + 3 | 0000 | 0010 | 1001 | 1000 | Decimal portion |
| | . . . | | | Output 7 | | |
| Group 2 | +28 | 1111 | 0000 | 0111 | 1111 | judgement of output 7 |
| | +29 | 0000 | 0001 | 0100 | 0011 | Last four digits of integer |
| | +30 | 0000 | 0000 | 0000 | 0000 | First two digits of integer, sign |
| | +31 | 0000 | 0010 | 0101 | 0000 | Decimal portion |

# SECTION 7
# RS-232C Menu Operation Settings

This section describes the communications settings for the RS-232C port when communications are in Menu operation mode. Menu operation mode allows F150 menus to be manipulated from a computer or other external device via the RS-232C port.

Make the same communications settings for the F150 and the external device. Set the F150 to Menu operation mode.
The measurement results will be output in Normal mode format in Menu operation mode → **p 165**

### Settings

| Item | Settings | |
|---|---|---|
| Baud rate | 2,400, 4,800, 9,600, 19,200, 38,400* (bps) | Use the same settings on the external device. |
| Data length | 7, 8* (bits) | |
| Parity | None*, even, odd | |
| Stop bits | 1*, 2 (bits) | |
| Delimiter | CR*, LF, CR+LF | |
| Mode | Select Menu operation (possible settings: Normal*, Host link, and Menu operation mode). | |

**Note** The default settings are marked with asterisks.*

### RS-232C Inputs Corresponding to Console Keys

The key codes shown on the right in the following table can be input from an external device to perform the same functions as the Console keys shown on the left.

| Console key | RS-232C input | |
|---|---|---|
| | Key | Code |
| ESC | CTRL + [ | ($1B) |
| TRIG | CTRL + A | ($01) |
| ENT | CTRL + M | ($0D) |
| Up Key | CTRL + E | ($05) |
| Down Key | CTRL + X | ($18) |
| Left Key | CTRL + S | ($13) |
| Right Key | CTRL + D | ($04) |

**Note** There is no key code that corresponds to the SHIFT Key on the Console.

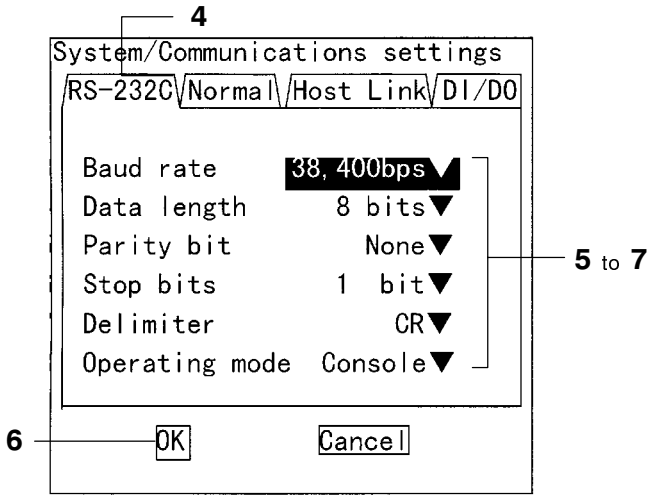
### Procedure

1 Move to the Basic screen (where the three modes can be selected).
The cursor cannot be moved to ***Scn*** ▼ when in Set mode.
Press the **ESC** Key to move to the Basic screen.

2 Move the cursor to ***Scn*** ▼ and press the **ENT** Key.

3 Move to ***System/Communications settings*** and press the **ENT** Key.

**4** Move the cursor to ***RS-232C*** and press the **ENT** Key. The following screen will be displayed.




**5** Using the **Up** and **Down** Keys, move the cursor to the item to be changed and press the **ENT** Key. A list of options will be displayed.

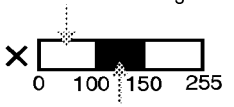
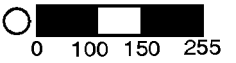
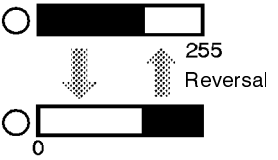
**6** Move the cursor to the item to be selected and press the **ENT** Key.

**7** Repeat steps (5) and (6) to change other items.

**8** Once all settings have been made, move the cursor to ***OK*** and then press the **ENT** Key. The communications settings will be saved.

# SECTION 8
# Troubleshooting

This section lists the errors that may occur during F150 operation, along with their probable causes and remedies.

| Message | Probable Cause and Remedy |
|---|---|
| Binary images cannot be reversed. | The following conditions apply to binary level settings:<br>Intermediate densities cannot be excluded from the measurement object.<br>White section being measured.<br>  <br><br>Densities 0 to 100 and 150 to 255 cannot be set as the measurement object.<br>Intermediate densities can be set as measurement object.<br>  <br><br>Densities 100 to 150 can be set for measurement.<br>Reverse can be used only when the lower limit is 0 or the upper limit is 255.<br>  <br> |
| Camera error.<br>(0500) | The Camera Cable is not connected properly. |
| Communications error. Please check RS-232 communications settings.<br>(0300) | An error has occurred with the communications via the RS-232C port.<br>Check the external device and F150 communications settings. |
| Data transmitted from the PLC is incorrect.<br>Transmit correct data.<br>(0304/0305) | The Host Link command received via the RS-232C port is incorrect.<br>Check that the data set to the Read Area is correct.<br>Check that an incorrect command has not been written, e.g., a command used for density search measurements may have been executed for a binary center of gravity and area region.<br>Check that the correct arguments have been set, e.g. a required argument may not have been set.<br>Make the same communications settings on the PLC and the F150. |
| *Error code* | Make a note of the error code displayed on the screen and contact your nearest OMRON representative. |
| Equation is too long. | Up to 30 digits can be set in an equation. Set 30 digits maximum within the brackets [ ] displayed on the screen. |

| Message | Probable Cause and Remedy |
|---|---|
| Illegal syntax in equation | Check the following for the equation:<br>There are the same number of right and left parentheses.<br>There is not more than one operator in a row without a variable in between them.<br>There is not more than one function in a row without a variable in between them.<br>There is not more than one region number in a row.<br>There is not more than one constant in a row. |
| Image cannot be read. Image memory is full. | New regions cannot be registered.<br>Reduce the size of the regions or delete unnecessary regions. |
| Incorrect data format received. (0302) | The data being sent via the RS-232C port is in an incorrect format.<br>Check that the cable connection is correct.<br>Check that the length of data output from the external device is not too short. |
| Insufficient flash memory. (0700) | Data cannot be saved because there is insufficient memory. Decrease the size of the region to be registered, or delete regions stored in memory that are no longer required.<br>If the error persists, the flash memory itself may be damaged. Contact your nearest OMRON representative. |
| Maximum number of graphics has already been drawn.<br>Limits: 16 per region<br>64 per scene | Up to 16 diagrams can be drawn for each region, and a total of 64 for each scene.<br>In some cases, up to 16 diagrams may not be drawn in a particular region if a lot of diagrams have already been drawn in other regions in that scene.<br>Delete any unnecessary diagrams. |
| NOT graphic cannot be drawn. Draw at least one OR graphic first | NOT mode is used to delete part of a drawn diagram.<br>Draw diagrams in OR mode. |
| Register only one region for position compensation using axis angle. | Axis angle cannot be selected if two position displacement compensation regions are registered for the binary axis angle.<br>Check that no density search or binary center of gravity and area regions are drawn.<br>Register only one binary axis angle region. |
| Register two regions for position compensation. | Register both region 0 and region 1 for position displacement compensation. |

| Message | Probable Cause and Remedy |
|---|---|
| There is nothing in the region. | The white pixels in the region have an area of 0, making calculation of the center of gravity impossible.<br>Place the measurement object correctly within the region. |
| Timeout error. Please check cable connections. (0301/0303) | A timeout error has occurred with communications via the RS-232C port.<br>Check that the RS-232C cable is connected. Check that the cable connection is correct. Check that the length of data output from the external device is not too short. |

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# Revision History

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


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

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